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SUMMARY REPORT: HOKO AND SKOKOMISH RIVER COHO SALMON INDICATOR STOCK STUDIES 1986-1989

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ABSTRACT

The Point No Point Treaty Council trapped and coded wire tagged wild coho salmon smolts in the Hoko and Skokomish rivers in years 1986 through 1989. The projects were part of a larger effort conducted by Western Washington treaty tribes and the Northwest Indian Fisheries Commission to compare catch distributions and contributions between selected hatchery and wild coho stocks. The number of annually tagged wild coho in the Hoko River ranged from 7,100 to 30,800 smolts over the four years of study. The annual average number of tagged fish was approximately 15,000. Over the same period, from 5,900 to 10,300 wild smolts were annually tagged in the Skokomish River, averaging approximately 7,700 each year.

The PNPTC attempted to estimate the numbers of wild coho smolts emigrating past the trap sites during the four years of study. Mark-recapture and catch expansion techniques were used to make the estimates. Estimated smolt yields for fish that overwintered upstream of the lower Skokomish River trap site (river mile 6.1) ranged from 31,200 to 54,900 during the four years. Some unknown, perhaps substantial, number of fish are believed to overwinter in habitat downstream of this trap site. The smolt yield estimates at two sites in the Hoko River system are considered conservative (minimum values) due to difficulties encountered during trapping. Estimated smolt yields for fish passing the mainstem Hoko River (river mile 10.0) and the Little Hoko River (river mile 0.0) traps ranged from 8,400 to 28,100 and 2,700 to 4,200 respectively in each year of study except the first. No estimates were made for the first year of the project.

Fishery recoveries of tagged Hoko River coho, expanded for catch sampling, ranged between about 290 and 1,400 fish in catch years 1987 through 1990. Contribution rates, including estimated shaker and non-retention fishery impacts, were estimated to range from 0.026 to 0.048 each year, averaging 0.040. The percentage of the catch caught by Canadian fisheries increased each year over the four year period, with approximately 84% of the catch being taken in Canadian waters in catch year 1990.

Fishery recoveries of tagged Skokomish River coho, expanded for catch sampling, ranged between about 260 and 1,200 fish in catch years 1987 through 1990. Contribution rates, including estimated shaker and non-retention fishery impacts, were estimated to range from 0.036 to 0.118 each year, averaging 0.070. The percentage of the catch caught by Canadian fisheries increased each year over the four year period, with approximately 54% of the catch being taken in Canadian waters in catch year 1990.

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1. INTRODUCTION

In 1986 the Point No Point Treaty Council (PNPTC) initiated multi-year coded wire tagging studies on wild coho salmon populations in the Hoko and Skokomish rivers. These projects were two of five wild coho indicator stock studies conducted by western Washington treaty tribes at approximately the same time. The overall purpose of the projects was to determine through recovery of tagged fish whether these wild stocks had ocean distributions, catch contributions, and exploitation rates similar to those of local hatchery stocks. Production from key hatchery stocks in each region were tagged in the same years so that a comparative analysis could be made between the wild and hatchery stocks. If distributions and exploitation rates were found similar, then hatchery stocks could be used to monitor fishery impacts on wild stocks.

The Hoko and Skokomish projects had two principal objectives. The first was to annually collect and tag sufficient numbers of wild smolts to provide for the comparative analysis with hatchery stocks. The projects as funded and reported here do not include that analysis, which will be performed by the Northwest Indian Fisheries Commission (NWIFC) for all the tribal wild coho indicator stock projects.

The second objective was to estimate total numbers of wild smolts produced from the areas being trapped to help determine the overall contribution of the wild populations to different fisheries. Estimates of smolt production, together with estimates of spawning escapement and fishery contribution rates from tag analysis, can be used to assess marine survival rates, fishery exploitation rates, and total contributions of the wild populations to various fisheries.

Concurrent with these projects, the PNPTC conducted studies to evaluate a methodology for estimating coho spawning escapements in the Hoko and Skokomish rivers. Sampling of coho adult returns for coded wire tags was an objective of those studies.[1]

The projects reported here were contracted through the NWIFC to gather information related to the implementation of the Pacific Salmon Treaty. Tagging of wild smolts was conducted in the Hoko and Skokomish rivers during the spring outmigrations of 1986 through 1989. Tagged fish in their third year of life contributed to fisheries in 1987 through 1990.

The purpose of this report is to summarize in one document the activities and accomplishments of the Hoko and Skokomish smolt tagging studies. Results of trapping and tagging are reported, together with contribution rates to fisheries. All information contained herein on the trapping and tagging aspects of the project was previously reported in annual

[1]A summary report is currently in preparation.

project reports prepared by the PNPTC. Annual reports for each of the four years of the Hoko project were prepared by Winter (1986), Volkhardt (1987), Willson (1991a), and Willson (1991b). Similarly, Skokomish project annual reports were prepared by Schuh and Dygert (1986), Schuh and Dygert (1988), Haymes and Dygert (1988), and Martenson and Dygert (1989). This report is comprised of three sections: Introduction, Hoko River summary, and Skokomish River summary.

2. HOKO RIVER

2.1 METHODS

2.1.1 Study Area

The Hoko River, which drains approximately 51 square miles, enters the Strait of Juan de Fuca roughly three miles west of Sekiu (Fig. 1). The drainage area is comprised principally of moderately sloped timberland with some development for agriculture and residence in the lower reaches. The largest tributary, the Little Hoko River, drains about 20% of the Hoko River basin, entering the main river at river mile (RM) 3.4. Coho salmon utilize at least 23 miles of the mainstem, 3.8 miles of the Little Hoko River, and various tributaries.

2.1.2 Study Design

The project was designed to collect migrant smolts by trapping in the mainstem Hoko River at RM 10.0 and in the Little Hoko River just upstream from its confluence with the mainstem (Fig. 1). Trapping below the site on the mainstem was not possible because hatchery coho smolts were released in 1986 and 1987 from the Hoko fish rearing facility, located downstream a short distance. Also, trapping would have been more difficult because of increasing stream size and discharge further downstream. Smolts captured at the two sites were coded wire tagged and adipose fin clipped using field procedures considered standard for such projects.

The numbers of smolts produced from habitat upstream from the trapping sites (yield) were to be estimated using mark-recapture techniques. When conditions were unsuited to this approach, yields were approximated by extrapolating catches during periods of trap operation to those when the traps were not fishing.

