Trapping and Coded Wire Tagging of Wild Coho Juveniles in the Vedder-Chilliwack River, 1976 to 1979

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Juvenile coho salmon were captured in the Vedder-Chilliwack River system for coded wire tagging between 1976 and 1979.

Smolts (age 1+) were generally captured at fence traps in tributaries during spring. Valid numbers of smolts tagged and their codes were: in 1976, 19,607 coho with code 2-15-13; in 1977, 111 coho with code 2-16-27 and 21,433 coho with code 2-4-13; and in 1978, 36,036 coho with code 2-21-24. Mean tag retention exceeded 99%, and pre- and post-tagging mortalities were less than 3% of total taggable fish. Age composition was over 90% age 1+ fish; the remainder were age 2+ fish. Mean lengths of 1+ coho ranged from 69.6 mm to 115.2 mm. Water tempteratures at tagging sites ranged from 4°C to 18°C.

Underyearling (age 0+) coho were generally captured by minnow trapping in Chilliwack Lake during fall. Valid numbers of underyearlings tagged and their codes were: in 1976, 6,189 coho with code 12-1-13 and 22,302 coho with code 2-15-11; in 1977, 5,313 coho with code 2-21-20; in 1978, 14,800 coho with code 2-21-30; and in 1979, 25,306 coho with code 2-17-60. Mean tag retention was 99%, and pre- and post-tagging mortalities were each less than 1% of total taggable fish. Mean lengths of 0+ coho ranged from 54.8 mm to 84.1 mm. Water temperatures at tagging sites ranged from 4°C to 12.5°C.

Mark recoveries indicated intrasystem migration of coho juveniles and overwintering in tributaries to age 2+.

Key words: coho, salmon, Vedder-Chilliwack River, coded wire tagging.

RÉSUMÉ

Fedorenko, A.Y. and R.J. Cook. 1982. Trapping and coded wire tagging of wild coho juveniles in the Vedder-Chilliwack River, 1976 to 1979. Can. MS Rep. Fish. Aquat. Sci. 1678: 79 p.

Le présent rapport porte sur la capture de saumons cohos juvéniles dans le système des rivières Chilliwack et Vedder, de 1976 à 1979, et de leur étiquetage à l'aide de fil métallique codé.

En général, les saumoneaux ont été capturés à l'aide de trappes placées dans les tributaires au printemps. Le nombre de poissons étiquetés et les codes sont les suivants: 1976, 19,607 (code 2-15-13); 1977, 111 (code 2-16-27) et 21,433 (code 2-4-13); et 1978, 36,036 (code 2-21-24). La rétention moyenne des étiquettes dépassait 99%, et la mortalité avant et après l'étiquetage était inférieure à 3% du total des poissons étiquetables. Plus de 90% étaient âgés de 1+ an, tandis que le reste avaient 2+ ans. La longueur moyenne des saumoneaux de 1+ an variait de 69.6 à 115.2 mm. La température de l'eaux aux sites d'étiquetage variait de 4 à 18°C.

Les poissons âgés de moins d'un an (0+) ont été capturés a l'aide de trappes à mènes dans le lac Chilliwack au cours de l'automne. Le nombre de poissons étiquetés et les codes sont les suivants: 1976, 6,189 (code 12-1-13) et 22,302 (code 2-15-11); 1977, 5,313 (code 2-21-20); 1978, 14,800 (code 2-21-30); et 1979, 25,306 (code 2-17-60). La rétention moyenne des étiquettes s'élevait à 99%, et la mortalité avant et après l'étiquetage était inférieure à 1% du total des poissons étiquetables. La longueur moyenne des saumons cohos âgés de 0+ variait de 54.8 a 84.1 mm. La température de l'eau aux sites d'étiquetage variant de 4 a 12.5°C.

Les recaptures portent à croire que les juveniles migrent et grandissent dans le système, et que les tributaires servent a l'hivernage jusqu'à l'âge de 2+.

Mots-clés: saumon coho, rivière Vedder, rivière Chilliwack, étiquetage à l'aide de fil métallique.

INTRODUCTION

The Vedder-Chilliwack River system (Fig. 1) is one of the most important producers of coho, chum and pink salmon in the Fraser River watershed. During 1976 to 1979, coded wire tagging of wild coho juveniles was undertaken to determine adult migration routes and timing, stock exploitation patterns and marine survival. This report describes the Vedder-Chilliwack River system tagging programs.

