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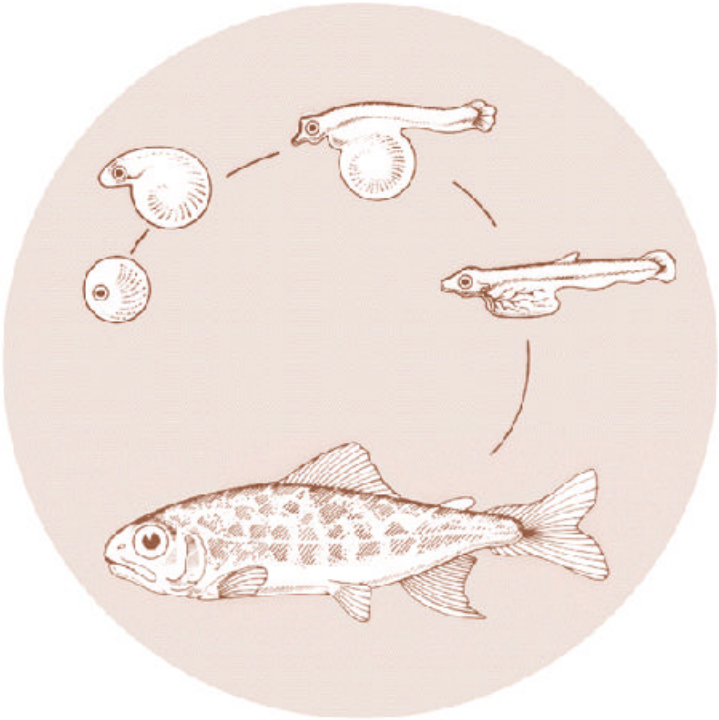
ANNUAL CODED WIRE TAG PROGRAM
WASHINGTON
MISSING PRODUCTION GROUPS

Annual Report 1996



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ANNUAL CODED WIRE TAG PROGRAM

WASHINGTON

MISSING PRODUCTION GROUPS
ANNUAL REPORT FOR 1996

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ABSTRACT

The Bonneville Power Administration (BPA) funds the "Annual Coded Wire Tag Program - Missing Production Groups for Columbia River Hatcheries" project. The Washington Department of Fish and Wildlife (WDFW), Oregon Department of Fish and Wildlife (ODFW) and the United States Fish and Wildlife Service (USFWS) all operate salmon and steelhead rearing programs in the Columbia River basin. The intent of the funding is to coded-wire tag at least one production group of each species at each Columbia Basin hatchery to provide a holistic assessment of survival and catch distribution over time.

Three main objectives of the WDFW portion of the study are to: 1) coded-wire tag at least one production group of each species at each Columbia Basin hatchery to enable evaluation of survival and catch distribution over time, 2) recover coded-wire tags from the snouts of fish tagged under objective 1 and estimate survival and contribution rates to the fisheries for each group, and 3) report findings of coded-wire tag recoveries for all 1986-l 989 broods of chinook, and 1988 and 1989 broods of coho released from WDFW Columbia Basin hatcheries.

Objective 1 for FY-96 was met with a few modifications to the original FY-96 proposal. Under Objective 2, snouts containing coded-wire tags that were recovered during FY-96 were decoded but survival estimates have not been made because data for these broods are still preliminary.

Survival, contribution rates to the various fisheries, and escapement have been analyzed for 1990 brood chinook and 1992 brood coho. However, not all fishery and spawning ground recoveries are complete for 1995.. Thus, the results for these broods are not complete for all groups and should be viewed as preliminary. Final data for these broods will be presented in 1998 when 1995 recovery data are complete.

Data generated by this project contributes to WDFW's obligations for representative tagging under the Endangered Species Act (ESA) permit for operating Columbia Basin facilities. WDFW facilities operating outside the Snake River basin are required to have either a Section 7 or Section 10, "Incidental Take" permit. Consistent with special conditions within this permit, WDFW has now reached its objective to tag representative groups from all WDFW Columbia Basin releases.

INTRODUCTION

The Columbia Basin Fish and Wildlife Program Section 203 (a) proposes an interim goal of doubling the runs of salmon and steelhead in the Columbia River basin. Doubling means increasing the current run size of 2.5 million fish to 5.0 million fish. As part of this effort Section 206 © states an objective of exploring methods to substantially increase and improve hatchery production at existing hatcheries. Section 206 (e) (1) states that the Bonneville Power Administration (BPA) shall fund collection of Columbia Basin hatchery data for anadromous fish. These data will include at a minimum: number of returning adults; disposition of returning adults; source and description of broodstock; actions to maintain genetic diversity; and size, location and time of release of juvenile fish.

A system of monitoring and evaluating survival and contribution is necessary to measure present and future levels of fish production by various hatchery and natural fish production components. In order to evaluate the success of this program in doubling the size of fish runs, a continuous long term data set is necessary.

In September 1989, under contract from the BPA, the Washington Department of Fisheries (now WDFW) began coded-wire tagging production groups of anadromous salmonids that were not tagged by other programs (i.e. missing production groups). This project began with the tagging of juvenile salmon in 1990 (1989 brood fall chinook and 1988 broods of spring and summer chinook, and coho).

The sequential tagging of representative groups of juvenile salmon from each WDFW facility allows for long term evaluation of survival and fishery contribution of all release groups from the hatcheries. This information is essential for evaluating the effectiveness of hatchery production in the Basin, as well as for determining where improvements in hatchery fish performance are needed. These data also aid in more effective fisheries management programs, particularly for listed salmonid stocks.

As salmon mature in the ocean they are either harvested in various fisheries, or return to freshwater spawning areas where they can be enumerated. Each fishery or freshwater spawning area is sampled to recover coded-wire tags. Recovery data are reported to the Pacific States Marine Fisheries Commission (PSMFC). Release and recovery data, sampling rates, and ratios of marked to unmarked fish in the sample are stored in PSMFC computers. These data are used to estimate survival and contribution rates to each fishery for every hatchery or wild production group. Calculated survival and contribution rates are then used as a relative measure of each production group's effectiveness in meeting program goals, which directs future efforts in maintaining or enhancing fish runs in the Columbia Basin and provides valuable information to salmon harvest managers.

APPROACH

The goals of this program are to develop a tool to estimate hatchery production survival and fishery contribution and to evaluate the effectiveness of WDFW Columbia River salmon hatcheries in meeting production goals consistent with ESA concerns. Work has progressed under the following three objectives:

Objective 1. Coded-wire tag at least one group of fish representative of each hatchery's production of a given species that is currently not being tagged through another program.

Objective 2. Recover fish coded-wire tagged under objective 1 and decode these tags to estimate survival and contribution of each group released each year, and evaluate the results.

Objective 3. Develop preliminary catch and contribution data for all WDFW Columbia River hatcheries using 1986-l 989 brood chinook, and 1988 and 1989 brood coho, and prepare an annual report for all WDFW Columbia Basin hatcheries. Compile and analyze catch and contribution data for all subsequent broods of fish tagged under this contract.

RESULTS

Objective 1. A total of 895,286 fall chinook, 486,311 spring chinook, and 416,931 coho (1,798,528 all species) were tagged during the contract period. Total expenditures on tagging were $202, 782 (Table 1). Releases of 1995 brood chinook tagged during FY-96 are given in Table 2. Releases of yearling chinook and coho (1994 brood) tagged during FY-96 are given in Tables 3 and 4, respectively. Releases of 1994 brood yearling salmon, and 1995 brood subyearling salmon tagged under other program funds are listed in Table 5.

There were differences in the number of fish proposed for tagging and the number actually tagged in FY-96 :

1. Of the 100,000 proposed tags for Grays River chinook, 49,199 were applied because of changes to the rearing program.
2. Of the 180,000 proposed tags for Elochoman fall chinook, 101,668 were applied because of changes to the rearing program.
3. Of the 100,000 proposed tags for spring chinook bound for rearing at the North Toutle Hatchery, none were applied because this rearing program was canceled for 1996.
4. Of the 60,000 tags to be used on coho reared at Lewis Hatchery but bound for release at other locations, 31 ,112 were applied to Type S coho bound for the Deep River Net Pens.
5. Of the 30,000 proposed tags for coho at Washougal Hatchery and bound for the Champion Pond on the Klickitat River, no fish were tagged because this rearing program was eliminated.

Of the 2,032,000 tags requested for FY-96, a total of 1,798,528 were applied.

Objective 2. A total of 1,266 tags were recovered from Columbia River fall, spring, and summer chinook, and coho during FY-96. A total of 116 fish with missing adipose fins had no tag in the snout resulting in a no or lost tag rate of 9.2%.

Table 1. Tagging summary and costs during FY-96 for 1994 brood yearling coho and chinook and 1995 brood subyearling chinook. Table includes those production groups tagged under contract with BPA. F= Fall ; Sp= Spring.

HATCHERY	SPECIES	TAGGING DATE	NUMBER TAGGED	COST ($)
GRAYS	F.CHINOOK	June 12, 1996	49,199	5559.49
GRAYS	TYPE-S COHO	December 20, 1995	31,443	3553.06
ELOCHOMAN	F.CHINOOK	May 22-June 6, 1996	192,471	21749.22
ELOCHOMAN	TYPE-N COHO	November 11-12, 1995	61,493	6948.71
ELOCHOMAN	TYPE-S COHO	November 17, 1995	30,624	3460.51
NORTH TOUTLE	F. CHINOOK	June 6, 1996	90,918	10273.73
NORTH TOUTLE	TYPE-S COHO	October 24, 1995	30,415	3436.90
NORTH TOUTLE	SP. CHINOOK	Not tagged		
FALLERT CREEK	F. CHINOOK	May 21, 1996	91,031	10286.50
FALLERT CREEK	SP. CHINOOK	July 13, 1995	114,602	12950.03
FALLERT CREEK	TYPE-S COHO	November 30, 1995	31,106	3514.98
KALAMA FALLS	F. CHINOOK	May 16, 1996	88,305	9978.47
KALAMA FALLS	TYPE-N COHO	November 28-29, 1995	30,764	3476.33
WASHOUGAL	F. CHINOOK	May 28-June 3, 1996	180,581	20405.65
WASHOUGAL	TYPE- N COHO ON-STATION	November 6, 1995	31,308	3537.80
WASHOUGAL	TYPE-N COHO KLICKITAT RIVER	November 1-3, 1995	92,532	10795.12
KLICKITAT	F. CHINOOK	April 26-May 1, 1996	202,781	22914.25
KLICKITAT	SP. CHINOOK (subyearling)	May 6-13, 1996	224,056	25318.33
KLICKITAT	SP. CHINOOK (yearling)	April 19, 1996	101,478	11467.01
KLICKITAT	TYPE-N COHO	October 18 & November 1, 1995	46,134	5213.14
LEWIS RIVER DEEP RIVER NET PENS	TYPE-S COHO	July 11-12, 1995	31,112	3515.66
RINGOLD	SP. CHINOOK	October 17-18, 1995	46,175	5217.78
TOTALS			**1,798,528**	**$ 203,233.66**

Table 2. Releases in 1996 of 1995 brood subyearling fall chinook coded wire tagged during FY-96 under contract with BPA.

HATCHERY	SPECIES	RELEASE DATE(S) IN 1996	NUMBER TAGGED FISH RELEASED	TOTAL RELEASE
GRAYS	FALL CHINOOK	June 15	48,863	1,101,600
ELOCHOMAN	FALL CHINOOK	June 16-17	99,173	2,834,700
NORTH TOUTLE	FALL CHINOOK	June 21-30; July 1	87,574	2,371,579
KALAMA FALLS	FALL CHINOOK	May 31-June 19	85,334	3,573,400
FALLERT CREEK	FALL CHINOOK	June 10-13, 22-26	88,876	2,150,700
WASHOUGAL	FALL CHINOOK	June 27; July 25	155,852	6,139,000
KLICKITAT	FALL CHINOOK	May 16-June 8	201,695	4,380,000
BEAVER CREEK	FALL CHINOOK	June 5-20	86,425	1,240,155
TOTALS			**853,792**	**23,791,134**

Table 3. Releases in 1996 of 1994 and 1995 brood spring (SP.) chinook coded wire tagged during FY-95[1] and FY-96 under contract with BPA.

HATCHERY	SPECIES	RELEASE DATE(S) IN 1996	NUMBER TAGGED FISH RELEASED	TOTAL RELEASE
FALLERT CREEK	SP.CHINOOK	March 15-31	110,431	436,600
KLICKITAT	SP. CHINOOK SUBYEARLINGS	May 28-29	221,654	223,000
KLICKITAT	SP. CHINOOK YEARLINGS	February 8; March 1-15	88,951	610,000
RINGOLD	SP. CHINOOK	April 1-5	38,698	1,025,494
NORTH TOUTLE	SP. CHINOOK	No releases made	NA	NA
TOTALS			459,734	**2,295,094**

[1] Some groups are tagged in the previous fiscal year due to logistical constraints. Billings for these groups occur in the proper fiscal year.

Table 4. Releases in 1996 of 1994 brood coho coded wire tagged during FY-96 under contract with BPA.

HATCHERY	SPECIES	RELEASE DATE(S) in 1996	NUMBER TAGGED FISH RELEASED	TOTAL RELEASE
GRAYS	TYPE-S COHO	April 9-16	28,237	163,300
DEEP RIVER NET PENS	TYPE-S COHO	May 7	28,321	200,100
ELOCHOMAN	TYPE-S COHO	April 9	30,567	468,300
ELOCHOMAN	TYPE-N COHO	February 8; April 17-30; May 1-8	59,366	1,320,200
NORTH TOUTLE	TYPE-S COHO	February 8; April 23-30; May 1-20	29,734	1,387,116
KALAMA FALLS	TYPE-N COHO	February 9	28,450	859,200
FALLERT CREEK	TYPE-S COHO	April 22-26	30,862	545,200
WASHOUGAL	TYPE-N COHO ON-STATION	April 29	30,207	535,550
WASHOUGAL	TYPE-N COHO KLICKITAT R.	April 2-13	91,308	2,627,827
KLICKITAT	TYPE-N COHO	April 1-May 31	42,958	1,568,800
TOTALS			400,010	**9,675,593**

Table 5. Releases in 1996 of 1994 brood yearling chinook and coho and 1995 brood subyearling chinook during FY-96. This table represents groups coded wire tagged under other (non-BPA) funding sources. SP= Spring, SU= Summer.

HATCHERY	SPECIES	RELEASE DATE(S) IN 1996	NUMBER TAGGED FISH RELEASED	TOTAL RELEASE
COWLITZ	FALL CHINOOK	June 10,17,20; July 1	190,700	6344,100
COWLITZ	SP. CHINOOK	March 5; April I; May 17	339,365	I,463,042
COWLITZ	TYPE-N COHO	May 1-3, 20	76,984	4,468,827[2]
LEWIS RIVER	SP. CHINOOK	February 8-9; May 22-26	182,358	1,178,272
LEWIS RIVER	TYPE-N COHO	April 5-30; May I-18	64,392	2,414,000
LEWIS RIVER	TYPE-S COHO	April 5-May 18	73,767	I,057,700
LYONS FERRY	FALL CHINOOK YEARLING	April 9-12	403,907[3]	404,270
LYONS FERRY	FALL CHINOOK SUBYEARLING	March 1-31	0	83,183
TUCANNON	SP. CHINOOK	March 16-31; April 1-22	128,422	130,069
RINGOLD	FALL CHINOOK	June 27-30	190,959	3,356,127
PRIEST RAPIDS	FALL CHINOOK	June 14-24	193,405	6,700,000
TURTLE ROCK	FALL CHINOOK	April 6	183,700	193,300
TURTLE ROCK	SU. CHINOOK	June 27-28	362,509	1,243,600
CHIWAWA	SP. CHINOOK	April 15-May 6	26,832	27,226
WENATCHEE	SU. CHINOOK	April 18-30, May 1-31; June 1-4	445,897	797,350
LAKE WENATCHEE	SOCKEYE	October 25	150,808 Ad clip only	150,808
WELLS DAM	SU. CHINOOK YEARLING	April 1-9	350,918	365,000
WELLS DAM	SU. CHINOOK SUBYEARLING	June 13-15; August 7	382,146	500,000
METHOW	SP. CHINOOK	April 21-27	35,821	36,166
CARLTON POND	SU. CHINOOK	April 26-27	387,970	406,560
SIMILKAMEEN	SU. CHINOOK	April 23	221,883	536,299
TOTALS			4,383,306	31,855,899

2 Does not include 540,355 subyearling coho released in 1996.

3 Does not include 3,230 CWT (3,233 total) released at Ice Harbor Dam and 113,977 CWT (I 14,041) released from April 12-15 from Pittsburgh Landing in Idaho.

Objective 3. Summaries of coded wire tag information for groups of 1986-1990 brood chinook and 1988-l 992 brood coho are listed by hatchery. “Survivals” are calculated by dividing the total estimated recoveries by the total number of tagged fish released. “Percent of total survival to fisheries” is calculated by dividing the total estimated recoveries in each fishery or escapement by the total number of estimated recoveries. Type-N coho refer to north migrating coho and Type-S coho to south migrating coho. For descriptions of individual hatcheries the reader is referred to “Operations Plans for Anadromous Fish Production Facilities in the Columbia River Basin: Volume IV"[4]

Grays River Hatchery- Grays River Hatchery rears and releases Tule fall chinook and Type-S (early) coho. Fall chinook survivals range from 0.1% to over 8.0% for broods 1974-1990 (Figure 1). Releases of 4-5 g fish in June generally result in survivals under 1 .O%. Fish released in the fall months (>20 g) generally survive at over 1 .O%. A group of large (>1 2 g) 1985 brood fish released in May survived at over 1%. Fall chinook from the 1989 and 1990 broods had survivals of 0.07% and 0.04% respectively. These fish contributed primarily to the Columbia River net fishery and escapement (Figure 2).

Type-S coho survivals range from O.Ol-3.7% for broods 19751992 (Figure 3). In recent years one group of coho has been released in April and the other in May. Data from these releases are pending. Survivals of 1988-1992 broods ranged from 0.03-3.7%. Grays River Type-S coho contributed primarily to escapement and the California fisheries, Oregon and Washington sport fisheries, and the Columbia River net fishery (Figure 4).

Elochoman River Hatchery- Elochoman Hatchery rears and releases Tule fall chinook, and both Type-N and Type-S coho. Fall chinook survivals range from 0.06-0.9% (Figure 5). Most tag groups represent fish released in June at sizes ranging from 4.5-6.0 g. A group of large fall chinook (>12 g; 1985 brood) juveniles released in the spring survived at nearly 1%. Fish from the 1986 and 1987 broods were not tagged. The 1988 brood was used in a release timing study along with fish at Kalama Falls Hatchery. Survival of the three release groups averaged 0.06%, with the lowest survival occurring in the June release. These fish contributed primarily to the Canadian troll fishery and escapement (Figure 6).

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[4] 1992 Annual Report, U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife.

Type-N coho survivals at this hatchery range from 0.01-8.1% (Figure 7). Survival of 1988-l 992 brood Type-N coho ranged from 0.01-8. 1%. These fish contributed primarily to the Oregon fisheries, the Columbia River net fishery, and to the Washington coastal sport fisheries (Figure 8). Survivals of Elochoman Type-S coho range from 0.03-3.5% (Figure 8). Survivals of the 1988-l 992 broods ranged from 0.03-3.5%. These broods contributed primarily to the Oregon and Washington coastal sport and troll fisheries and to escapement (Figure IO).

Cowlitz River Hatchery- Cowlitz Hatchery rears and releases fall chinook, spring chinook, and Type-N coho. Survivals of fall chinook range from 0.05-l .7% (Figure 11). Most tag groups represent fish released in June at sizes ranging from 5.0-6.5 g, however, there have been some releases of large chinook in the fall months. Survivals of 1986-1990 broods of fall chinook ranged from 0.05%-0.9%. These broods contributed mainly to escapement (53.6%), but moderate catches were made by Washington coastal sport and troll fishers and Canadian fishers (Figure 12).

Cowlitz spring chinook survivals range from 0.8-l 0.2% (Figure 13). Most tag groups represent fish released as yearlings (45-60 g) in either March, April, or May. Survivals of 1986-1990 brood fish ranged from 0.45-2.6%. The majority of the survival was as escapement either to the hatchery or freshwater sport fisheries (Figure 14). Moderate catches were made by Washington coastal sport and troll fishers, and Canadian fishers. Two broods, 1988 and 1990, of tagged subyearling spring chinook survived at 0.07% and 0.02% respectively (Figure 15). These fish contributed primarily to escapement and the Washington troll fishery (Figure 16).

Survivals of Cowlitz Type-N coho range from 0.2-6.9% (Figure 17). Survivals of 1988-1992 broods ranged from 0.17- 4.6%. Oregon and Washington fishers accounted for most of the catch of these fish (Figure 18). The Columbia River net fishery and escapement accounted for 21% and 28% of the total survival , respectively.

North Toutle Hatchery- North Toutle Hatchery rears and releases Tule fall chinook and Type-S coho. The hatchery was destroyed in the 1980 eruption of Mt. Saint Helens. The hatchery was partially restored and operated in 1987, and is now in full production. Survivals of 1971-1977 brood fall chinook ranged from 0.3-0.9% (Figure 19). The survival of the 1987-1990 brood fall chinook ranged from 0.03%-0.13%. Chinook released at North Toutle Hatchery range in size from 4.5-5.5 g, and are released primarily in June. The majority of fish were caught by Canadian fishers, coastal sport

fishers and in the freshwater sport fishery (Figure 20). Escapement was nearly 49% of the total survival.

Toutle Type-S coho survivals range from 0.1-5.9% (Figure 21). Survivals of the 1988-1992 brood fish ranged from 0.2- 5.1%. Oregon and Washington coastal fishers caught the majority of these fish. Escapement averaged nearly 36% of the total survival (Figure 22).

Fallert Creek Hatchery- Fallert Creek Hatchery rears and releases Tule fall chinook, spring chinook, and Type-S coho. Fall chinook are typically reared until June and released at 4.5-5.5 g. Tag data for this hatchery are limited (Figure 23) and have ranged from 0.06-I .O%. This hatchery was only recently included in this project (I 991 brood) and therefore no current survival or contribution data are available.

Spring chinook are normally reared until late-March or April and released at sizes ranging from 45-55 g. These fish were included in the project beginning with the 1989 brood and survived at 0.36%. The 1990 brood survival was 0.39% (Figure 24). Nearly 62% of the total survival was to escapement (Figure 25). The freshwater sport fishery also had a large component (22%) of the total survival.

Tag groups of 1980 and 1981 brood Type-N coho were released from the hatchery and had survivals of 2.7% in each brood. Survivals of the 1988-1992 broods of Type-S coho range from 0.3-6.0% (Figure 26). Oregon and Washington coastal sport fishers harvested the largest proportion of these fish. Nearly 31% of the total survival was to escapement (Figure 27).

Kalama Falls Hatchery- Kalama Falls Hatchery rears and releases fall chinook, and Type-N coho. Fall chinook are reared to 4.5-5.5 g and released in late-May to July. Fall chinook (1971-1981 broods) survivals have ranged from 0.1-I .4% (Figure 28). The 1988 brood was most recently tagged as part of a release timing study. Single tag groups were released in each of three months: June, July, and August of 1989. The average survival of the three 1988 brood groups was 0.17%. The June release had the lowest overall survival and the July group the highest overall survival. About 41% of the total survival was to escapement (Figure 29). Fish were harvested in greater proportion in the Canadian and Alaska fisheries.

Type-N coho survivals range from 0.1-8.9% (Figure 30). No tagged fish of this stock

were released prior to 1983. The survivals of the 1988-l 992 broods ranged from 0.1%-8.9%. Columbia River gillnetters caught the highest proportion, 38%, of these fish (Figure 31). Oregon fishers also caught a large proportion of these fish.

Lewis River Hatchery- Lewis River Hatchery rears and releases spring chinook and both Type-N and Type-S coho. The hatchery has reared only a few broods of fall chinook. The 1988 through 1990 brood spring chinook were tagged with funds provided by Pacific Power and Light Company. Survival of these broods ranged from 0.4%-2.1% (Figure 32). Escapement and the freshwater sport fishery accounted for over 74% of the total survival (Figure 33). The Canadian and Washington troll fisheries each harvested significant numbers of these fish.

Six broods of Type-N coho have been tagged at Lewis River Hatchery. Funding for this tagging is from the Pacific Salmon Treaty (PST). Survivals range from 0.6-8.4% (Figure 34). Survivals of the 1988-1992 broods ranged 0.6-6.7%. The Washington and Oregon coastal sport fisheries caught moderate numbers of these fish. The Columbia River net fishery and escapement accounted for the majority of the total survival (Figure 35).

Survivals of Type-S coho range from 0.2-6.9% (Figure 36). The survival of 1988-92 broods ranged from 0.3% to 5.6%. The majority of the survival of these broods was to the Oregon and Washington coastal fisheries. Escapement accounted for about 41% of the total survival (Figure 37). The 1990 brood was reared at Speelyai Hatchery.

The Lewis River supports a viable self-sustaining population of naturally reproducing fall chinook. Survivals of these wild chinook range from 0.1-l .9% (Figure 38). Survivals of the 1986-l 990 broods ranged from 0.1-l .8%. The majority of the survival was to escapement (60%). Significant catches were made by Canadian, and Columbia River gillnet fisheries (Figure 39).

Speelyai Hatchery- Speelyai Hatchery rears both coho and spring chinook, but transfers most of these fish to Lewis River. Releases directly from the hatchery support a resident coho fishery in Merwin Lake. There was one release of **1990** brood year spring chinook yearlings. Survival was 0.13%,with the majority of the survival to escapement, 64%.

Washougal River Hatchery- Washougal Hatchery rears and releases tule fall chinook and Type-N coho. Type-S coho have been reared at the hatchery in the past. The

hatchery also provides Type-N coho for off-station plants into the Klickitat River as part of mitigation for the U.S. v. Oregon court decision. These fish are released either directly into the river from transport trucks, or for one year from Champion Pond.

Fall chinook survivals range from 0.3-I .5% (Figure 40). Generally, higher survivals have been obtained from larger fish (> 15 g) released in the early fall, however most of the chinook production is released in June at sizes ranging from 4.5-6.0 g. Survivals of the 1986, 1987, 1989 and 1990 broods were all about 0.2%. Canadian fisheries and escapement accounted for most of the survival (Figure 41).

Survivals of Type-N coho released on-station range from 0.1-5.2% (Figure 42). Survivals of 1988-1992 brood coho ranged from 0.1-4.6%. Most of the catch was by Oregon and Washington coastal sport fishers and Canadian trollers. Escapement and Columbia River net catches accounted for about 27% and 24% of the total survival, respectively (Figure 43).

Fewer Type-N coho released off-station into the Klickitat River survived than those released at either Washougal or Klickitat Hatcheries. Survival of the 1988-1992 broods ranged from 0.03-I .6% (Figure 44). The majority of the surviving fish released off-station contributed to the Oregon and Washington coastal fisheries and the Columbia River net fishery. Escapement amounted to 6.0% of the total survival (Figure 45).

Klickitat River Hatchery- Klickitat Hatchery currently rears Upriver Bright chinook that are imported as eggs from Lyons Ferry Hatchery. Prior to introducing this stock at Klickitat, Tule fall chinook were released. The hatchery also rears and releases spring chinook and Type-N coho. Type-S coho were reared previously. Spring chinook have been tagged in recent years as part of a BPA funded experiment to determine the effects of acclimation to river water prior to release. Survivals of fall chinook range from 0.03-1% (Figure 46). Survival of 1986, 1989 and 1990 brood chinook was 0.4%, 0.06% and 0.17%, respectively. The majority of the catch was in the Columbia River net fishery, the Canadian troll fishery and Alaska fisheries (Figure 47). Escapement accounted for the largest (27%) component.

Survival of 1989 and 1990 brood spring chinook was 0.29% and 0.08% (Figure 48). Nearly 91% of the total survival was in escapement (Figure 49).

Survivals of Type-N coho have range from 0.1-4.5% (Figure 50). Survival of the 1988-

1992 broods ranged from 0.1-I .7%. Washington and Oregon coastal sport fishers, and Columbia River netters caught the majority of the fish from these broods (Figure 51). Only a few fish (0.2%) returned to the hatchery.

Lyons Ferry Hatchery- Lyons Ferry Hatchery rears and releases Snake River fall chinook. In recent years 100% of the releases have been marked or tagged to ensure the genetic purity of this stock. The hatchery generally releases four groups of fall chinook, both yearlings or subyearlings. About half of the yearling and subyearling production is loaded onto barges and released downstream of the hatchery, bypassing several dams. Survivals of sub-yearling fish (range: 0.01-0.6%, Figure 52) have been much lower than survivals of yearling fish (0.7-7.4%; Figure 53). Survivals of barged fish, regardless of age, have been equal to or greater than survivals of fish released on-station (Figures 52 and 53). Subyearling fish, released on-station or barged, contributed primarily to the Columbia River net fishery, the Canadian commercial fisheries, and escapement (Figure 54). Escapement of subyearling fish released on-station appears to be slightly lower than those released from barges (Figures 54 and 55). Contribution of yearling fish, regardless of release type, has been mainly to Canadian, Columbia River net, and Washington coastal troll fisheries (Figures 56 and 57). Escapement amounted to approximately 31% of the survival, however the estimated escapement reported here is an underestimate because data from trapping operations at the dams are not available. The method of release did not appear to affect fishery distribution within either the subyearling or yearling groups.

Tucannon River Hatchery- The Tucannon Hatchery is a satellite rearing and capture location operating in conjunction with the Lyons Ferry Hatchery. Wild spring chinook returning to the Tucannon River were captured at the Tucannon River trap beginning in 1985 to supply to supply brood for the hatchery releases. Adults are now transported to the Lyons Ferry Hatchery and spawned there. This change in procedure has resulted in higher adult pre-spawning survivals, and higher egg to fry survivals. After rearing to approximately 18 g at the Lyons Ferry Hatchery, these fish are transported to an acclimation pond at the Tucannon Hatchery, reared through the winter, and volitionally released in the spring. Survivals of these yearling plants have ranged from 0.03-0.35% (Figure 58). About 98% of the total survival of the 1986-1990 broods was to escapement. A few fish have been captured in Oregon test fisheries, Washington freshwater sport fisheries (Figure 59). No tag recoveries from these broods were found in the Columbia River net fishery.

Ringold Springs Hatchery- Ringold springs hatchery rears spring chinook and in the past has reared a few groups of upriver bright fall chinook. The fish are released as yearlings ranging in size between 45-l 15 g. Broods between 1978 and 1988 were not tagged. Survival of the 1989 and 1990 brood spring chinook was 0.41% and 0.019%, respectively (Figure 60). All surviving fish were recovered at the hatchery (53%) or the freshwater sport fishery (45%)(Figure 61).

Priest Rapids Hatchery- Priest Rapids Hatchery rears and releases Upriver Bright chinook. Most fish are released in June as subyearlings ranging in size from 5-9 g. Survivals have ranged from 0.1-2.0% depending on brood (Figure 62). Survivals of the 1986-l 990 broods ranged from 0.1%-0.6%. The majority of the survival of these broods was in Alaska and Canadian fisheries, the Columbia River net fishery, and escapement (Figure 63).

Hanford Reach Wild Upriver Bright (URB) Fall Chinook: In 1988 efforts were begun to capture juvenile fall chinook that are naturally produced along the Hanford Reach of the Columbia River. Juveniles are captured in June when about 1.5-2.5 grams in size. The fish are tagged and released back into the river. Survivals of the 19867-l 990 broods ranged from 0.12-0.34% (Figure 62). The majority of the survival was to the Alaska, and Canadian fisheries, the Columbia River net fishery, and escapement (Figure 64).

Rocky Reach Hatchery- Rocky Reach Hatchery rears fall chinook and coho, although the coho program was discontinued after 1993 and replaced with a subyearling fall chinook program. Rocky Reach rears and releases both yearling and subyearling fall chinook. The yearling fish are released at 41-50 g in April or May. Survivals of yearling fish have ranged from 0.07-3.6% (Figure 65). The 1986-1990 brood survivals ranged from 0.08-0.6%. Chinook released as yearlings contributed primarily to the Canadian and Columbia River net fisheries (Figure 66). Escapement was approximately 25% of the total survival.

Rocky Reach coho were tagged only in 1976, 1989 and 1991. Survivals were 0.9%, 0.2% and 0.01%, respectively (Figure 67). The majority of survivors contributed to the Oregon sport fishery, the Canadian troll, and the Columbia River net fishery (Figure 68).

Eastbank Hatchery Complex- The Eastbank complex consists of a central adult holding, incubation, and rearing facility with associated acclimation ponds located on the Chiwawa River, Wenatchee River, Similkameen River, and net pens located on Lake Wenatchee. Chiwawa River spring chinook yearlings are released from acclimation ponds located on the Chiwawa River. The 1989 and 1989 broods survived at 0.44% and 0.04%, respectively (Figure 69). Most of this survival was to escapement, although some fish were caught in the fresh water sport fishery (Figure 70). Dryden Pond is located on the Wenatchee River and rears and releases Wenatchee summer chinook yearlings. Survival of the 1989 and 1990 broods was 0.51% and 0.04%, respectively (Figure 71). Alaska and Canadian fishers caught the majority of these fish, although catches were made in a number of fisheries (Figure 72). Escapement was 50% of the total survival. The Similkameen Pond rears and releases yearling summer chinook. Survival of the 1989 and 1990 broods was 1.75% and 0.1 1%,respectively (Figure 73). Fishery catches for this group were very similar to the Dryden Pond group (Figure 74), with most fish caught by Alaska and Canadian fishers, however Similkameen Pond had a large escapement of 58%.

Wells Dam Hatchery- Wells Dam Hatchery rears and releases yearling and subyearling summer chinook. Yearling summer chinook are released at sizes ranging from 30-45 g in mid-April. Survivals of yearling releases have ranged from 0.1-0.9% (Figure 75). Survivals of the 1986-1990 brood yearlings ranged from O.l%-0.5%. These broods contributed primarily to Canadian and Alaskan fisheries and to escapement (Figure 76).

Survivals of 1986-1990 brood subyearling releases ranged from 0.03%-0.2%, (Figure 77). Contribution of subyearling fish was primarily to Canadian fishers, Columbia River net fisheries and to escapement (Figure 78).

SUMMARY

In FY-96 all three objectives were met. Under **objective one,** at least one production group from every hatchery was coded-wire tagged. Tag numbers declined from previous fiscal years due to shortages of fish at some hatcheries, or changes in rearing programs. Under **objective** two, returning adults to each hatchery were surveyed for the absence of an adipose fin and the snout from these fish was removed. Coded-wire tags were extracted from these snouts and the data will be sent to the PSMFC data base in Portland, Oregon. For **objective three** survival and contribution rates were determined

for coho salmon released between 1990 and 1994 (1988-1992 broods) and chinook released between 1987 and 1991 (1986-1990 broods). Figures I-80 depict the data base for both estimated survival and contribution by brood.

The data show a continued trend toward low survival for both strains of coho from the 1989-l 992 broods. Coho survivals vary among hatcheries but in some cases, are equal to, or lower than survivals of subyearling fall chinook of the same brood. The cause for the continued low survivals of coho may be due to unfavorable ocean conditions caused by the 1992-93 El Nino and the lingering pool of warm water that resided off the Washington coast through 1994. Survivals of fall chinook sub-yearlings and spring chinook yearlings tended to be lower than 0.5% for the past few broods, regardless of hatchery or natural origin. Presumably the same factors affecting coho survival are affecting chinook survivals.

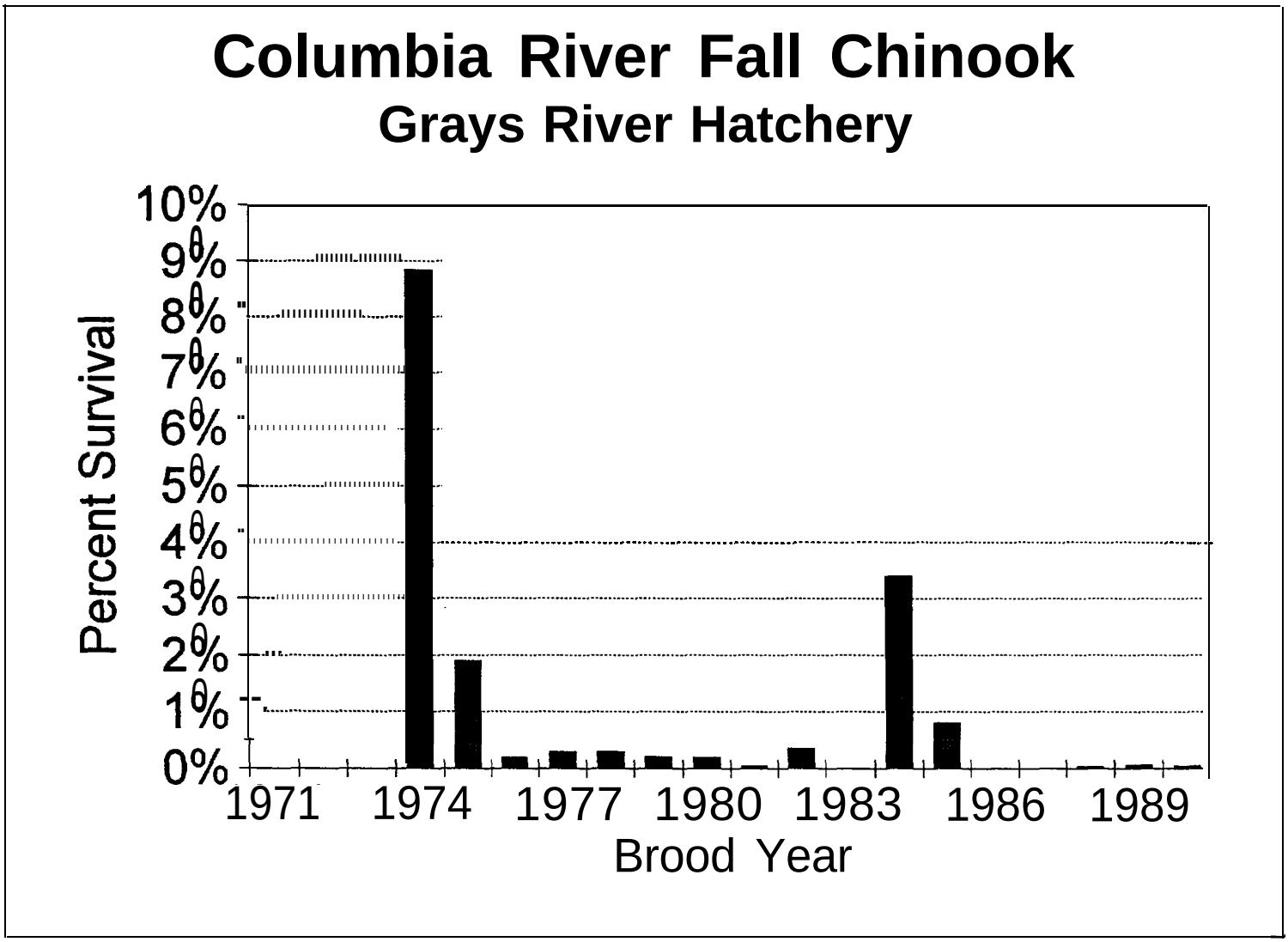

Figure 1. Survival by brood of Grays River Hatchery fall chinook.

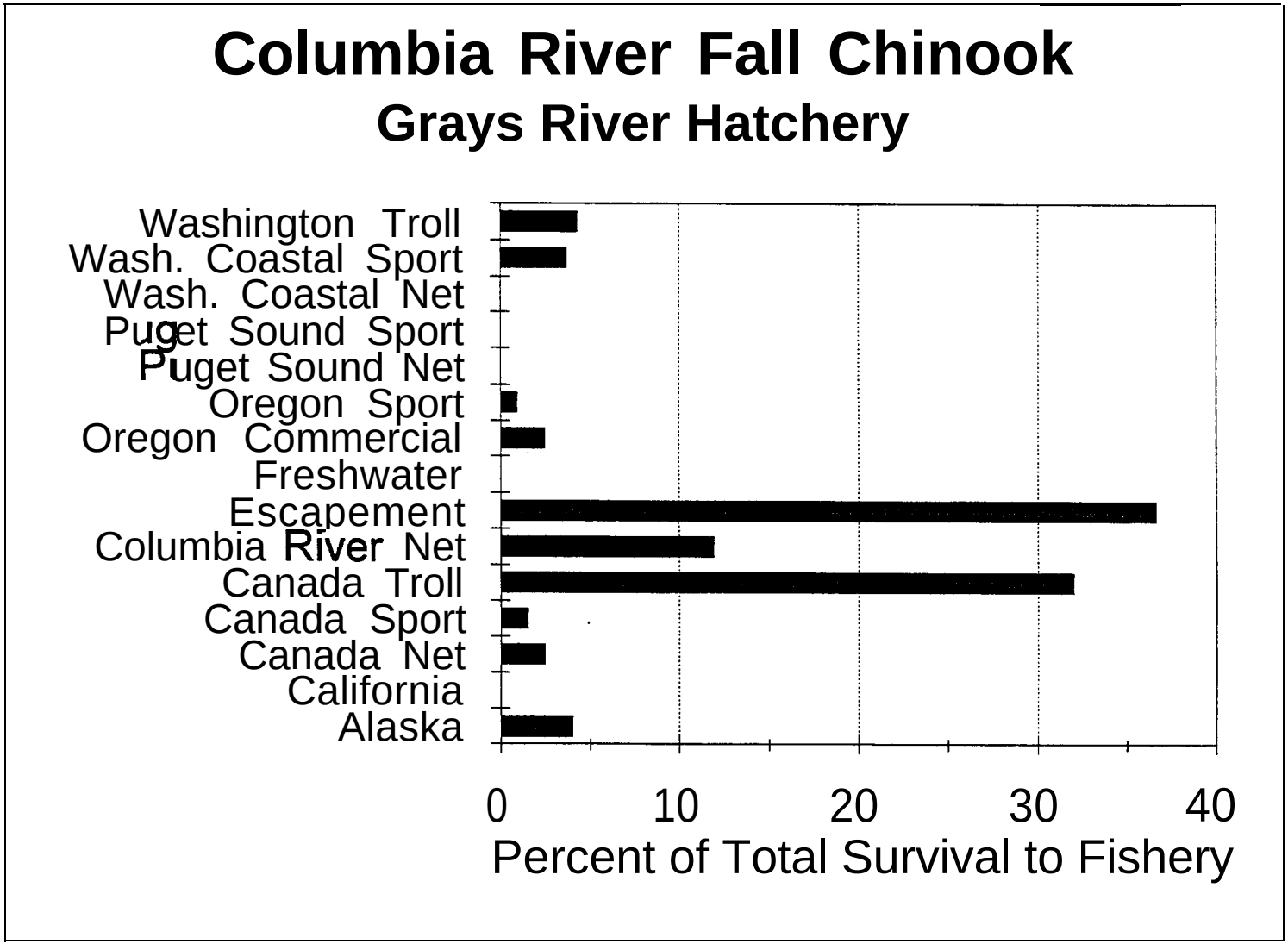

Figure 2. Percent of total survival to fisheries and escapement of 1989 through 1990 brood Grays River Hatchery fall chinook.