2.1.3 Fish Collection and Tagging

The smolt traps consisted of "V" or "W" shaped fence panels placed in the stream, connected via PVC pipe to trap boxes located downstream. The panels were supported by metal fence posts driven into the substrate and secured with additional bracing as needed. Panels were covered with metal hardware cloth screen. The panels were removable from outer frames during periods of high water to minimize damage to the traps at such times. Six inch PVC pipe was generally used to transport downstream migrants into the trap boxes, which also helped to pass steelhead kelts downstream. Two or three trap boxes were used in conjunction with each pipe to ensure adequate holding space for captured fish.

Upstream migrating adult steelhead were given passage past the traps in all years of the project. Steelhead spawners are known to utilize areas upstream of both traps. Passage in the mainstem was provided by 1) installing the trap as late as possible to minimize interactions with upstream migrants, 2) periodic removal of fence panels during periods of both high and low water, and 3) incorporation of an upstream adult trap beginning in 1987. The adult trap on the mainstem was constructed from 4 x 8 ft aluminum fish crowding panels wired to metal fence posts driven into the substrate. The trap was located immediately downstream of one side of the smolt trap.

Juvenile salmonids caught in the traps were identified to species and counted. All fish except coho smolts were released immediately after enumeration, except as required to obtain length measurements on catch subsamples at least once weekly. Steelhead (and rainbow trout) that did not appear to have undergone smoltification were classified as parr (age 1+).

Coho smolts were transferred to a holding box for tagging on either the same day of capture or soon thereafter. At time of tagging, the smolts were anesthetized with MS222, adipose fin clipped, and tagged using a portable coded wire tag injector. Fish found to be in poor condition were released unmarked. On each day of tagging, approximately 50 tagged smolts were retained in a live box to assess tag loss and delayed mortality after 24 hours. Once or twice weekly, approximately 50 smolts were subsampled for fork length.

2.1.4 Yield Estimation

Because the traps were not expected to be operated every day of the smolt migrations, attempts were made in all years except 1986 to estimate trap efficiency by releasing several groups of known numbers of marked smolts above the traps at different times each season. Test groups consisted of between approximately 40 to 100 fish. The fish used in the efficiency tests had been captured in the traps, then marked and tagged. The fish were transported approximately 100 yards upstream of the traps and released. Mark recaptures at the traps were to be used to estimate the total numbers of coho smolt migrants passing the traps using either a stratified Peterson method (Chapman 1951) or through simple application of trap efficiency estimates to the catch.

The use of this approach was severely hampered, however, due to high flow conditions in some years and an indication that migration behavior was altered by the use of fish that had already experienced being captured in the trap. A second approach to estimate numbers of migrants when the traps were not operating was simply to extrapolate from average catches prior to and after the period of missing data. Due to conditions encountered, a combination of these two approaches were used in 1987 to 1989 to obtain minimum estimates of total smolt yield produced from habitat upstream of the traps. Total smolt yield was not estimated in 1986.

The estimates also included extrapolations from the periods of trap operation to periods prior to the initiation and after the termination of trapping. Linear interpolation was used to estimate a hypothetical catch for each day during these periods by assuming a start and end date for the smolt migration.

2.1.5 Assessment of Fishery Contributions

Summaries of coded wire tag recoveries in all fisheries were obtained from the Coded-Wire Tag Retrieval & Analysis System (CRAS) maintained by NWIFC and are presented in this report. The recovery data used in that system are obtained from the data base maintained by the Pacific States Marine Fisheries Commission.

Contribution rates are presented with and without indirect fishery losses, i.e., shaker and non-retention mortalities. Contribution rates excluding indirect mortalities are computed simply as the expanded number of fishery recoveries divided by the number of tagged smolts. CRAS provides an estimate of contribution rate that includes all indirect fishery losses. Estimates of marine survival rate and fishery exploitation rate are not presented in this report.

2.2 RESULTS AND DISCUSSION

2.2.1 Trap Operation

The traps were generally operated each year beginning in mid April to early May and extending through mid June (Table 1). Installation occurred earliest in the Little Hoko River each year because of the lower flows in that stream compared to the mainstem Hoko River. Trapping commenced in late April to early May in the larger stream to reduce chances for operating during spring freshets and to avoid the early portion of the adult steelhead migration. The traps were removed after coho catches had declined to only a few fish, except in 1986 when the Little Hoko trap was removed on May 21 due to severe trap damage by freshet flows. Dates when the traps were not operated due to high flows are listed in Table 1.

2.2.2 Numbers Caught and Tagged

The combined annual catch of coho smolts for the two traps in the Hoko River system varied between approximately 7,600 and 31,400 over the four years of the project (Table 2). Numbers of fish tagged and released ranged between 7,100 and 30,800 over the same period. Estimates of the number of fish that retained tags and survived handling stress were slightly less (Table 2). The average number of fish tagged annually was approximately 15,000. Coded wire tag codes are listed in Table 3.

Trap catches also included significant numbers of juvenile steelhead and cutthroat at both sites (Table 4). Relatively large numbers of juvenile chinook were caught in the mainstem trap.

The average length of coho smolts at both sites and for all years ranged between 100 to 107 mm, except in the Little Hoko River in 1986 when smolts averaged 114 mm in size (Table 5). Winter (1986) reported that some of the smolts caught in the Little Hoko River in that year were likely hatchery smolts that moved out of the mainstem and into the tributary following their release from the Hoko Ponds. Such movements into tributary streams are not uncommon for hatchery coho smolts during their downstream migration, having been observed on several occasions in the Queets River system (Lestelle and Curtright 1987).

The smolts caught at the two sites combined were assumed to be representative of the entire Hoko smolt population in fish size and migration timing. Data collected in the Queets River demonstrate that smolt size and emigration timing can differ significantly between tributaries in a river system the size of the Queets (G. Blair, Quinault Fisheries Division, *personal communication*). These attributes can apparently result in marked differences in marine survival between components of the population (G. Blair, *personal communication*). The comparatively smaller sized Hoko River compared to the Queets River and the likelihood that over 50% of the outmigrant population was sampled by trapping suggests that possible differences between tagged and untagged components for the Hoko population were insignificant.

We have not included a summary of fork lengths of other species in this report. See Winter (1986), Volkhardt (1988), Willson (1991), and Willson (1991) for summaries of available information.