FISHERY RESOURCE

All five species of Pacific salmon spawn in the Vedder-Chilliwack River system. Annual escapements to the system in the last 30 years have ranged from 25,000 to 250,000 odd-year pink salmon (Oncorhynchus gorbuscha); 8,000 to 90,000 chum salmon (O. keta); 3,000 to 76,000 coho (O. kisutch); 25 to 2,000 sockeye (O. nerka); and 25 to 1,500 chinook (O. tshawytscha). (Append 1).

The mainstem supports the majority of salmon spawners, with minor spawning also occurring in approximately 20 smaller tributaries. Coho and odd-year pink salmon spawn throughout the watershed, with coho most abundant above the Slesse Creek confluence. Chum spawn primarily in the main river and its tributaries mostly below Centre Creek. Sockeye spawn mainly in Sweltzer River and Cultus Lake, with some spawning also occurring in Chilliwack Lake and its tributaries. Chinook spawn primarily in the upper reaches of the Chilliwack River (Fig. 1). Salmon spawn in the system from early September (sockeye and chinook), to late January (chum and coho).

Other fish utilizing the system include the residual and anadromous forms of rainbow trout (Salmo gairdneri), cutthroat trout (S. clarki), Dolly Varden (Salvelinus malma), kokanee (O. nerka), and mountain whitefish (Prosopium williamsoni), as well as catfish (Ameiuridae), lampreys (Petromyzonidae), minnows (Cyprinidae), sculpins (Cottidae), sticklebacks (Gasterosteidae), and suckers (Castostomidae).

DESCRIPTION OF THE STUDY AREA

The Vedder-Chilliwack River, the largest system entering the Fraser River from the south between Hope and the sea, may be divided into several main sections: 1) upper Chilliwack River, 2) Chilliwack Lake 3) Chilliwack River, and 4) Vedder River (Fig. 1). The following area descriptions are based on Walker et al. (1972), Marshall et al. (1980), estimates made during the course of this study, and previously collected unpublished Department of Fisheries and Oceans (DFO) data.

Upper Chilliwack River

Locally known as Dolly Varden Creek, the upper Chilliwack River originates in the Cascade Mountains of Washington State, and flows for 24 km northwest into the south end of Chilliwack Lake. Only the final 3.2 km of the river are in Canadian territory. The river has a drainage area of 425 km^2 and a mean width of 15 m at its mouth. The mean discharge in April, 1971, was 9.9 m^3/sec.