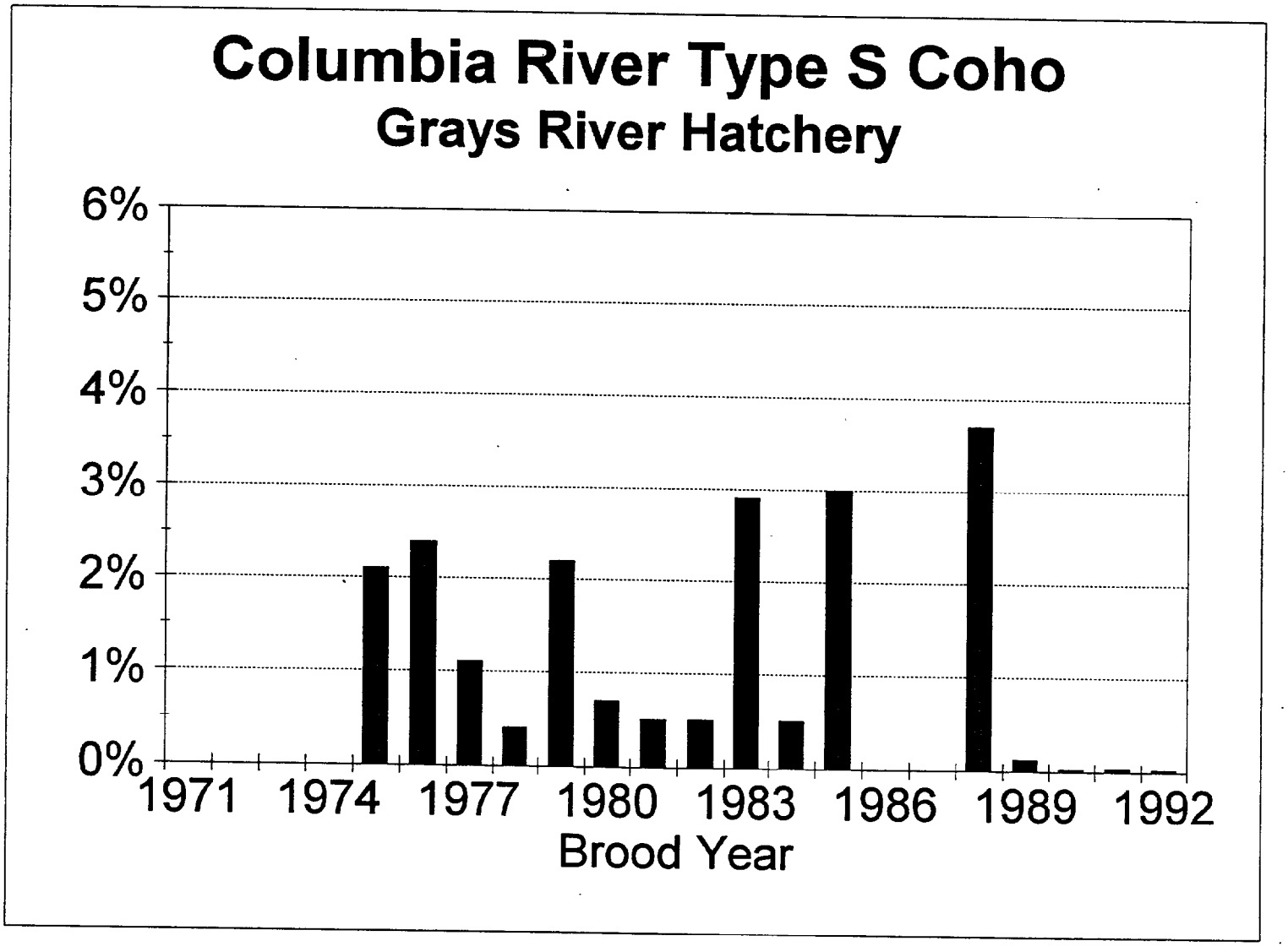

Figure 3. Survival by brood of Grays River Hatchery Type S coho.

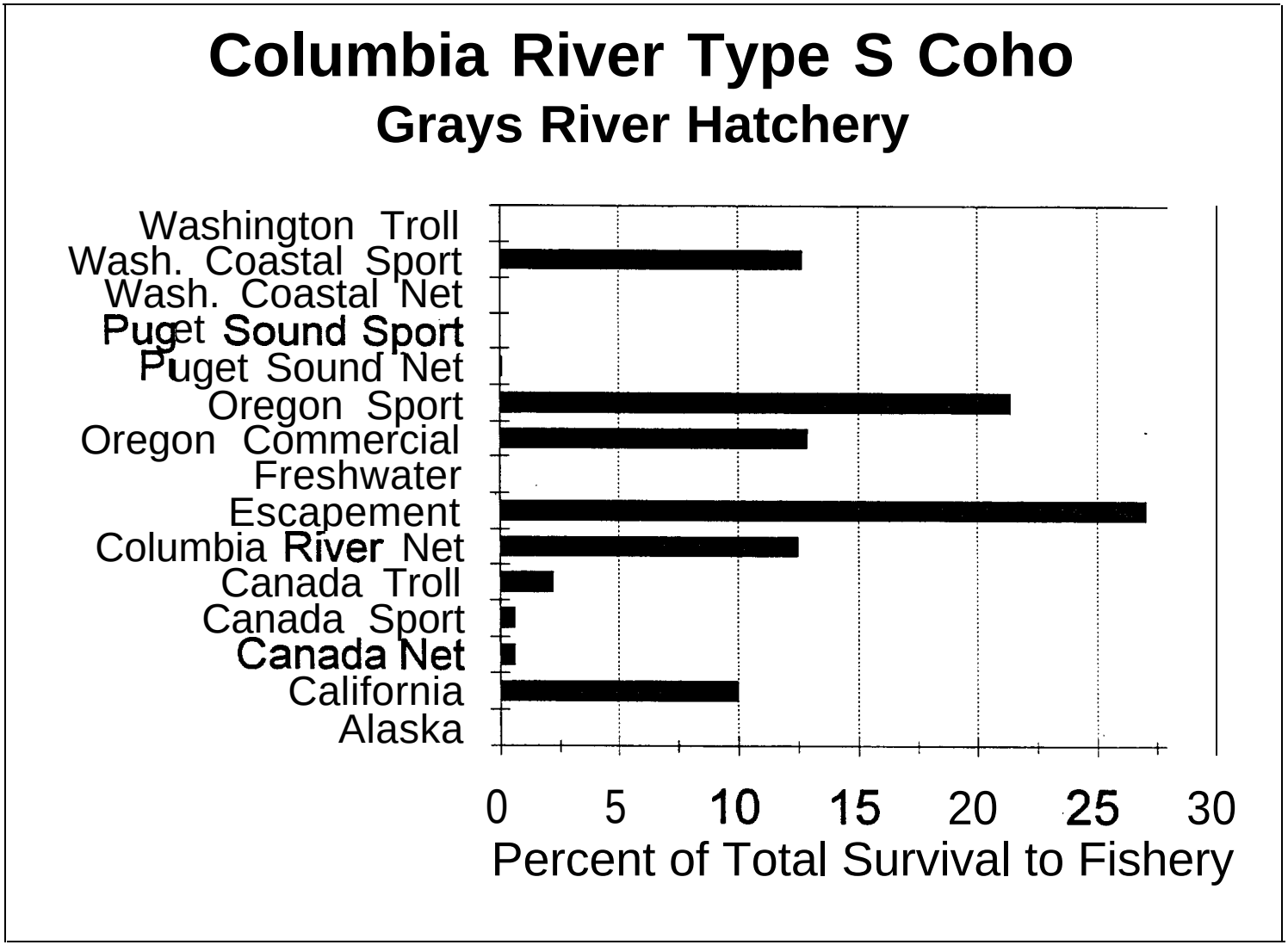

Figure 4. Percent of total survival to fisheries and escapement of Grays River Hatchery 1988-l 992 broods Type S coho.

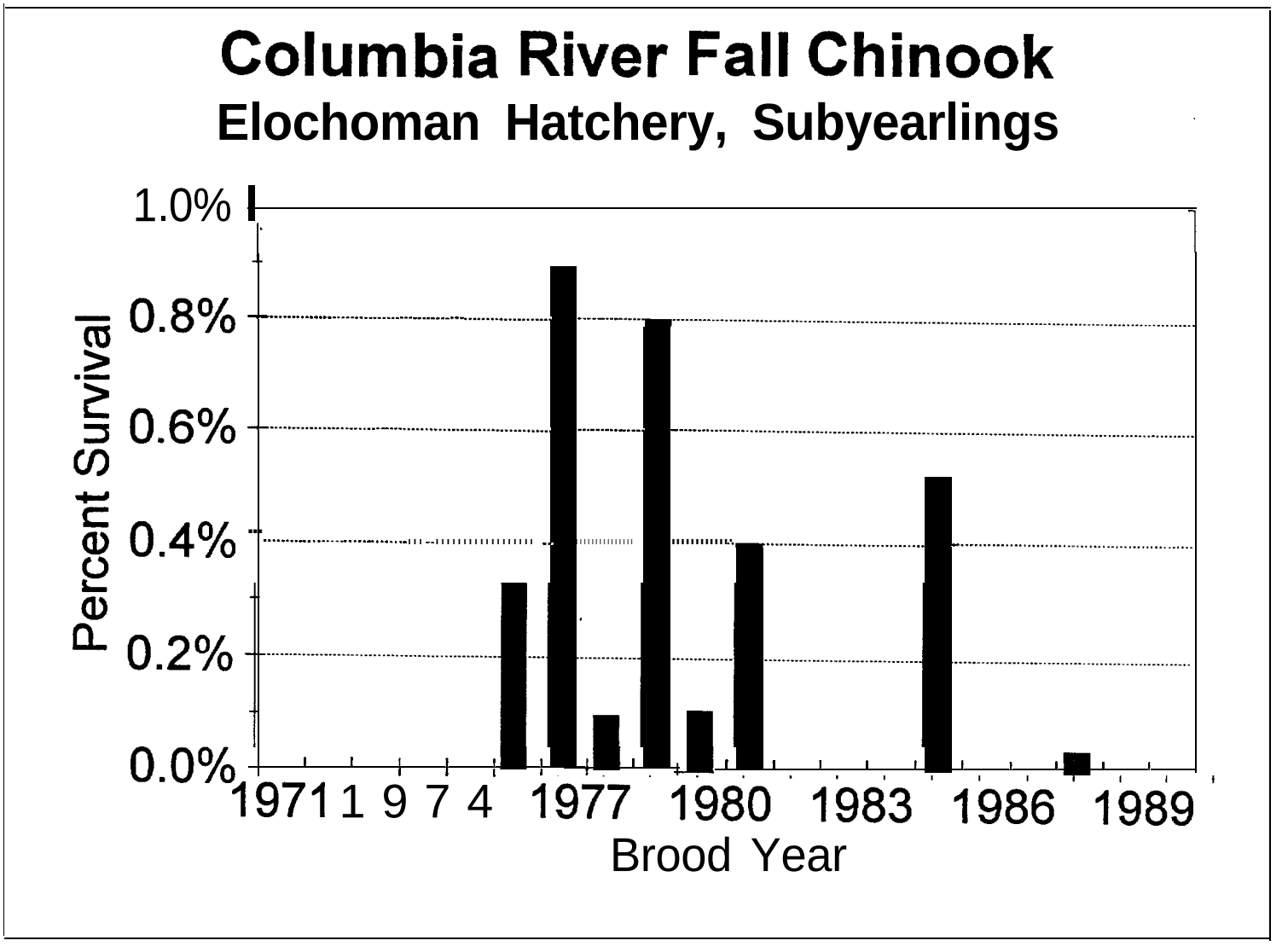

Figure 5. Survival by brood of Elochoman Hatchery fall chinook.

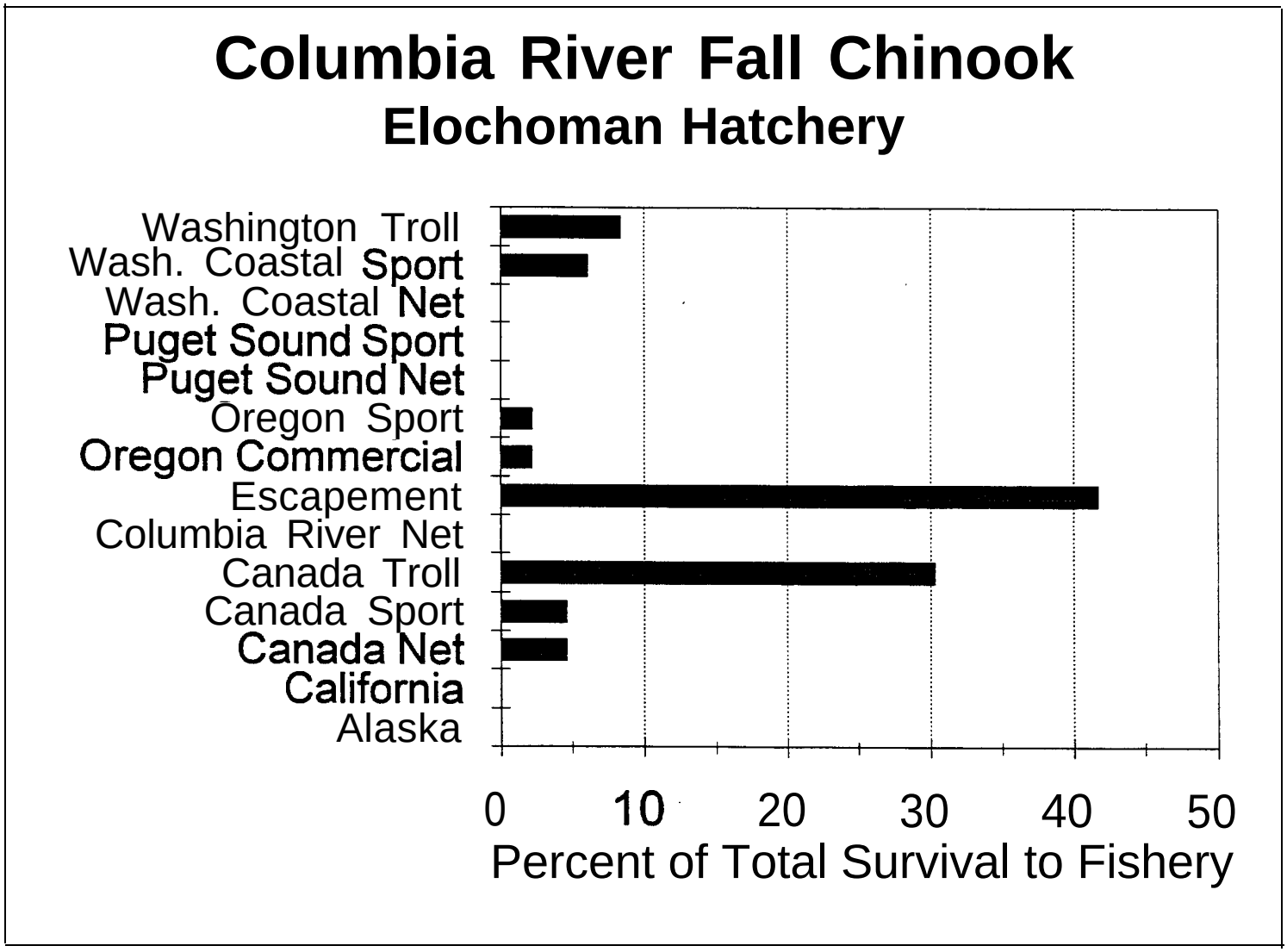

Figure 6. Percent of total survival to fisheries and escapement of Elochoman Hatchery 1988 brood fall chinook.

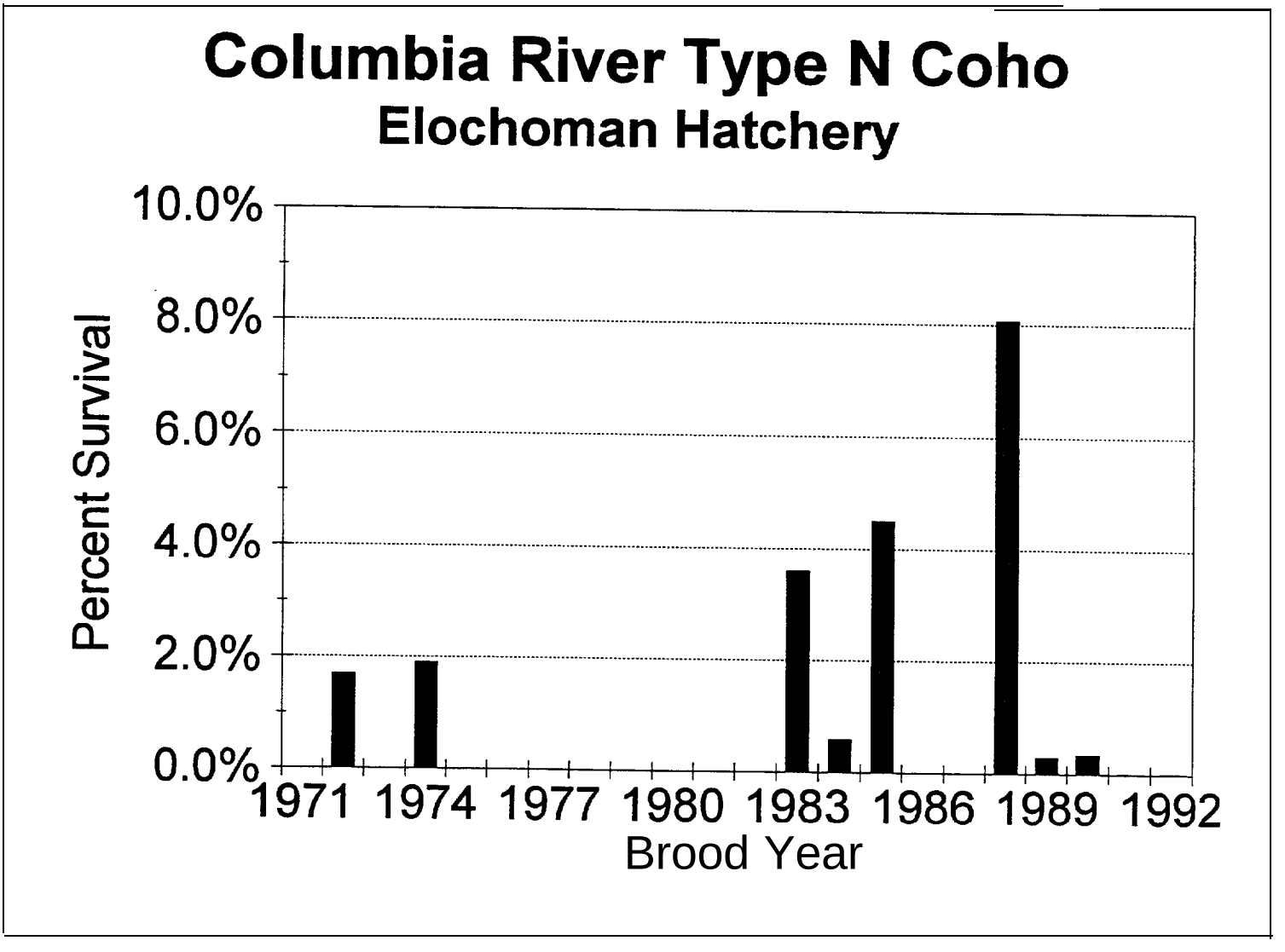

Figure 7. Survival by brood of Elochoman Hatchery Type N coho.

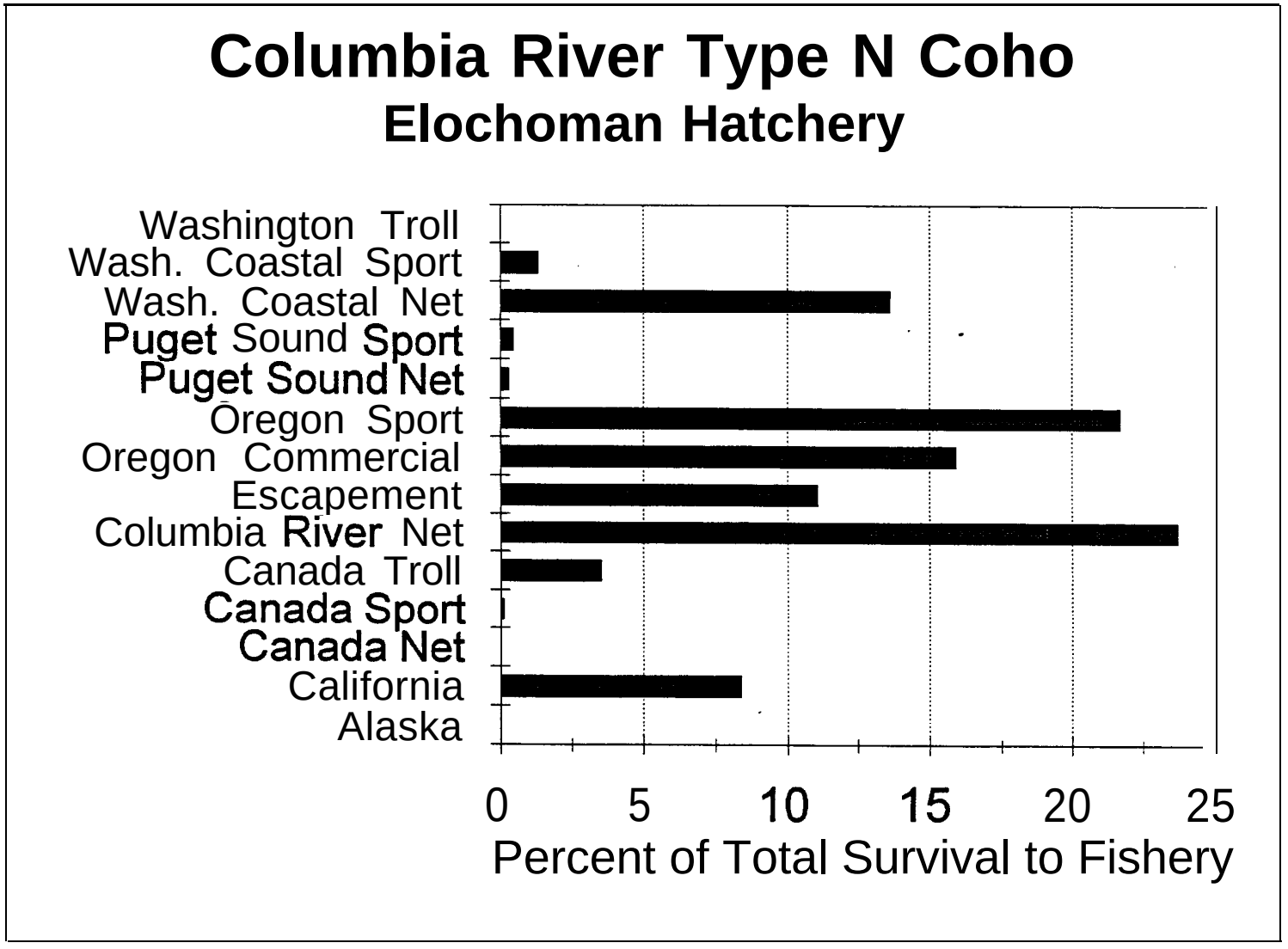

Figure 8. Percent of total survival to fisheries and escapement of Elochoman Hatchery 1988-1992 broods Type N coho.

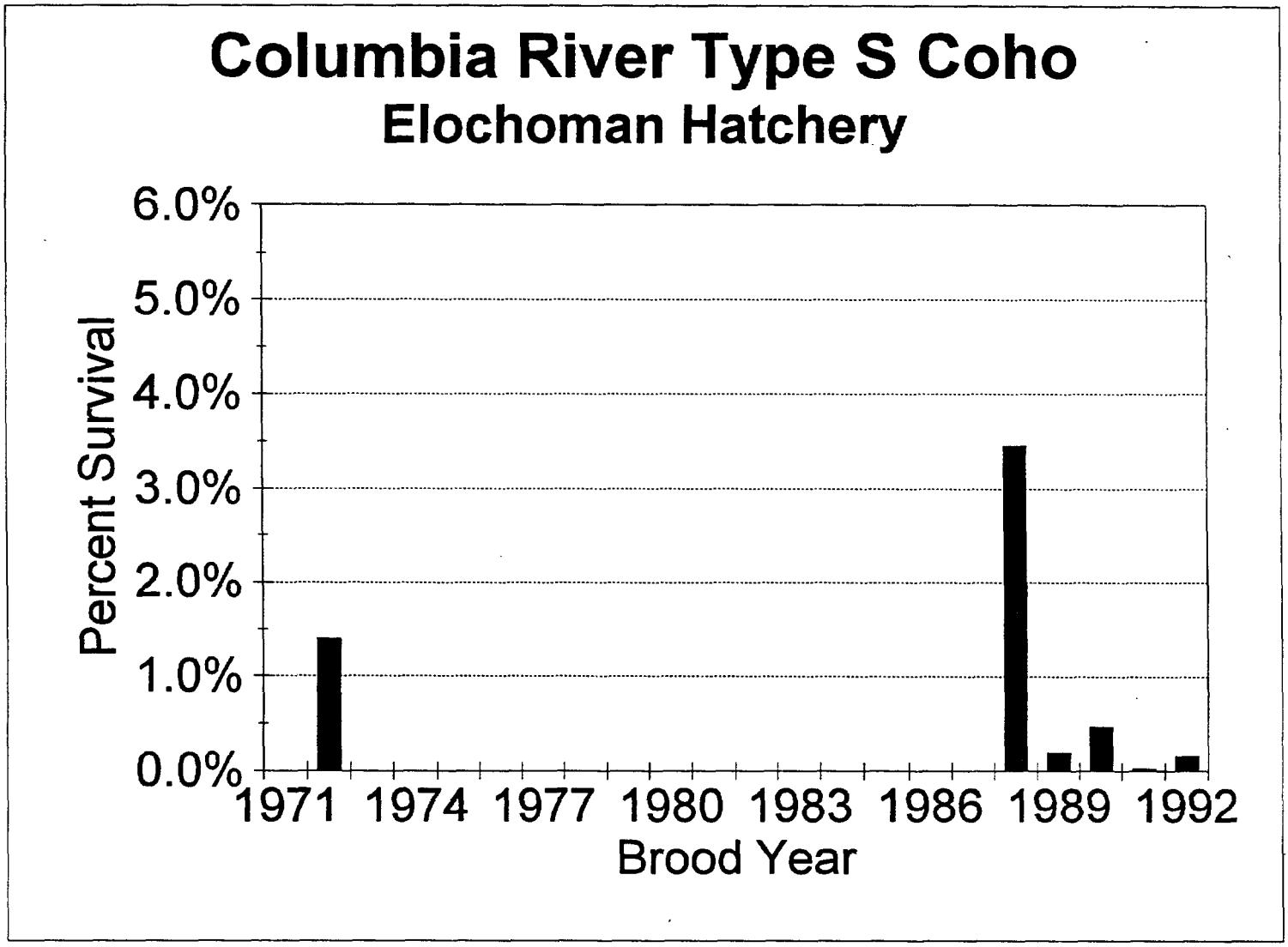

Figure 9. Survival by brood of Elochoman Hatchery Type S coho.

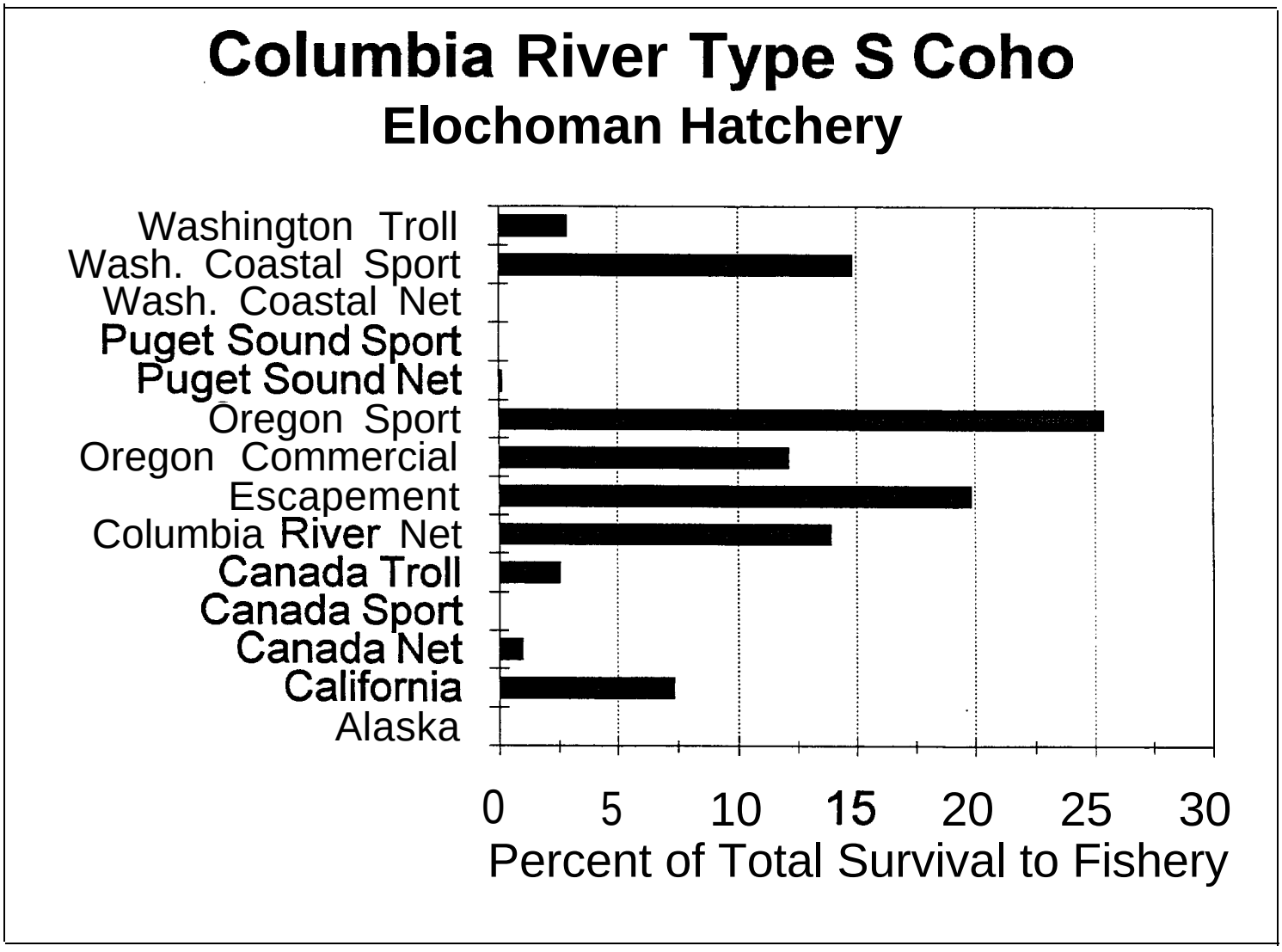

Figure 10. Percent of total survival to fisheries and escapement of Elochoman Hatchery 1988-l 992 broods Type S coho.

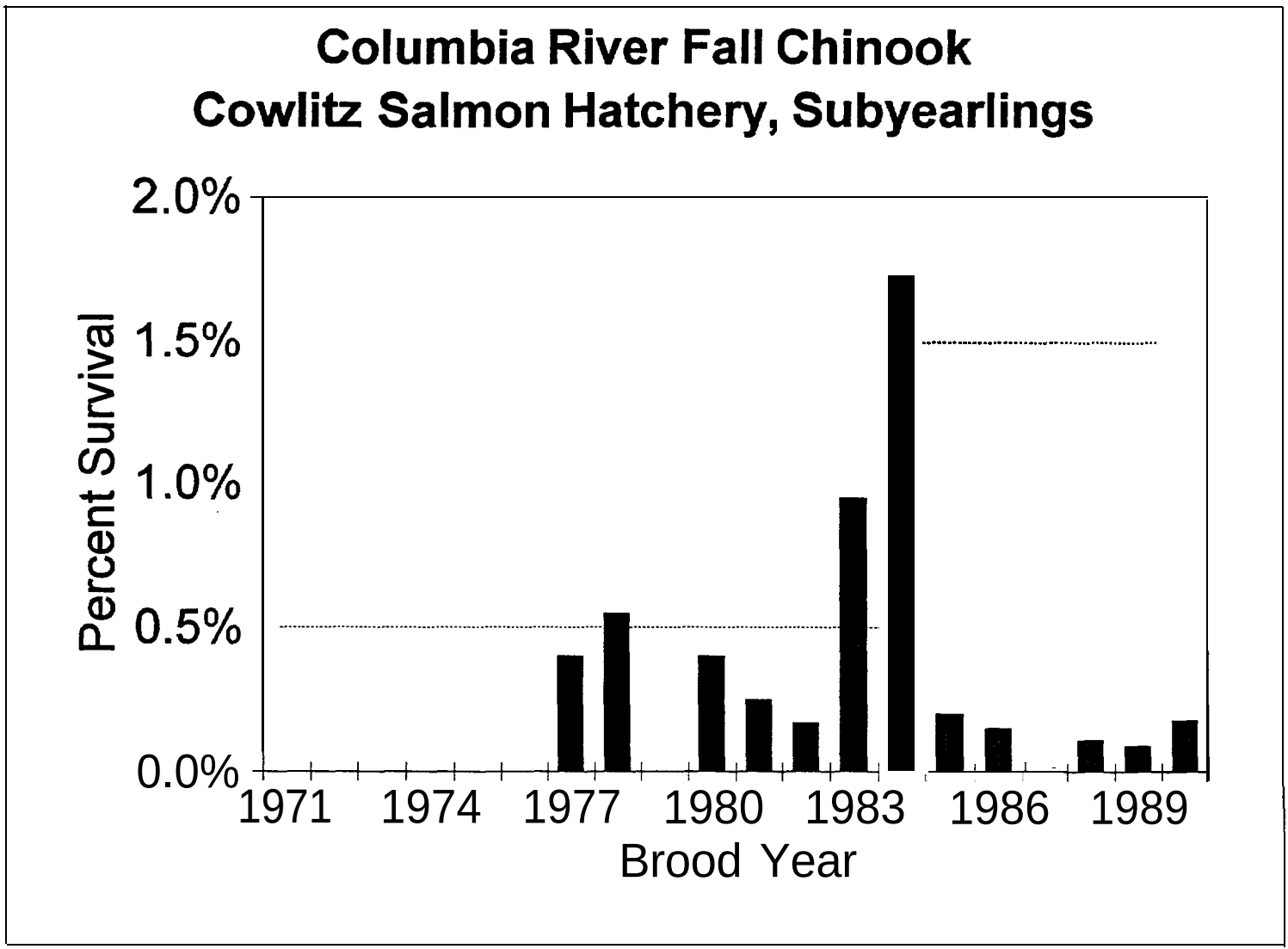

Figure II. Survival by brood of Cowlitz Hatchery fall chinook.

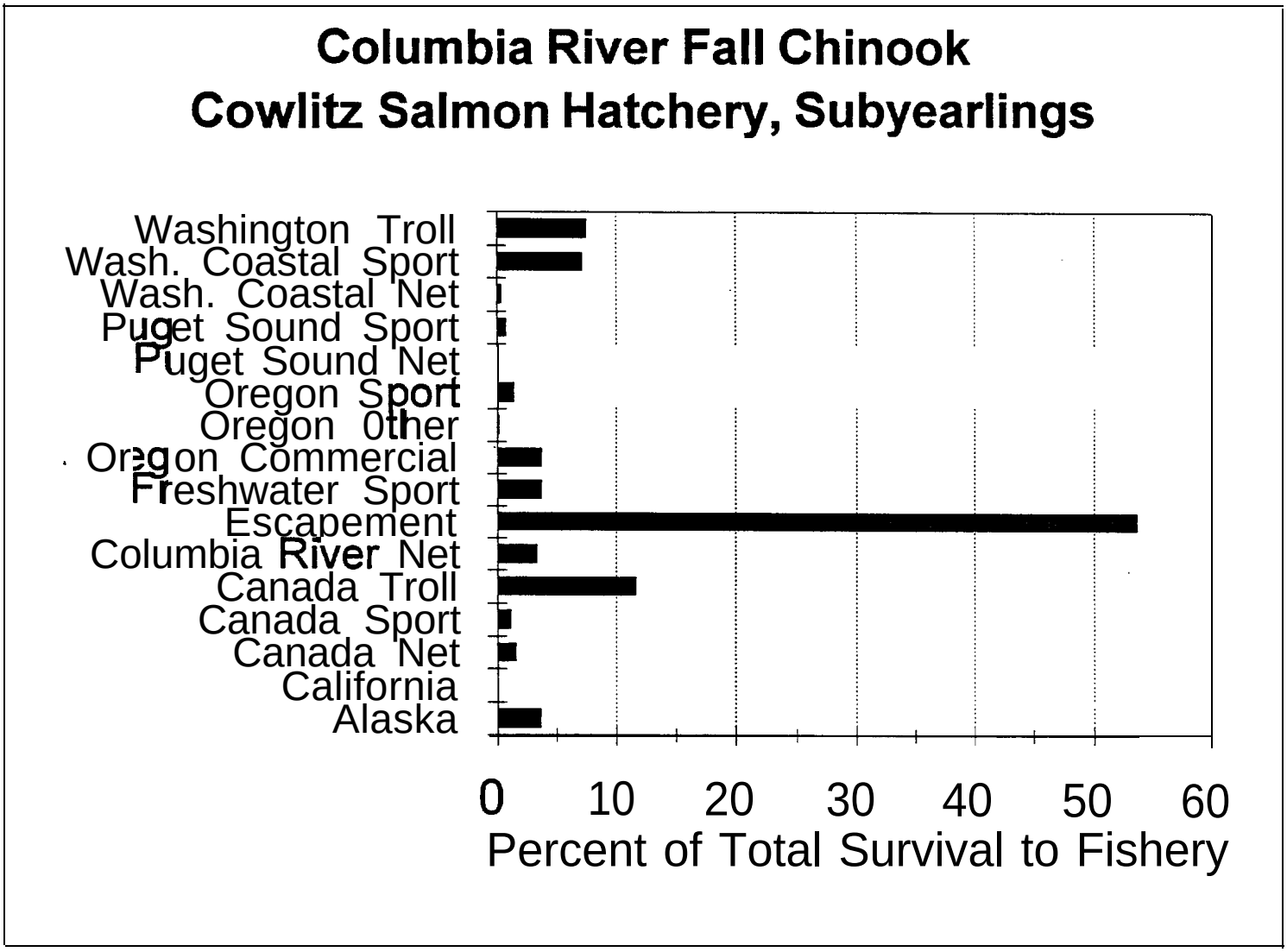

Figure 12. Percent of total survival to fisheries and escapement of Cowlitz Hatchery 1986-l 990 broods fall chinook.

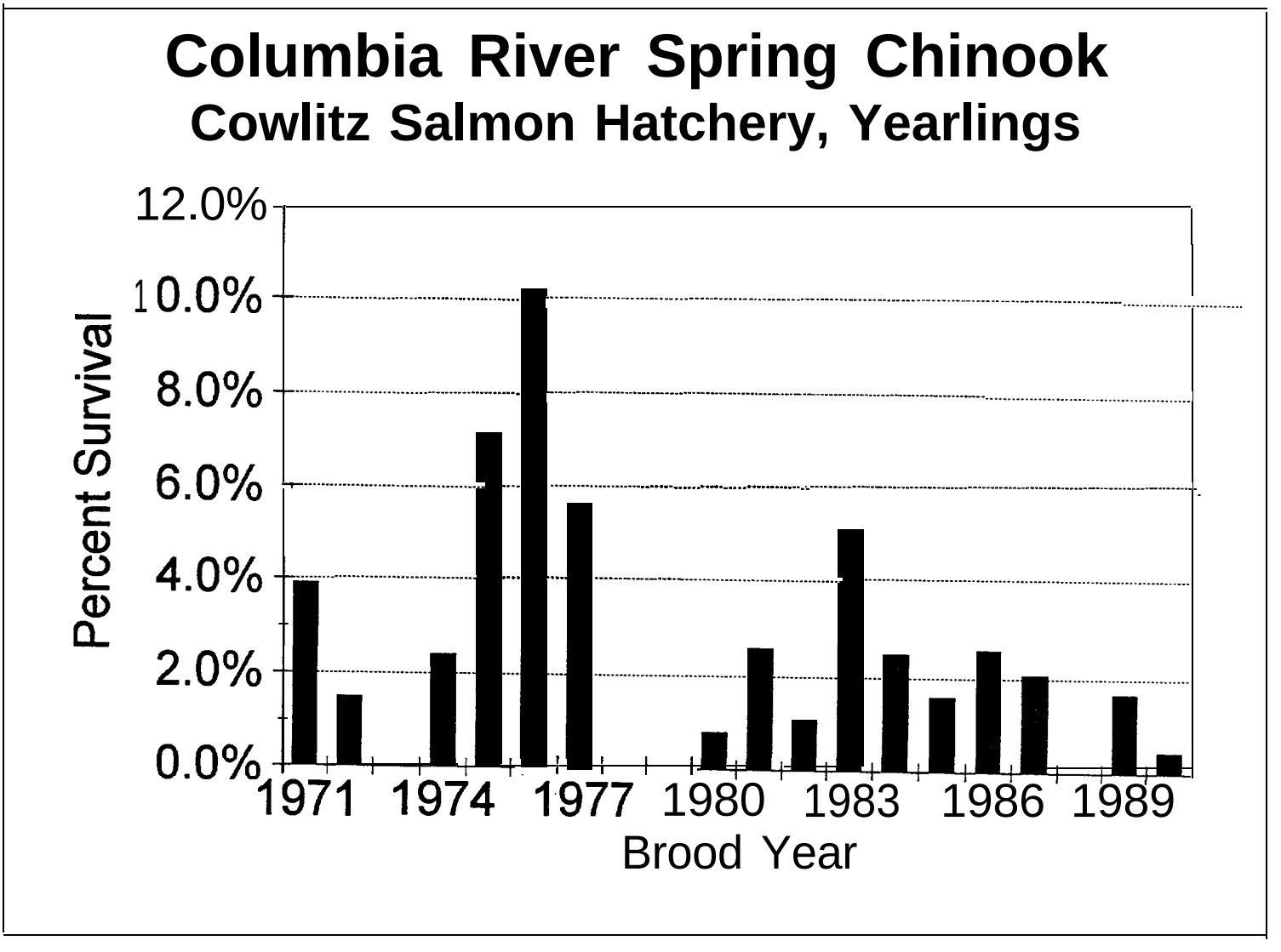

Figure 13. Survival by brood of Cowlitz Hatchery yearling spring chinook.

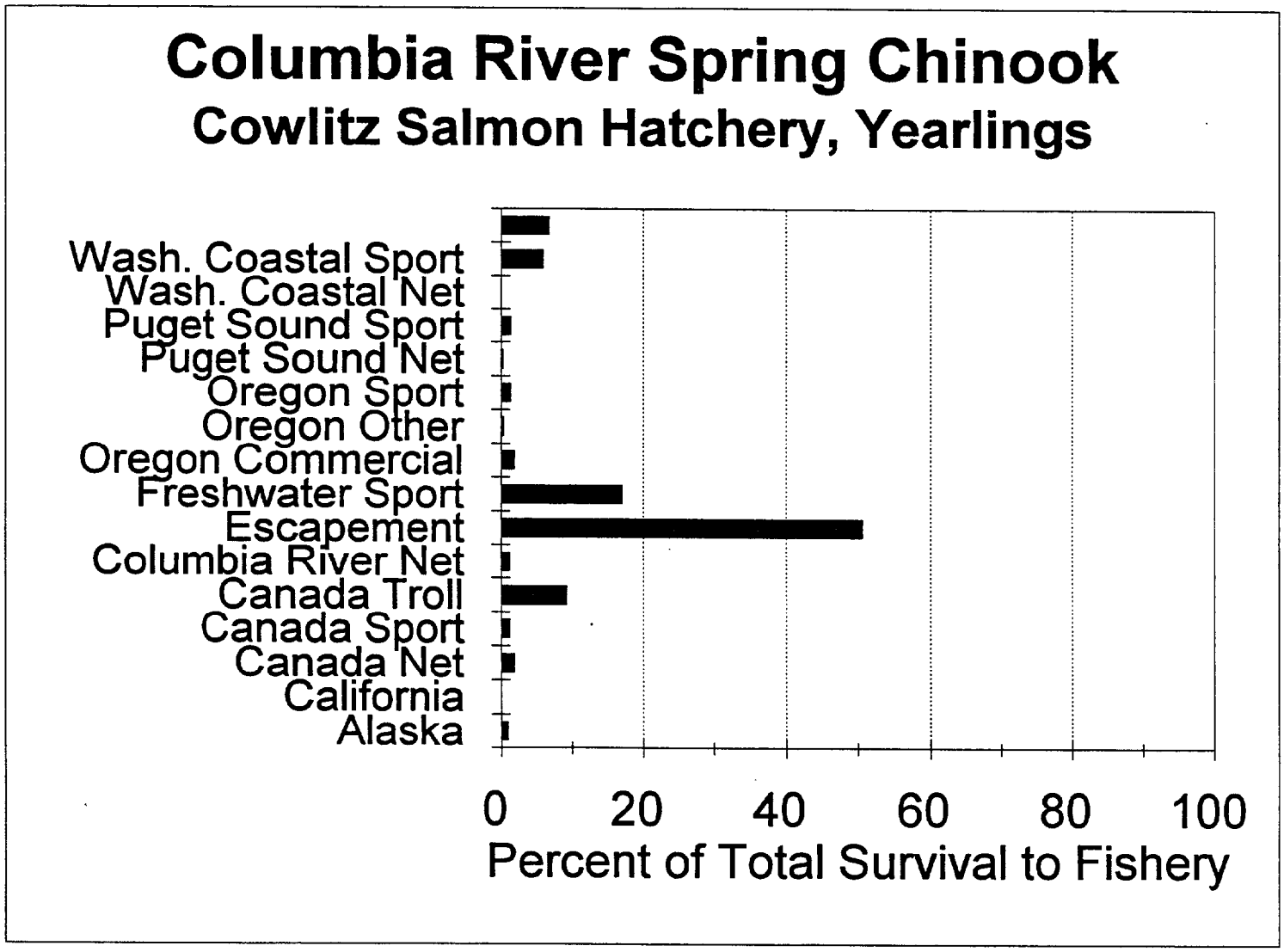

Figure 14. Percent of total survival to fisheries and escapement of Cowlitz Hatchery 1986,1987, 1989 and 1990 brood yearling spring chinook.