2.2.3 Smolt Yield

Estimating trap efficiencies at both trapping sites was found to be extremely difficult. The estimates of smolt yield reported for 1987 to 1989 are considered to be minimum values (Table 6) and may not accurately reflect actual production levels. Difficulties were encountered in estimating trap efficiency due primarily to two factors. The first factor was the interruption of trap operation because of high flow and the need to periodically remove panels for passage by migrating adult steelhead. The second factor was an apparent alteration of migration behavior that can occur when smolts caught in a trap are marked and released upstream of the trap. Fish that have experienced being captured by a V-shaped trap appear to be reluctant to move through the structure again (Volkhardt 1988). One author (Lestelle) has observed the same pattern for trap-experienced smolts in streams along the Washington coast.

2.2.4 Fishery Contributions

Fishery recoveries expanded for catch sampling of tagged Hoko coho in catch years 1987 to 1990 ranged between 287 fish to nearly 1,400 (Table 7). Contribution rates for landed fish ranged between 0.025 and 0.045. Rates including shaker and non-retention fishery impacts ranged between 0.026 and 0.048 (Fig. 2), averaging 0.040. On the average, therefore, 4% of tagged wild smolts were landed or died indirectly by fisheries.

Tagging results show that the percentage of the catch caught by Canadian fisheries increased each year for the four years of tagging (Fig. 3). In catch year 1990 (smolt year 1989), approximately 84% of the catch was taken in Canadian fisheries. Catch distributions by fishery are provided in Appendix A, shown separately for each tag code used.

3. SKOKOMISH RIVER

3.1 METHODS

3.1.1 Study Area

The Skokomish River, which heads in the Olympic Mountains, drains an area of 240 square miles (Fig. 4). The river enters Hood Canal at the canal's furthest southern point. While the upper reaches of the river flow through steep and rugged terrain, the lower river passes through a broad flood plain. Two hydroelectric projects are located in the canyon on the North Fork. The lower dam at RM 17.3 (distance from saltwater) prevents upstream migration past that point. Flows in the North Fork are heavily regulated. Coho utilization in the South Fork drainage occurs principally downstream of a steep canyon that begins at about RM 3.

The George Adams Hatchery, operated by WDF, is located on Purdy Creek, a tributary to the lower Skokomish River. Purdy Creek enters the mainstem at RM 4.1. Coho produced from this hatchery comprised an average of 24 percent of the total Hood Canal coho run between 1980 and 1989 (WDF 1990).

3.1.2 Study Design

In 1986 migrant smolts were trapped at a single site in the river system, at RM 6.1 on the main river (Fig. 4). The site was selected for its access and suitability for trapping using a floating inclined plane screen trap (scoop trap). In 1987, 1988, and 1989 a second trap (fence type), located at RM 13.6 on the North Fork, was fished in addition to the scoop trap in the lower river. The addition of the second trap provided an increased number of smolts for tagging, as well as giving a way of releasing marked smolts upstream of the scoop trap for estimating scoop trap efficiency. Smolts captured at the two sites were coded wire tagged and adipose fin-clipped using field procedures considered standard for such projects. The numbers of smolts produced from habitat upstream of the scoop trap (yield) were estimated using mark-recapture techniques, as described below.

3.1.3 Fish Collection and Tagging

The scoop trap is a floating trap that is used in larger rivers to capture downstream migrants. Basic trap design is described in Seiler et al. (1981). The trap was installed each year at Washington Department of Wildlife's public access site at RM 6.1. The trap was fished in a chute of relatively fast water by securing it in place with cables attached to shore. The trap was operated by a crew of three individuals.

3.1.4 Yield Estimation

Estimates of the number of coho smolts produced in habitat above the scoop trap site were made for each year using mark-recapture techniques. In three of the four years (1986, 1988 and 1989) a stratified or simple Peterson estimator was used (Chapman 1951). A trap efficiency estimate obtained by assessing rate of recapture of North Fork marks was used in 1987.

Each year three or four groups of marked fish were transported to a site approximately one mile upstream of the scoop trap and released. The fish previously captured in the scoop trap, were coded wire tagged and differentially marked with a ventral fin clip to distinguish them from any North Fork tagged fish. Recovery of the marks provided the basis for computing stratified Peterson estimates with 95% confidence intervals.

In 1987 the efficiency of the scoop trap dropped significantly during short time periods of low water, which introduced sources of error into the estimation process that used recaptures of fish released a mile upstream of the trap. The population estimate was obtained in this year by applying the rate of recapture of North Fork marks to the total catch of smolts at the scoop trap.

The yield estimates derived for the periods of trap operation were expanded in all years to account for fish that emigrated prior to installation of the scoop trap and after its removal. Linear interpolation was used to estimate a hypothetical catch for each day during these periods by assuming a start and end date for the smolt migration.

3.1.5 Assessment of Fishery Contributions

Summaries of coded wire tag recoveries in all fisheries were obtained from the Coded-Wire Tag Retrieval & Analysis System (CRAS) maintained by NWIFC and are presented in this report. The recovery data used in that system are obtained from the data base maintained by the Pacific States Marine Fisheries Commission.

Contribution rates are presented with and without indirect fishery losses, i.e., shaker and non-retention mortalities. Contribution rates excluding indirect mortalities are computed simply as the expanded number of fishery recoveries divided by the number of tagged smolts. CRAS provides an estimate of contribution rate that includes all indirect fishery losses. Estimates of marine survival rate and fishery exploitation rate are not presented in this report.

Questions have been raised about the potential for significant smolt production from overwintering sites below the scoop trap. Off-channel habitat appears to have the potential to produce significant numbers of smolts. Smolts that are produced from those sites would likely be the progeny of spawners that utilize the upper river system, as has been observed for smolts that overwinter in off-channel areas in the lower reaches of rivers on the Washington coast (Lestelle et al. 1993). Therefore, it is important to recognize that the yield estimates in Table 13 represent only that portion of the coho smolt production that overwinters upstream of RM 6.1.

3.2.4 Fishery Contributions

Fishery recoveries expanded for catch sampling of tagged Skokomish coho in catch years 1987 to 1990 inclusive ranged between 263 and 1,210 (Table 14). Contribution rates for landed fish ranged between 0.036 and 0.118. Rates including shaker and non-retention fishery impacts ranged between 0.038 and 0.122 (Fig. 5), averaging 0.070. On the average, therefore, seven percent of tagged smolts were caught and landed or died indirectly by fisheries. This average contribution rate is 75% greater than the average value estimated for Hoko coho in the same years.

Tagging results show that the percentage of the catch caught by Canadian fisheries increased each year for the four years of tagging (Fig. 6), as found for Hoko coho. The percentage of the catch taken by Canadian fisheries was much less than for Hoko coho, however. In catch year 1990 (smolt year 1989), approximately 54% of the catch was taken in Canadian fisheries. Catch distributions by fishery are provided in Appendix A.