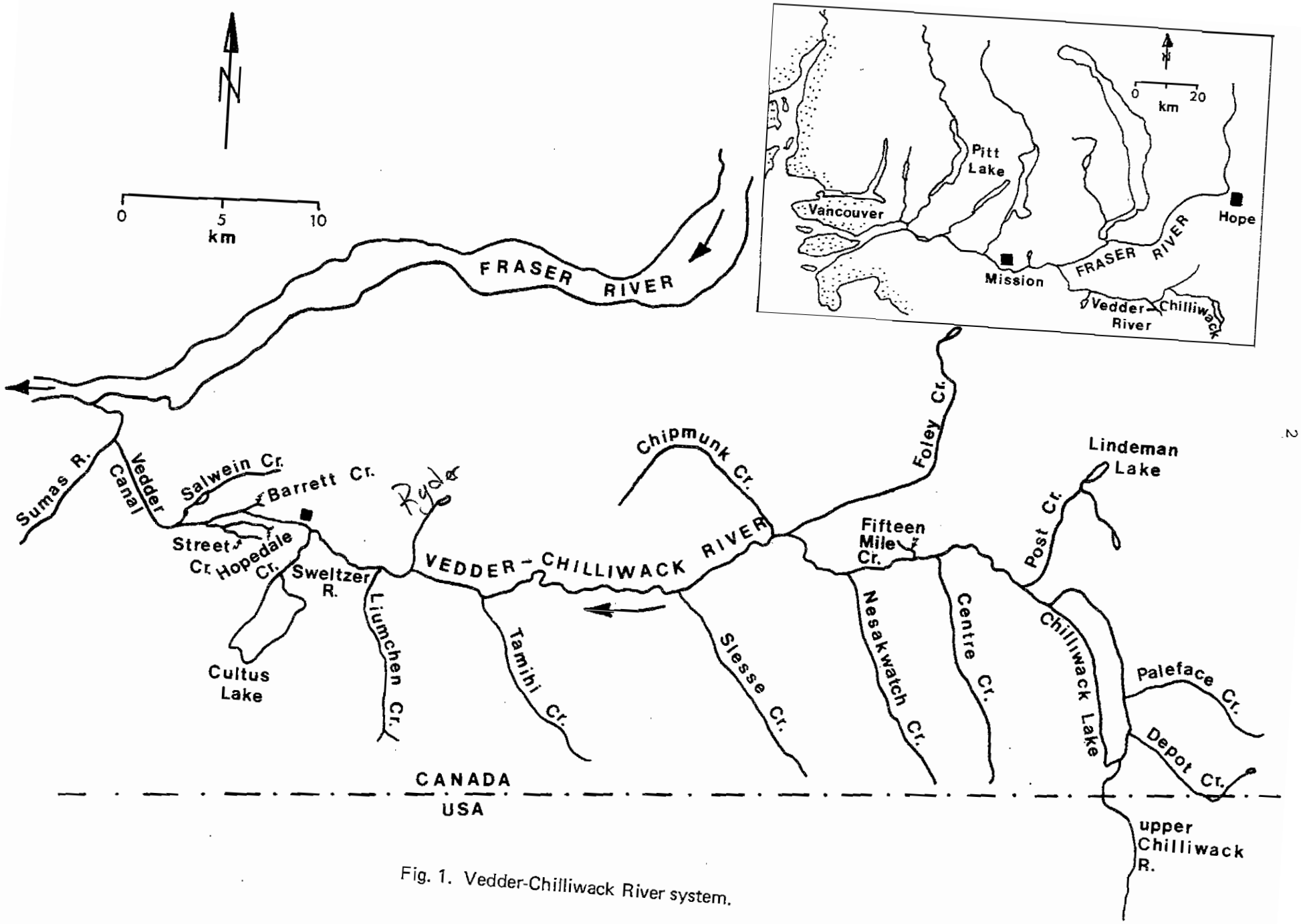

Fig. 1. Vedder-Chilliwack River system.

The upper Chilliwack River has a low gradient of less than 0.3% and is very stable, partly because no logging has taken place in the watershed. The substrate consists mainly of silt near the mouth. Above 0.8 km, the channel is characterized by riffle-run development and extensive gravel deposits.

Coho is the dominant salmonid species utilizing the creek, but smaller numbers of chum, chinook, pink and sockeye have also been observed. Coho spawn from late October to December, mostly in the upper creek reaches. Annual coho escapements during 1976 to 1980 averaged 3,160 fish (Table 1). Most coho juveniles migrating out of Chilliwack Lake originate in the upper Chilliwack River.

Chilliwack Lake

This is a deep, creek fed lake which lies 630 m above sea level. The lake is 9 km long and 1.3 km wide, with an area of 11.9 km^2. The main inflowing source of water is the upper Chilliwack River at the lake's south end; Chilliwack River drains the lake at its north end.

Coho spawn in tributaries to the lake (Paleface and Depot Creeks), and sockeye spawn in the lake and the tributaries.

Vedder-Chilliwack River

The river mainstream (discussed below as Chilliwack River and Vedder River) flows west for 61 km from the north end of Chilliwack Lake to join the Sumas River and subsequently the Fraser River 80 km east of Vancouver (Fig.1). The Vedder-Chilliwack River drains an area of 1,212 km^2 and has a wetted area of 1.8×10^6 m^2. The overall mean width is 30.5 m. Annual mean discharge below Slesse Creek confluence for the period of record is 47 m^3/sec (Water Survey of Canada, Station No. 08MH055). Minimum and maximum extremes in flow for the period of record are 10 m^3/sec (January 22, 1960) and 194 m^3/sec (November 24, 1959) respectively (Environment Canada 1980).

All five species of salmon utilize the Vedder-Chilliwack River (see above). The annual coho escapement to the mainstem during 1976 to 1980 averaged 5,200 fish (Table 1). Annual escapements of other salmon species during that period averged 37,500 odd-year pink salmon, 48,200 chum, 565 sockeye, and 50 chinook (Table 1).

Chilliwack River: The river mainstream below Chilliwack Lake to Vedder Crossing, a distance of 45 km (Fig. 1) is called the Chilliwack River. Just below the lake, the river is 15 m wide with a mean discharge of 18.5 m^3. Chilliwack River is confined to a U-shaped valley, and has a mean gradient of 0.7%.

Vedder River: The river mainstem below Vedder Crossing is called the Vedder River. In its first 6.4 km, it flows on an alluvial fan with an average gradient of 0.4%. Extensive gravel deposits exist in this area and substantial quantities of gravel have been removed for development purposes. In the lower 6 km of its course, the Vedder River is confined between dykes and flows across the former flood plain of the Fraser River into the Sumas River approximately 2.5 km upstream of the confluence with the Fraser River. The dyking was constructed with river gravel and resulted in severe

Table 1. Annual coho escapements to Vedder-Chilliwack River and its tributaries, 1951-1981 (from Fraser et al. MS 1982, in prep'n).