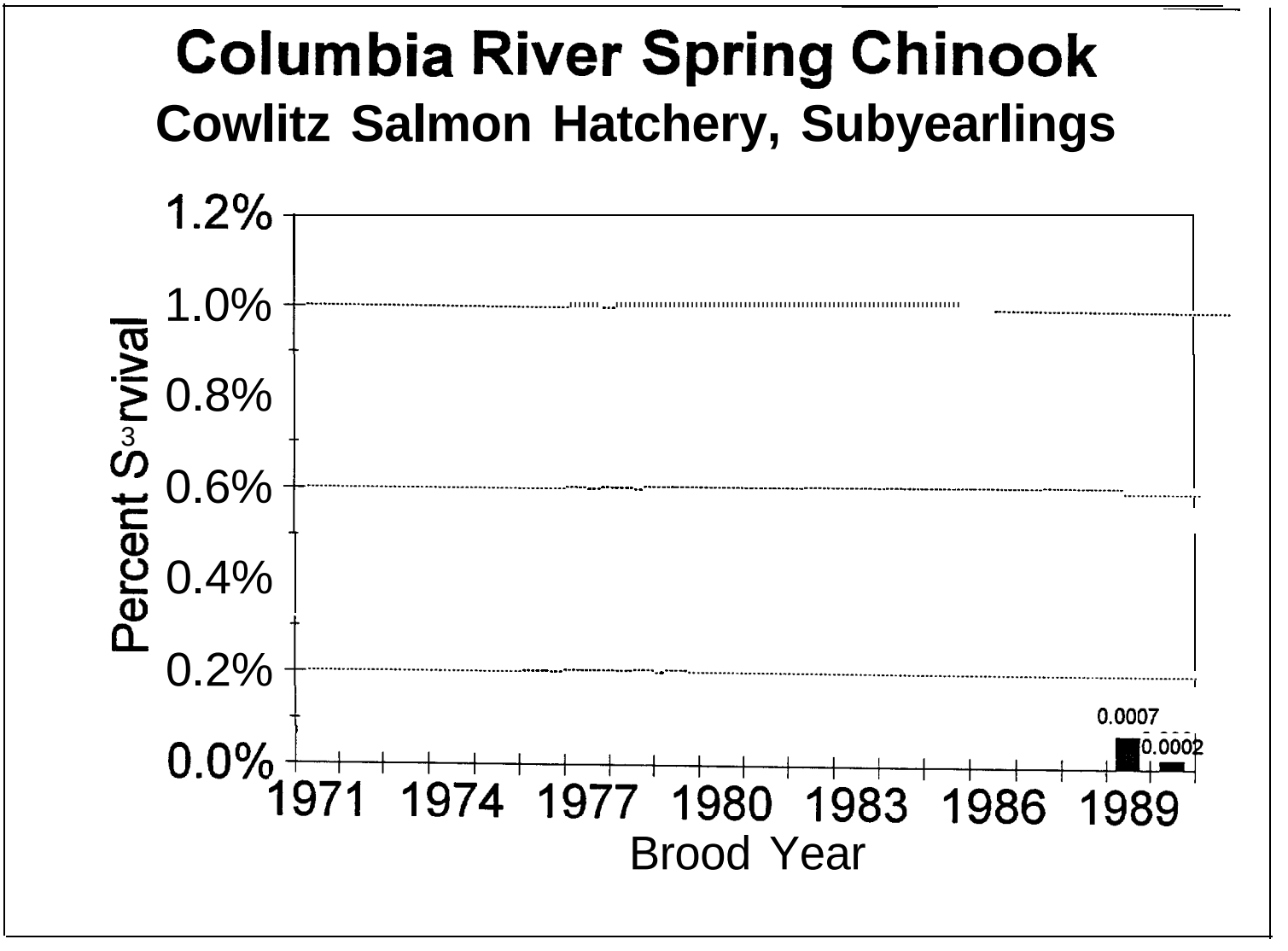

Figure **15.** Survival by brood of Cowlitz Hatchery subyearling spring chinook.

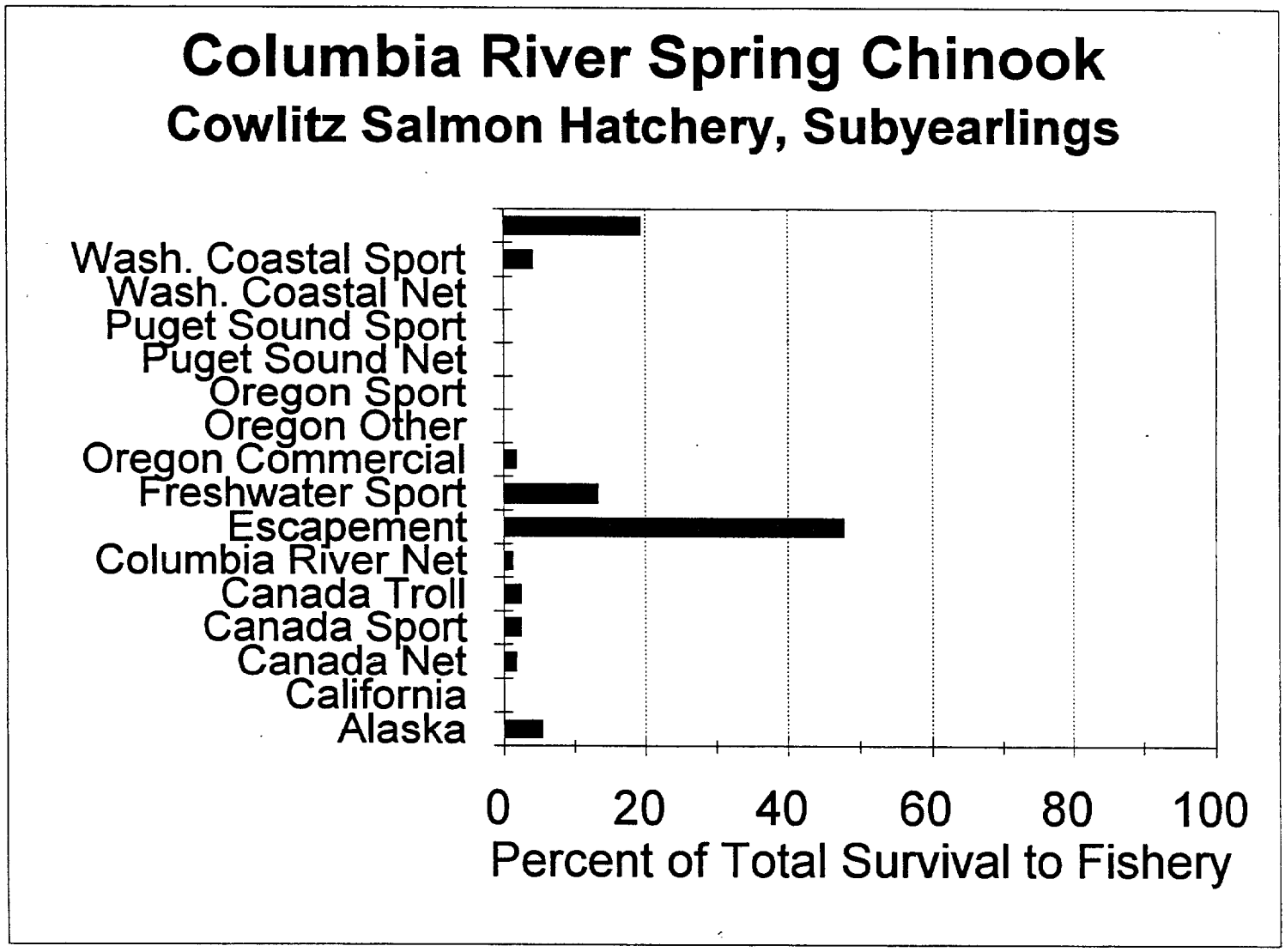

Figure 16. Percent of total survival to fisheries and escapement of Cowlitz Hatchery 1989 and 1990 brood subyearling spring chinook.

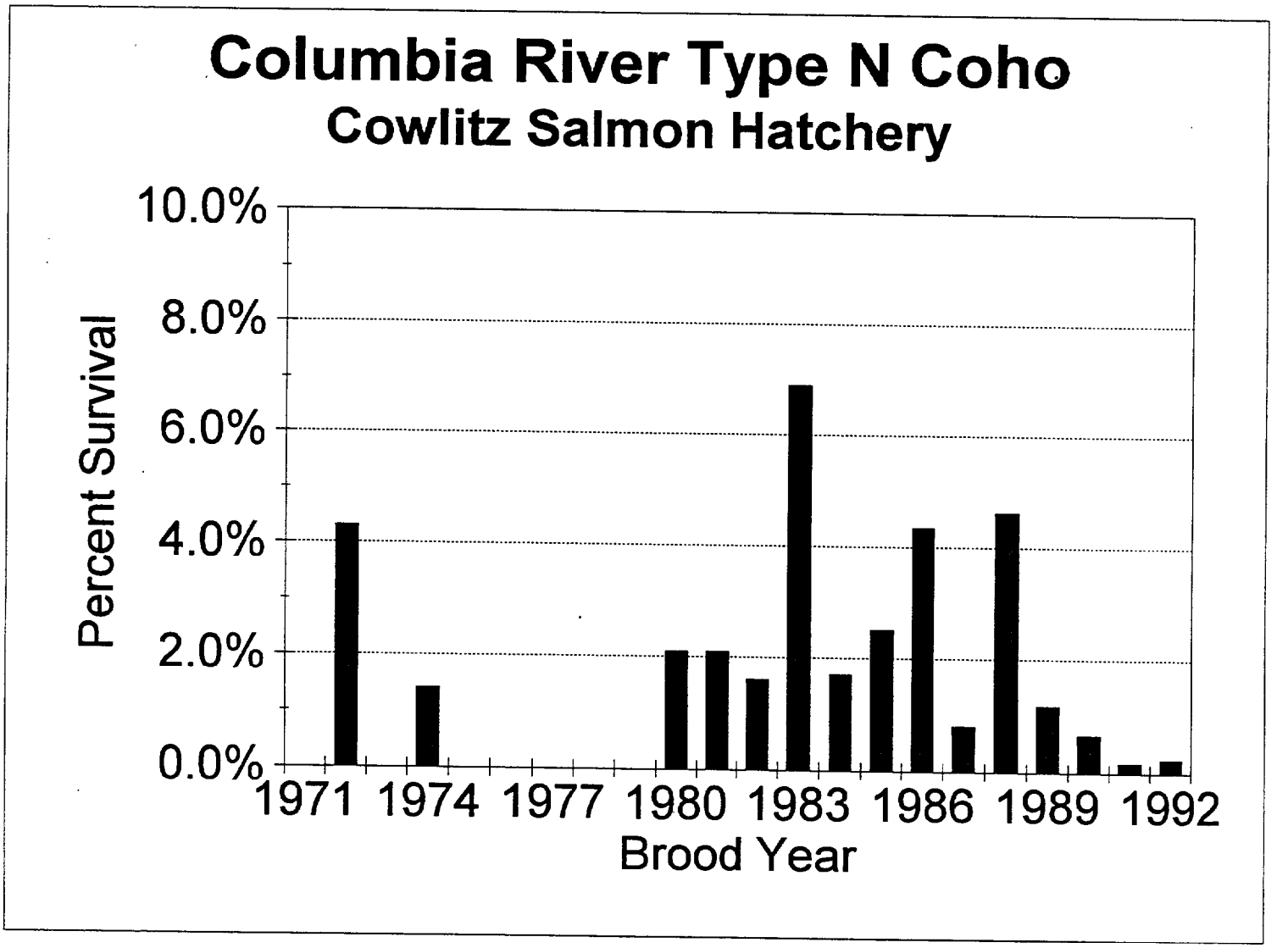

Figure 17. Survival by brood of Cowlitz Hatchery Type N coho.

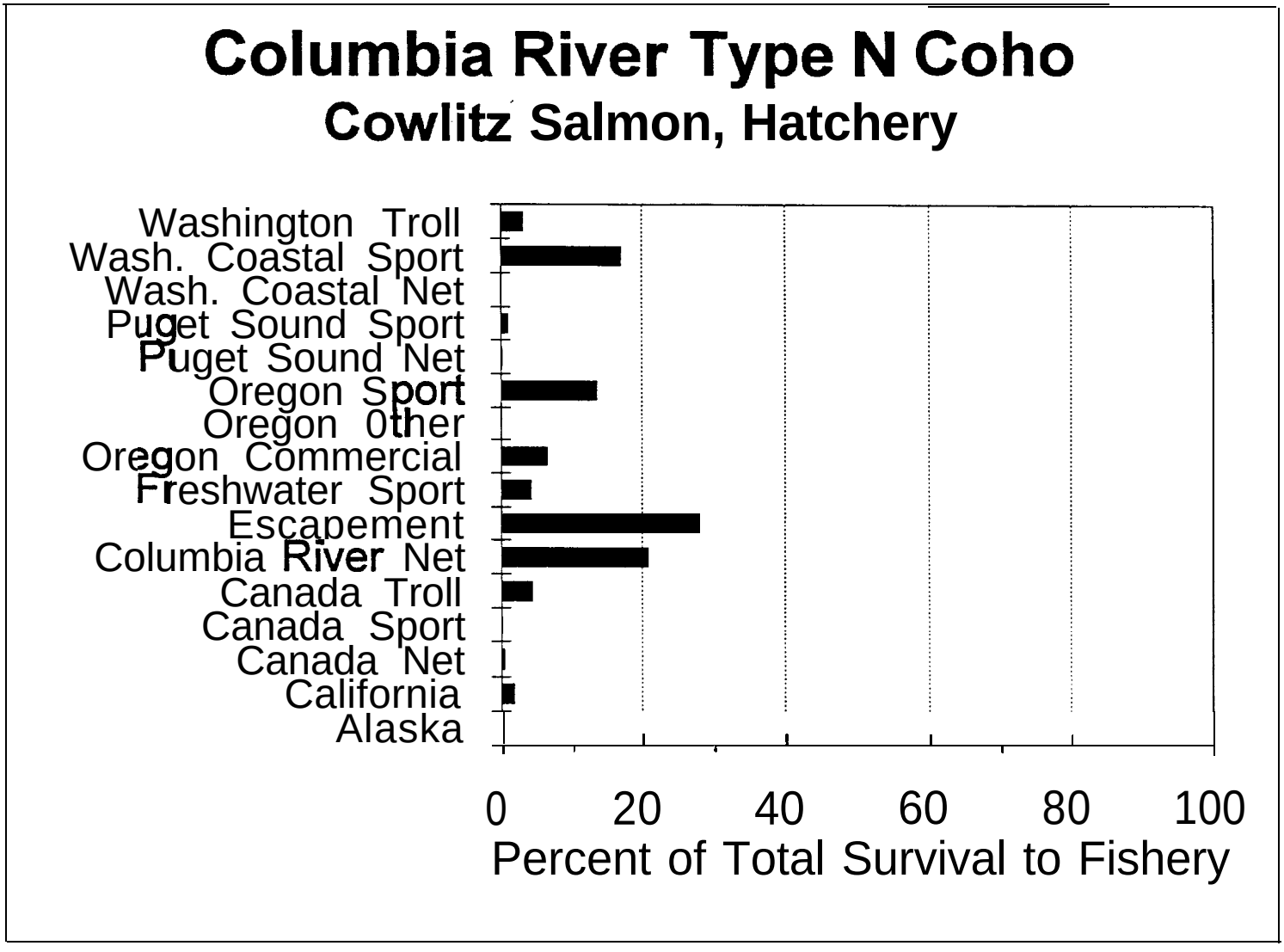

Figure 18. Percent of total survival to fisheries and escapement of Cowlitz Hatchery 1988-I 992 broods Type N coho.

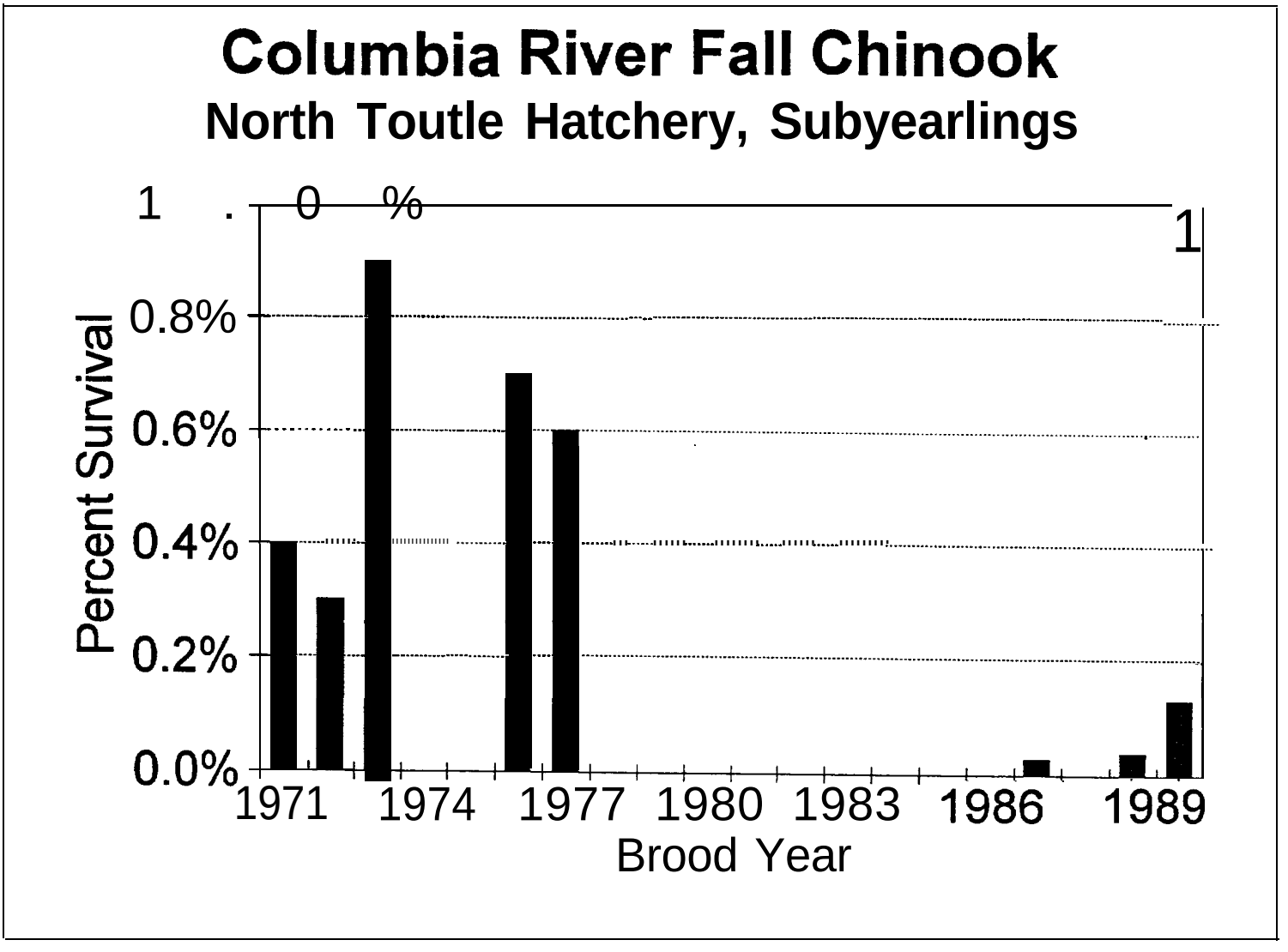

Figure 19. Survival by brood of North Toutle Hatchery fall chinook.

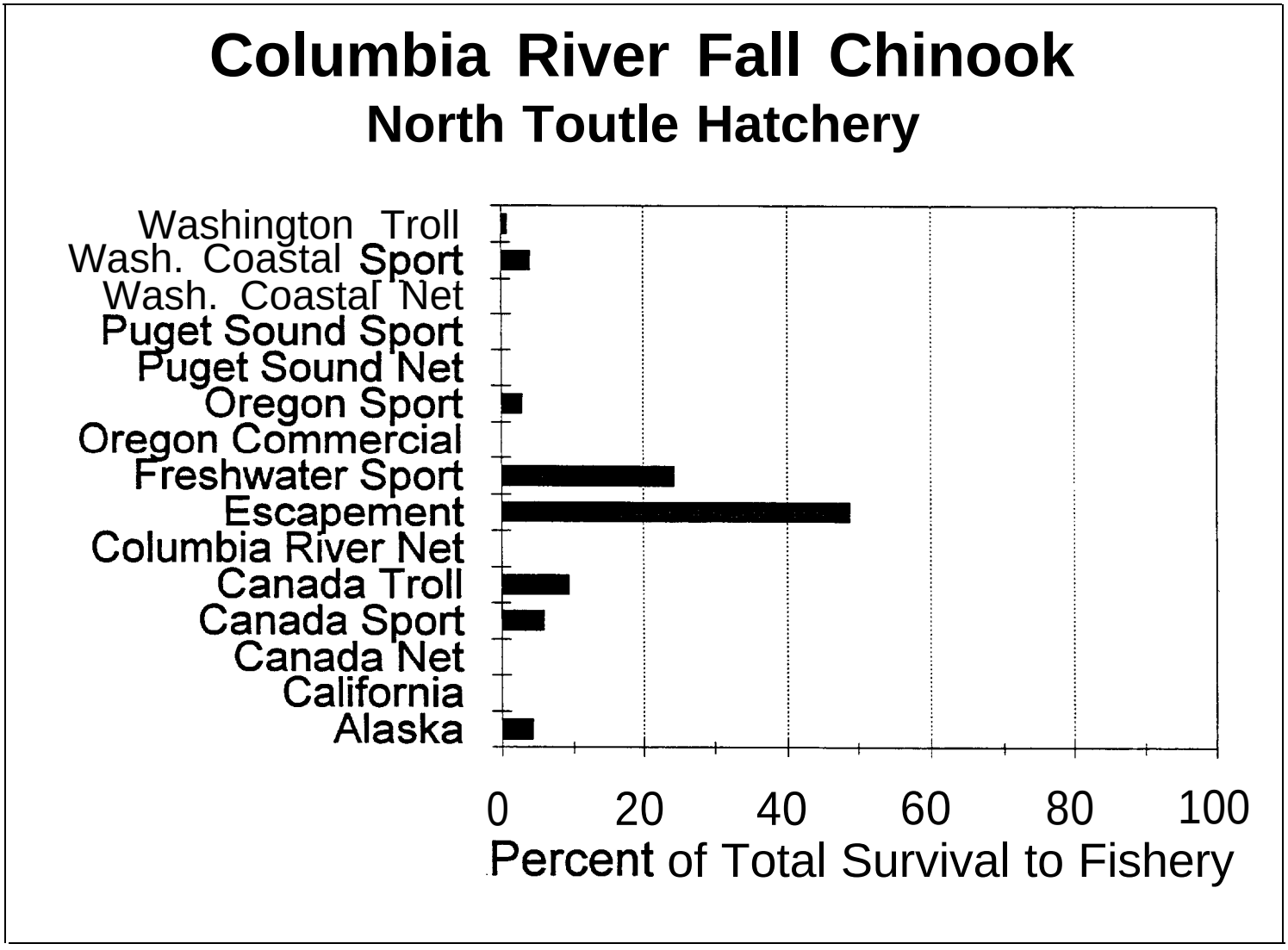

Figure 20. Percent of total survival to fisheries and escapement of North Toutle Hatchery 1987, 1989 and 1990 brood fall chinook.

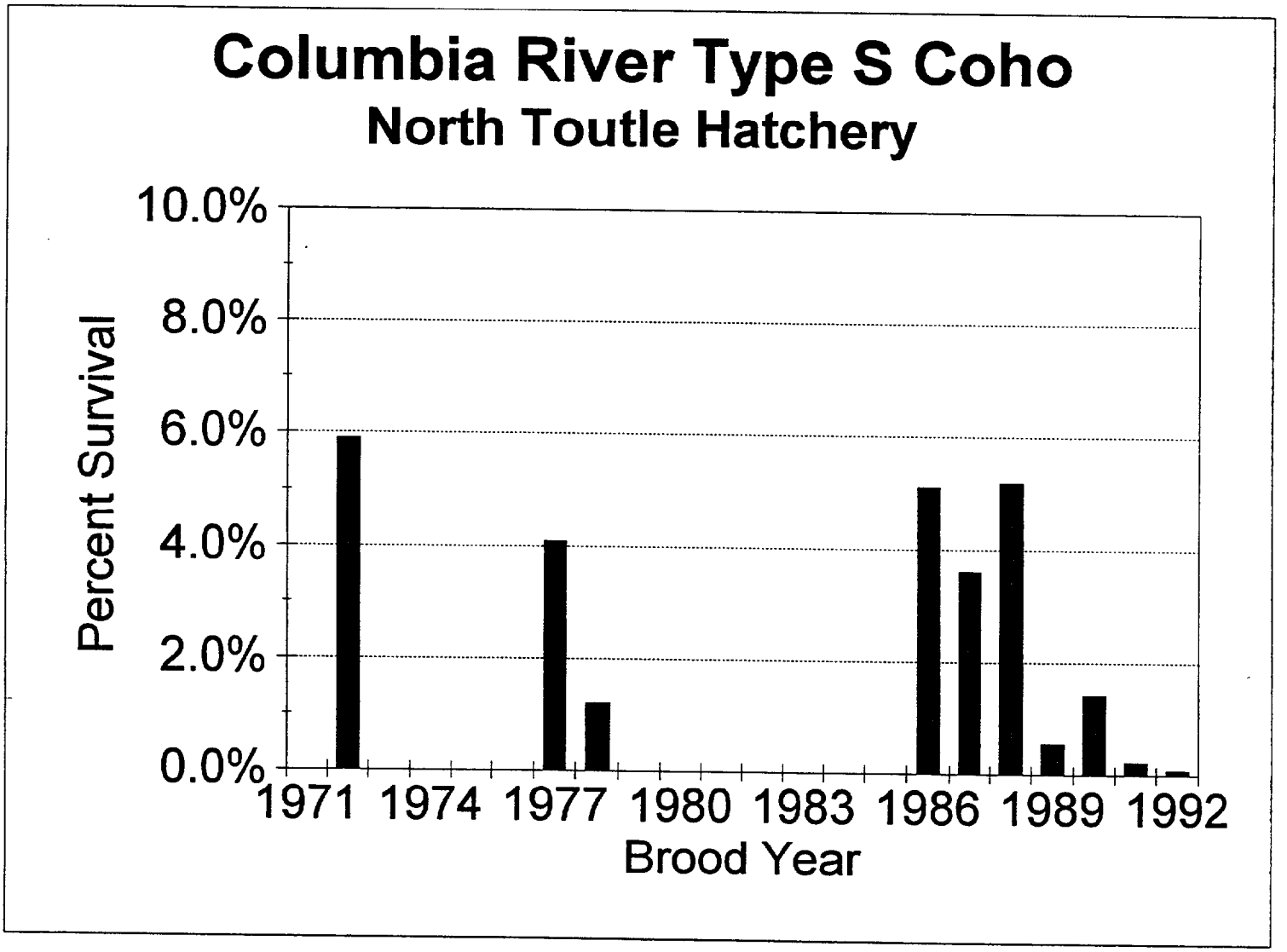

Figure 21. Survival by brood of North Toutle Hatchery Type S coho.

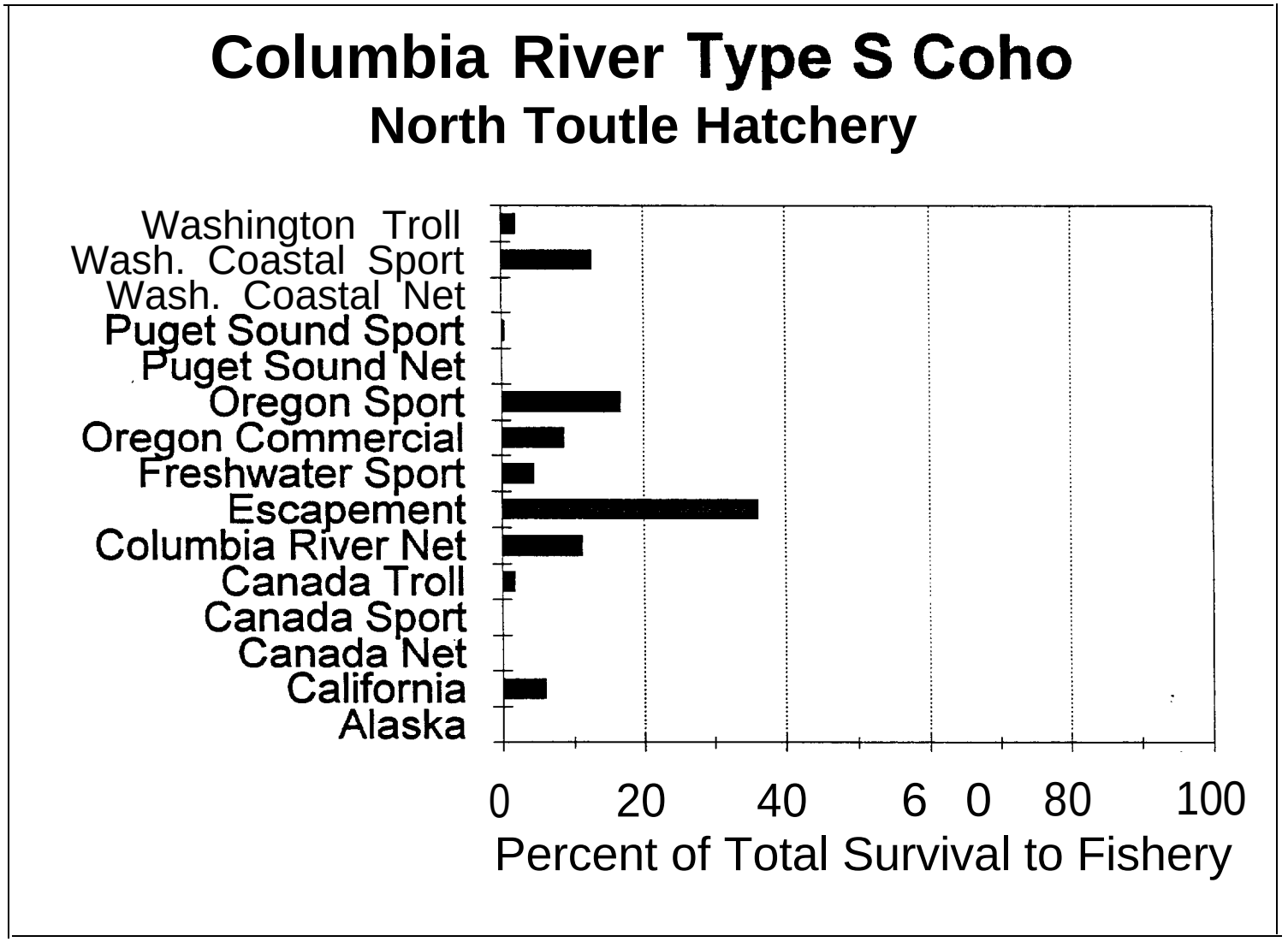

Figure 22. Percent of total survival to fisheries and escapement of North Toutle Hatchery 1988-l 992 broods Type S coho.

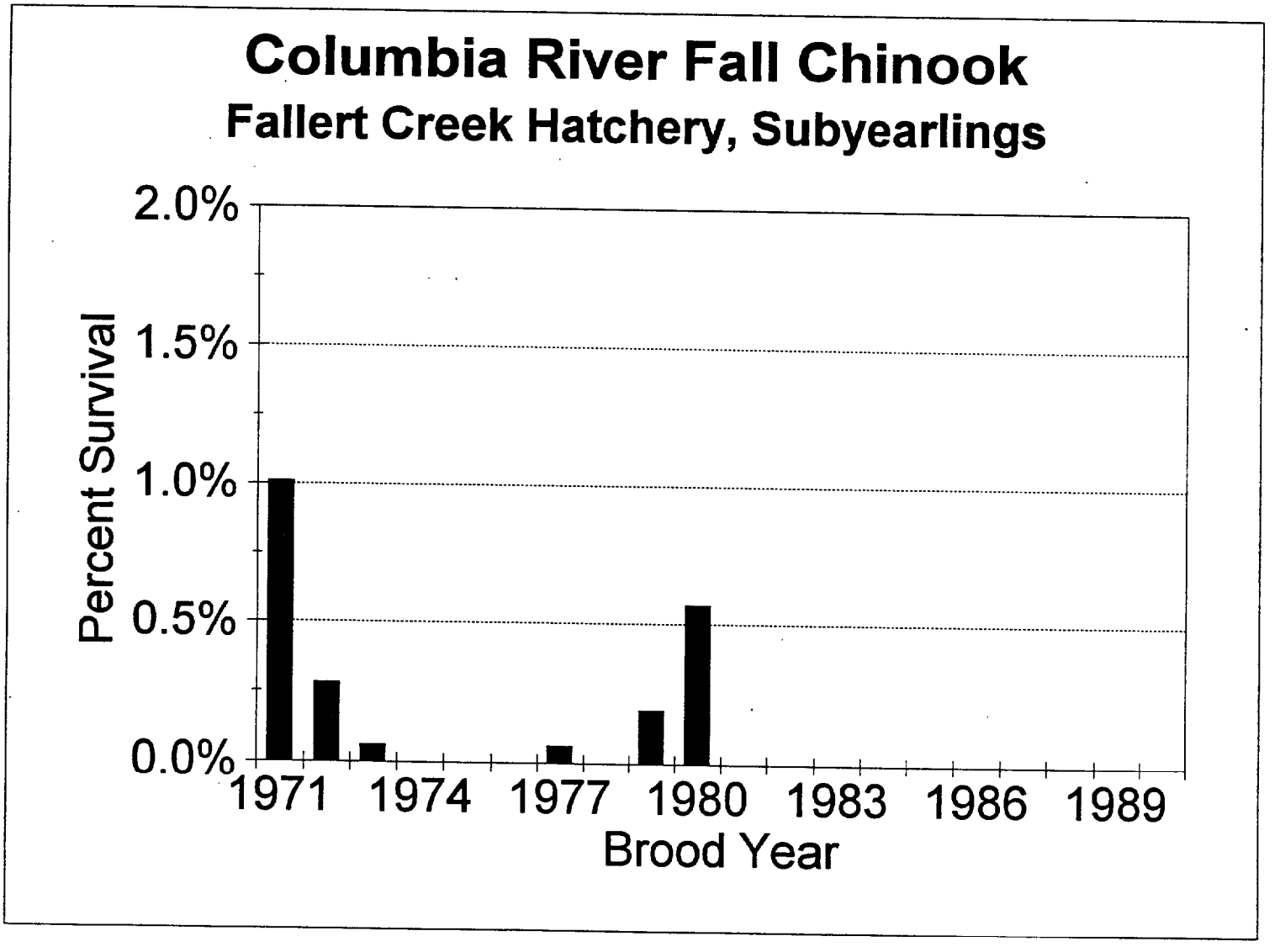

Figure 23. Survival by brood of Fallert Creek Hatchery fall chinook.

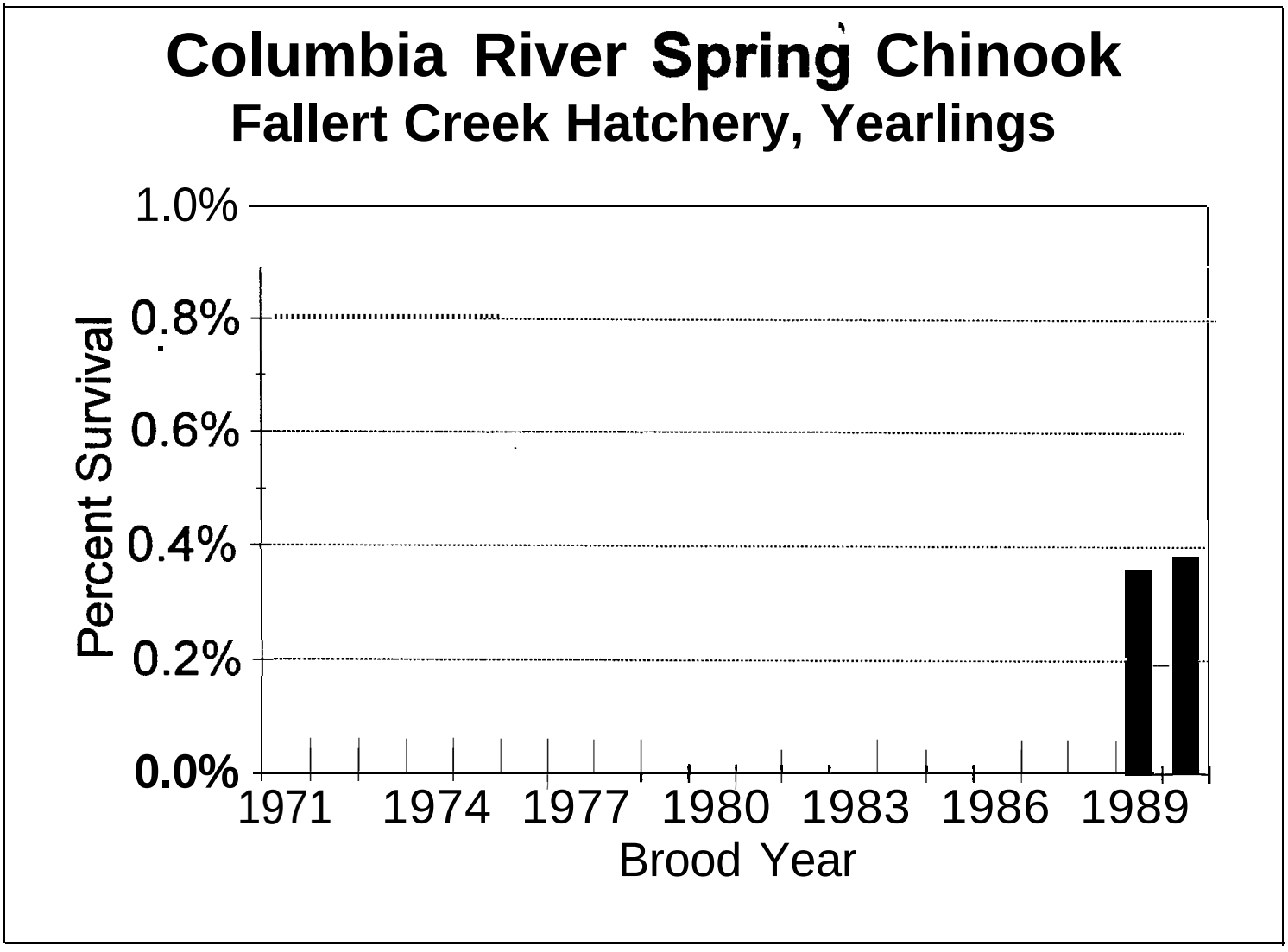

Figure 24. Survival by brood of Fallert Creek Hatchery yearling spring chinook.

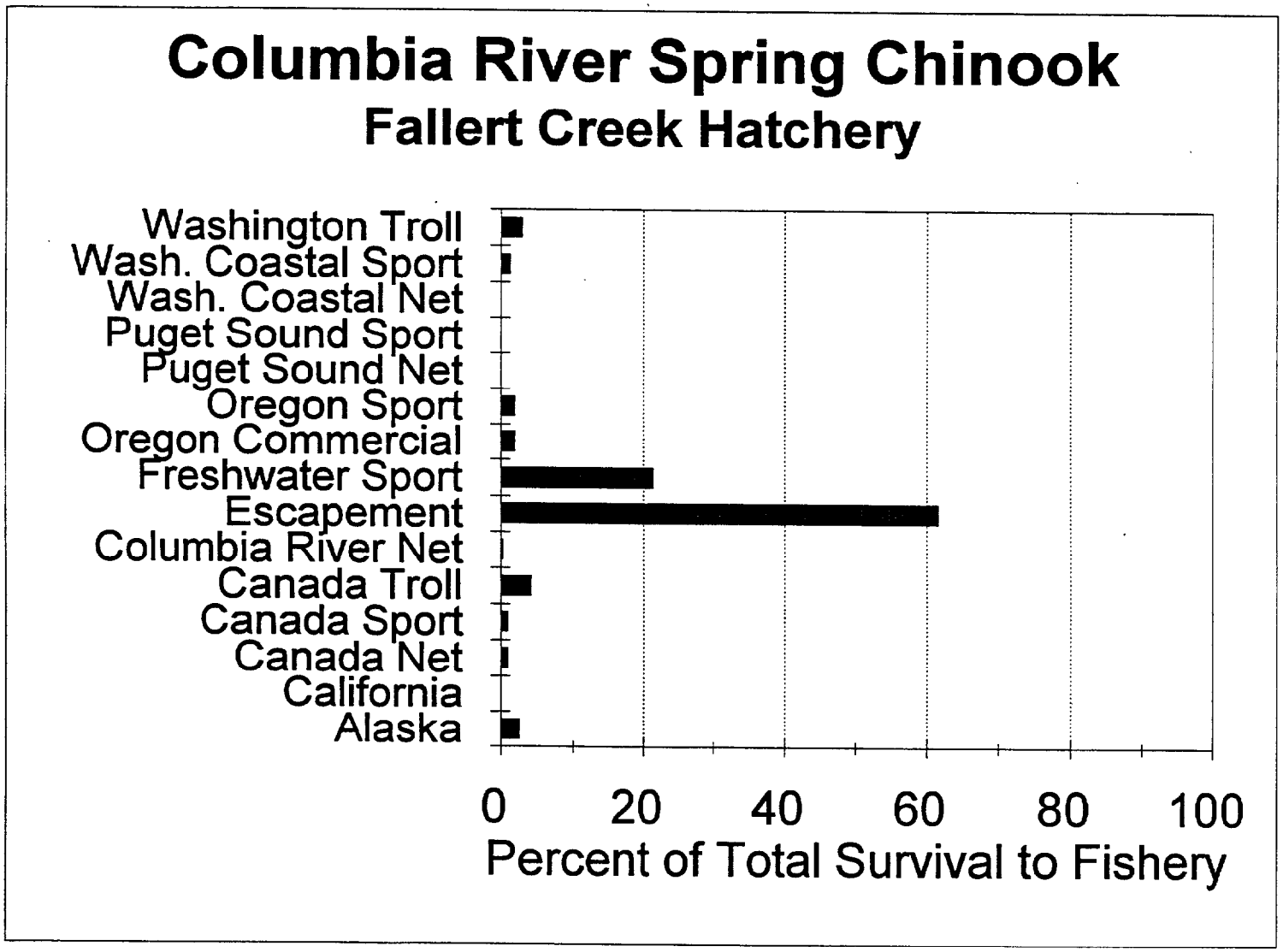

Figure 25. Percent of total survival to fisheries and escapement of Fallert Creek Hatchery 1989 and 1990 brood yearling spring chinook.