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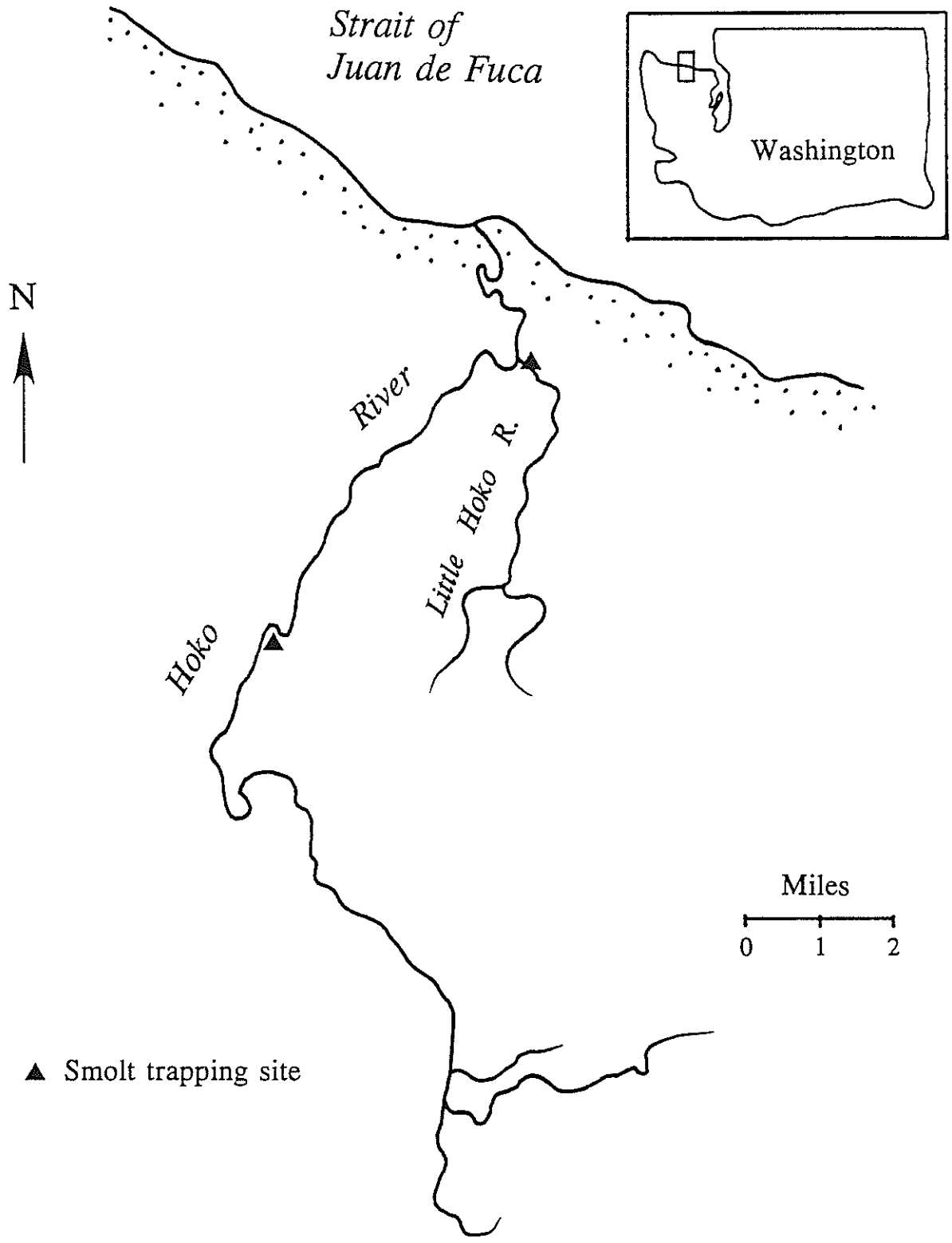

Figure 1. The Hoko River system and trapping sites in 1986 to 1989.

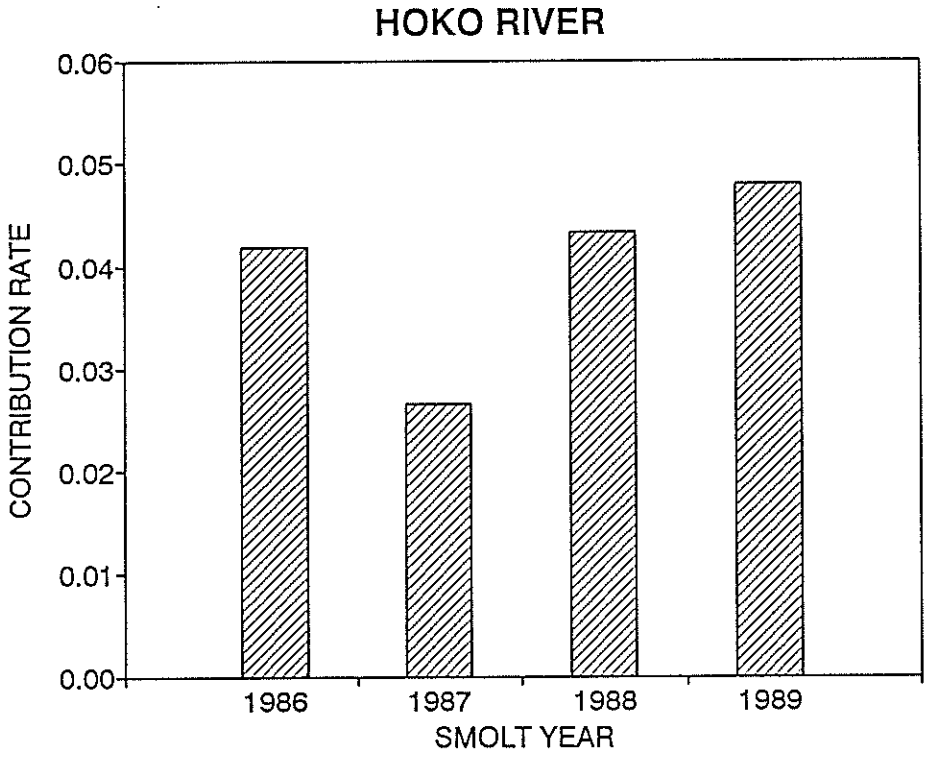

Figure 2. Estimated contribution rates of tagged wild coho from the Hoko River to all fisheries for smolt years 1986 to 1989 (catch years 1987 to 1990). Contribution rates are computed as the number of expanded fishery recoveries, adjusted to include shaker and non-retention losses, divided by the number of tagged smolts released.