YEAR	BARRETT CR.	BORDEN CR.	CHILLIWACK R.[a]	DEPOT CR.	DOLLY VARDEN CR.[b]	FIFTEEN MILE CR.	FOLEY CR.[c]	FOURTEEN MILE CR.	GUNTHER DITCH	HOPEDALE CR.	HOPEDALE SLGH.	LIUMCHEN CR.	LONZO CR.[d]	NESAKWATCH CR.[e]	PALEFACE CR.	POST CR.	RYDER CR.	SALWEIN CR.	SLESSE CR.	STEWART SLGH.	STREET CR.	SUMAS R.	SWELTZER CR.	TAMIHI CR.	TOTAL
1951	N/R	75	16500	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	75	N/R	200	400	N/R	17250
1952	N/R	75	18500	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	75	N/R	N/D	N/R	75	400	N/R	19125
1953	N/R	400	15750	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	25	N/R	25	N/R	75	750	N/R	17025
1954	N/R	200	9000	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	25	200	75	N/R	200	400	N/R	10100
1955	N/R	75	16500	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	75	200	25	N/R	75	96	N/R	17046
1956	N/R	25	15400	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	25	N/R	N/R	N/R	N/R	25	75	25	N/R	75	200	N/R	15850
1957	N/R	200	15200	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	25	N/R	N/R	N/R	N/R	25	750	25	N/R	200	75	N/R	16500
1958	N/R	75	35750	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	25	N/R	N/R	N/R	N/R	75	200	25	N/R	75	25	N/R	36250
1959	N/R	75	15400	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	25	N/R	N/R	N/R	N/R	75	400	25	N/R	200	400	N/R	16600
1960	N/R	200	7700	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/D	N/R	N/R	N/R	N/R	25	750	25	N/R	200	75	N/R	8975
1961	N/R	200	15400	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	25	N/R	N/R	N/R	N/R	75	400	25	N/R	200	25	N/R	16350
1962	N/R	75	76500[f]	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	25	N/R	N/R	N/R	N/R	75	200	25	N/R	400	200	N/R	77500
1963	N/R	75	75750[f]	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	25	N/R	N/R	N/R	N/R	25	200	25	N/R	75	75	N/R	76250
1964	N/R	25	35750	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	25	N/R	N/R	N/R	N/R	75	75	25	N/R	200	75	N/R	36250
1965	N/R	25	7900	25	1500	N/R	200	N/R	N/R	N/R	N/R	N/R	25	200	75	N/R	75	200	N/D	N/R	N/R	200	75	N/R	10500
1966	N/R	25	15400	25	1500	N/R	200	N/R	N/R	N/R	N/R	N/R	25	200	25	N/R	75	200	75	N/R	N/R	75	75	N/R	17900
1967	N/R	76	5000	25	200	N/R	25	N/R	N/R	N/R	N/R	N/R	25	125	25	N/R	75	75	75	N/R	N/R	25	188	N/R	5939
1968	N/R	110	7000	25	75	N/R	25	N/R	N/R	N/R	N/R	N/R	25	200	25	N/R	80	120	N/D	N/R	20	200	160	N/R	8065
1969	N/R	200	7000	25	2020	N/R	75	N/R	N/R	N/R	N/R	N/R	25	174	N/D	N/R	250	100	N/D	N/R	25	25[g]	150	N/R	10069
1970	N/R	75	7000	25	3000	N/R	25	N/R	N/R	N/R	N/R	N/R	25	200	25	N/R	200	75	75	N/R	N/D	25[g]	200	N/R	10950
1971	N/R	75	6000	N/D	2000	N/R	25	N/R	N/R	N/R	N/R	N/R	25	200	N/D	N/R	200	200	75	N/R	N/D	N/R	200	N/R	9000
1972	50	75	4000	25	250	N/R	50	N/R	N/R	N/R	N/R	N/R	25	75	N/D	N/R	200	100	75	N/R	30	75[g]	50	N/R	5080
1973	50	300	10000	N/D	2000	N/R	50	N/R	N/R	N/R	N/R	N/R	25	50	N/D	N/R	350	900	100	N/R	225	200	250	N/R	14500
1974	20	125	9500	N/D	1000	N/R	50	N/R	N/R	N/R	N/R	N/R	25	75	N/D	N/R	600	500	25	N/R	200	200	500	N/R	12820
1975	20	100	8000	N/D	400	N/R	100	N/R	N/R	N/R	N/R	N/R	20	20	N/D	N/R	300	100	100	N/R	20	200	75	N/R	9455
1976	150[h]	25[h]	3000[i]	25[h]	3000[j]	50[h]	75[h]	N/R	N/R	300[h]	N/R	25[h]	25	75[h]	25[h]	150[h]	150[h]	527[k]	150[h]	N/R	25[h]	100	150[f]	25[h]	8052
1977	225[h]	150[h]	6000[i]	20[h]	5000[j]	200[h]	20[h]	50[h]	20[h]	700[h]	75[h]	25[h]	25	75[h]	75[h]	350[h]	200[h]	649[k]	25[h]	N/R	225[h]	400	250[f]	25[h]	14784[m]
1978	150[h]	150[h]	5000[i]	25[h]	3000[j]	150[h]	175[h]	200[h]	10[h]	130[h]	25[h]	50[h]	25	150[h]	25[h]	150[h]	312[h]	724[k]	500[h]	N/R	50[h]	50	250[f]	50[h]	11351
1979	60	50	9000	20	3300	65	30	60	16	210	N/R	N/R	6	100	11	150	75	400	150	N/R	20	200	50	N/R	13973
1980	N/D	44	3000	N/D	1500	30	20	20	6	110	N/R	N/R	N/D	N/D	10	70	14	50	30	N/R	4	150	37	N/R	5095
1981	N/D	35	4000	20	1500	N/R	20	N/R	N/D	25	75	N/R	N/R	N/R	10	350	50	250	N/D	N/R	15	100	20	N/R	6470