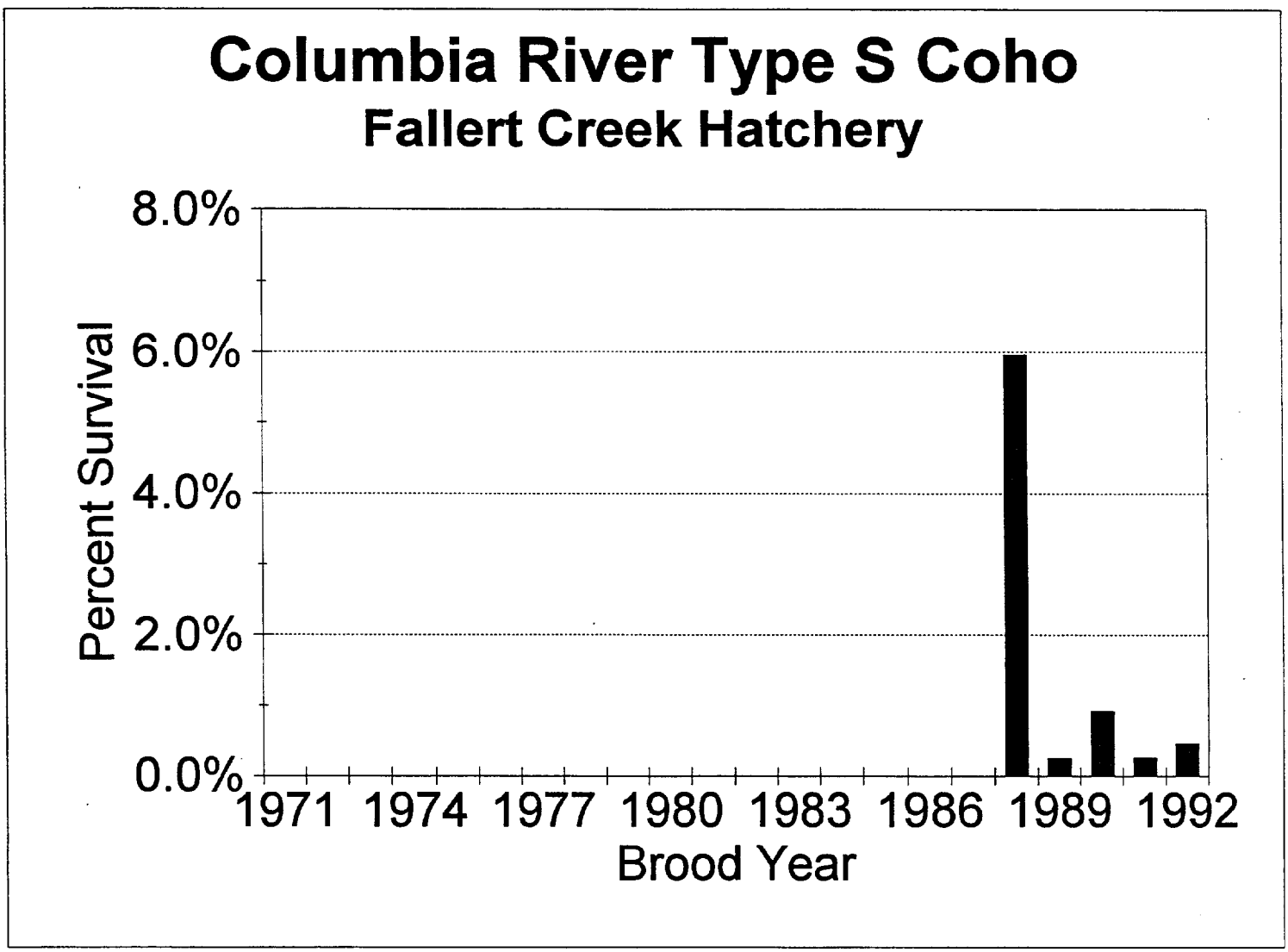

Figure 26. Survival by brood of Fallert Creek Hatchery Type S coho.

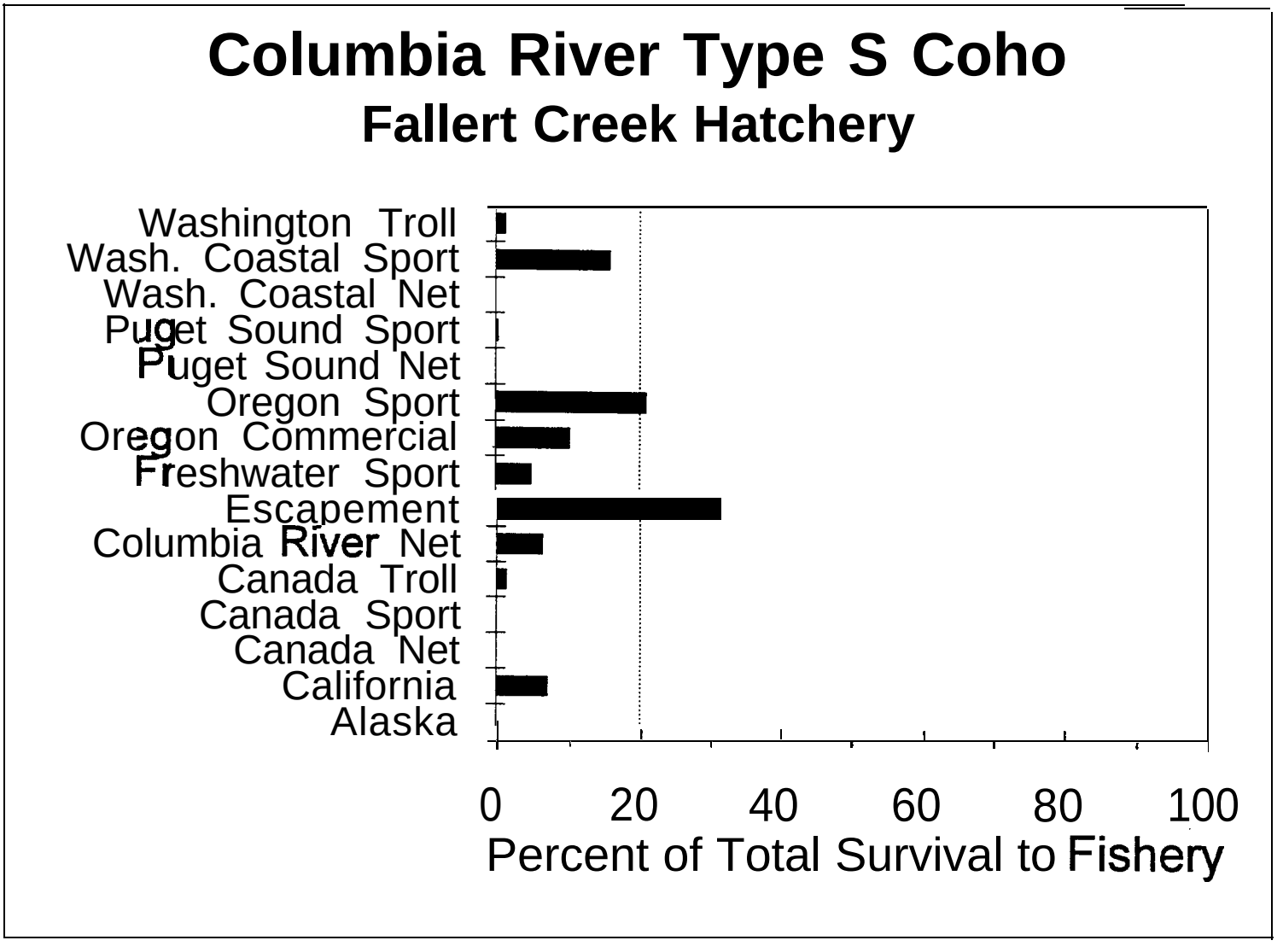

Figure 27. Percent of total survival to fisheries and escapement of Fallert Creek Hatchery 1988-1992 broods Type S coho.

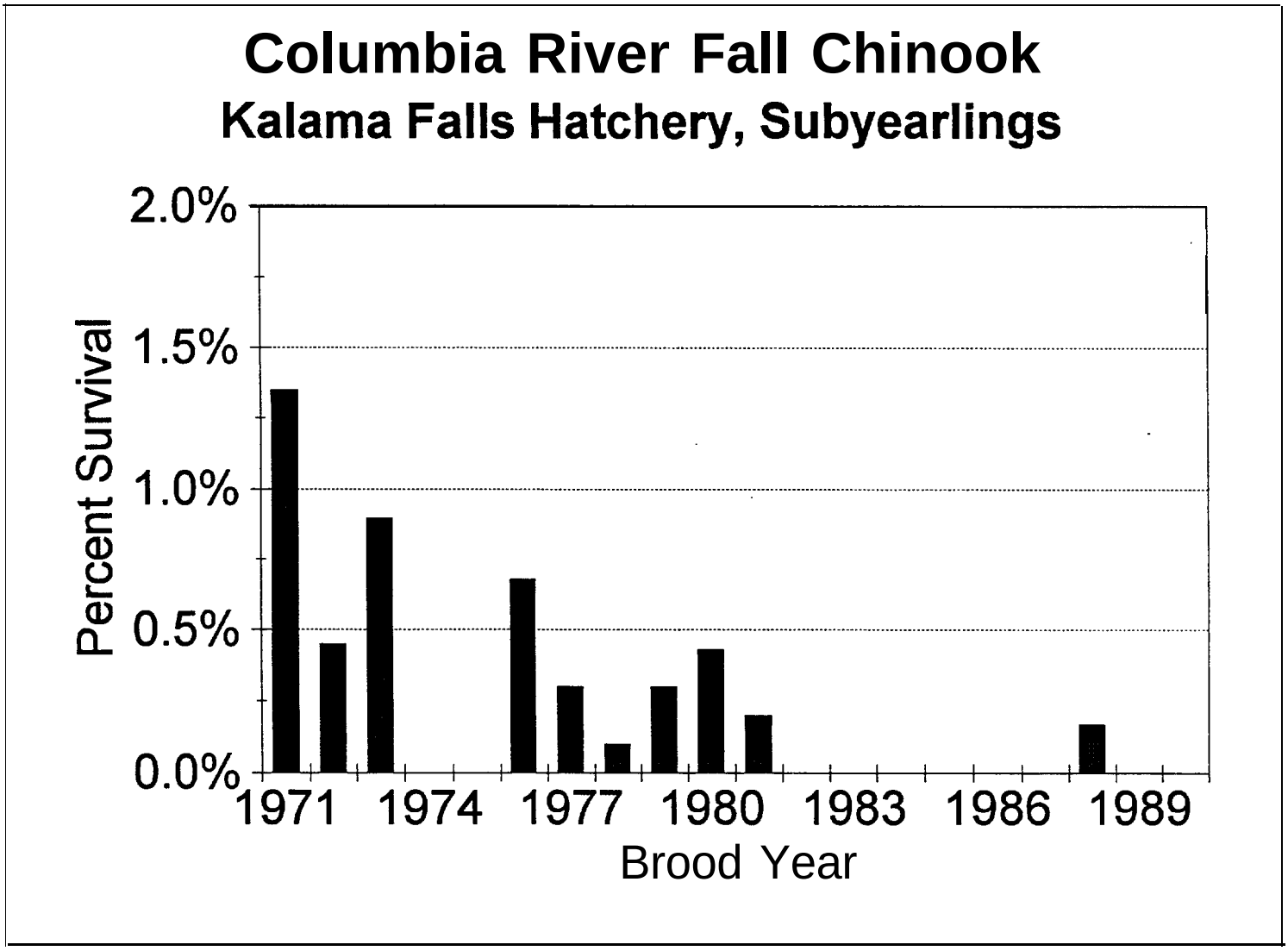

Figure 28. Survival by brood of Kalama Falls Hatchery fall chinook.

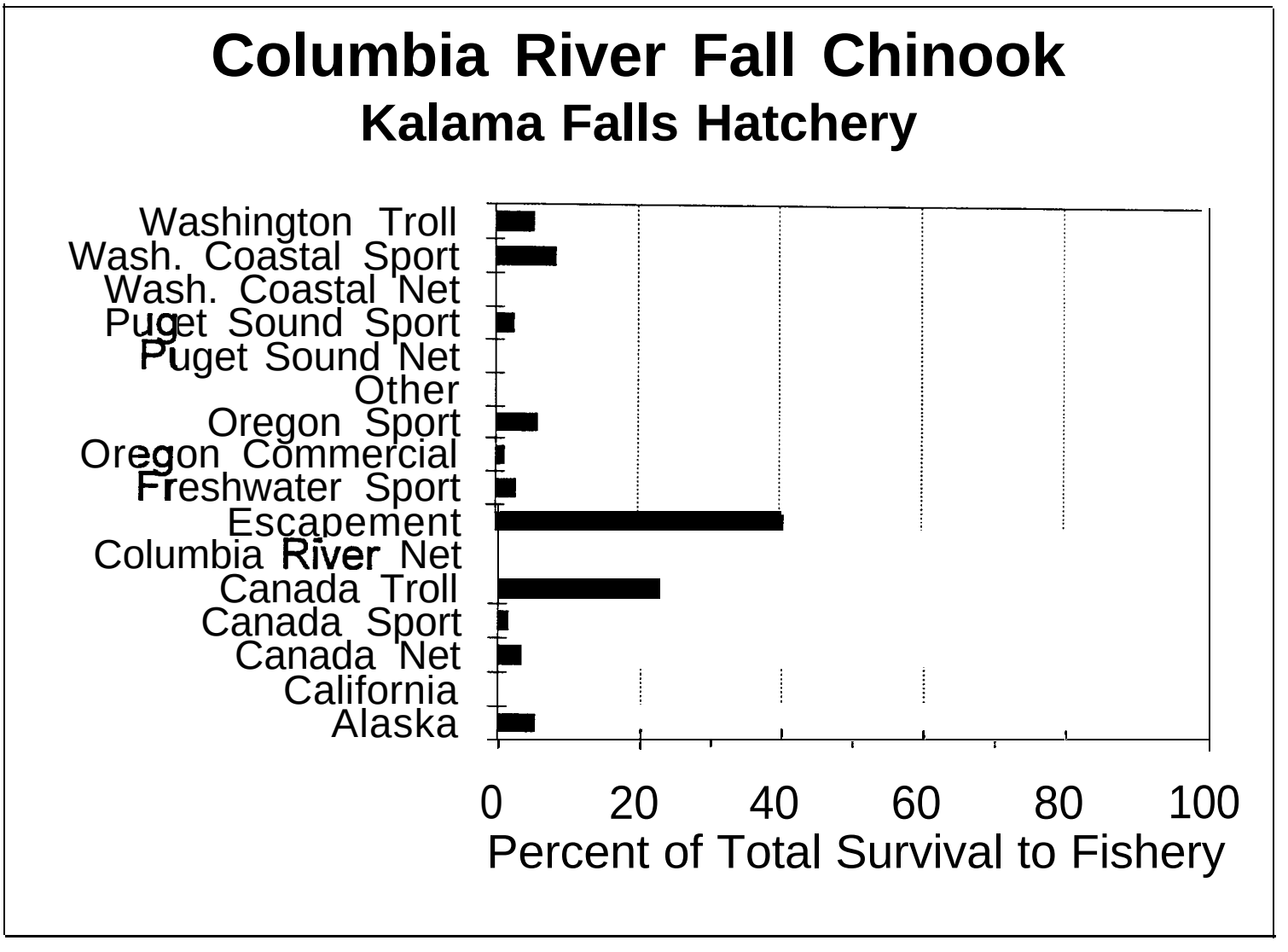

Figure 29. Percent of total survival to fisheries and escapement of Kalama Falls Hatchery 1988 brood fall chinook.

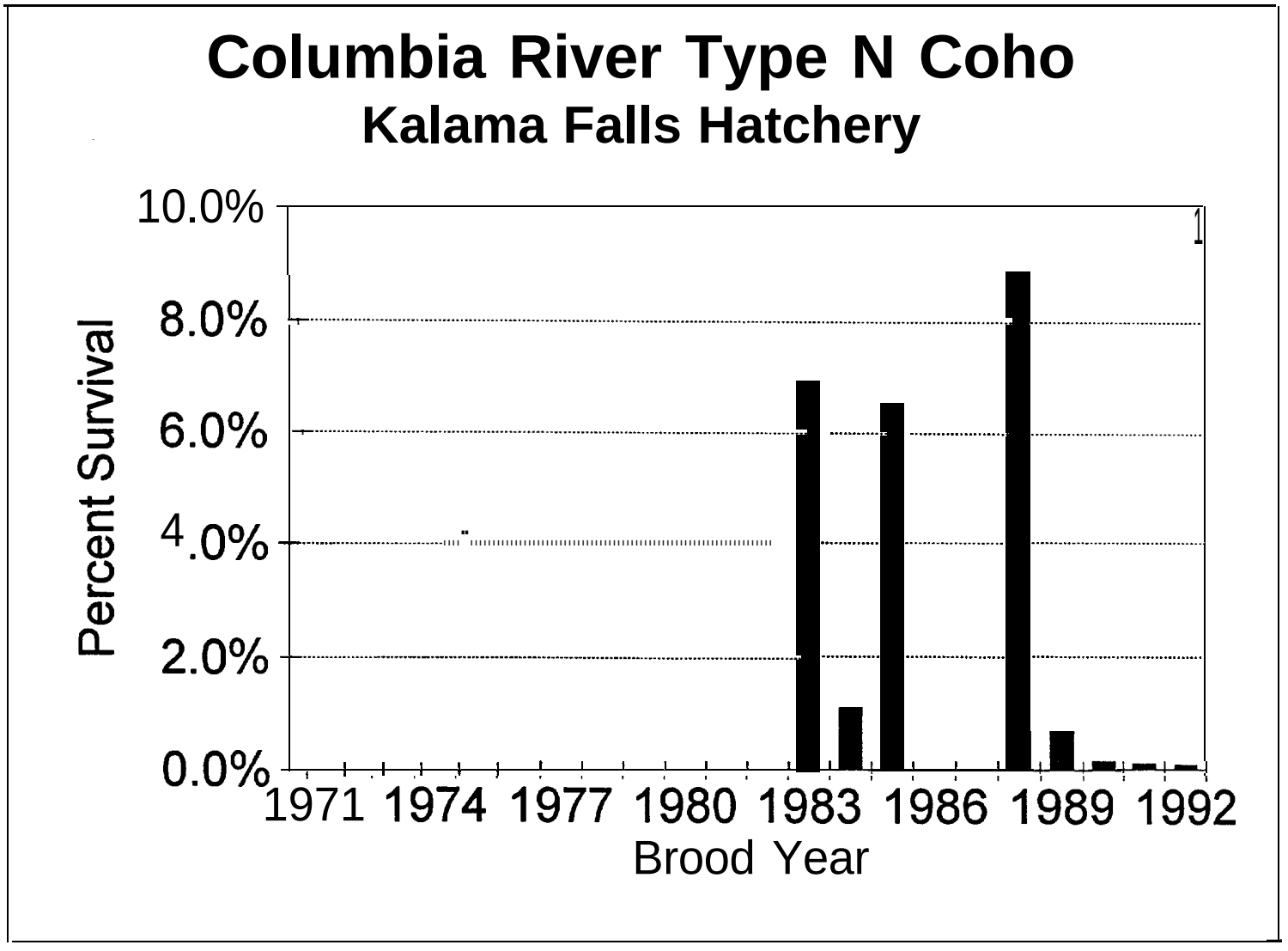

Figure 30. Survival by brood of Kalama Falls Hatchery Type N coho.

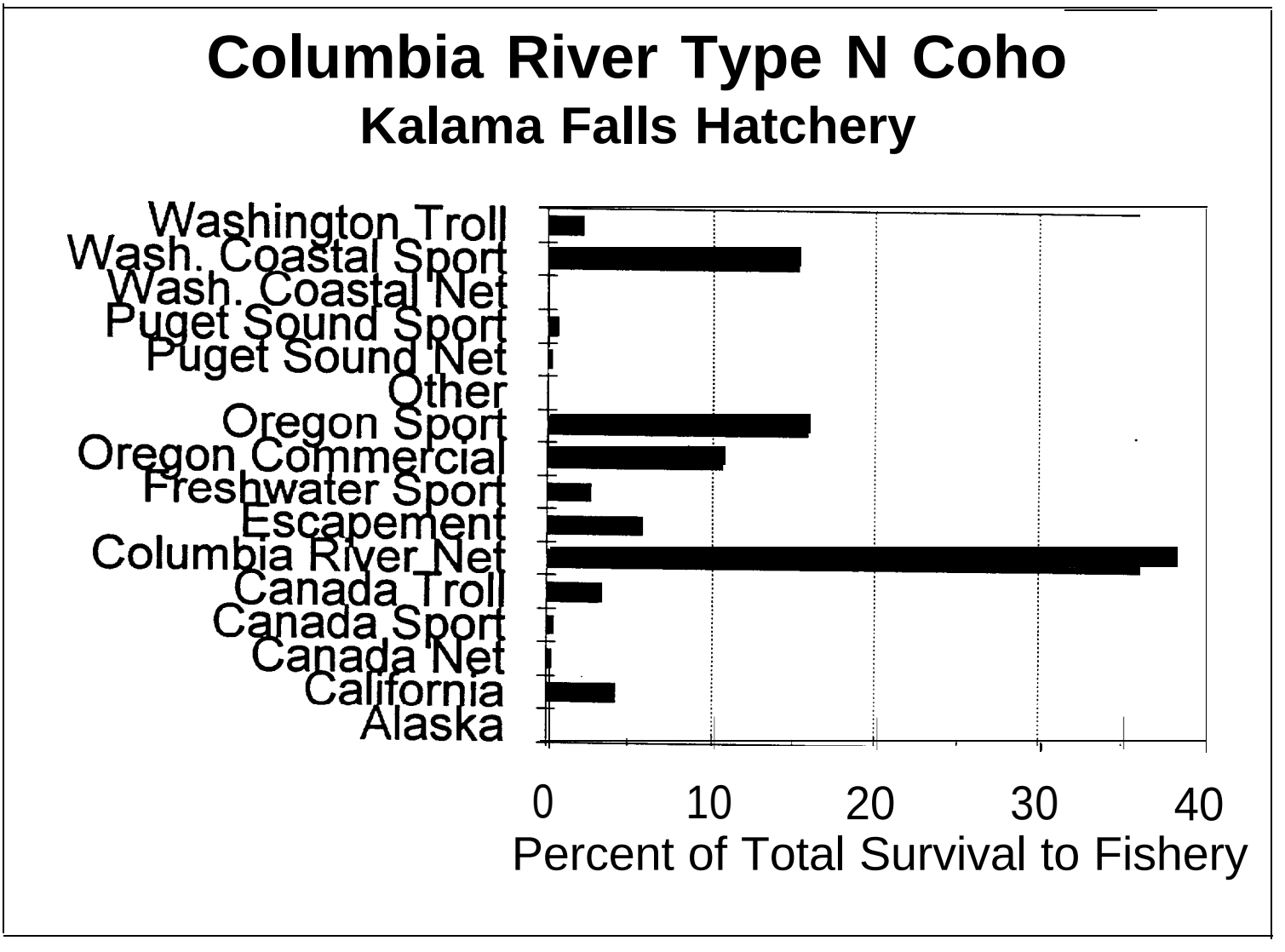

Figure 31. Percent of total survival to fisheries and escapement of Kalama Falls Hatchery 1988-1992 broods Type N coho.

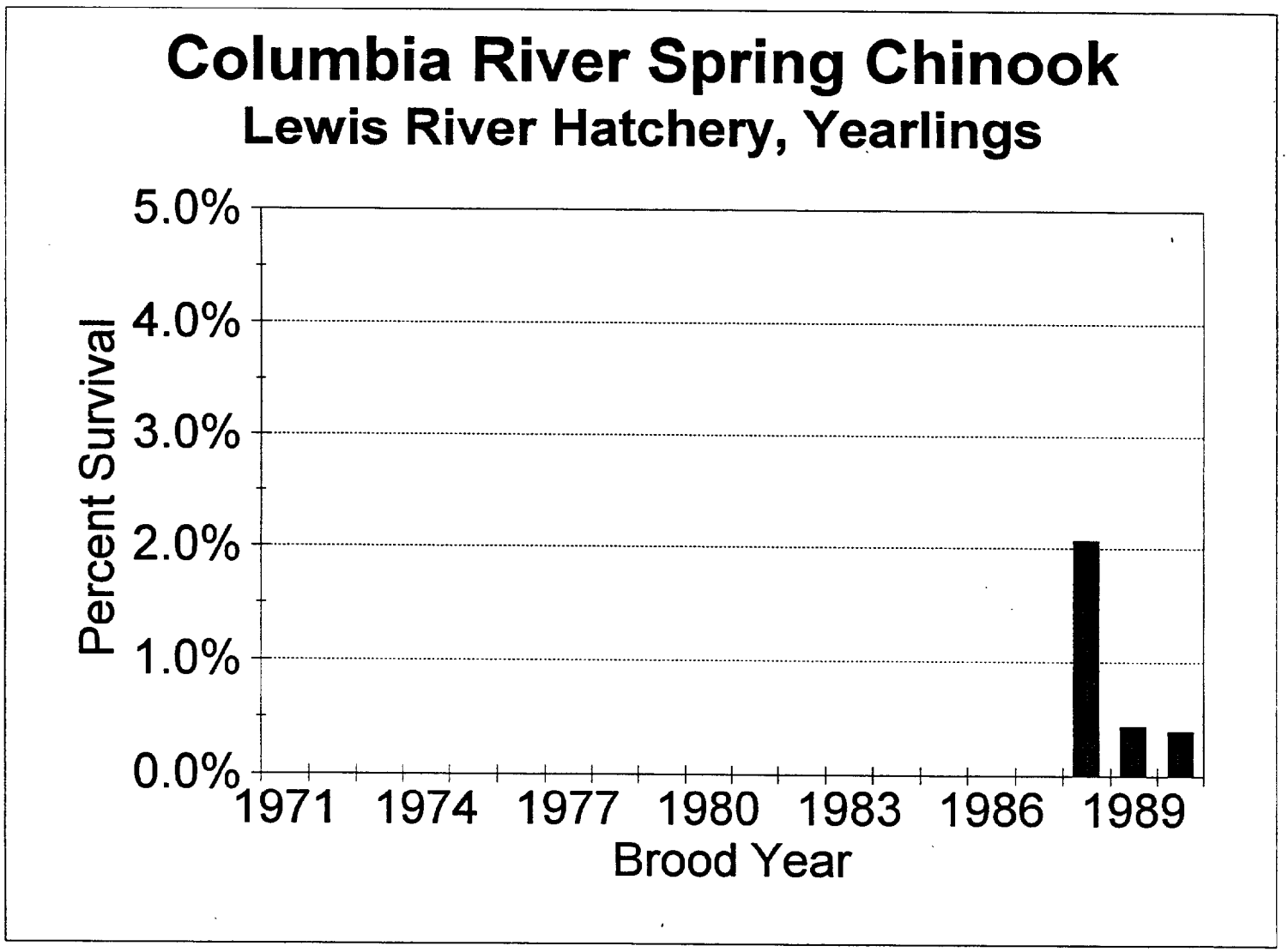

Figure 32. Survival by brood of Lewis River Hatchery yearling spring chinook.

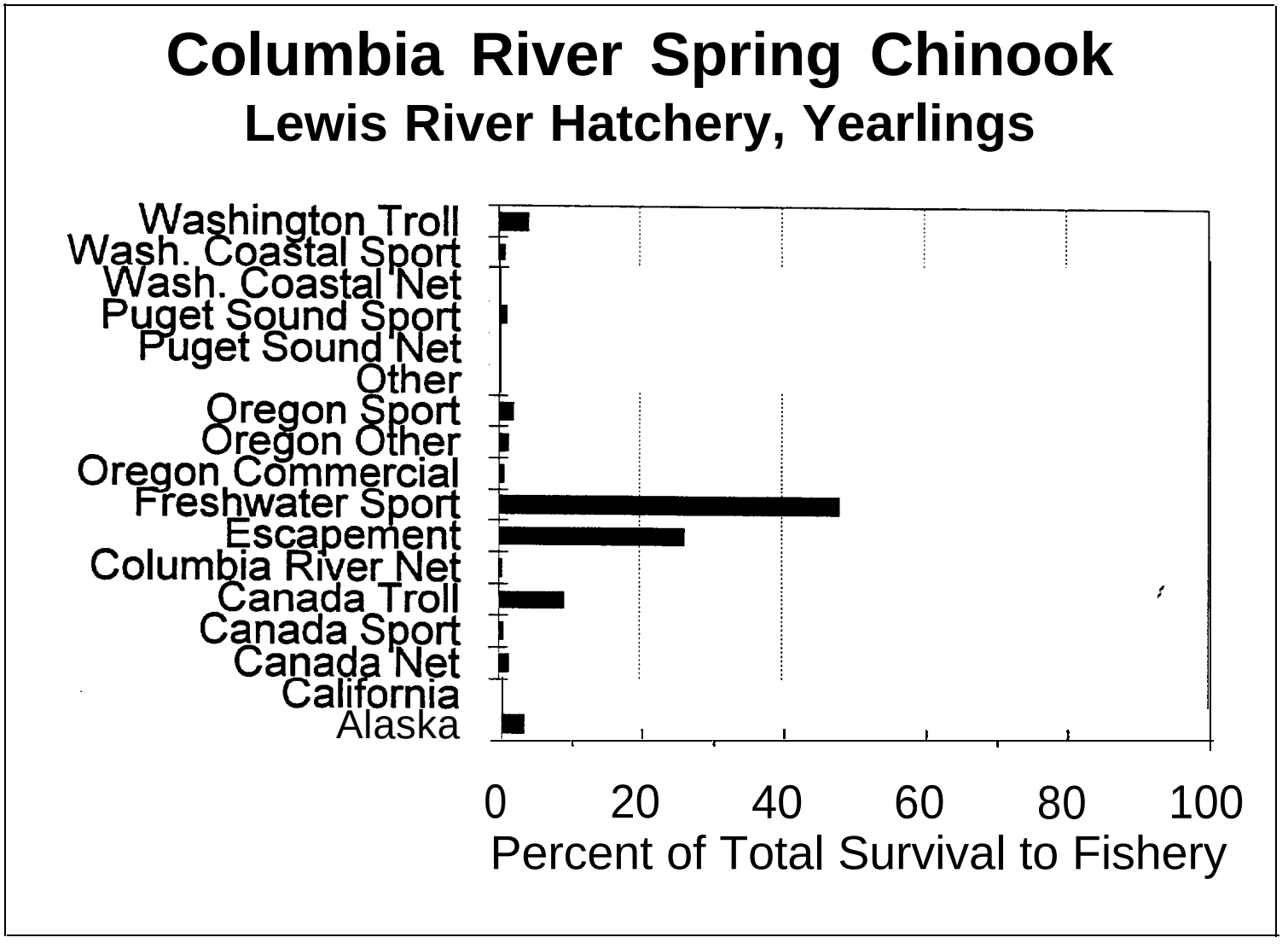

Figure 33. Percent of total survival to fisheries and escapement of Lewis River Hatchery 1988, 1989 and 1990 yearling spring chinook.

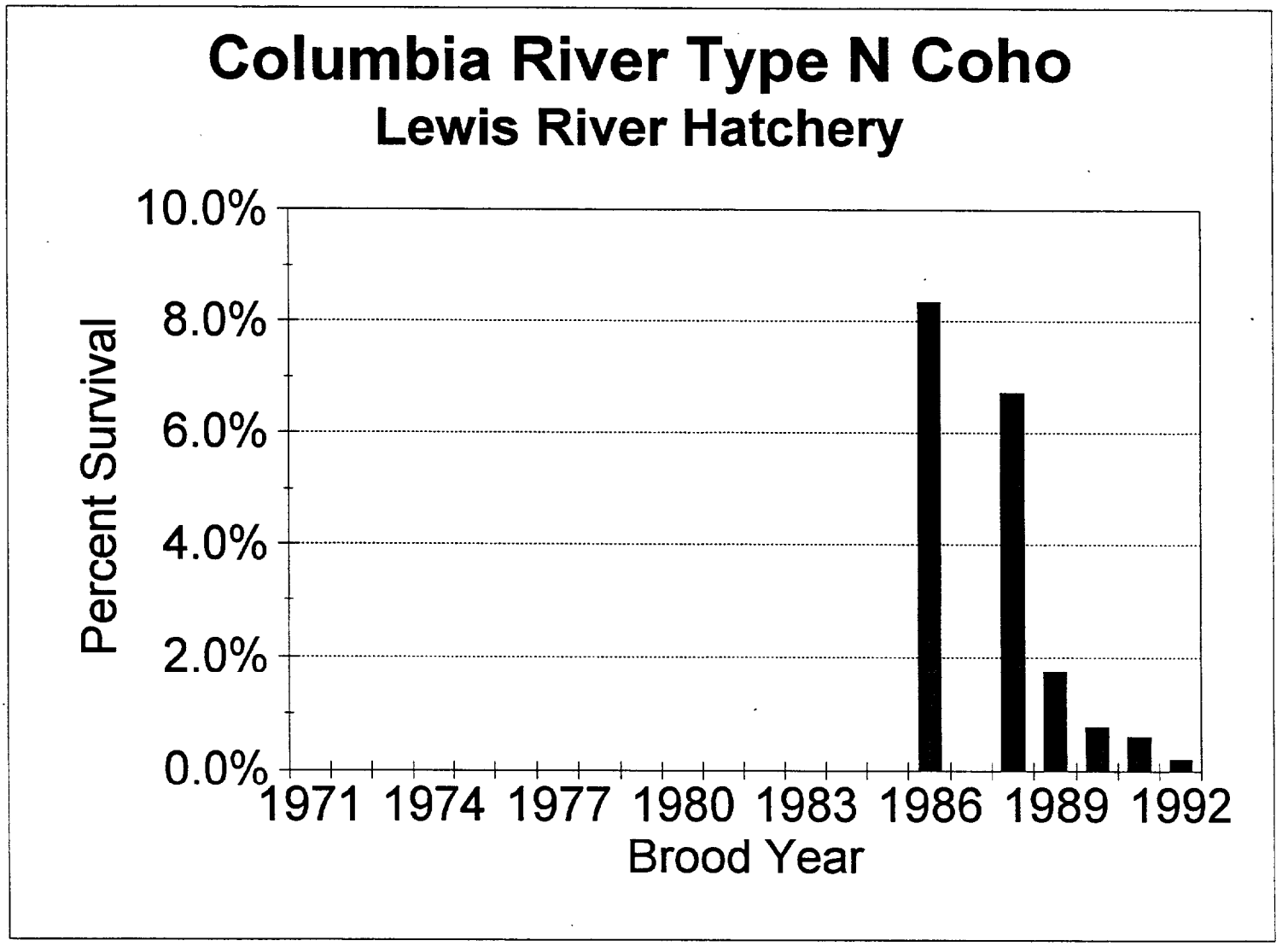

Figure 34. Survival by brood of Lewis River Hatchery Type N coho.

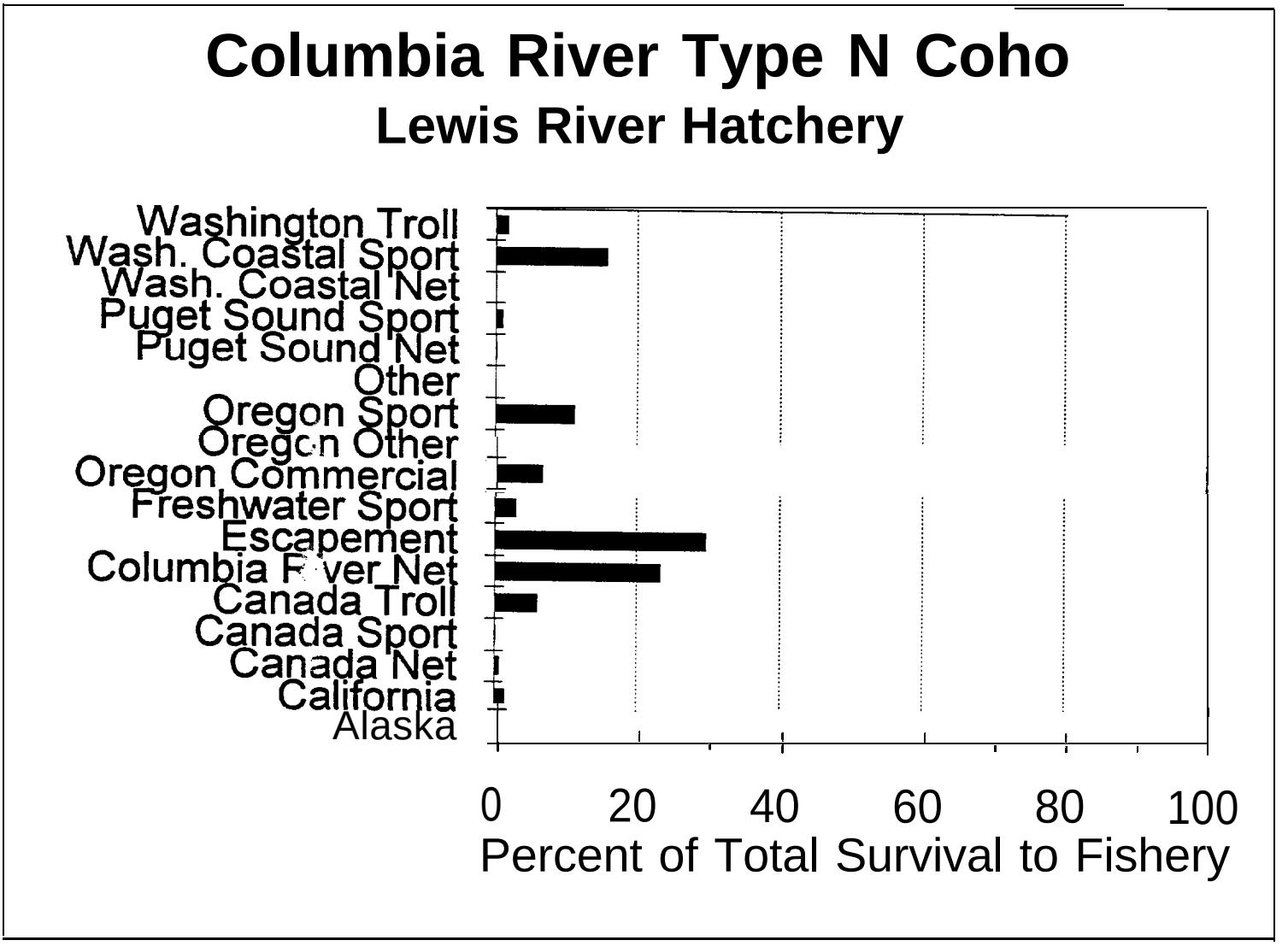

Figure 35. Percent of total survival to fisheries and escapement of Lewis River Hatchery 1988-1992 broods Type N coho.

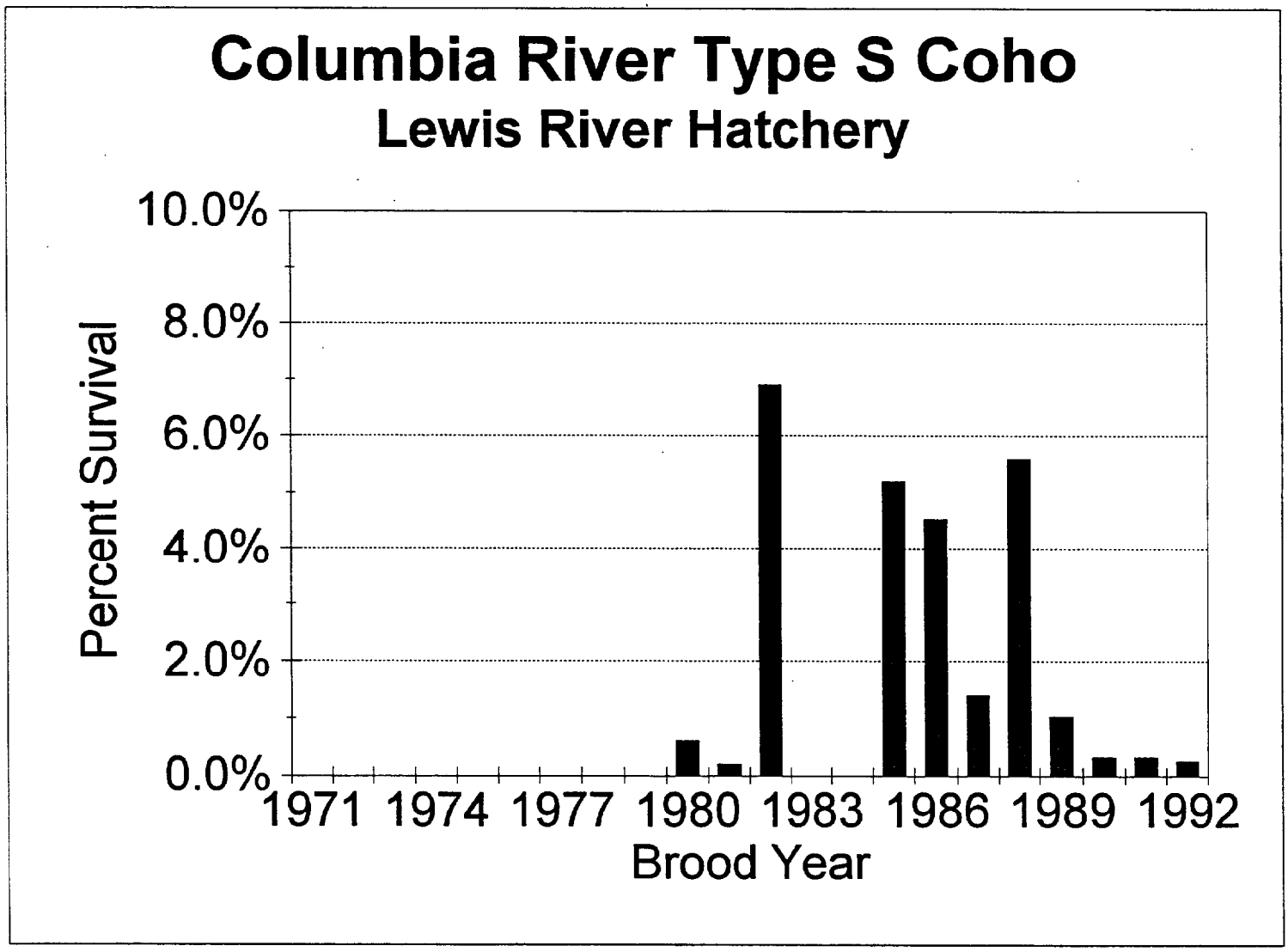

Figure 36. Survival by brood of Lewis River Hatchery Type S coho.