HOKO RIVER

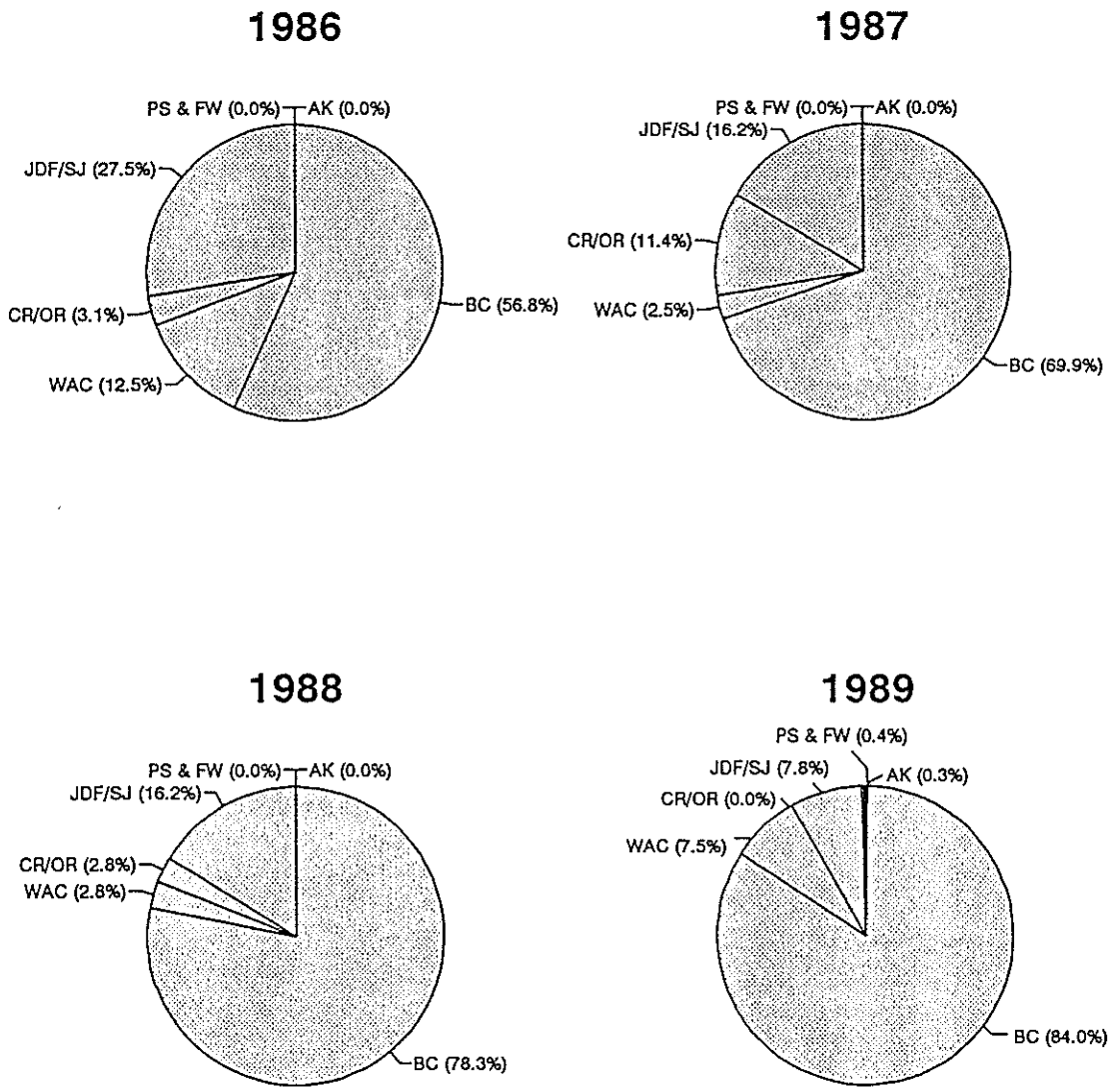

Figure 3. Distributions of fishery recoveries of tagged wild coho from the Hoko River, smolt years 1986 to 1989 (catch years 1987 to 1990). Abbreviations: Ak - Alaska, BC - British Columbia, WAC - Washington coastal, CR/OR - Columbia River and Oregon, JDF/SJ - Strait of Juan de Fuca and San Juans, PS & FW - Puget Sound and freshwater.