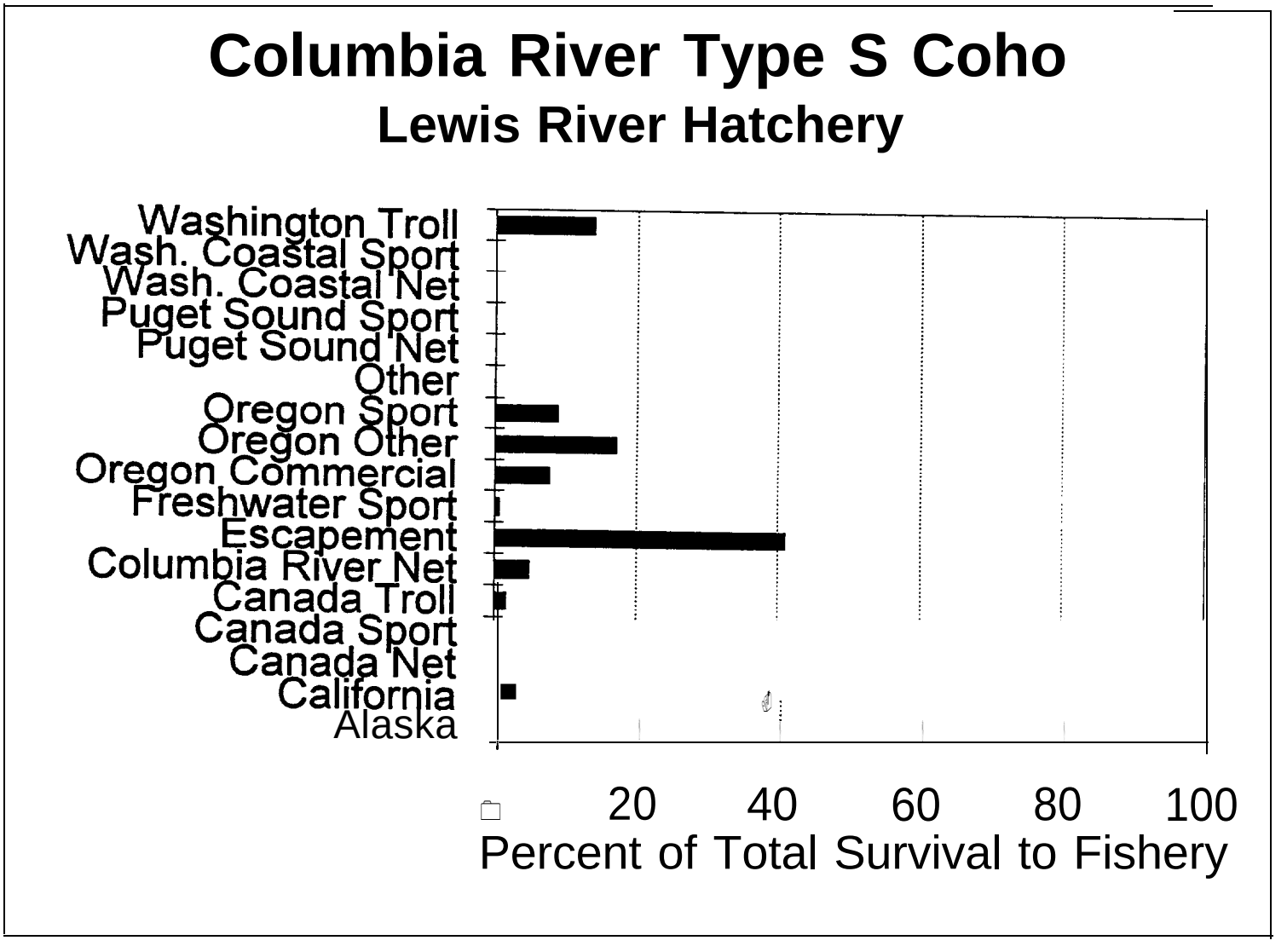

Figure 37. Percent of total survival to fisheries and escapement of Lewis River Hatchery 1988-l 992 broods Type S coho.

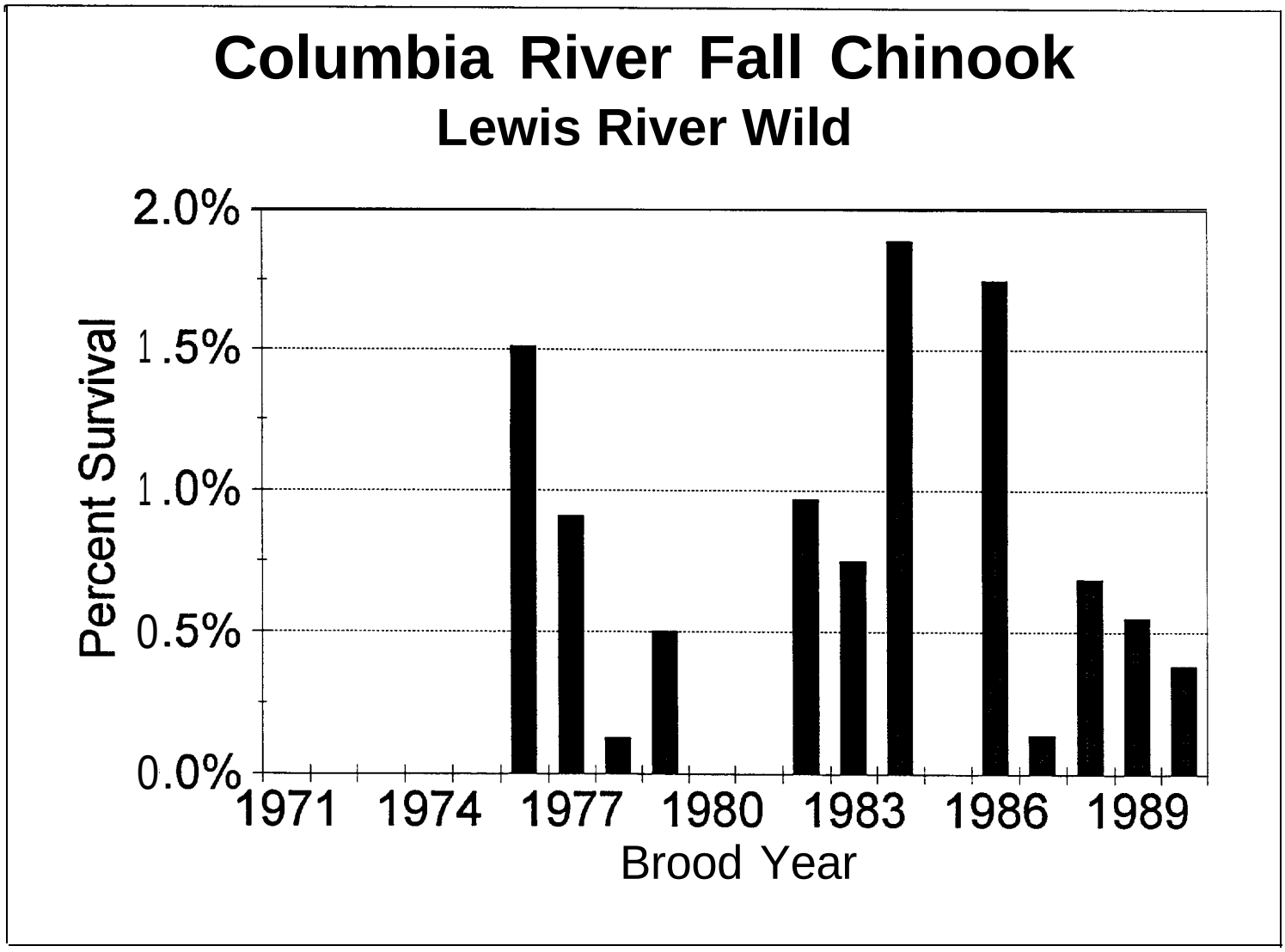

Figure 38. Survival by brood of Lewis River wild fall chinook.

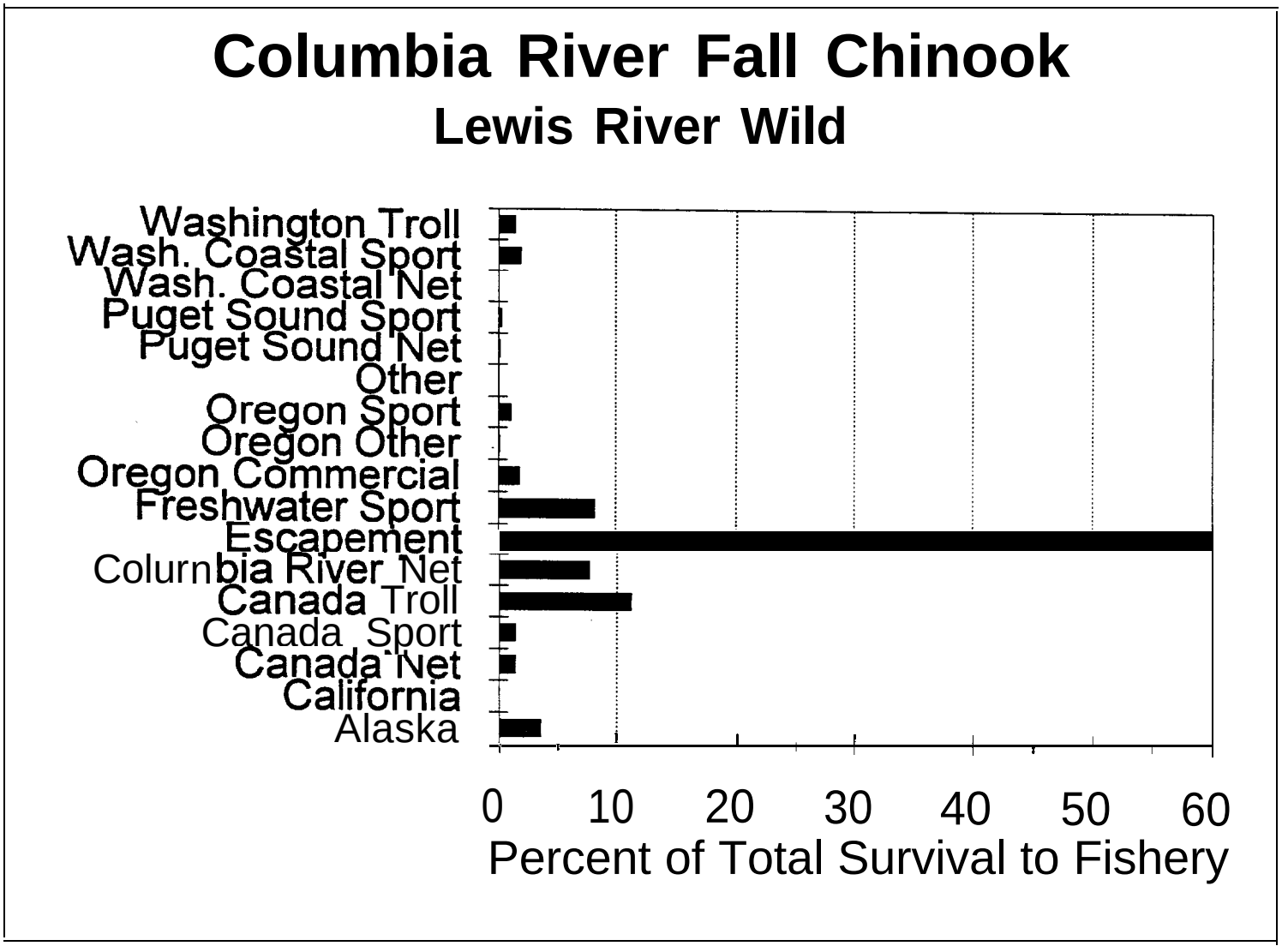

Figure 39. Percent of total survival to fisheries and escapement of Lewis River wild fall chinook. Broods: 1986-l 990.

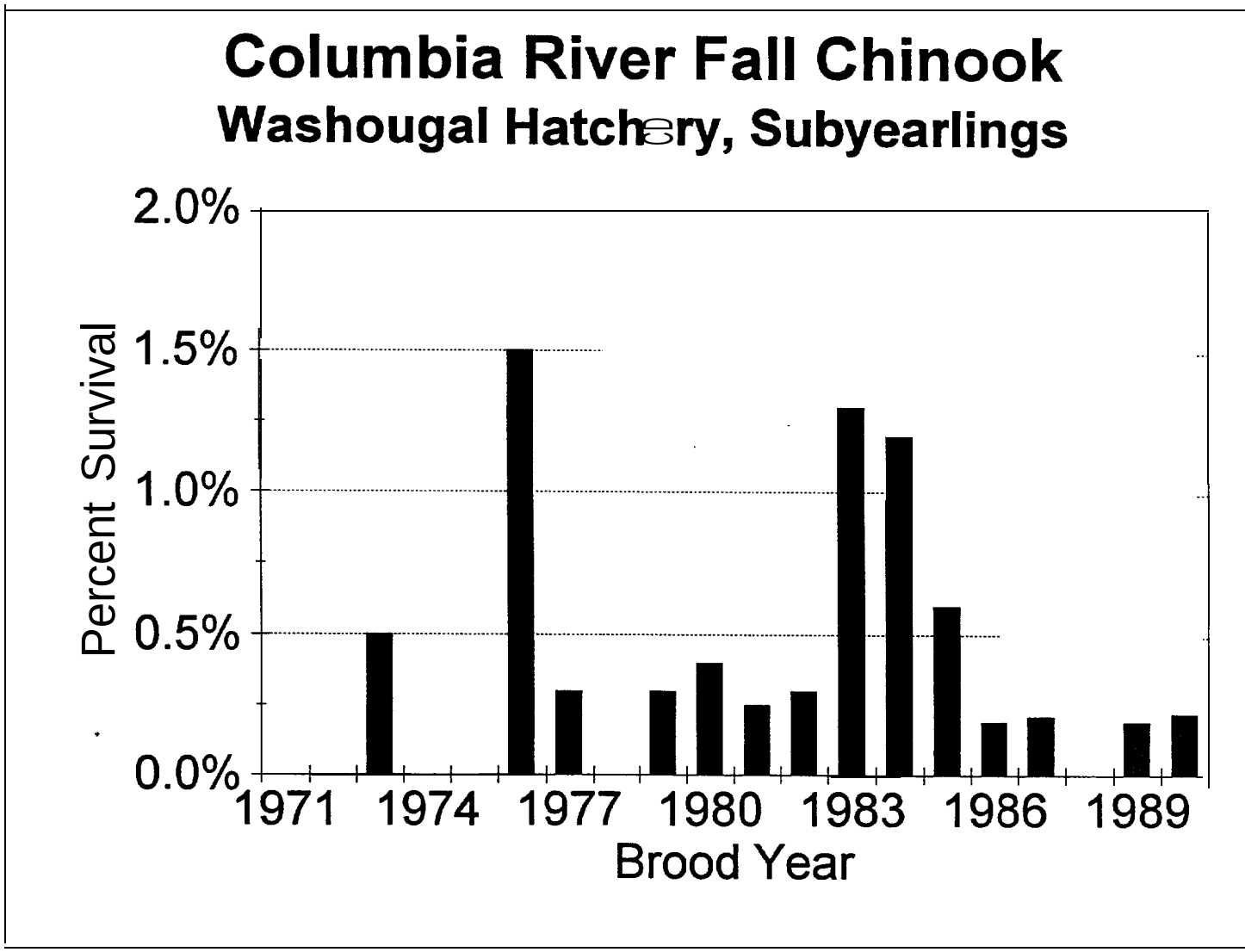

Figure 40. Survival by brood of Washougal Hatchery fall chinook

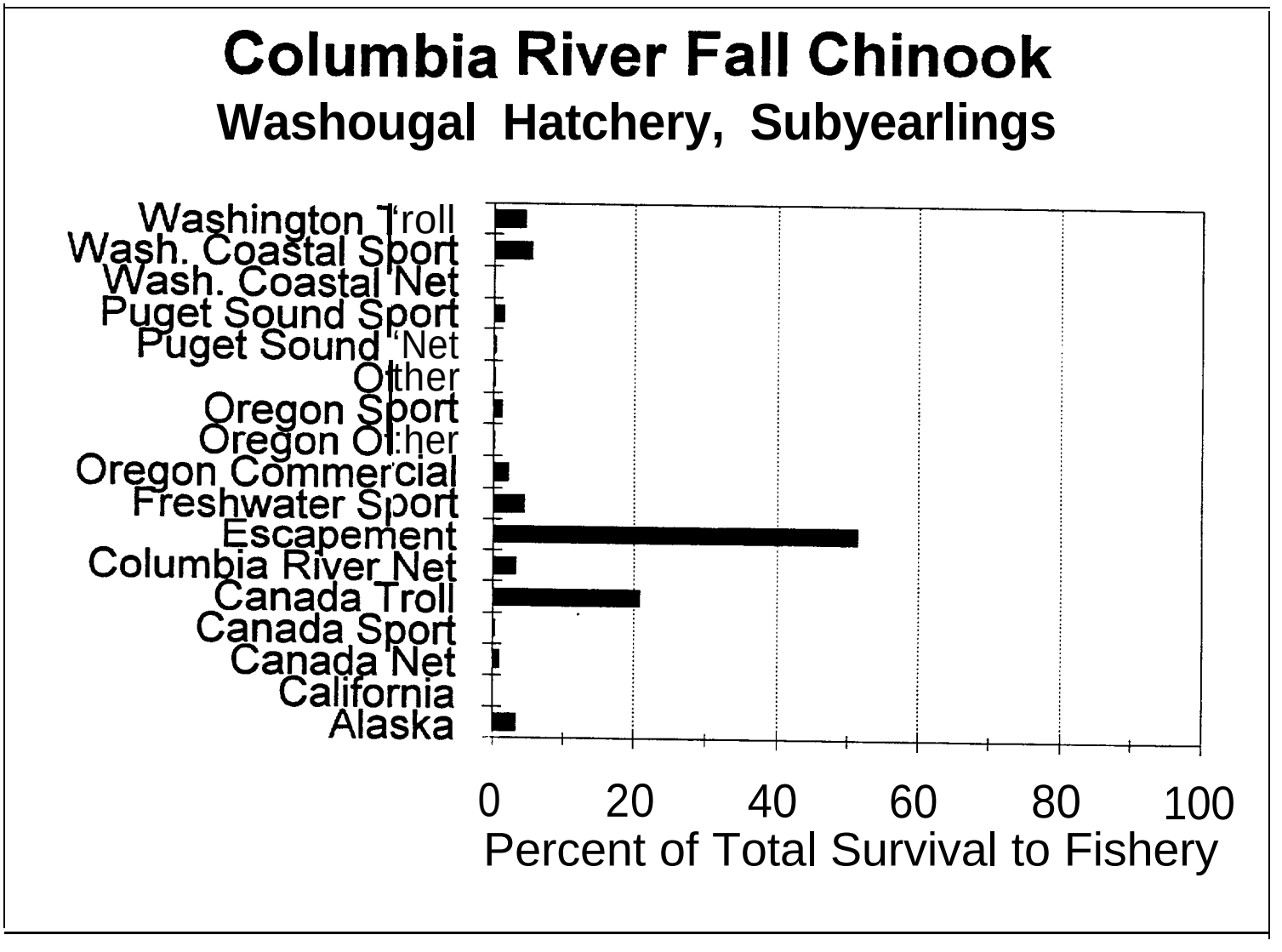

Figure 41. Percent of total survival to fisheries and escapement of Washougal Hatchery 1986, 1987, 1989 and 1990 fall chinook.

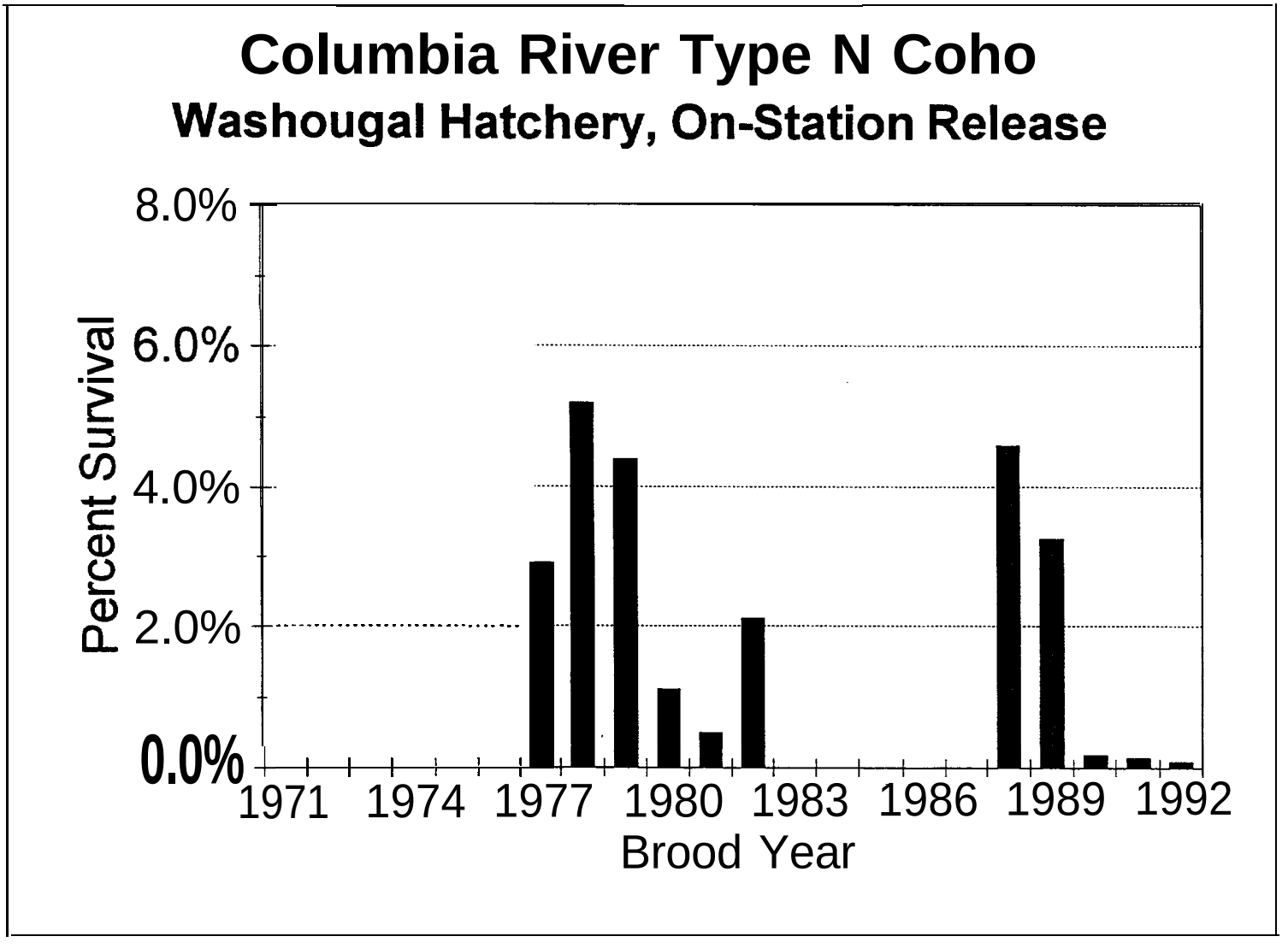

Figure 42. Survival by brood of Washougal Hatchery Type N coho released on-station.

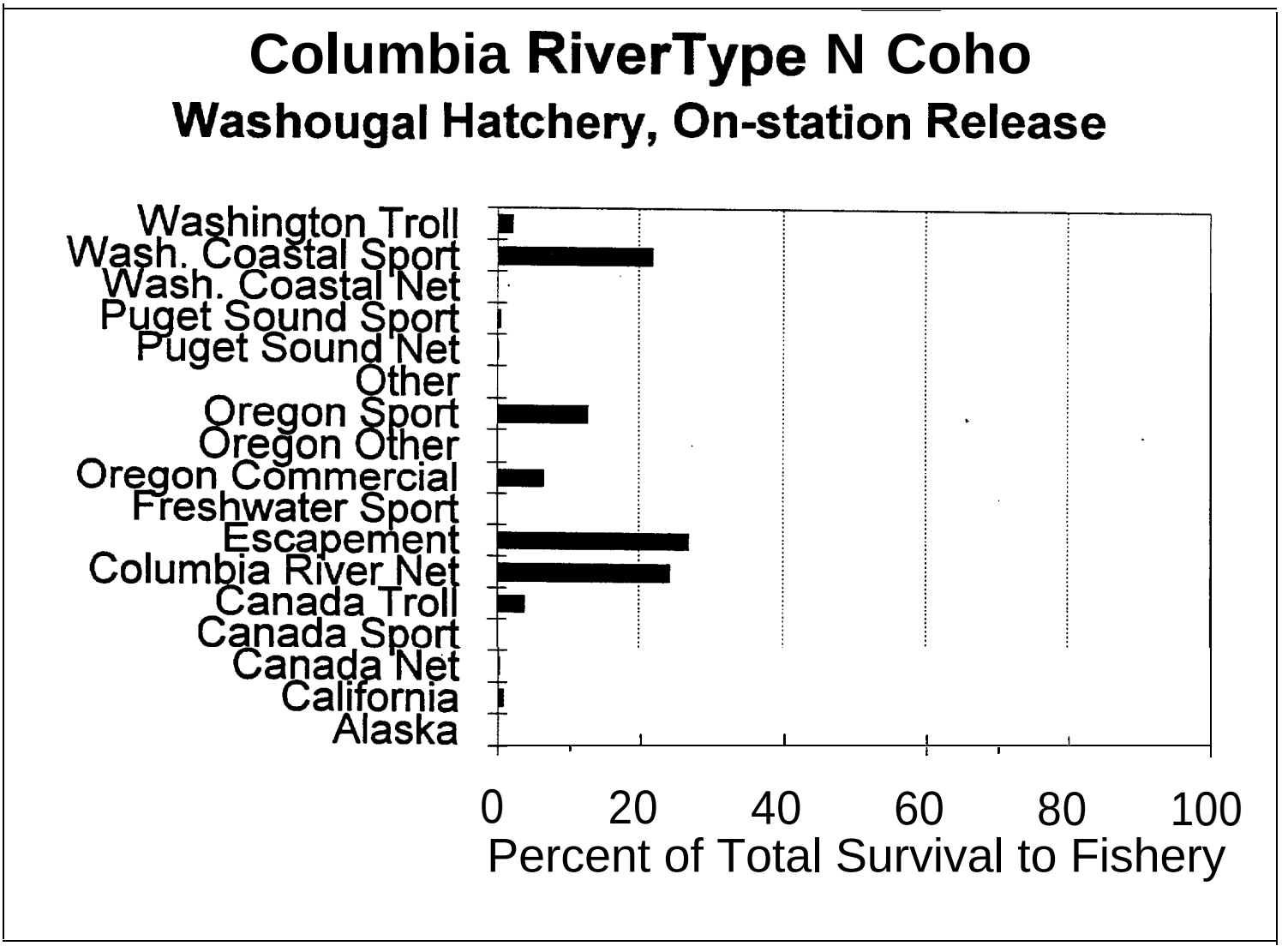

Figure 43. Percent of total survival to fisheries and escapement of Washougal Hatchery 1988-l 992 broods Type N coho released on-station.

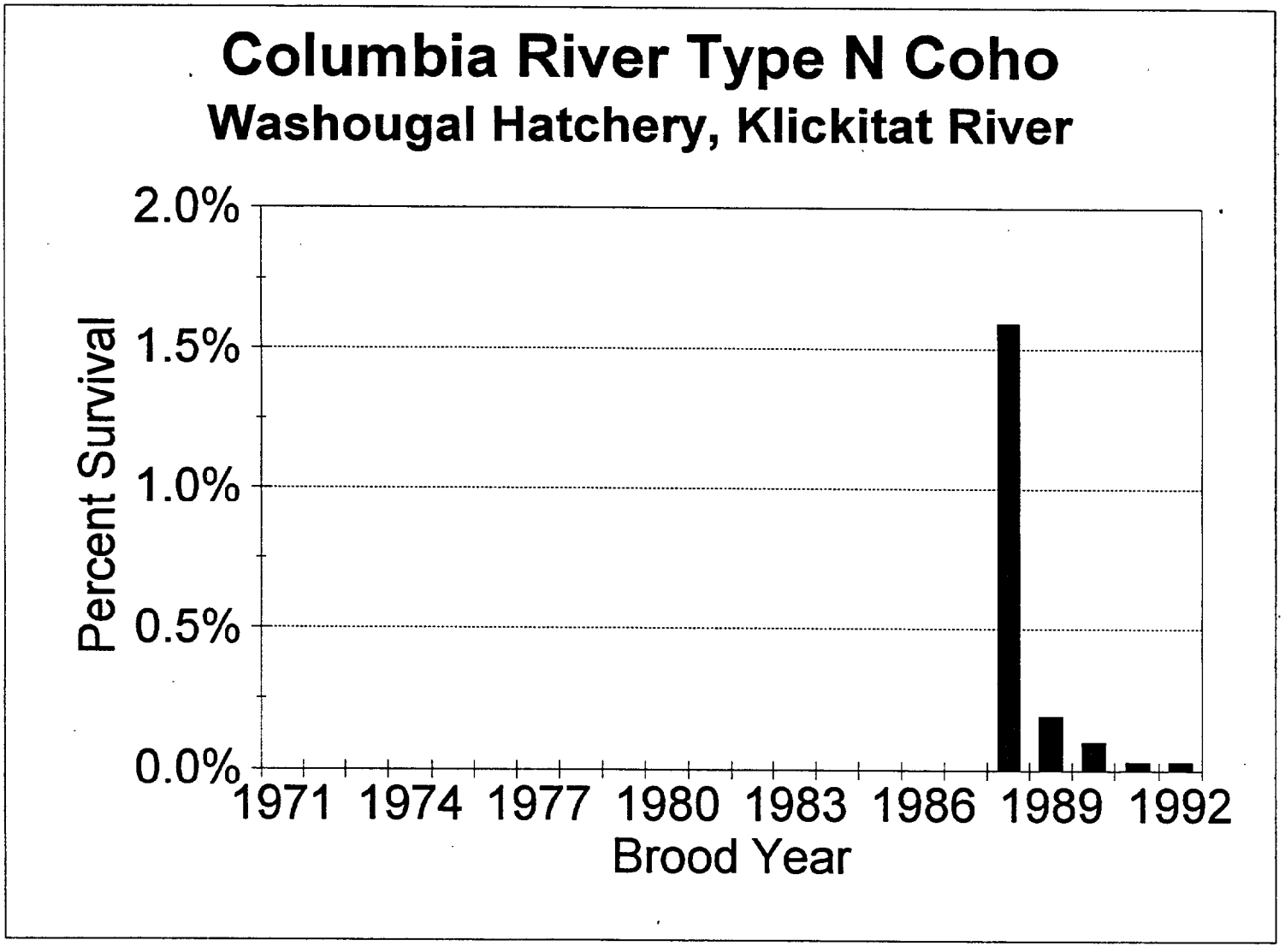

Figure 44. Survival by brood of Washougal Hatchery Type N coho released into the Klickitat River.

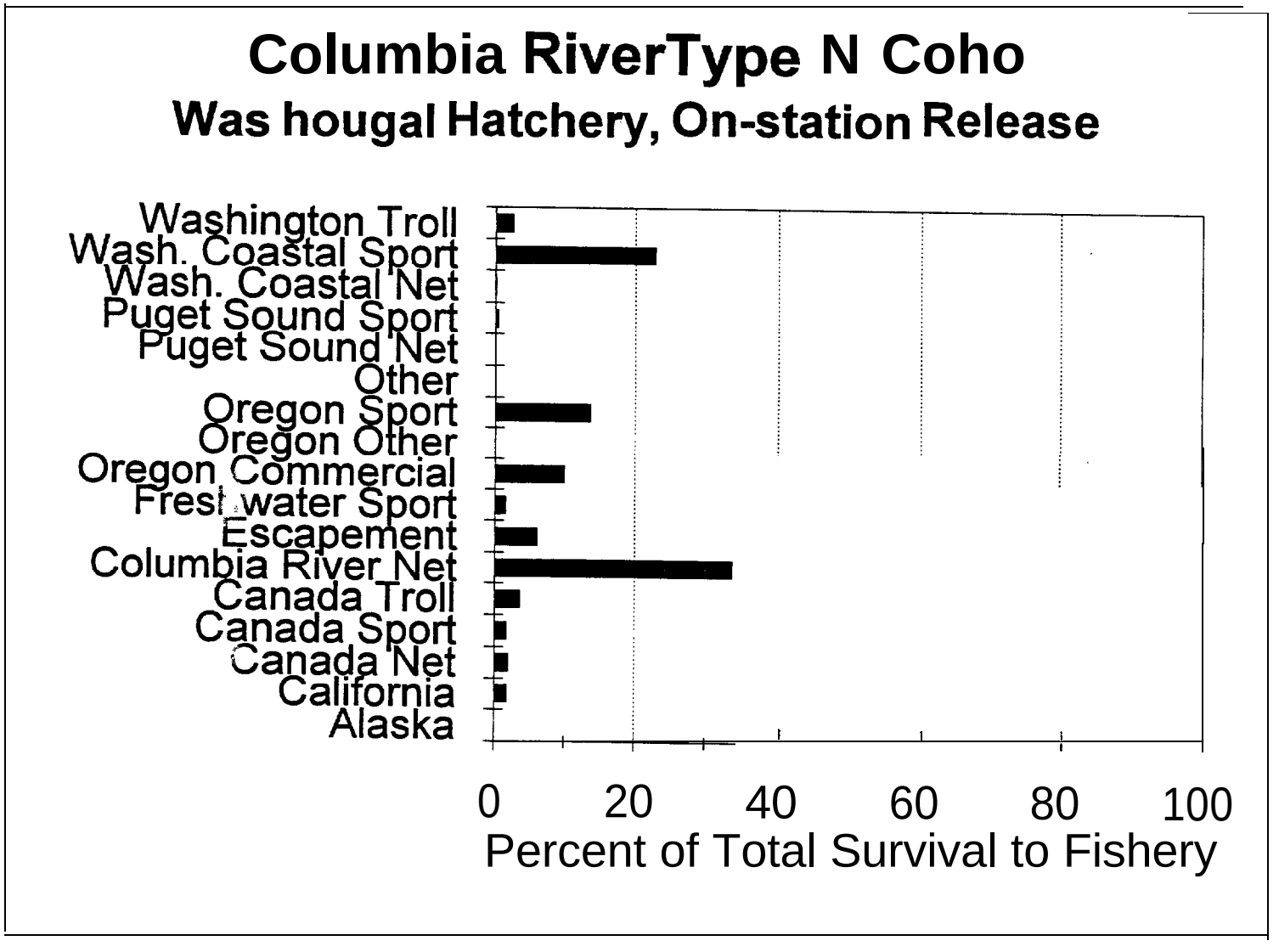

Figure 45. Percent of total survival to fisheries and escapement of Washougal Hatchery 1988-1992 brood Type N coho released into the Klickitat River.

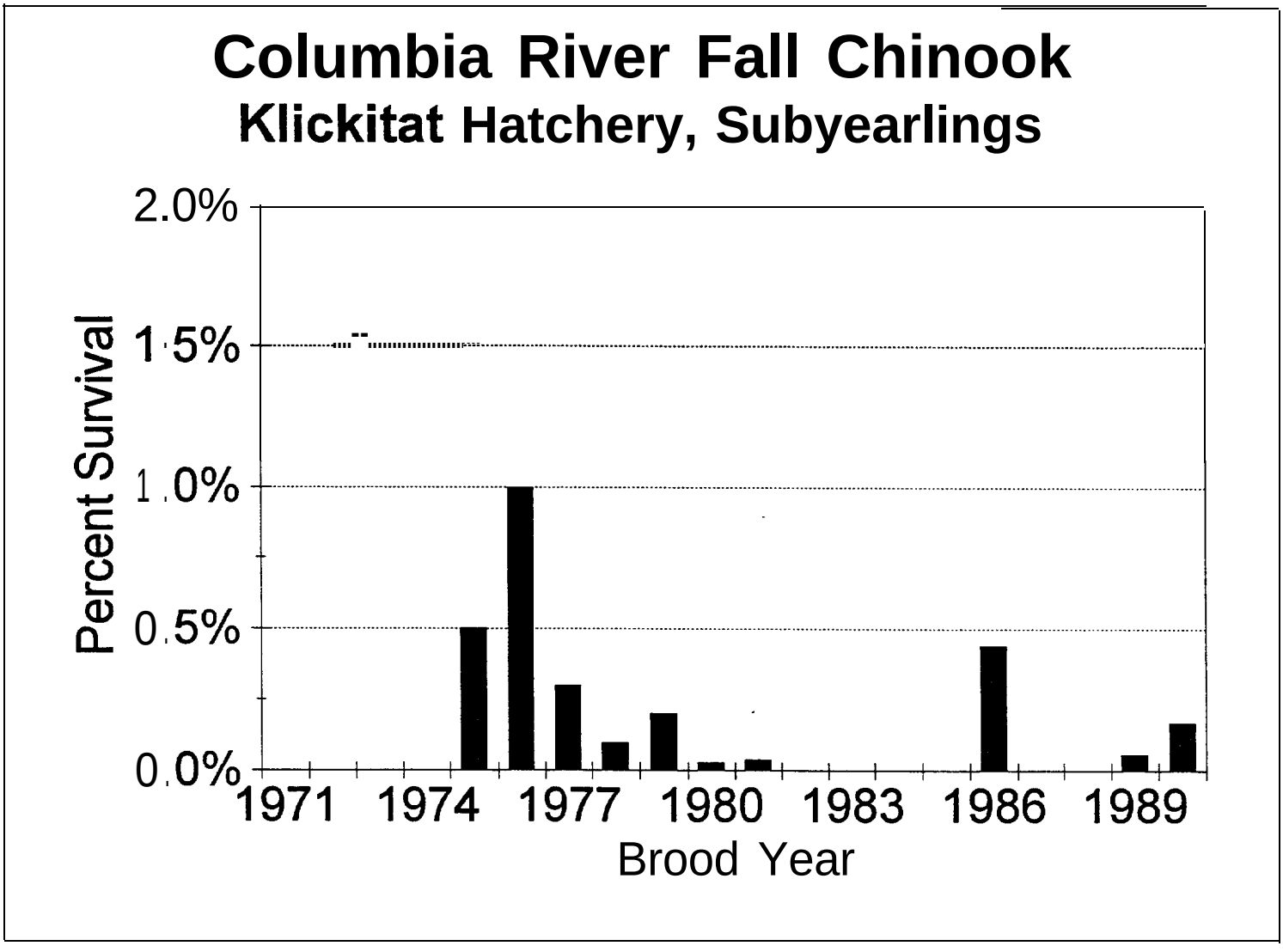

Figure 46. Survival by brood of Klickitat Hatchery fall chinook.

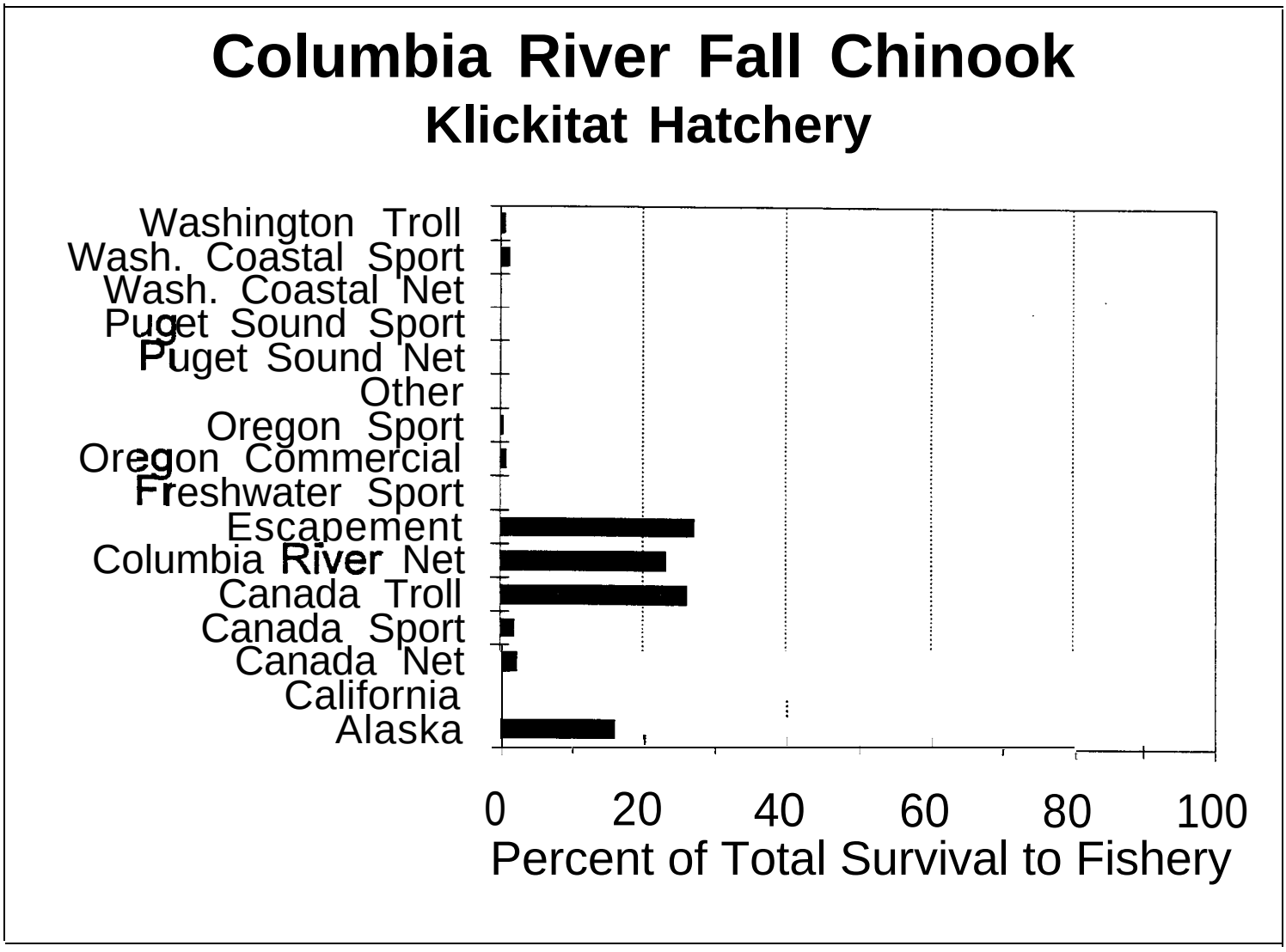

Figure 47. Percent of total survival to fisheries and escapement of Klickitat Hatchery 1986, 1989 and 1990 brood fall chinook.

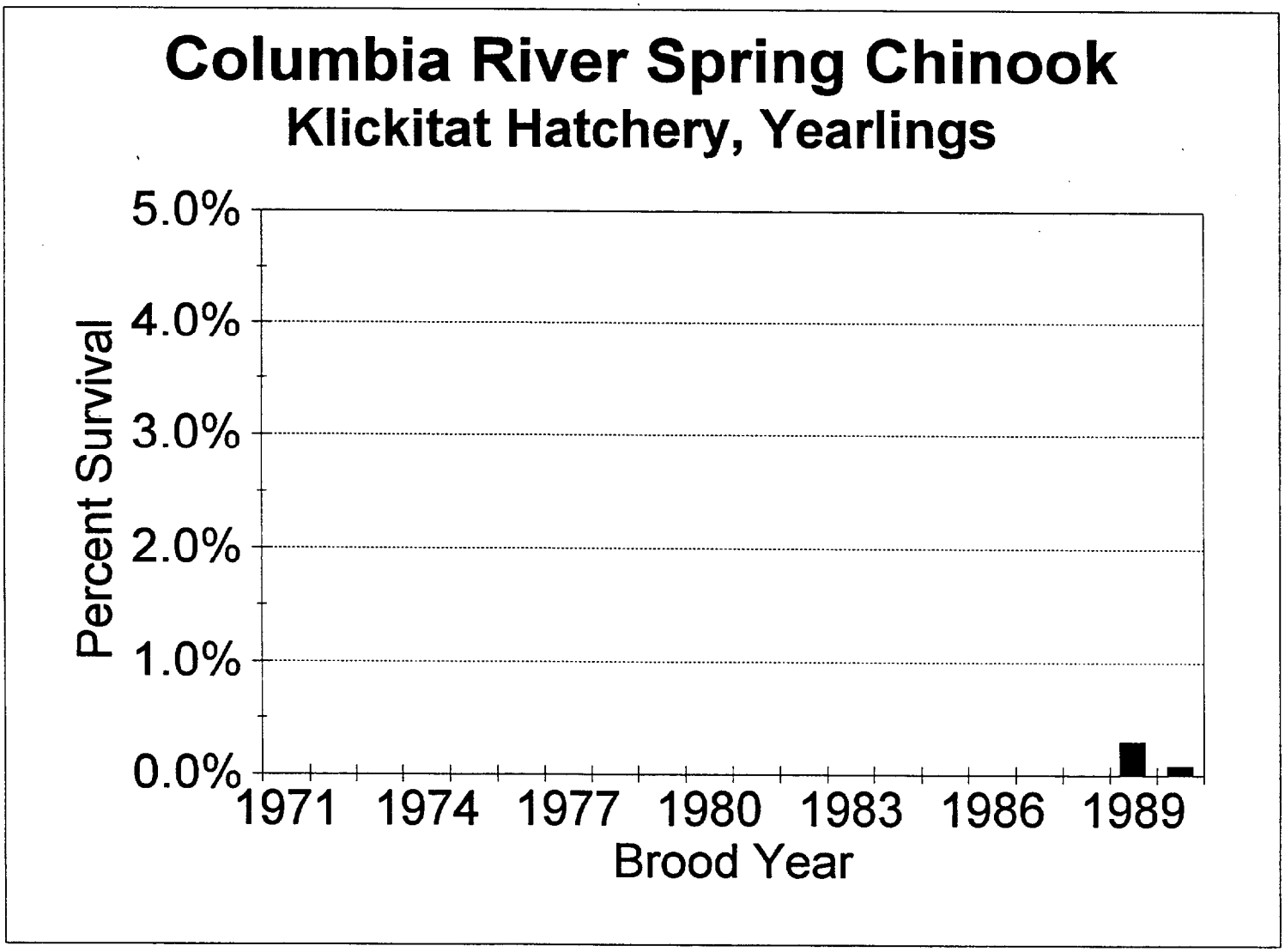

Figure 48. Survival by brood of Klickitat Hatchery yearling spring chinook.

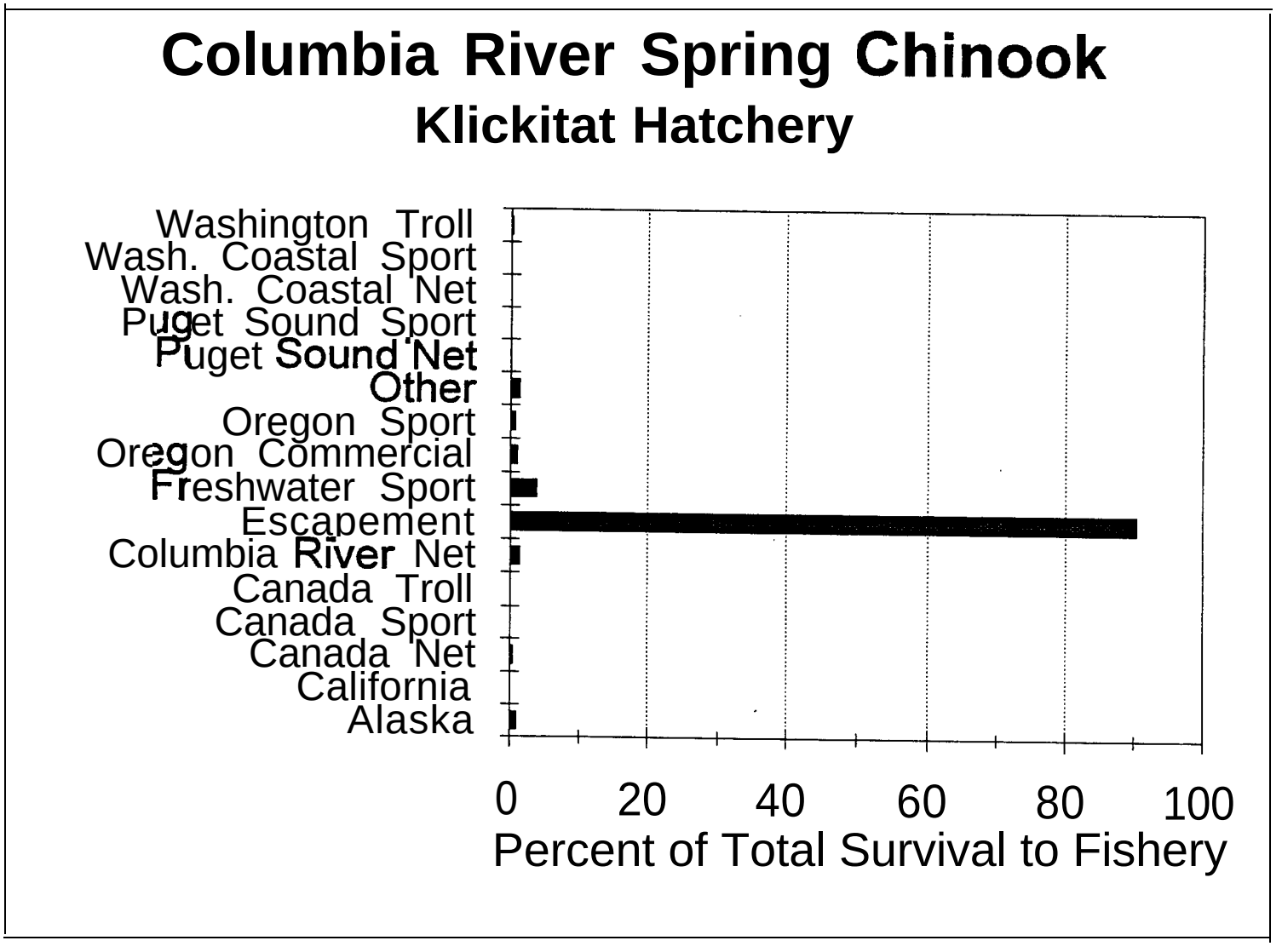

Figure 49. Percent of total survival to fisheries and escapement of Klickitat Hatchery 1989 brood yearling spring chinook.

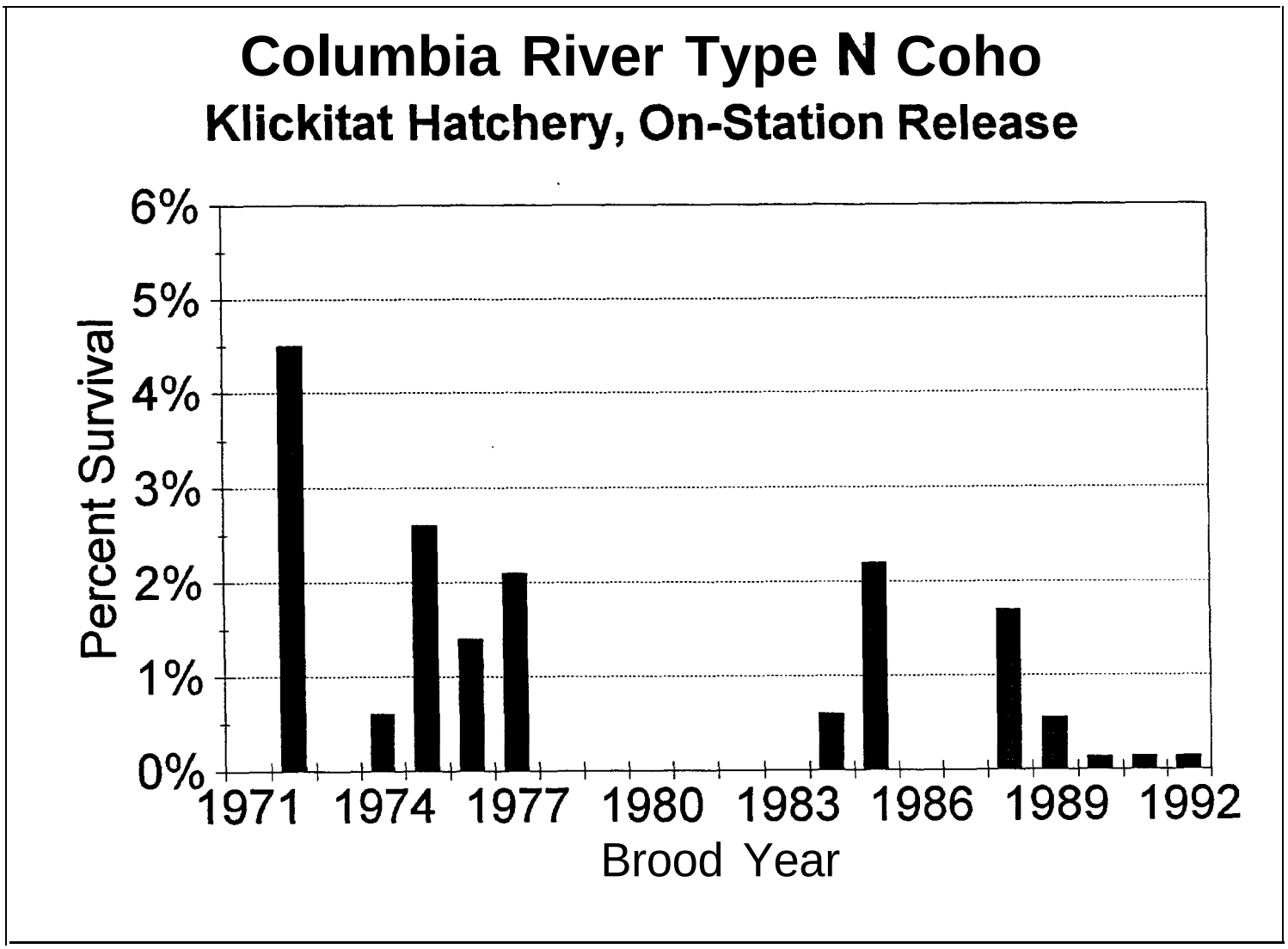

Figure 50. Survival by brood of Klickitat Hatchery Type N coho.

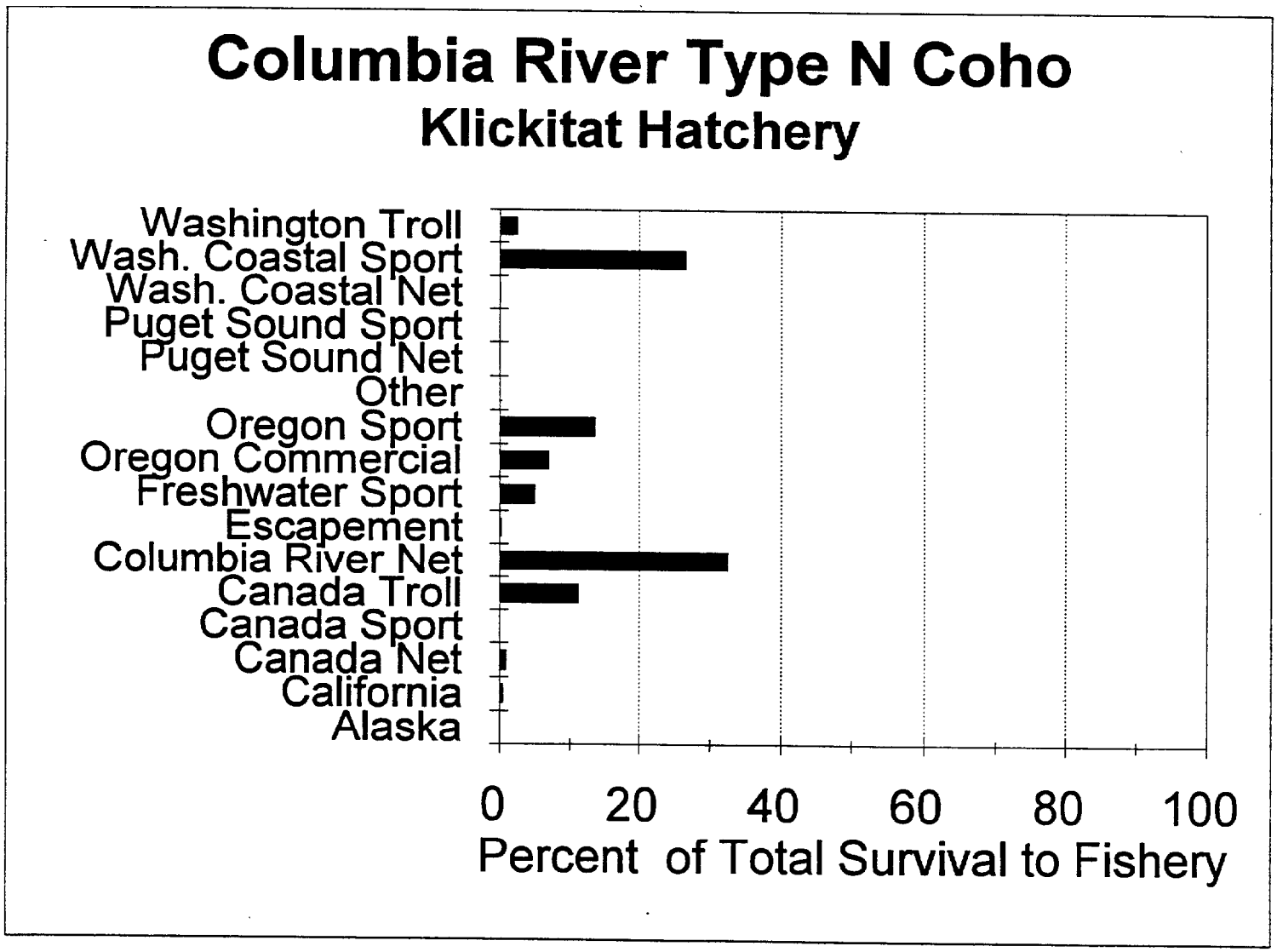

Figure 51. Percent of total survival to fisheries and escapement of Klickitat Hatchery 1988-1992 broods Type N coho.

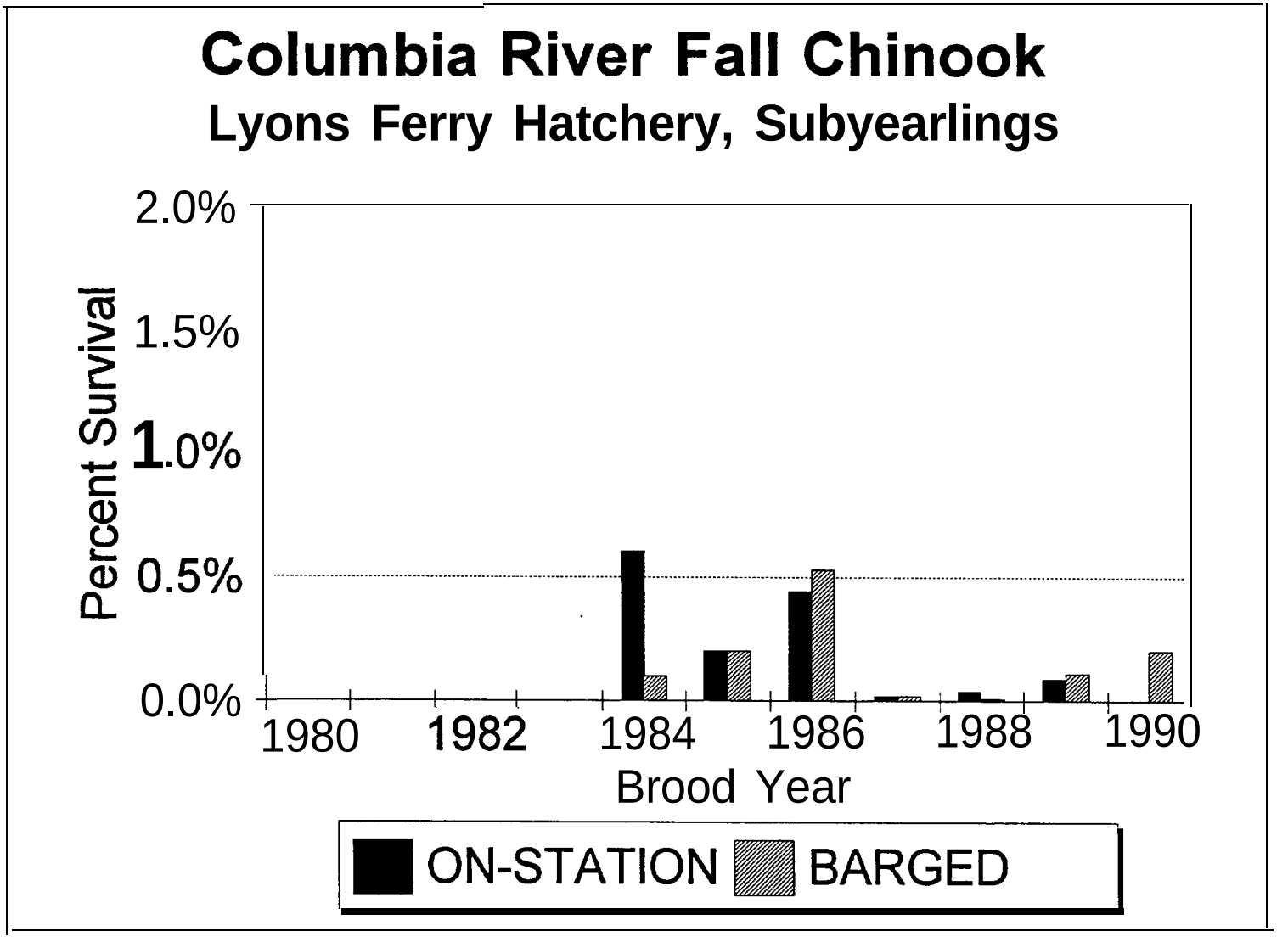

Figure 52. Survival by brood of Lyons Ferry Hatchery subyearling fall chinook released on-station or barged downstream.

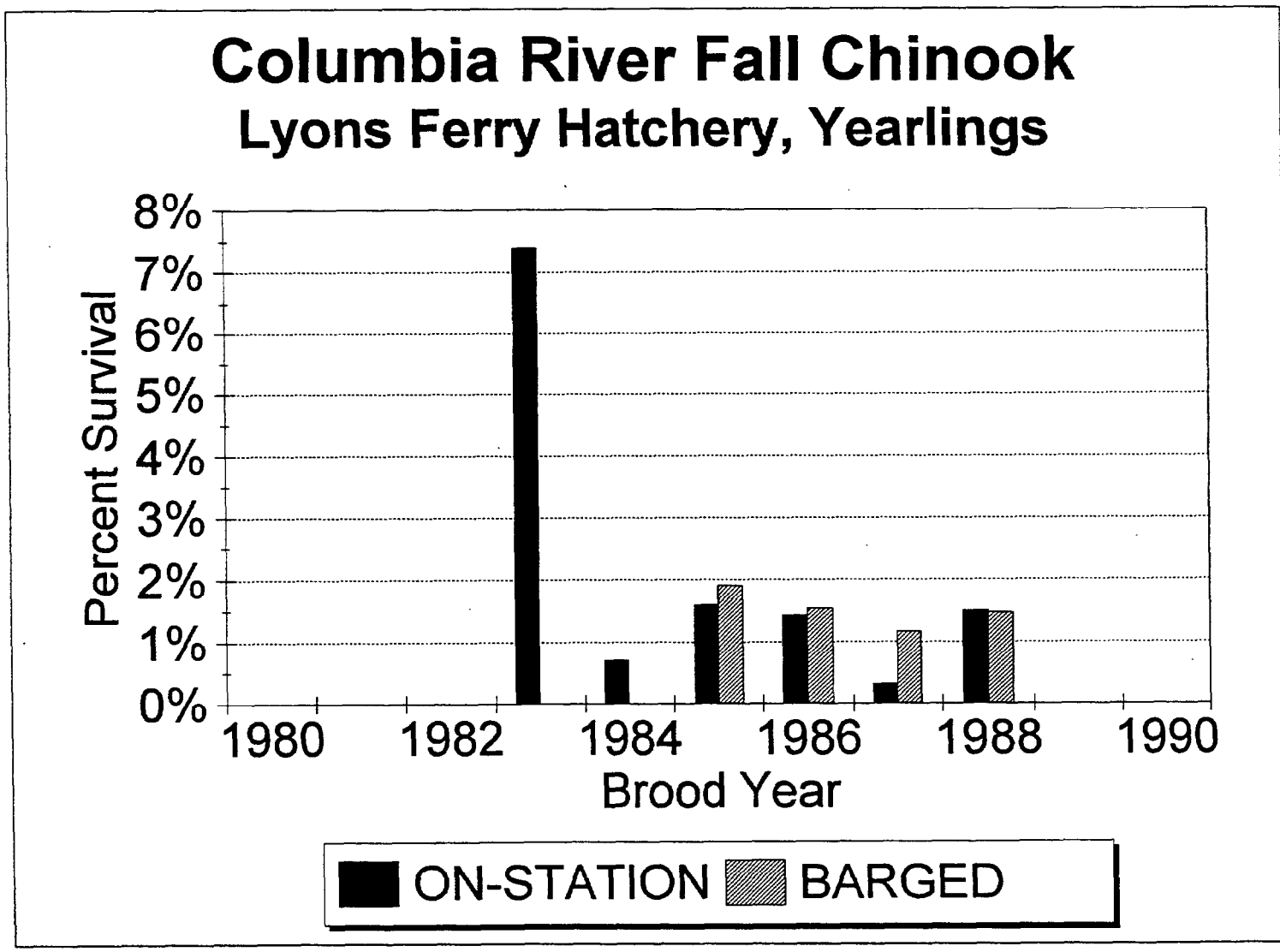

Figure 53. Survival by brood of Lyons Ferry Hatchery yearling fall chinook released on-station or barged downstream.

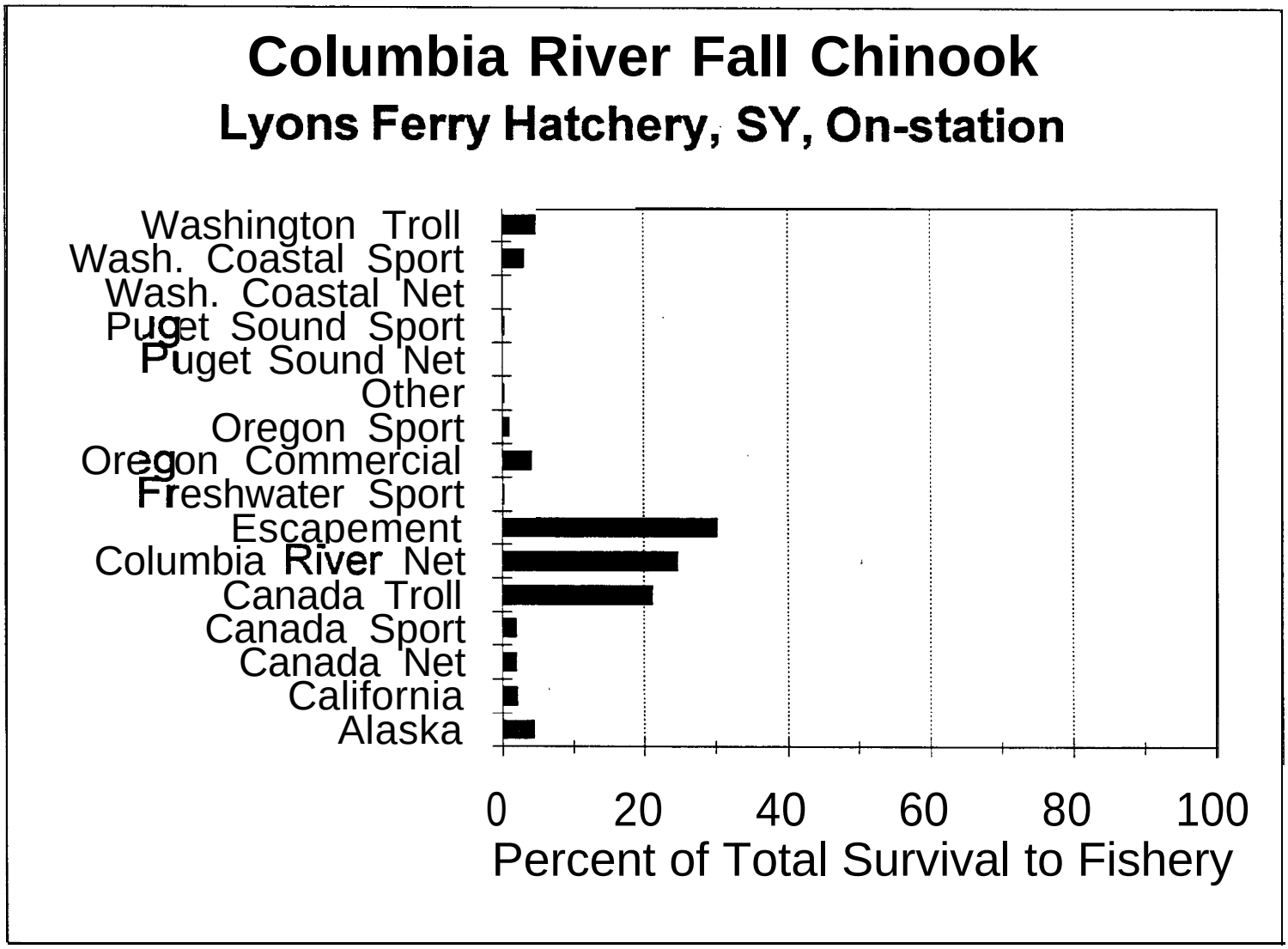

Figure 54. Percent of total survival to fisheries and escapement of Lyons Ferry Hatchery 1986-l 990 broods subyearling fall chinook released on-station.

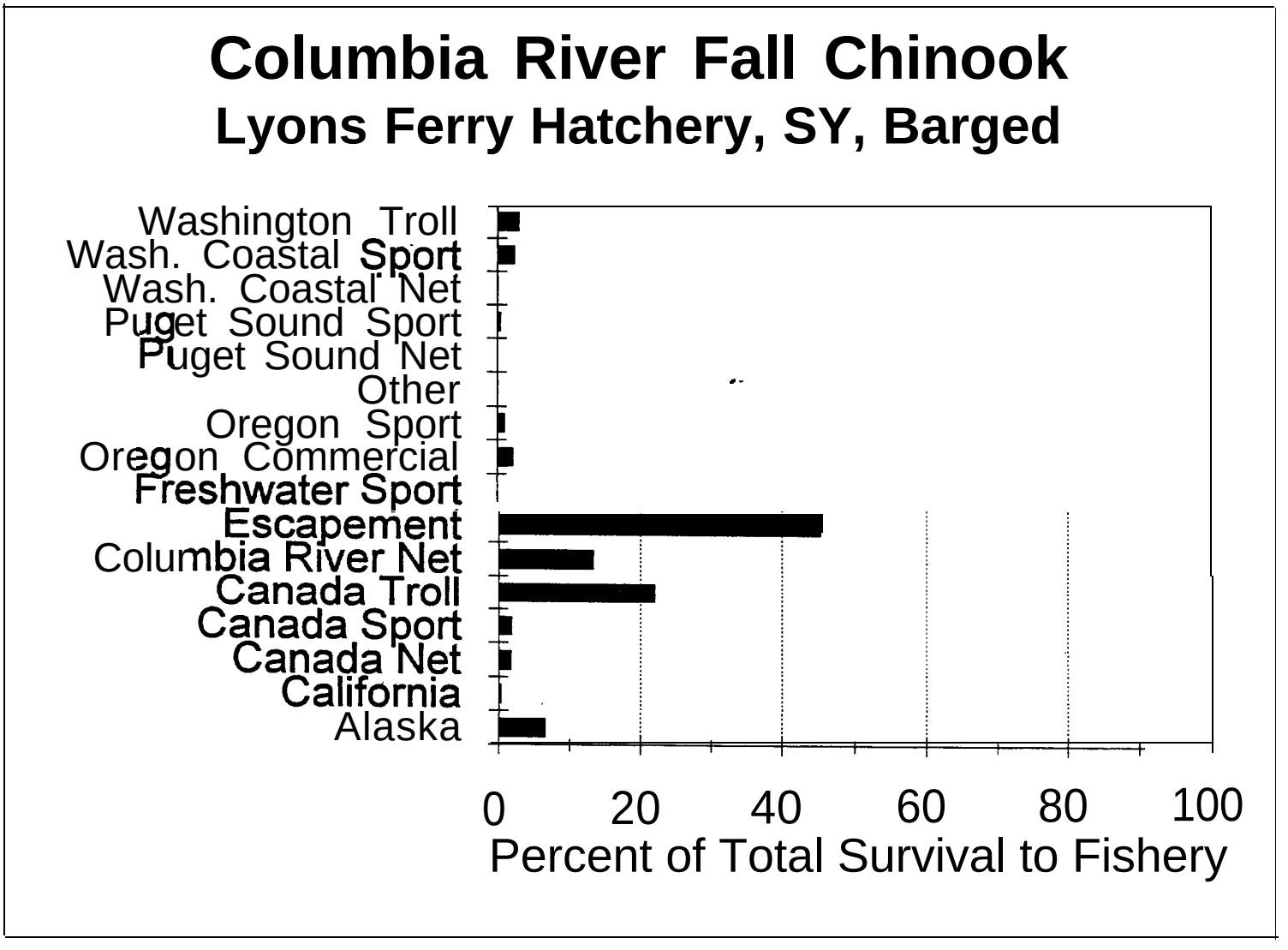

Figure 55. Percent of total survival to fisheries and escapement of Lyons Ferry Hatchery 1986-l 990 broods subyearling fall chinook barged downstream.

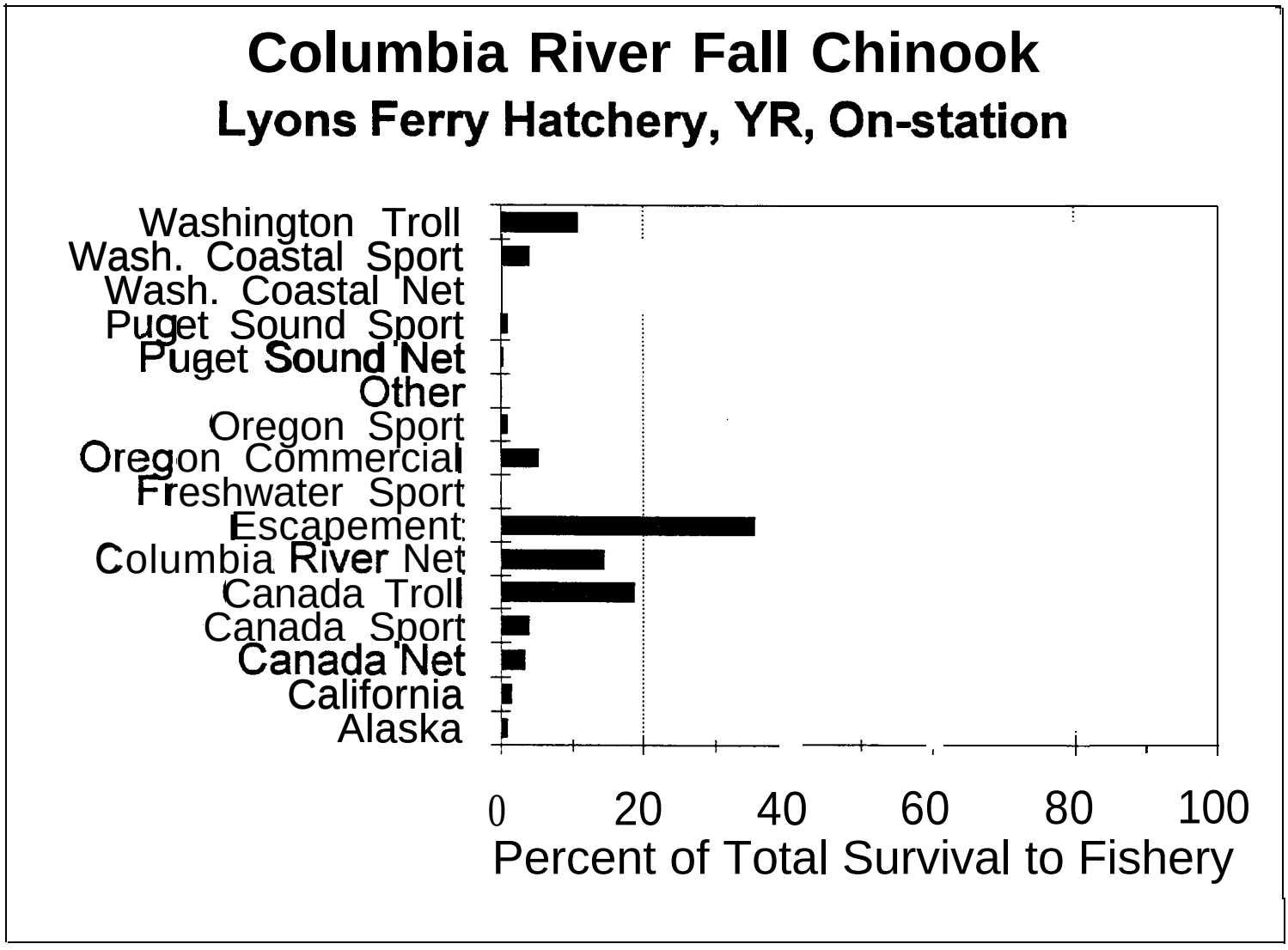

Figure 56. Percent of total survival to fisheries and escapement of Lyons Ferry Hatchery 1986-l 988 and 1990 brood yearling fall chinook released on-station.

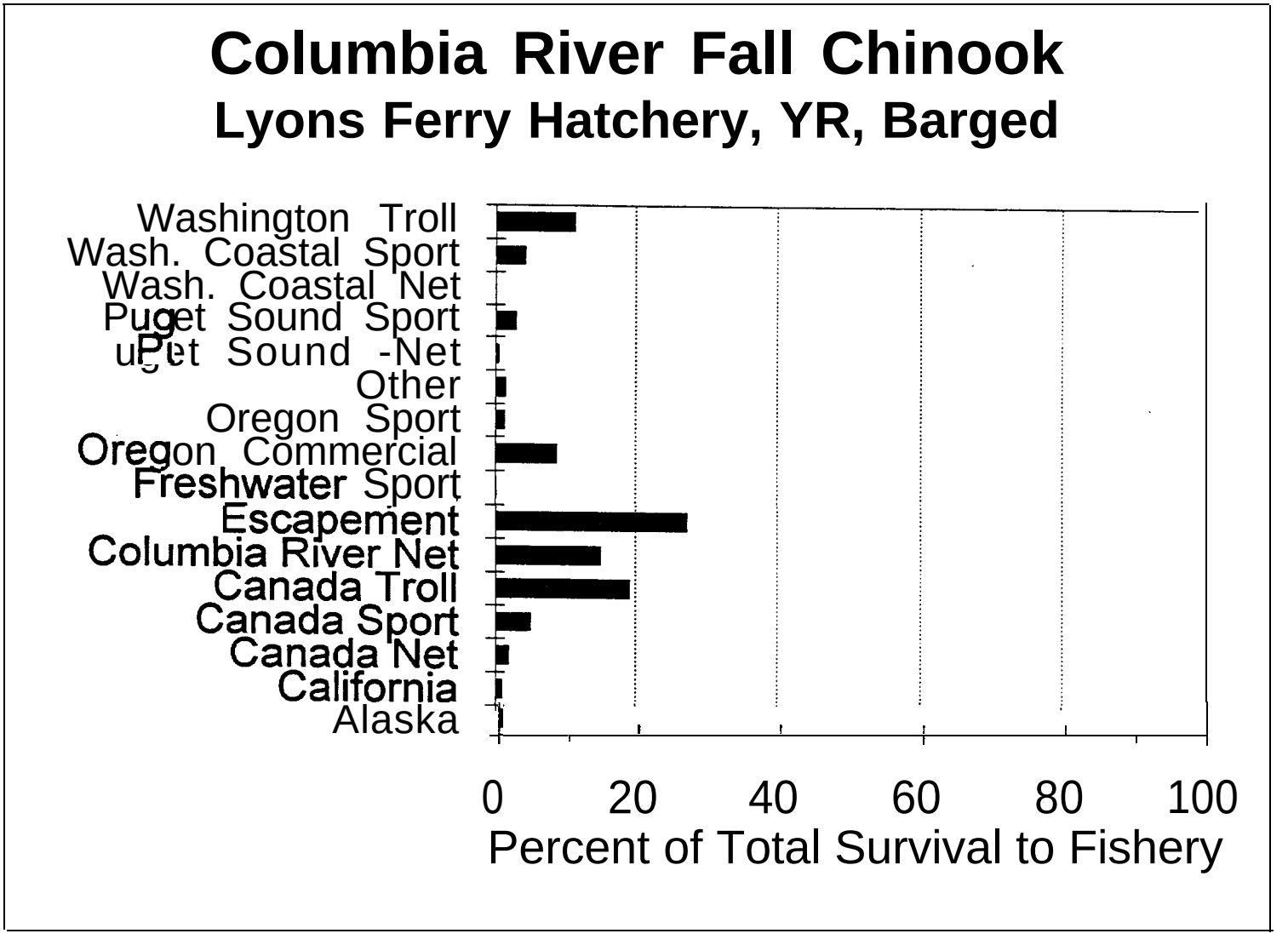

Figure 57. Percent of total survival to fisheries and escapement of Lyons Ferry Hatchery 1986-l 988 broods yearling fall chinook barged downstream.

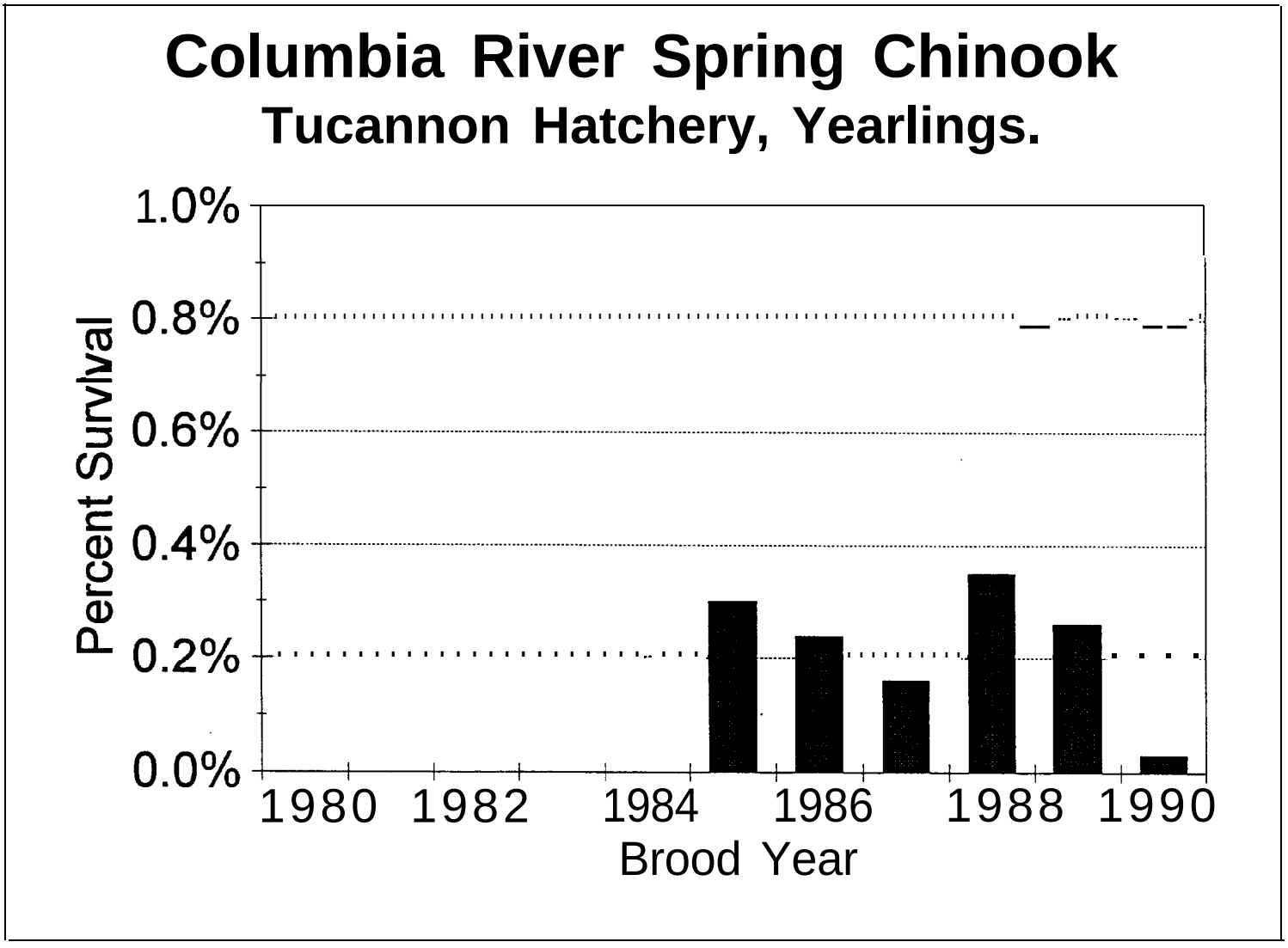

Figure 58. Survival by brood of Tucannon Hatchery spring chinook.

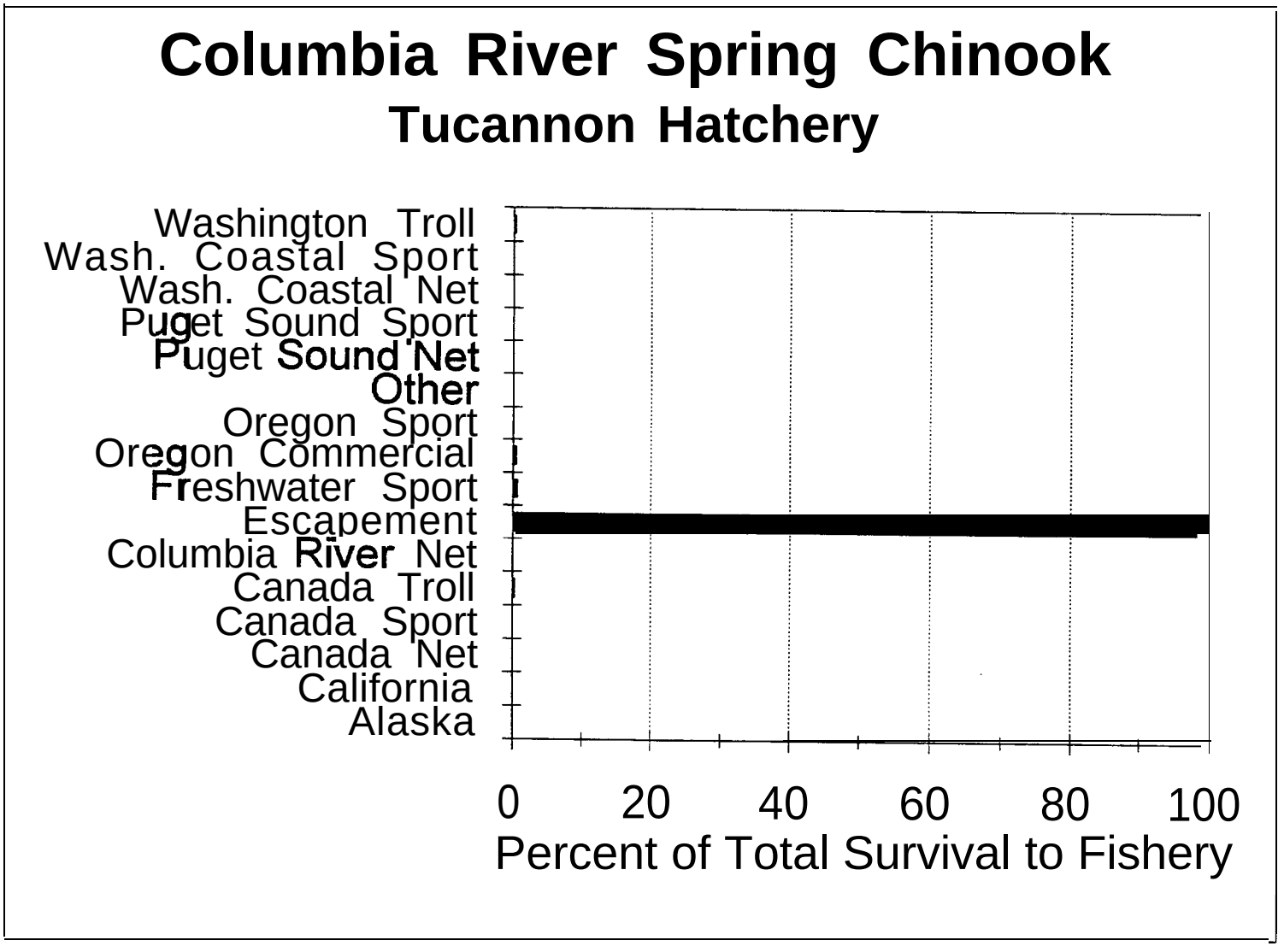

Figure 59. Percent of total survival to fisheries and escapement of Tucannon Hatchery 1986-l 990 broods spring chinook.