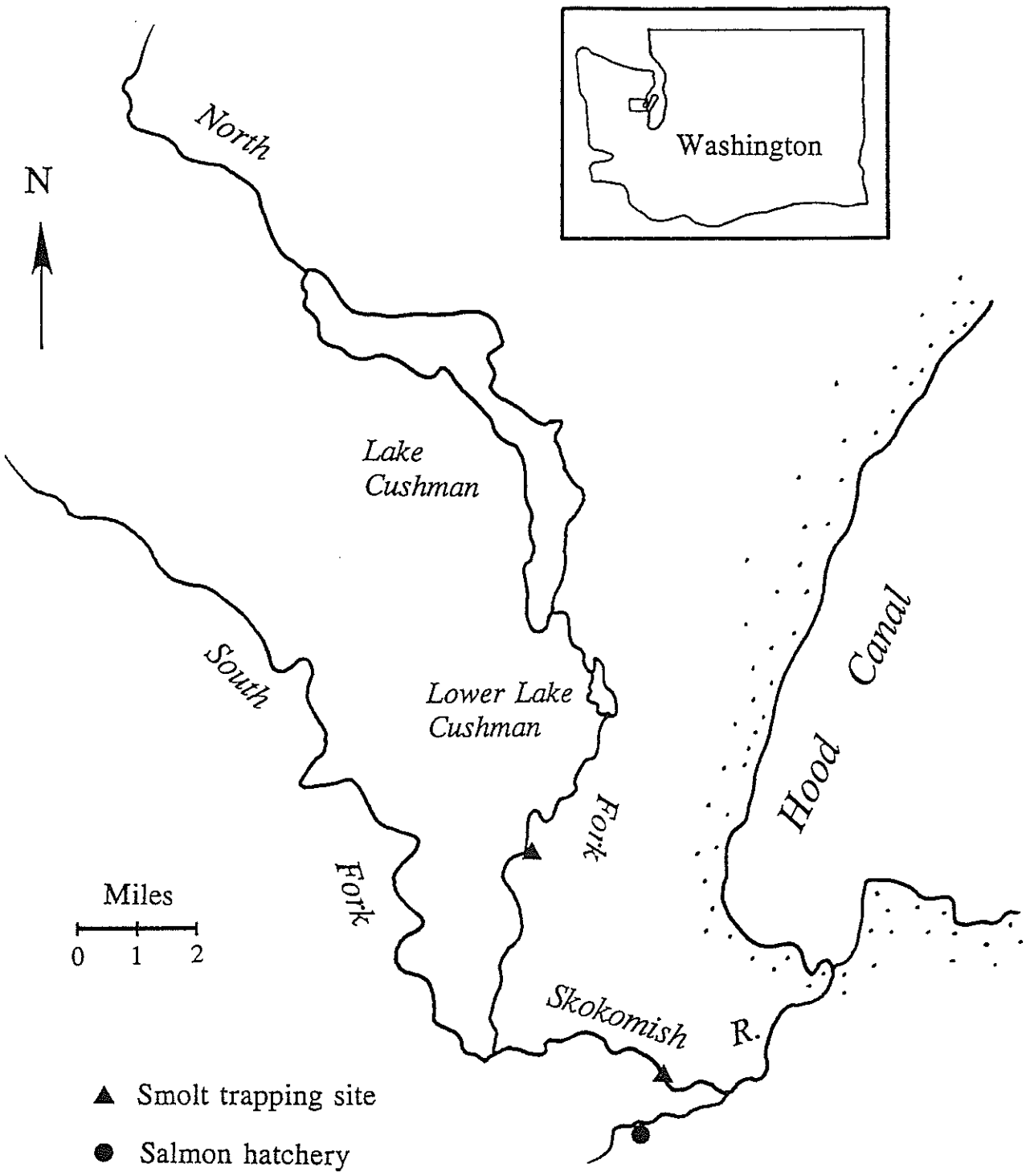

Figure 4. The Skokomish River system and trapping sites in 1986 to 1989.

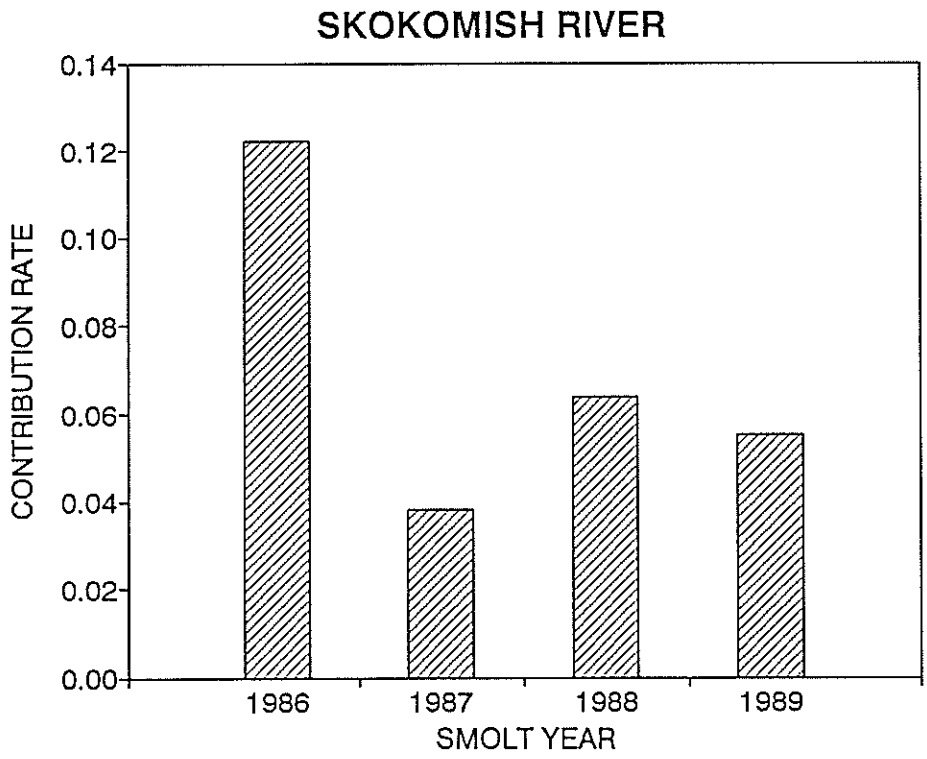

Figure 5. Estimated contribution rates of tagged wild coho from the Skokomish River to all fisheries for smolt years 1986 to 1989 (catch years 1987 to 1990). Contribution rates are computed as the number of expanded fishery recoveries, adjusted to include shaker and non-retention losses, divided by the number of tagged smolts released.