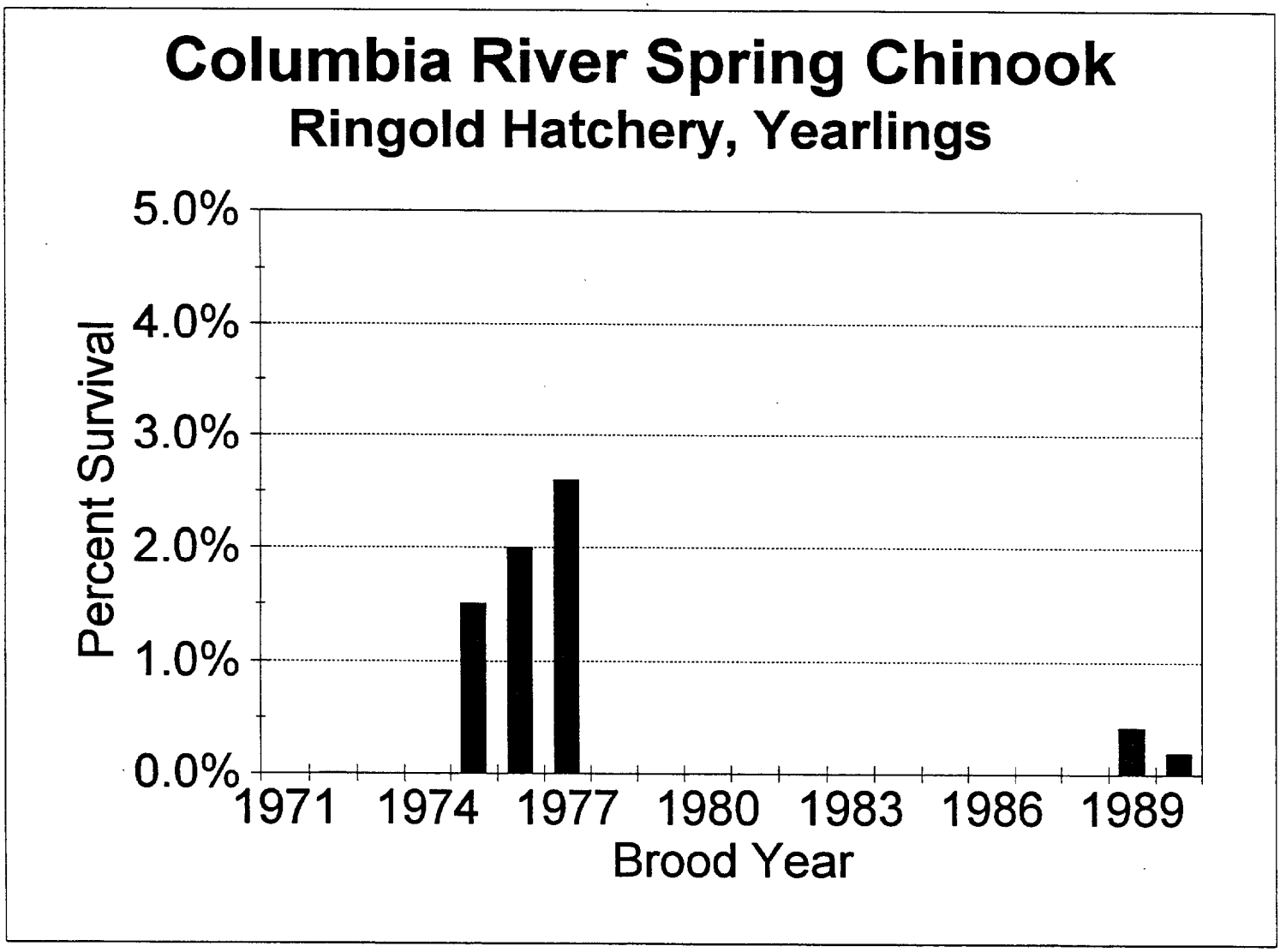

Figure 60. Survival by brood of Ringold Hatchery spring chinook.

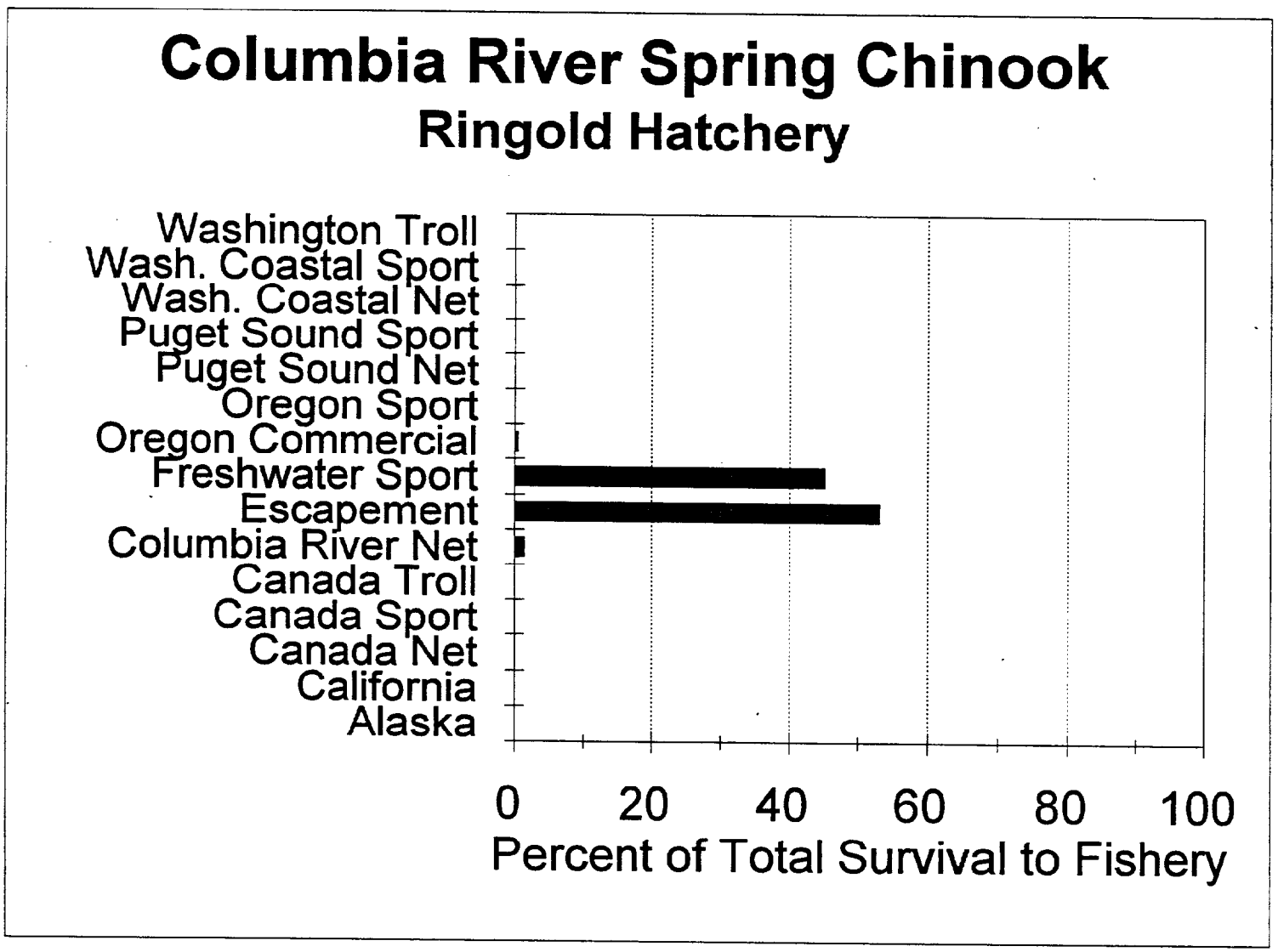

Figure 61. Percent of total survival to fisheries and escapement of Ringold Hatchery 1989 and 1990 brood spring chinook.

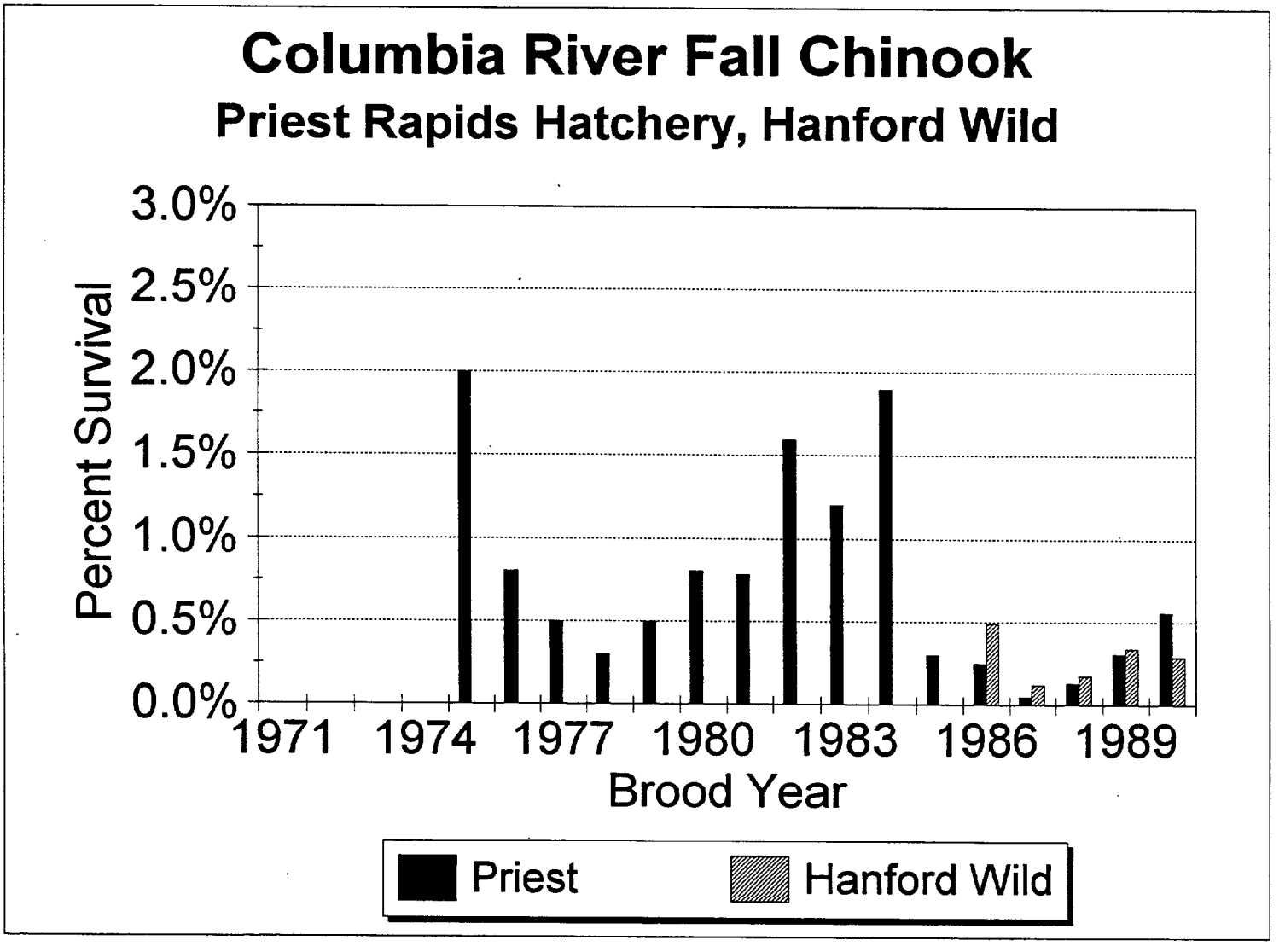

Figure 62. Survival by brood of Priest Rapids Hatchery and Hanford Reach wild upriver bright chinook.

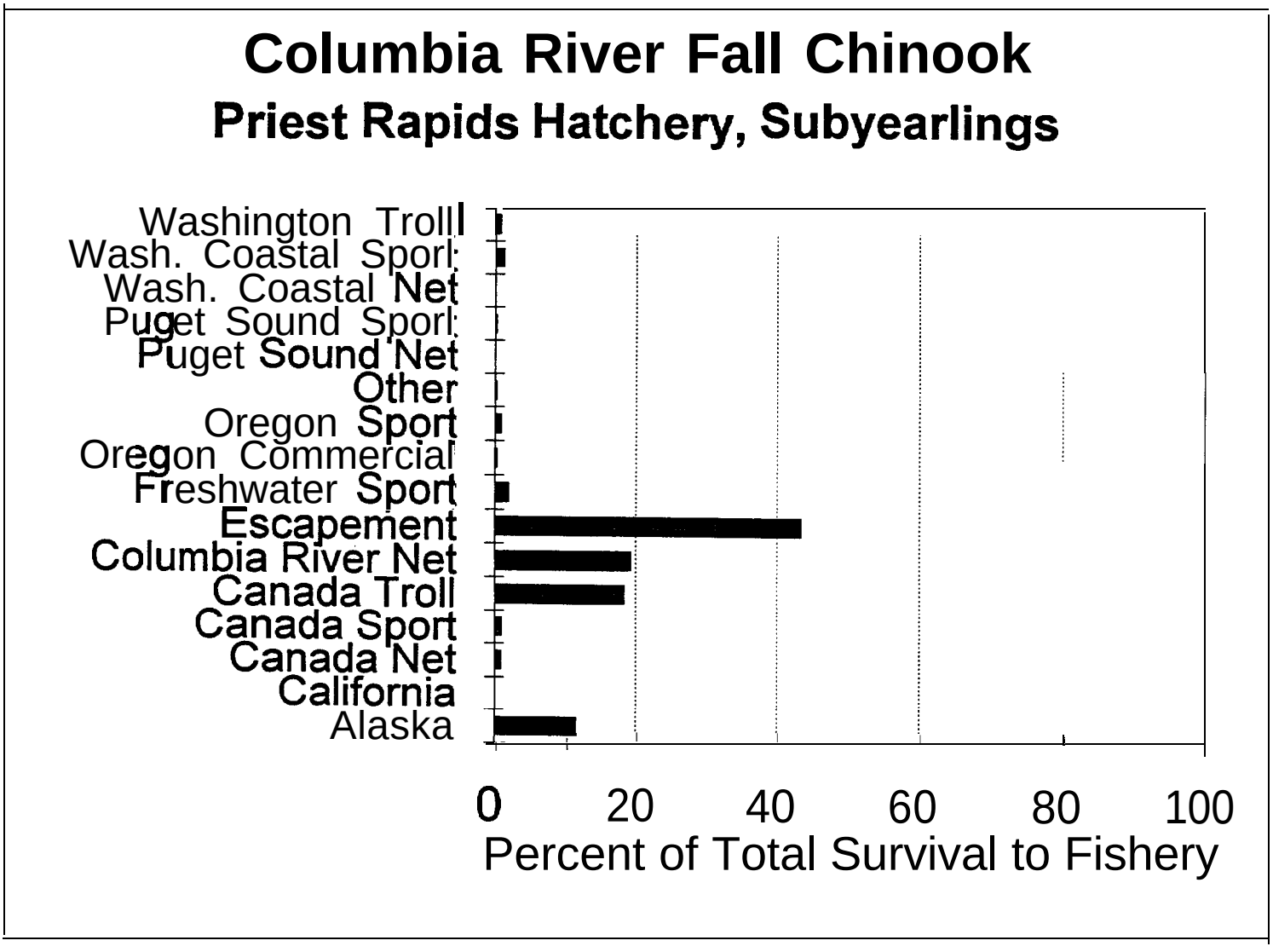

Figure 63. Percent of total survival to fisheries and escapement of Priest Rapids Hatchery 1986-l 990 broods upriver bright fall chinook.

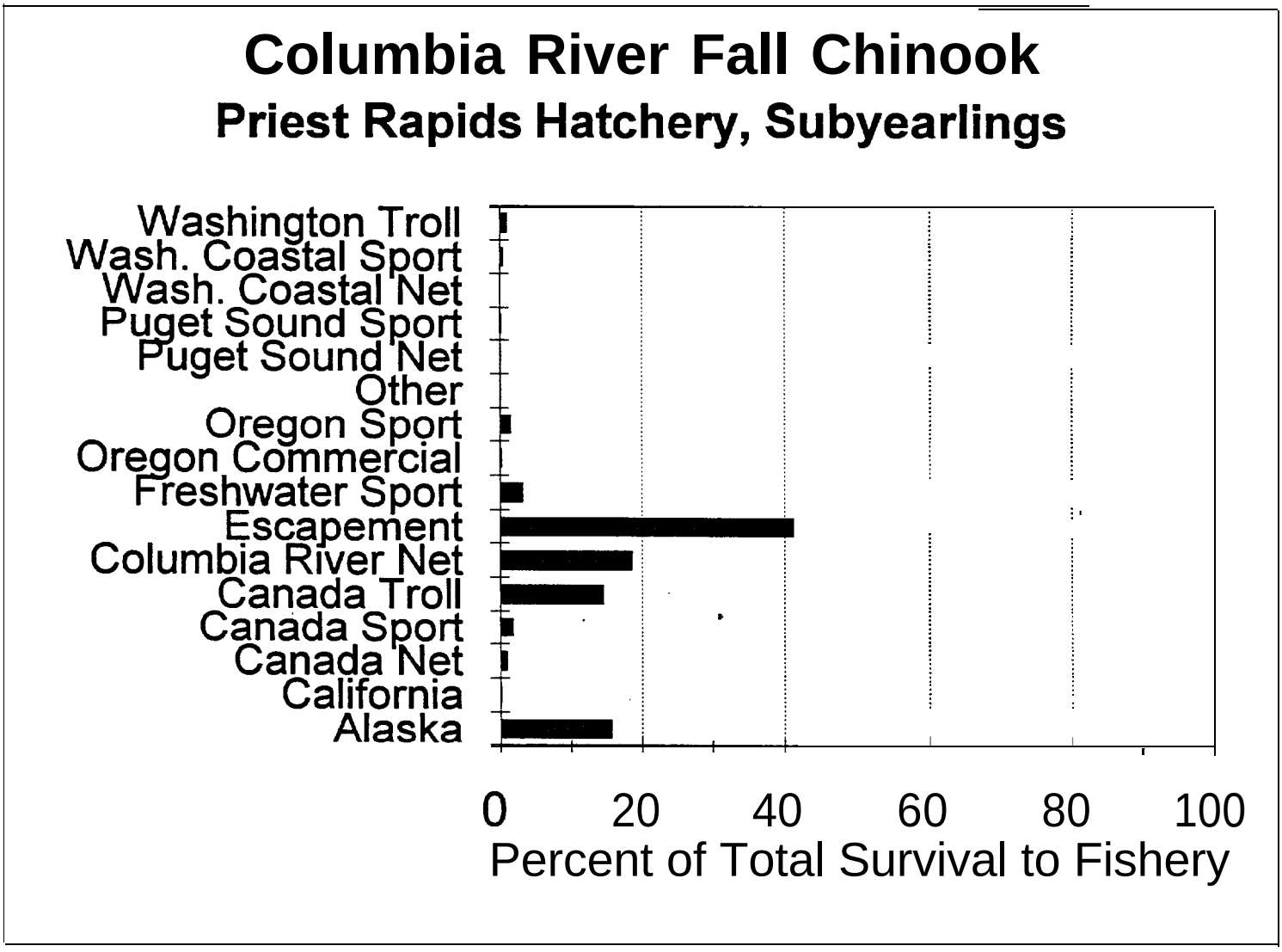

Figure 64. Percent of total survival to fisheries and escapement of Hanford Reach 1987-1989 broods upriver bright wild fall chinook.

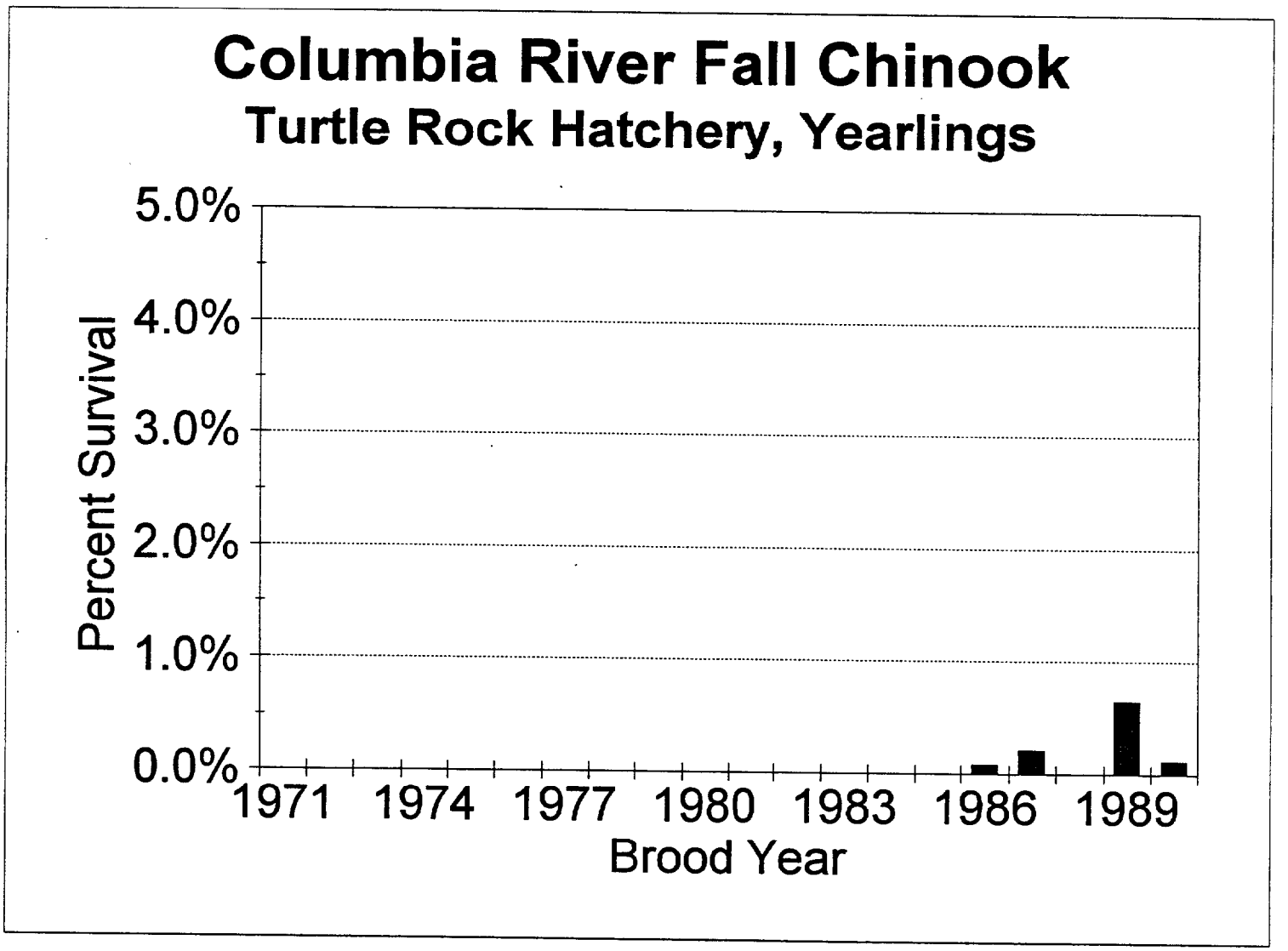

Figure 65. Survival by brood of Turtle Rock Hatchery yearling fall chinook.

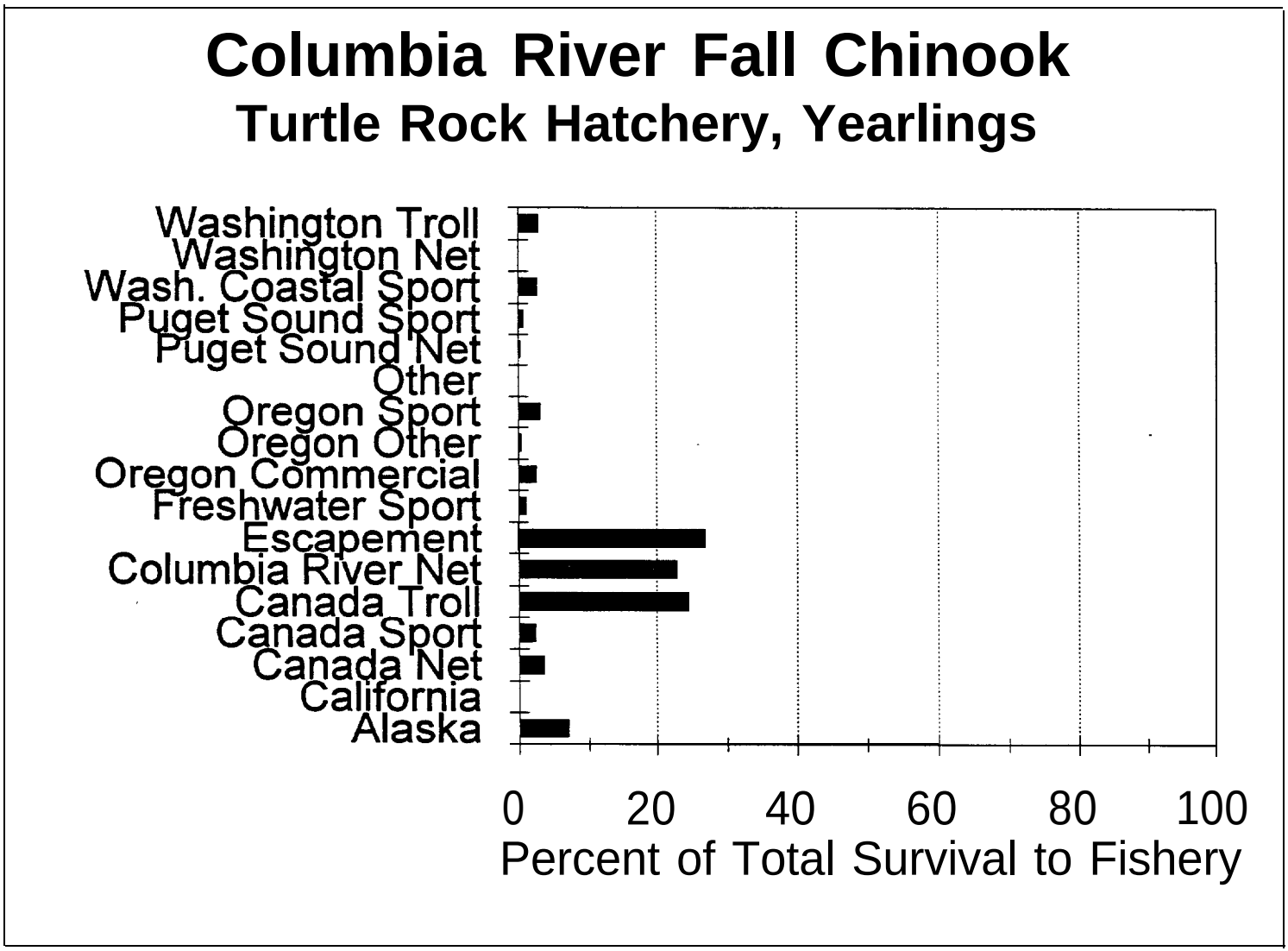

Figure 66. Percent of total survival to fisheries and escapement of Turtle Rock Hatchery 1986,1987, 1989 and 1990 brood yearling fall chinook.

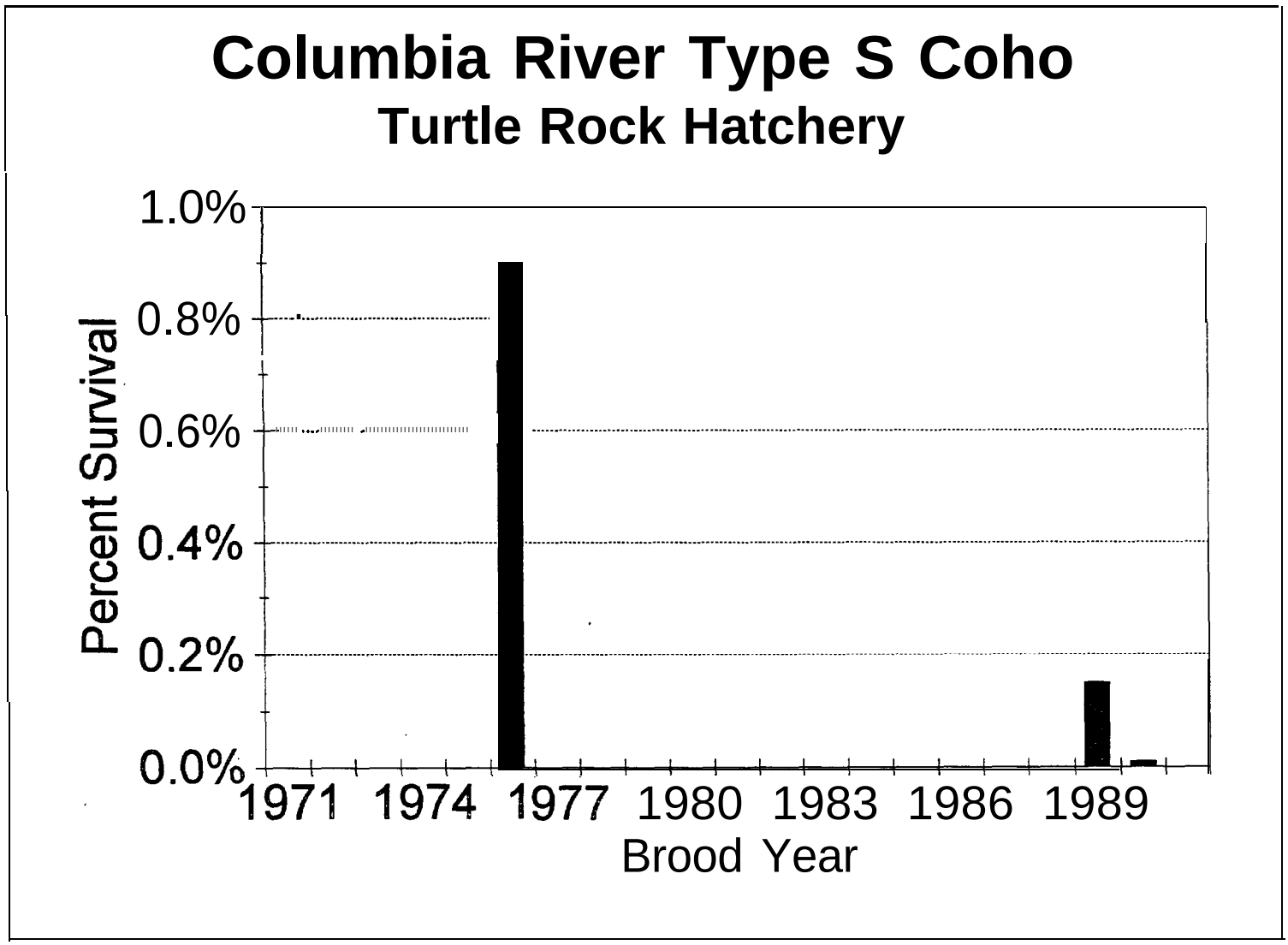

Figure 67. Survival by brood of Turtle Rock Hatchery Type S coho.

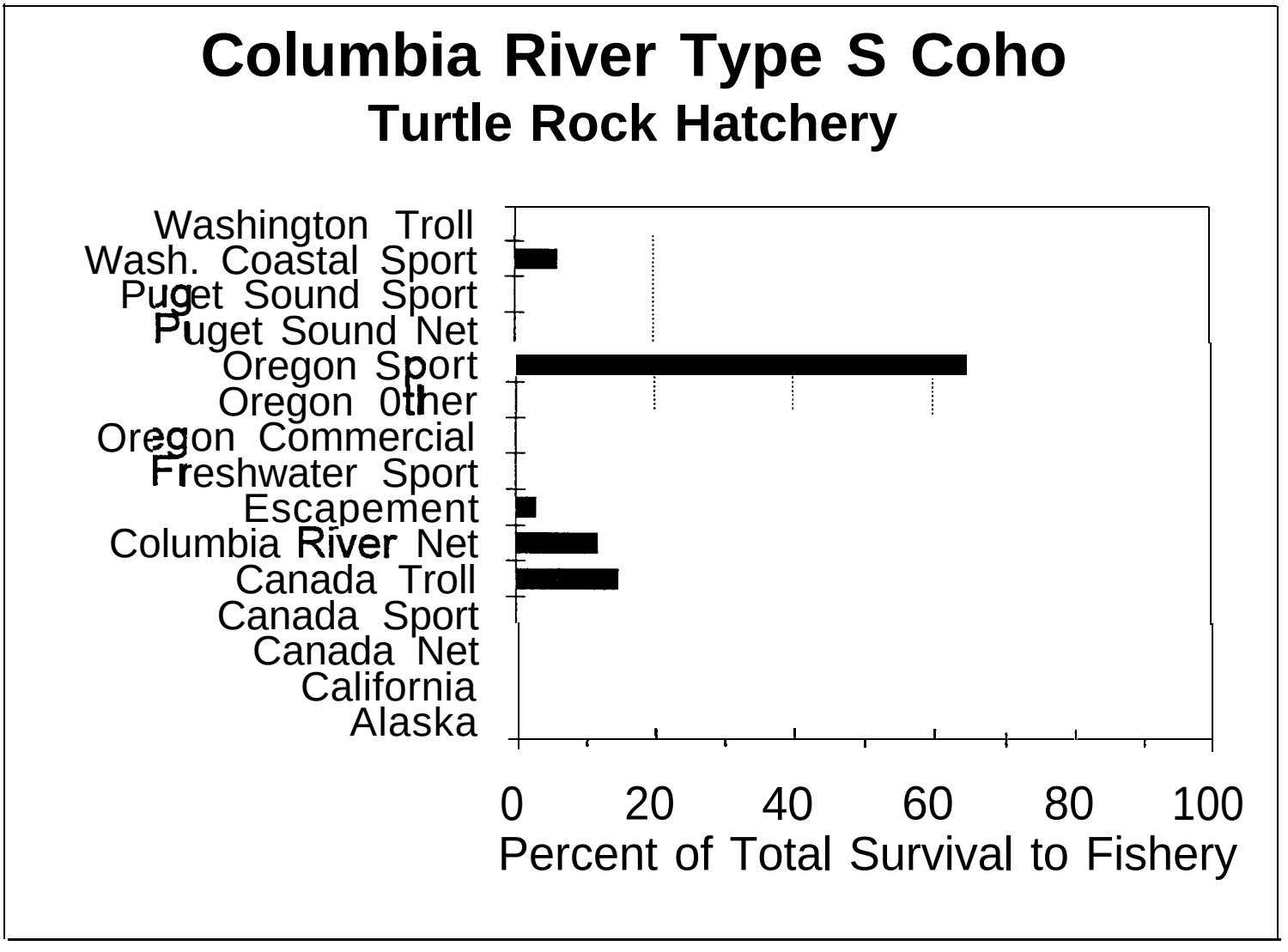

Figure 68. Percent of total survival to fisheries and escapement of Turtle Rock Hatchery 1989 and 1991 broods Type S coho.

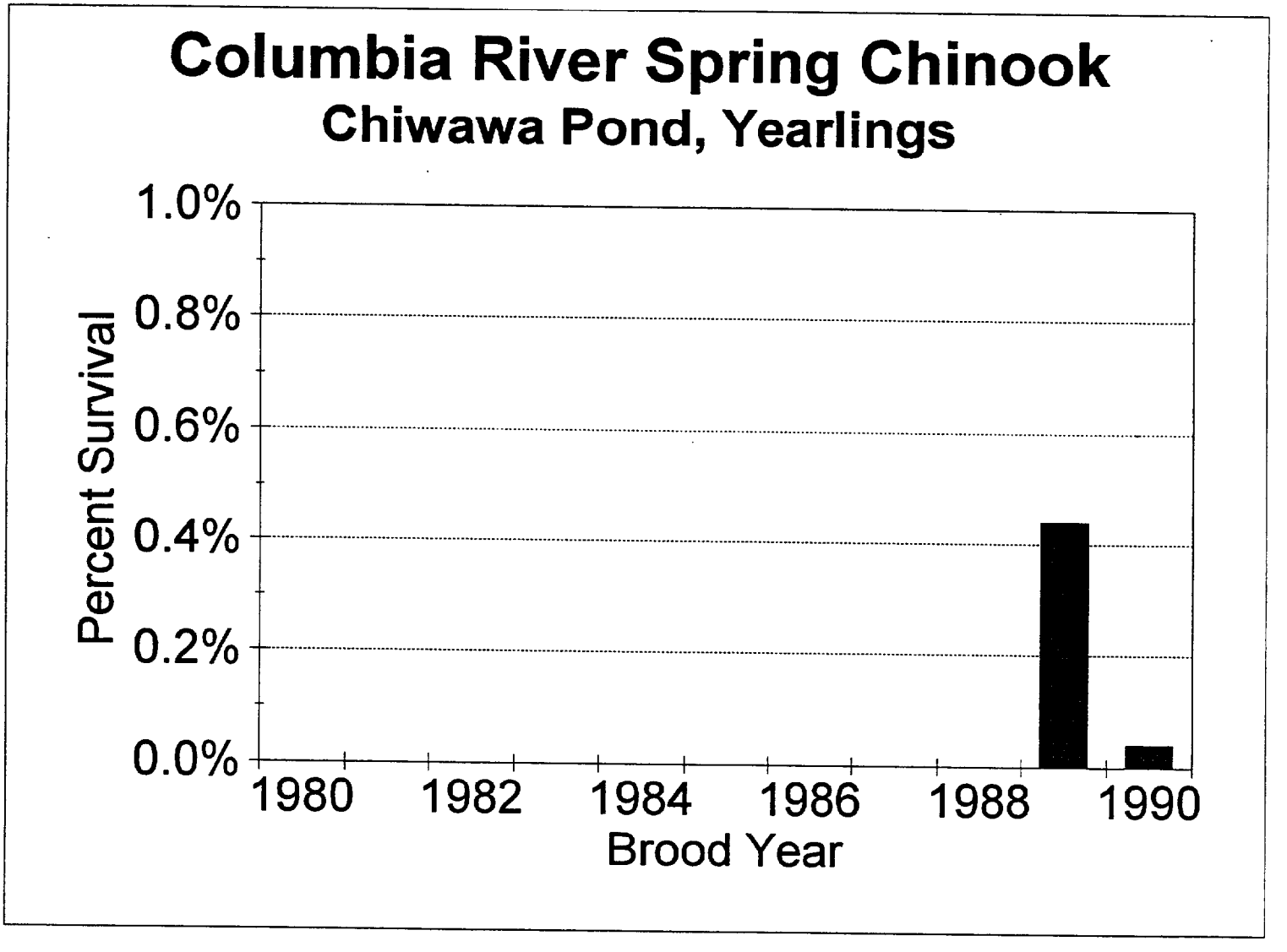

Figure 69. Survival by brood of Chiwawa Rearing Ponds yearling spring chinook.

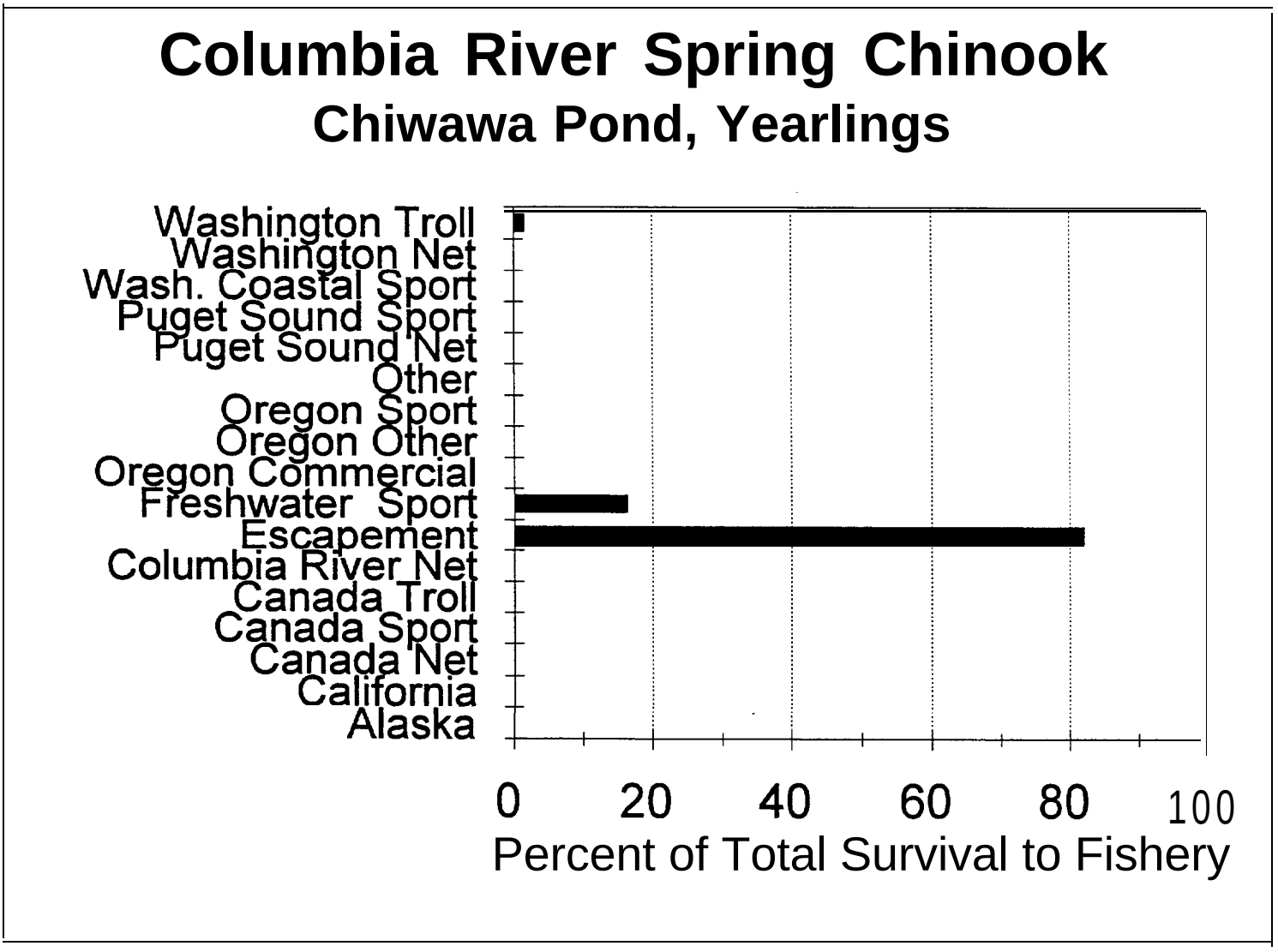

Figure 70. Percent of total survival to fisheries and escapement of Chiwawa Rearing Ponds 1989 and 1990 brood spring chinook.