SKOKOMISH RIVER

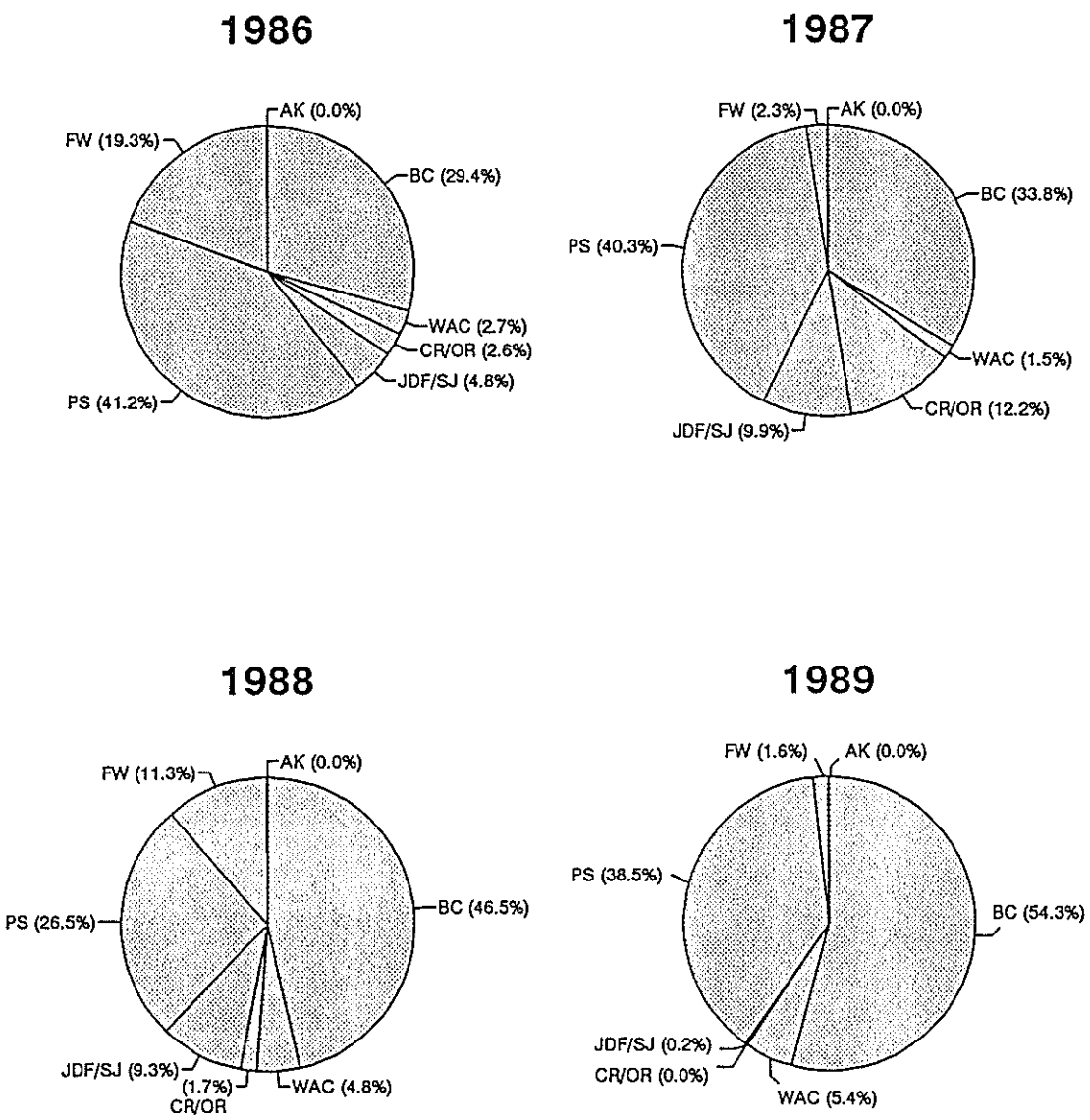

Figure 6. Distributions of fishery recoveries of tagged wild coho from the Skokomish River, smolt years 1986 to 1989 (catch years 1987 to 1990). Abbreviations: Ak - Alaska, BC - British Columbia, WAC - Washington coastal, CR/OR - Columbia River and Oregon, JDF/SJ - Strait of Juan de Fuca and San Juans, PS & FW - Puget Sound and freshwater.

Table 1. Dates of coho smolt trap operation in the Hoko River system, 1986 to 1989.

Year	Trap	Date installed	Date removed	Dates of inoperation[1/]
1986	Little Hoko	4/19	5/21	5/12-18[2/]
	mainstem	5/10	6/26	5/12-27[2/]
1987	Little Hoko	4/19	6/18	5/14; 5/31-6/1[2/]
	mainstem	5/1	6/25	5/12-13; 5/14-15; 5/30-6/2[2/]
1988	Little Hoko	4/16	6/20	5/2-4; 5/28-29; 6/2-4[2/]
	mainstem	5/6	6/25	5/14-15; 5/16-19; 5/27-30; 6/2-4[2/]
1989	Little Hoko	4/2	6/12	4/5-13
	mainstem	4/25	6/20	no interruption

1/ Due to storm events and/or trap damage.

2/ Short periods of inoperation to pass migrating adult steelhead not shown.

Table 2. Numbers of coho smolts coded wire tagged in the Hoko River system, 1986 to 1989. NA indicates information was not available.

Year	Site	Catch	Tagged and released	Adjusted for tag loss and mortality[1/]	Percent of catch
1986	L. Hoko	1,590	1,508	NA	94.8
	mainstem	6,306	5,647	NA	89.5
	total	7,896	7,155	NA	90.6
1987	L. Hoko	2,880	2,767	2,762	95.9
	mainstem	11,918	11,563	11,555	97.0
	total	14,798	14,330	14,317	96.7
1988	L. Hoko	2,362	2,156	2,118	89.7
	mainstem	5,212	5,045	4,909	94.2
	total	7,574	7,201	7,027	92.8
1989	L. Hoko	4,024	3,964	3,952	98.2
	mainstem	27,417	26,807	26,459	96.5
	total	31,441	30,771	30,411	96.7

1/ Based on delayed mortality and tag retention assessments.

Table 3. Tag codes used to tag wild coho smolts in the Hoko River, 1986 to 1989.

Year	Tag code
1986	211913, 211914
1987	212222, 212226
1988	212819, 212821
1989	211728, 213237, 213238, 213514

Table 4. **Trap catches of salmonids in the Hoko River system, 1986 to 1989. Steelhead smolts are labeled "Sth ≥1+", steelhead parr and/or juvenile rainbow trout are labeled "Sth/Rb 0+." NA indicates information was not available.**

Year	Site	Coho 1+	Coho 0+	Chinook	Chum	Sth ≥1+	Sth/Rb ≥0+	Cutthroat	Adult sth
1986	L. Hoko	1,590	0	NA	NA	NA[1/]	473[1/]	140	10
	mainstem	6,306	0	NA	NA	NA[1/]	101[1/]	34	12
	total	7,896	0	NA	NA	NA[1/]	574[1/]	174	22
1987	L. Hoko	2,880	NA	29	0	520	680	412	9
	mainstem	11,918	NA	2,816	0	327	167	115	11
	total	14,798	NA	2,845	0	847	847	527	20
1988	L. Hoko	2,362	47[2/]	53	8	NA[1/]	1,335[1/]	520	3
	mainstem	5,212	155[2/]	2,306	1	NA[1/]	291[1/]	67	3
	total	7,574	202[2/]	2,359	9	NA[1/]	1,626[1/]	587	6
1989	L. Hoko	4,137	112	426	79	786	829	343	NA
	mainstem	27,558	116	13,297	0	2,739	234	75	NA
	total	31,695	228	13,723	79	3,525	1,063	418	NA

1/ Steelhead age ≥1+ were not distinguished from steelhead/rainbow age ≥0+.

2/ Small age 1+ coho not likely to undergo smoltification in 1988 are included.

Table 5. Length statistics for coho smolts captured in the Hoko River system, 1986 to 1989. All measurements were taken for fork length. NA indicates information was not available.

Year	Site	Sample size	Mean length (mm)	Range (mm)	Std dev (mm)
1986	L. Hoko	222	114	77-138	NA
	mainstem	585	106	90-129	NA
1987	L. Hoko	368	105	78-140	NA
	mainstem	670	105	81-132	NA
1988	L. Hoko	293	107	80-133	NA
	mainstem	351	106	85-133	NA
1989	L. Hoko	312	103	69-135	10.2
	mainstem	904	100	79-135	7.9

Table 6. Estimated coho smolt yields produced from habitat upstream of traps in the Hoko River system, 1986 to 1989. All estimates incorporated 1) averaging of catches prior to and after periods of non-fishing when trap panels were removed and 2) extrapolation of initial and final catches to assumed start and end dates of smolt migration.

Year	Site	Method	Yield estimate
1986	L. Hoko	no estimate made	-
	mainstem	no estimate made	-
1987	L. Hoko	stratified Peterson with averaging/extrapolation	3,450
	mainstem	stratified Peterson with averaging/extrapolation	16,197
1988	L. Hoko	averaging/extrapolation	2,683
	mainstem	averaging/extrapolation	8,389
1989	L. Hoko	averaging/extrapolation	4,203
	mainstem	averaging/extrapolation	28,144

Table 7. Estimated catches of coded wire tagged Hoko wild coho (observed recoveries expanded for catch sampling), proportions of tagged smolts released and total recoveries, and total contribution rate to all fisheries (including shaker and non-retention losses).

Smolt year	Number tagged[1/]	Fisheries location	Expanded recoveries	Proportion of release	Proportion of total recoveries	Total fisheries contribution rate[2/]
1986	7,155	Alaska	0	0.000	0.000	-
		British Columbia	163	0.023	0.568	-
		Washington coastal	36	0.005	0.125	-
		Columbia R. and south	9	0.001	0.031	-
		Juan de Fuca-San Juans	79	0.011	0.275	-
		Puget Sound	0	0.000	0.000	-
		Terminal freshwater	0	0.000	0.000	-
		Total	287	0.040	1.000	0.042
1987	14,330	Alaska	0	0.000	0.000	-
		British Columbia	251	0.018	0.699	-
		Washington coastal	9	0.001	0.025	-
		Columbia R. and south	41	0.003	0.114	-
		Juan de Fuca-San Juans	58	0.004	0.162	-
		Puget Sound	0	0.000	0.000	-
		Terminal freshwater	0	0.000	0.000	-
		Total	359	0.025	1.000	0.026
1988	7,201	Alaska	0	0.000	0.000	-
		British Columbia	227	0.032	0.783	-
		Washington coastal	8	0.001	0.028	-
		Columbia R. and south	8	0.001	0.028	-
		Juan de Fuca-San Juans	47	0.007	0.162	-
		Puget Sound	0	0.000	0.000	-
		Terminal freshwater	0	0.000	0.000	-
		Total	290	0.041	1.000	0.043
1989	30,771	Alaska	4	0.000	0.003	-
		British Columbia	1,161	0.038	0.840	-
		Washington coastal	104	0.003	0.075	-
		Columbia R. and south	0	0.000	0.000	-
		Juan de Fuca-San Juans	108	0.004	0.078	-
		Puget Sound	2	0.000	0.001	-
		Terminal freshwater	3	0.000	0.002	-
		Total	1,382	0.045	1.000	0.048

1/ Numbers shown in table are the unadjusted releases from Table 2, which may differ from the numbers provided in in the Coded-Wire Tag Retrieval & Analysis System that include adjustments for any tag loss.

2/ Rates include shaker and non-retention fishery impacts.

Table 8. Dates of coho smolt trap operation in the Skokomish River system, 1986 to 1989.

Year	Trap	Date installed	Date removed	Dates of inoperation[1/]
1986	mainstem	4/6	6/23	no interruption[2/]
1987	mainstem	4/8	6/10	no interruption[2/ 3/]
	North Fork	3/21	6/7	no interruption
1988	mainstem	4/3	6/9	4/4; 4/5-6; 4/9; 4/13-14; 5/18; 5/28; 6/3[2/]
	North Fork	4/3	6/9	no interruption
1989	mainstem	4/20	6/10	no interruption[2/]
	North Fork	4/8	6/10	no interruption

1/ Due to storm events and/or trap damage.

2/ Trap operated primarily from dusk to the following morning of each 24-hour period.

3/ Trap efficiency was reduced in 1987 due to periods of low water.

Table 9. Numbers of coho smolts coded wire tagged in the Skokomish River system, 1986 to 1989. NA indicates information was not available.

Year	Site	Catch	Tagged and released	Adjusted for tag loss and mortality[1/]	Percent of catch
1986	mainstem	11,212	10,269	10,218[2/]	91.1
1987	mainstem	4,404	NA	NA	NA
	North Fork	3,159	NA	NA	NA
	total	7,563	7,306	7,299[2/]	96.5
1988	mainstem	3,589	NA	NA	NA
	North Fork	2,670	NA	NA	NA
	total	6,259	5,899	5,811	92.8
1989	mainstem	5,402	NA	NA	NA
	North Fork	2,720	NA	NA	NA
	total	8,122	8,071	7,990	98.4

1/ Based on delayed mortality and tag retention assessments.
2/ Miscalculated number reported in annual report. Corrected number shown here.

Table 10. Tag codes used to tag wild coho smolts in the Skokomish River, 1986 to 1989.

Year	Tag code
1986	211909
1987	212225
1988	212814
1989	211729

Table 11. Trap catches of salmonids in the Skokomish River system, 1986 to 1989. Steelhead smolts are labeled "Sth ≥1+", steelhead parr and/or juvenile rainbow trout are labeled "Sth/Rb 0+."

Year	Site	Coho 1+	Coho 0+	Chinook 1+	Chinook 0+	Sth ≥1+	Sth/Rb ≥0+	Cutthroat
1986	mainstem	11,212	796	4	6,373	416[1/]	1,568	28
1987	mainstem	4,404	1,157	0	5,440	144[2/]	1,252	14
	North Fork	3,159	0	0	0	138	460	0
	total	7,563	1,157	0	5,440	377	1,712	14
1988	mainstem	3,589	2,246	0	849	121[3/]	669	0
	North Fork	2,670	150	0	0	76	222	3
	total	6,259	2,396	0	849	439	891	3
1989	mainstem	5,402	1,591	0	771	78	529	1
	North Fork	2,720	0	0	0	141	170	0
	total	8,122	1,591	0	771	219	699	1

1/ Does not include 127 hatchery steelhead smolts.

2/ Does not include 95 hatchery steelhead smolts.

3/ Does not include 242 hatchery steelhead smolts.