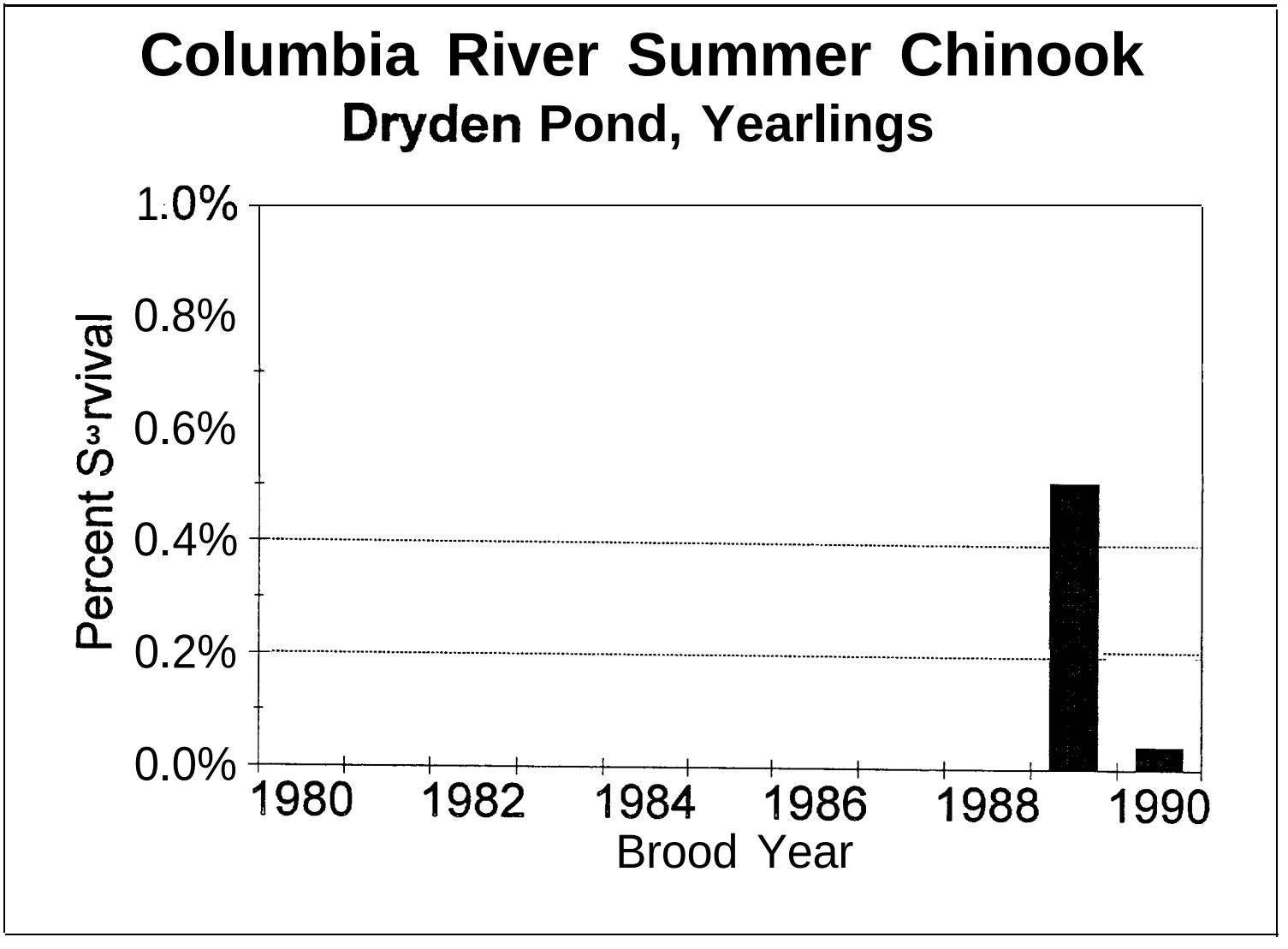

Figure 71. Survival by brood of Dryden Rearing Pond yearling summer chinook.

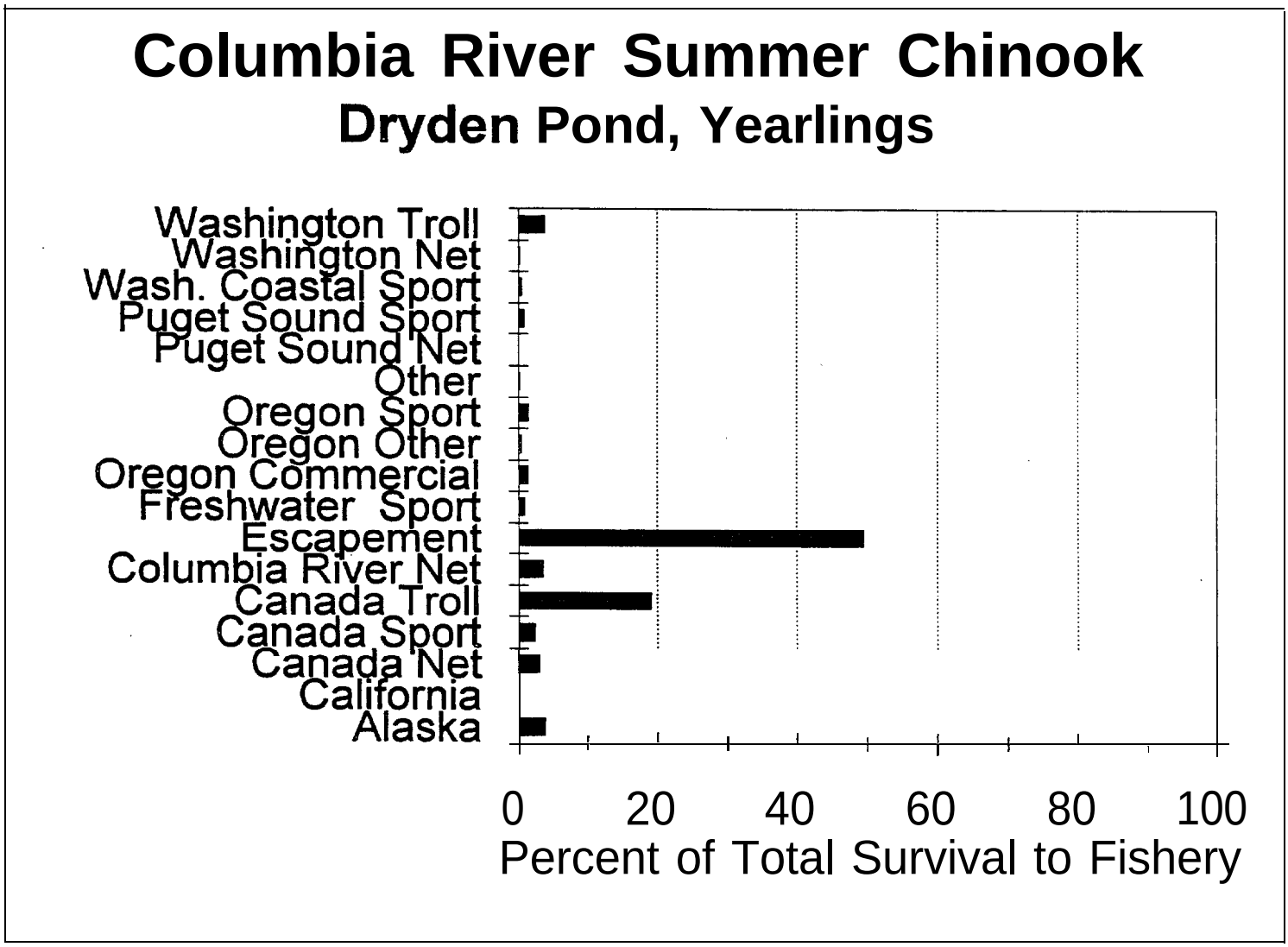

Figure 72. Percent of total survival to fisheries and escapement of Dryden Rearing Pond 1989 and 1990 brood yearling summer chinook.

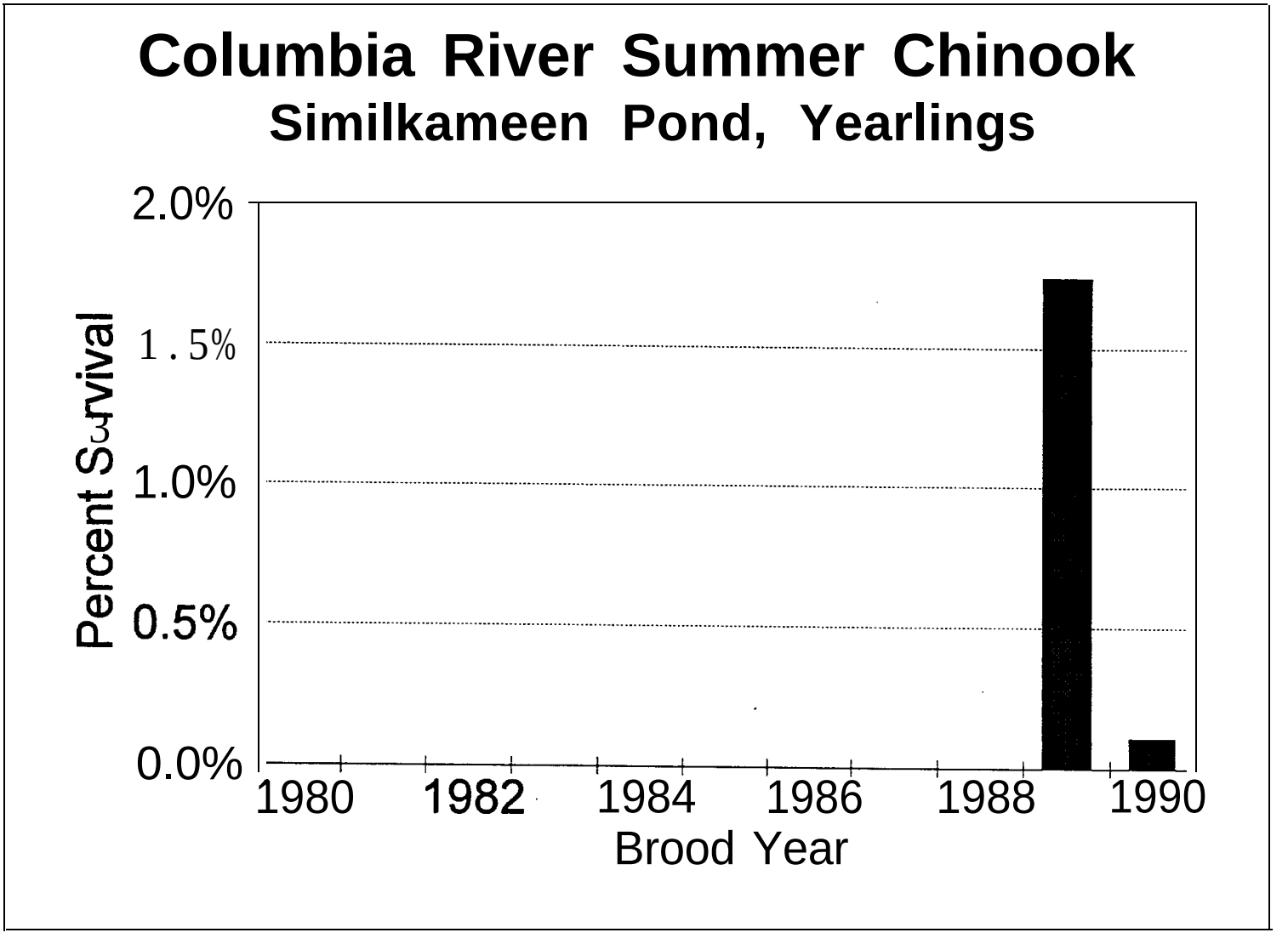

Figure 73. Survival by brood of Similkameen Rearing Pond yearling summer chinook.

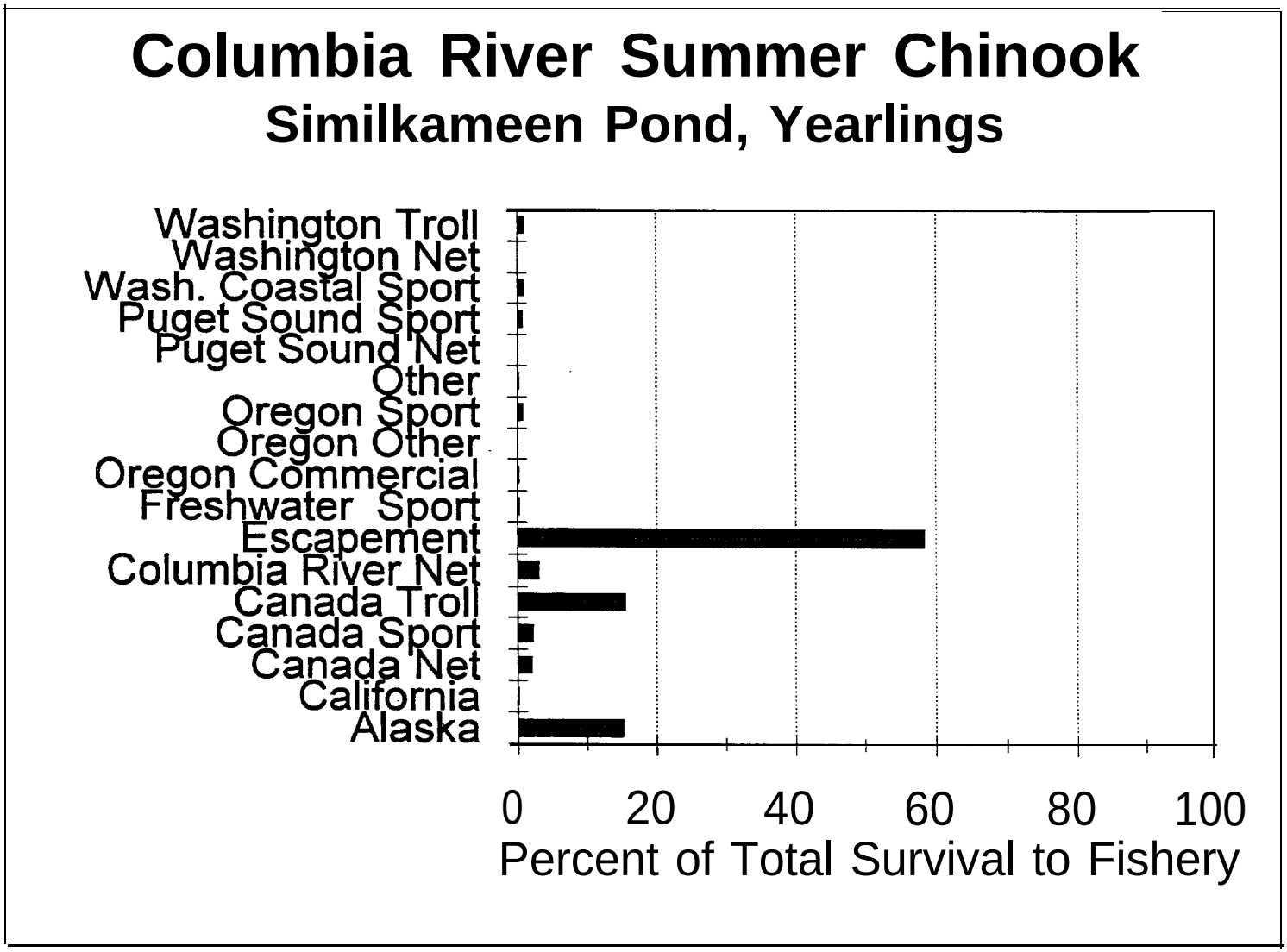

Figure 74. Percent of total survival to fisheries and escapement of Similkameen Rearing Pond 1989 and 1990 brood yearling summer chinook.

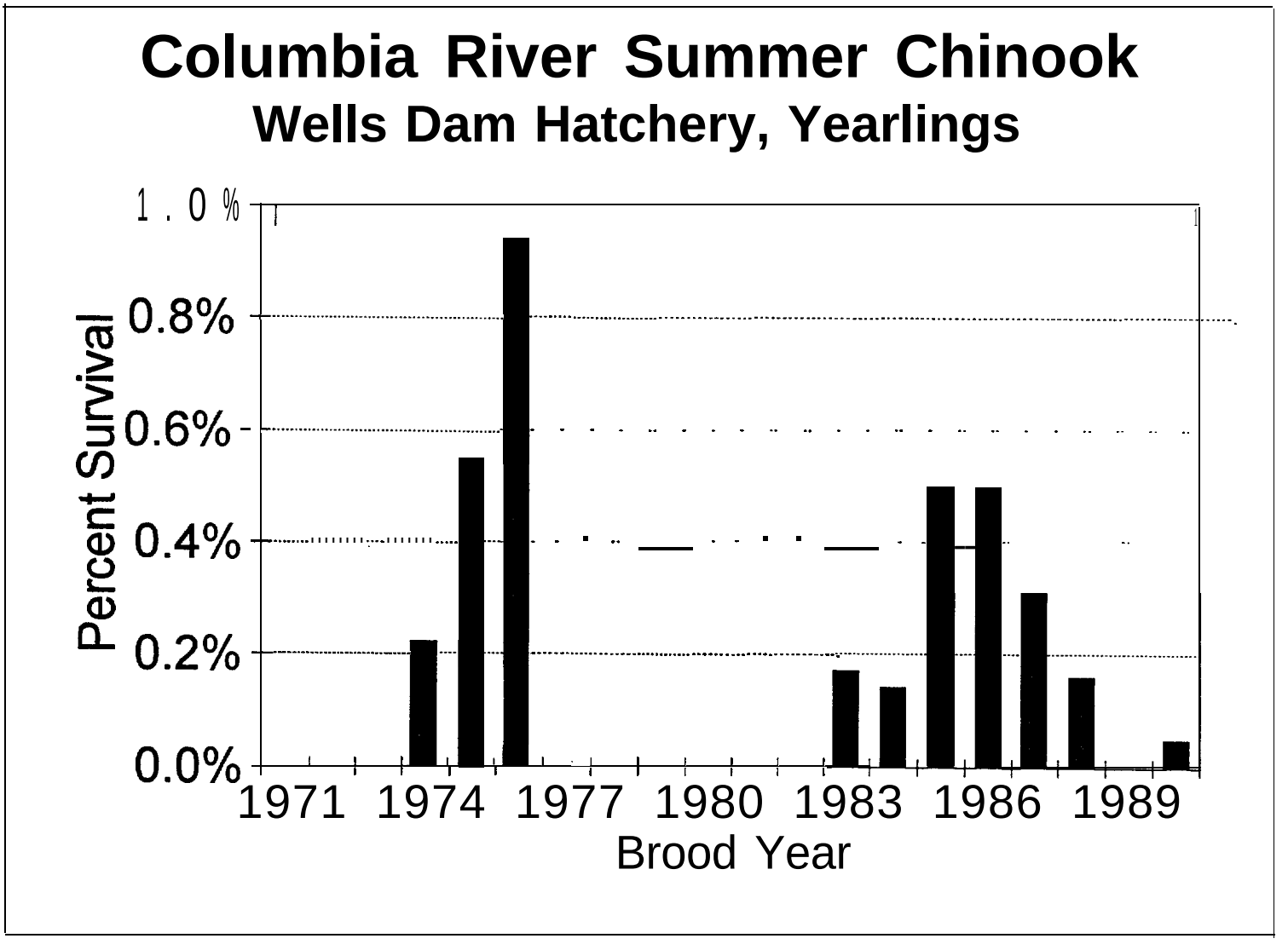

Figure 75. Survival by brood of Wells Hatchery yearling summer chinook.

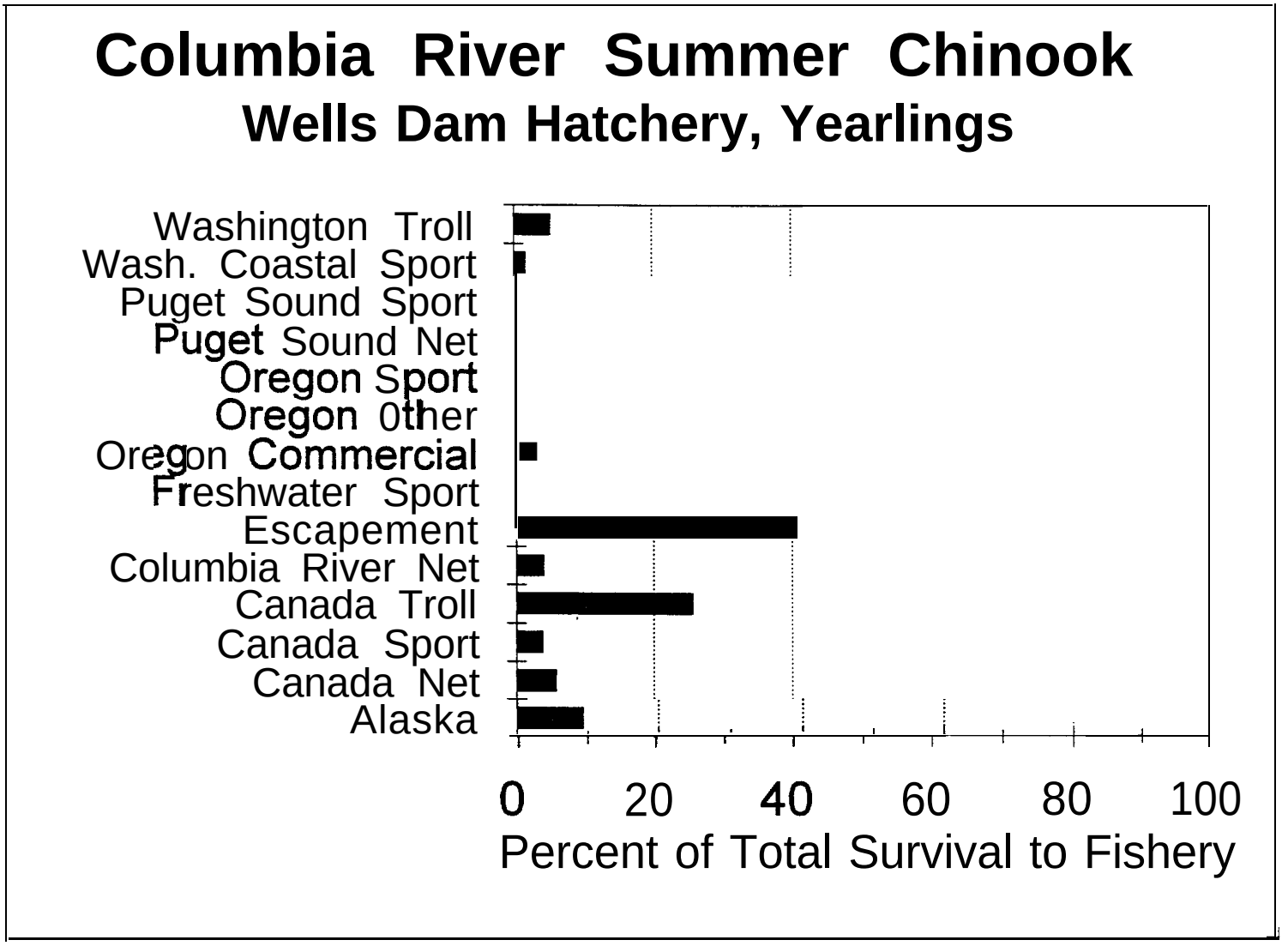

Figure 76. Percent of total survival to fisheries and escapement of Wells Hatchery 1986-1990 brood yearling summer chinook.

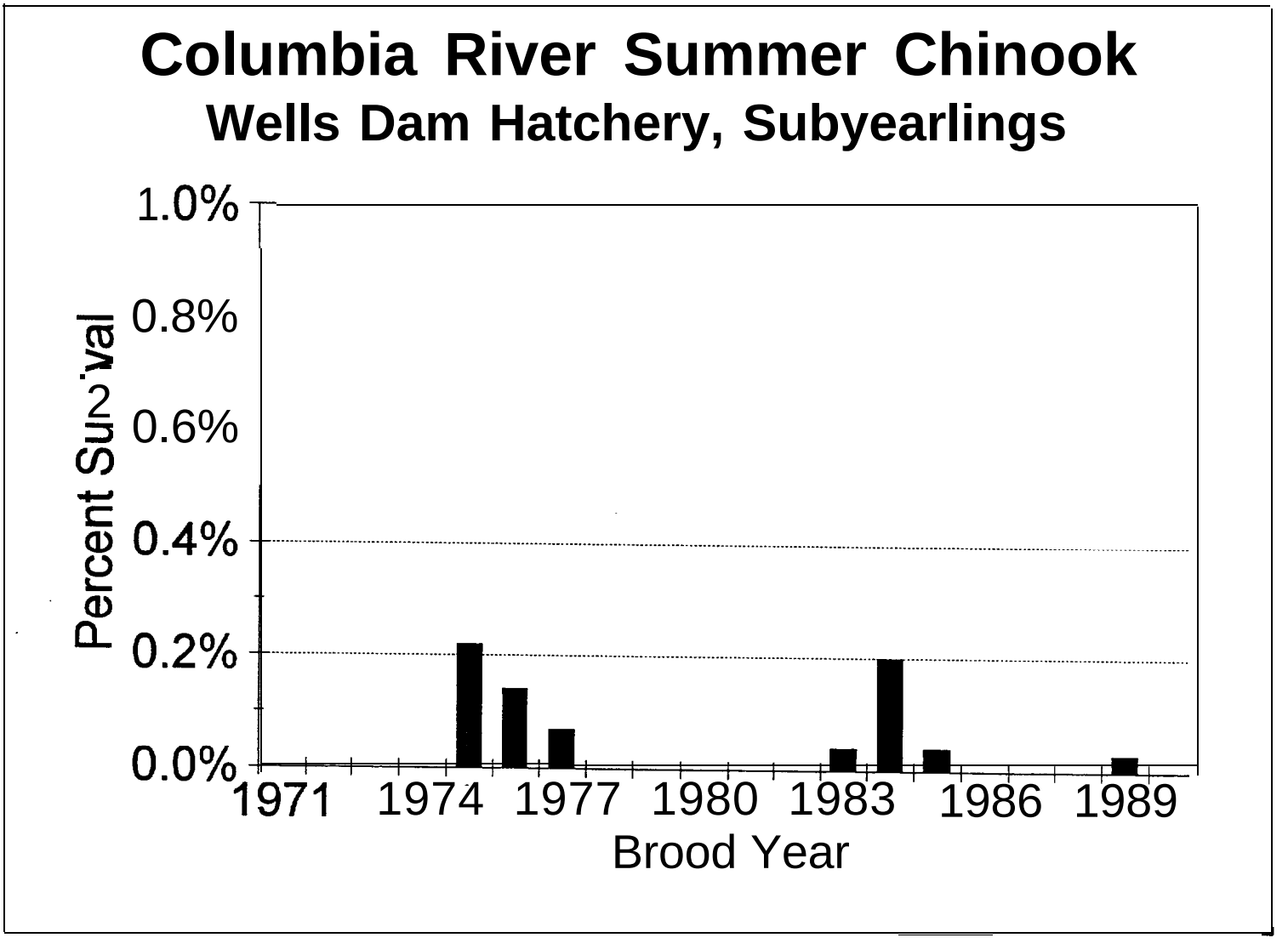

Figure 77. Survival by brood of Wells Hatchery subyearling summer chinook.

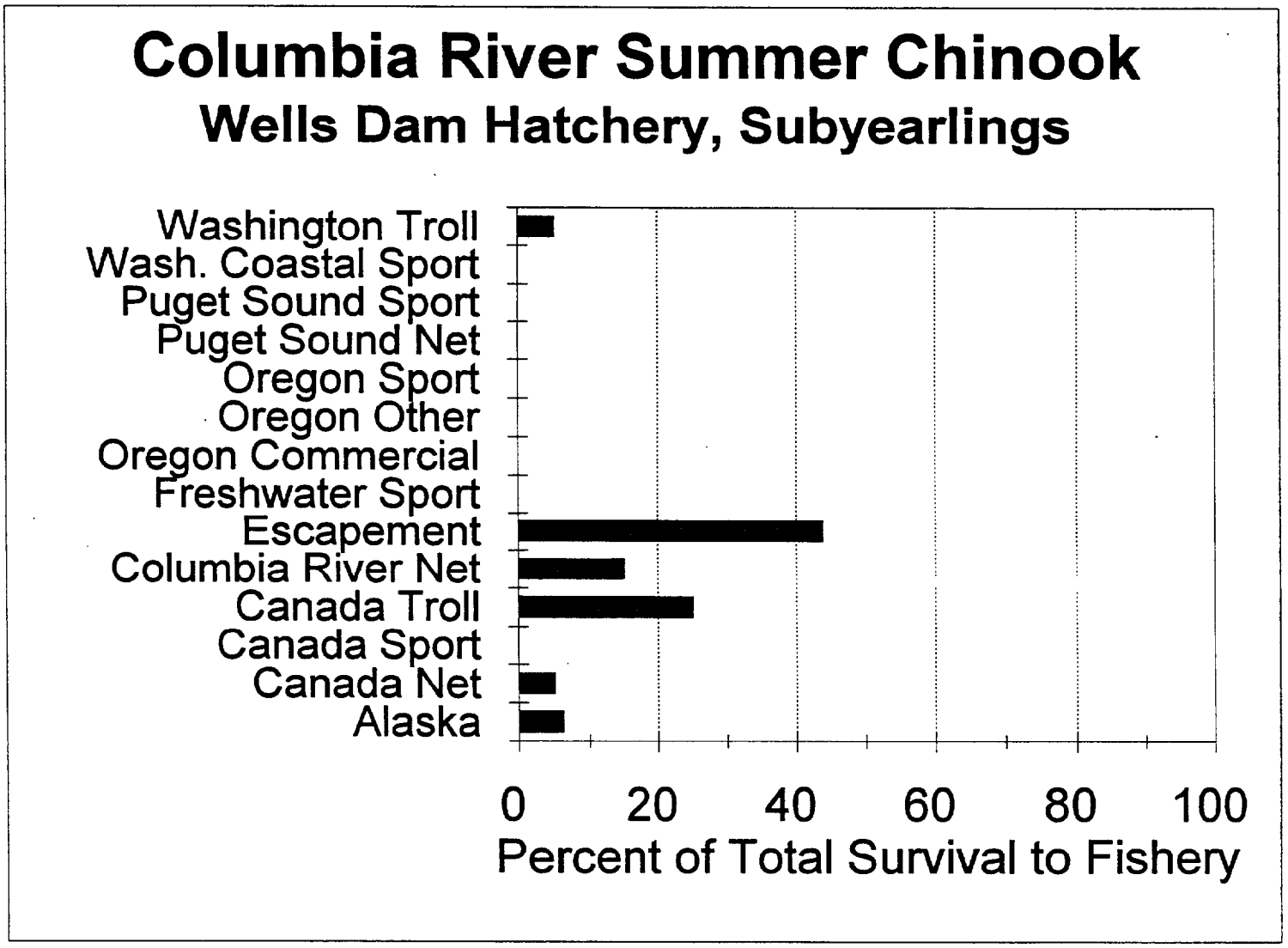

Figure 78. Percent of total survival to fisheries and escapement of Wells Hatchery 1986-1990 brood subyearling summer chinook.

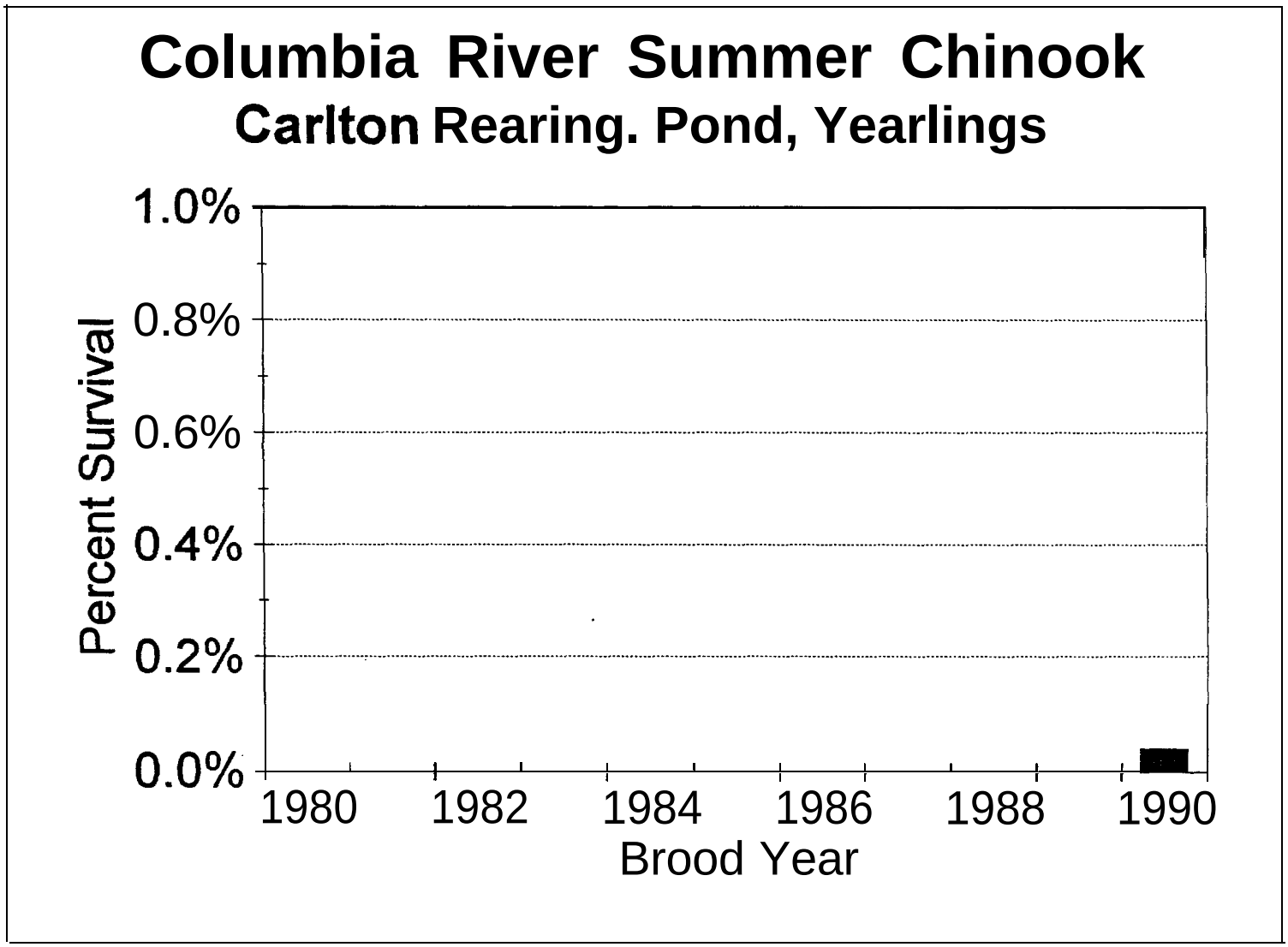

Figure 79. Survival by brood of Carlton Rearing Pond yearling spring chinook.

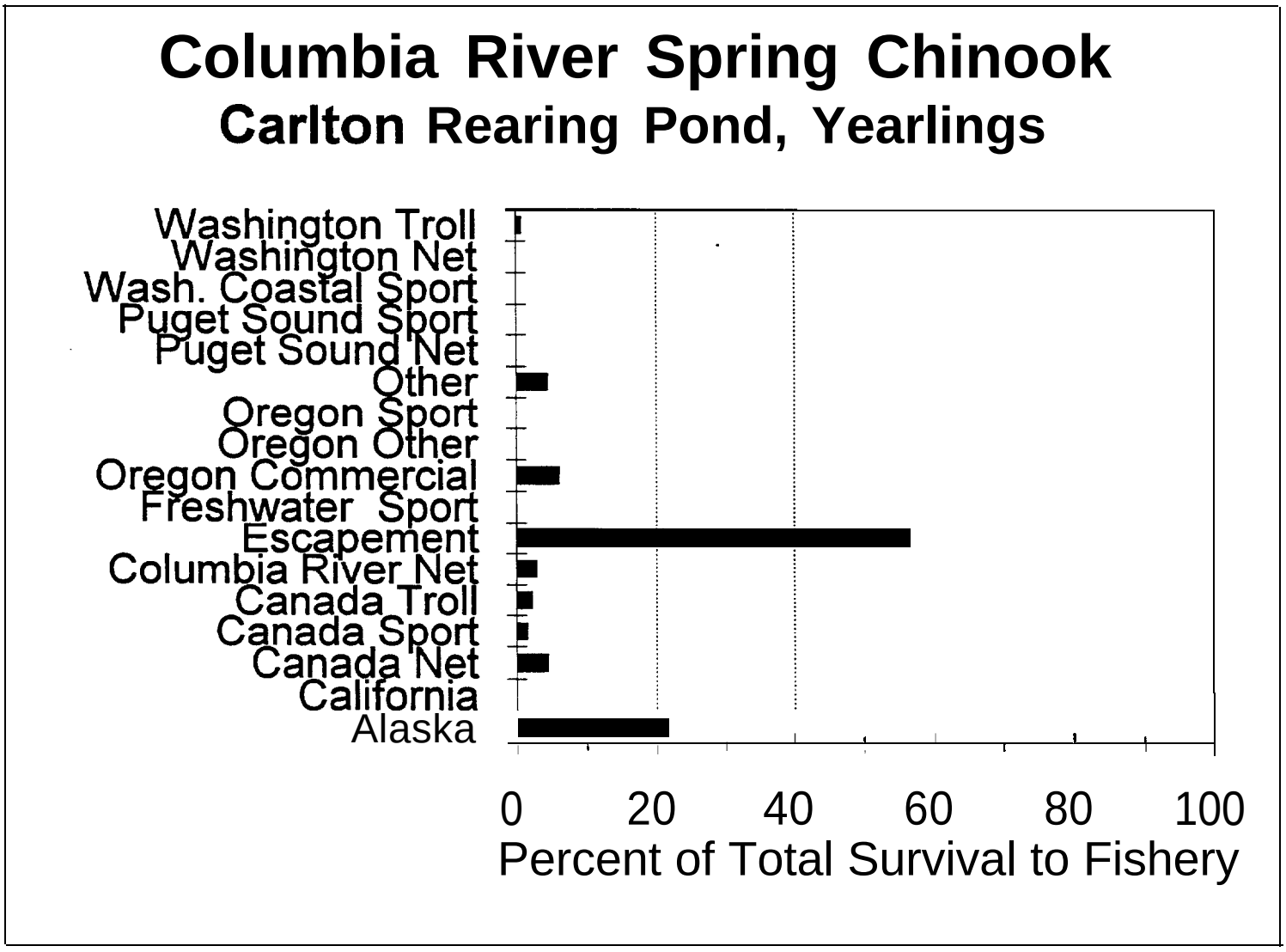

Figure 80. Percent of total survival to fisheries and escapement of Carlton Rearing Pond 1990 brood yearling spring chinook.

Appendix 1. Survivals by brood of Columbia River tule fall chinook

Brood Year	Grays River	Elochoman	Cowlitz	N. Toutle	Fallert Ck.	K. Falls	Lewis	Wild	Washouflal
1971				0.400%	1.010%	1.350%			
1972				0.300%	0.280%	0.450%			
1973				0.900%	0.060%	0.900%			0.500%
1974	8.850%								
1975	1.900%								
1976	0.200%	0.330%		0.700%		0.680%	1.510%		1.500%
1977	0.300%	0.900%	0.400%	0.800%	0.980%	0.300%	0.910%		0.300%
1978	0.300%	0.100%	0.550%			0.100%	0.130%		
1979	0.210%	0.800%			0.189%	0.300%	0.500%		0.300%
1980	0.200%	0.110%	0.400%		0.570%	0.430%			0.400%
1981	0.040%	0.400%	0.250%			0.200%			0.250%
1982	0.380%		0.170%				0.970%		0.300%
1983	3.400%		0.950%				0.750%		1.300%
1984	0.810%		1.730%				1.890%		1.200%
1985		0.520%	0.200%						0.800%
1986			0.150%				1.750%		0.190%
1987			0.050%	0.030%			0.140%		0.210%
1988	0.030%	0.040%	0.110%			0.170%	0.890%		
1989	0.070%		0.090%	0.040%			0.550%		0.190%
1990	0.040%		0.180%	0.130%			0.380%		0.220%
Mean	1.194%	0.400%	0.402%	0.388%	0.362%	0.488%	0.848%		0.533%
Standard Error	0.617%	0.107%	0.125%	0.107%	0.138%	0.117%	0.163%		0.117%

Appendix 2. Survivals by brood of Columbia River upriver bright fall chinook

Brood Year	Lyons Ferry Yrlng, On-stat.	Lyons Ferry Yrlng, Barged	Lyons Ferry Sub-yrlng, On-stat.	Lyons Ferry Sub-yrtng, Barged	Priest Rapids	Hanford Reach
1971						
1972						
1973						
1974						
1975					2.000%	
1976					0.800%	
1977					0.500%	
1978					0.300%	
1979					0.500%	
1980					0.800%	
1981					0.780%	
1982					1.600%	
1983	7.400%				1.200%	
1984	0.700%		0.800%	0.100%	1.900%	
1985	1.600%	1.900%	0.200%	0.200%	0.300%	
1986	1.430%	1.540%	0.440%	0.530%	0.250%	0.490%
1987	0.320%	1.160%	0.020%	0.020%	0.050%	0.120%
1988	1.500%	1.470%	0.040%	0.010%	0.130%	0.170%
1989			0.090%	0.110%	0.310%	0.340%
1990				0.200%	0.560%	0.290%
Mean	2.158%	1.518%	0.232%	0.162%	0.761%	0.280%
Standard Error	0.975%	0.132%	0.088%	0.062%	0.149%	0.058%

Appendix 3. Survivals by brood of Columbia River spring chinook

Brood Year	Cowlitz	Fallert Ck.	Lewis R.	Klickitat	Tucannon	Rinflold	Chiwawa	Carlton Pd
1971	3.900%							
1972	1.500%					0.010%		
1973								
1974	2.400%							
1975	7.100%					1.500%		
1976	10.200%					2.000%		
1977	5.600%					2.600%		
1978								
1979								
1980	0.800%							
1981	2.600%							
1982	1.100%							
1983	5.100%							
1984	2.500%							
1985	1.600%				0.300%			
1986	2.600%				0.240%			
1987	2.080%				0.160%			
1988			2.070%		0.350%			
1989	1.880%	0.360%	0.440%	0.290%	0.260%	0.410%	0.440%	
1990	0.450%	0.390%	0.400%	0.080%	0.030%	0.190%	0.040%	0.040%
Mean	3.201%	0.375%	0.970%	0.185%	0.223%	1.118%	0.240%	0.040%
Standard Error	0.633%	0.011%	0.449%	0.074%	0.042%	0.398%	0.141%	0.000%

Appendix 4. Survivals by brood of Columbia River summer chinook

Brood Year	Dryden Pd Wells Hatch.	Yrlng. Wells Hatch.	Subyrlng.
1971			
1972			
1973			
1974		0.0022	
1975		0.0055	0.0022
1976		0.0094	0.0014
1977			0.0007
1978			
1979			
1980			
1981			
1982			
1983		0.0017	0.0004
1984		0.0014	0.002
1985		0.005	0.0004
1986		0.005	0
1987		0.0031	0
1988		0.0016	0
1989	0.0051		0.0003
1990	0.0004	0.0005	0
Mean	0.275%	0.354%	0.067%
Standard Error	0.166%	0.061%	0.024%

Appendix 5. Survivals by brood of Columbia River Type N coho

Brood Year	Elochoman	Cowlitt	K. Falls	Lewis River	Washouflat	Wash. to Klick.	Klickitat
1971							
1972	1.700%	4.300%					4.500%
1973							
1974	1.900%	1.400%					0.600%
1975							2.600%
1976							1.400%
1977					2.900%		2.100%
1978					5.200%		
1979					4.400%		
1980		2.100%			1.100%		
1981		2.100%			0.500%		
1982		1.600%			2.100%		
1983	3.600%	6.900%	6.900%				
1984	0.600%	1.700%	1.100%				0.600%
1985	4.500%	2.500%	8.500%				2.200%
1986		4.340%		8.350%			
1987		0.790%					
1988	8.070%	4.610%	8.850%	6.710%	4.590%	1.590%	1.700%
1989	0.300%	1.170%	0.680%	1.750%	3.250%	0.190%	0.550%
1990	0.350%	0.650%	0.160%	0.770%	0.170%	0.100%	0.130%
1991	0.010%	0.170%	0.110%	0.600%	0.130%	0.030%	0.140%
1992	0.010%	0.240%	0.080%	0.200%	0.080%	0.030%	0.140%
Mean	2.104%	2.305%	3.048%	3.063%	2.220%	0.388%	1.388%
Standard Error	0.782%	0.478%	1.222%	1.318%	0.562%	0.270%	0.364%