Table 1. (cont'd).

YEAR	BARRETT CR.	BORDEN CR.	CHILLIWACK R.	DEPOT CR.	DOLLY VARDEN CR.	FIFTEEN MILE CR.	FOLEY CR.	FOURTEEN MILE CR.	GUNTHER DITCH	HOPEDALE CR.	HOPEDALE SLGH.	LIUMCHEN CR.	LONZO CR.	NESAKWATCH CR.	PALEFACE CR.	POST CR.	RYDER CR.	SALWEIN CR.	SLESSE CR.	STEWART SLGH.	STREET CR.	SUMAS R.	SWELTZER CR.	TAMIHI CR.	TOTAL
51-60	N/R	140	16570	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	25	N/R	N/R	N/R	N/R	47	368	36	N/R	138	282	N/R	17472
61-70	N/R	89	25270	25	1383	N/R	92	N/R	N/R	N/R	N/R	N/R	25	183	35	N/R	126	102	157	25	23	143	122	N/R	26977
71-80	91	109	6350	23	2145	99	60	83	13	290	50	33	22	91	29	174	240	415	123	N/R	89	175	181	33	10411
76-80	146	84	5200	23	3160	99	64	83	13	290	50	33	20	100	29	174	150	470	171	N/R	65	180	147	33	10651

N/O=none observed; N/R=no record; PRES =present.

[a] Also known as Vedder-Chilliwack R.; includes spawning in mainstem, side channels, sloughs and unlisted creeks.

[b] Mainstem above Chilliwack L.

[c] Also known as Ford Cr.

[d] Also known as Marshall Cr.

[e] Also known as Middle Cr.

[f] Probably overestimated.

[g] Records obtained from District Office.

[h] Estimate made by Field Services Branch (DFO).

[i] Residual escapement left after subtracting revised Dolly Varden Cr. escapement.

[j] Dolly Varden Cr. estimates based on results from 1979 fence enumeration.

[k] Fence enumeration.

[l] Includes Frosst Cr.; estimated by Field Services Branch (DFO).

[m] Total spawning for Chilliwack system (excluding Sumas R. and Lonzo Cr.), estimated by Petersen tag, mark-recapture experiment (DFO, unpublished).

deterioration of spawning grounds. The gradient in the dyked segment averages 0.1%, allowing considerable siltation to occur.

Tributaries

Post Creek: Post Creek flows from its source at Lindeman Lake, southwest for 4.8 km and enters the north side of the Chilliwack River approximately 2 km below the Chilliwack Lake outlet (Fig. 1). The creek's discharge during October, 1976, was estimated at 0.4-0.8 m^3/sec (DFO, unpublished data).

From its mouth to 3 km upstream, Post Creek is characterized by pool-run development with a substrate of silt and sand with patches of gravel. The gradient throughout this section is 0.5%, but increases sharply to 8% in the final 1.8 km. A rock jam at 3 km from the outlet prevents further fish passage.

Coho, steelhead and Dolly Varden are present in Post Creek. Coho spawn throughout the accessible length from November to January (Fig. 2). The annual coho escapement to Post Creek during 1976 to 1980 averaged 174 fish (Table 1).

Fifteen Mile Creek: Fifteen Mile Creek flows south for 2.4 km and enters the north side of the Chilliwack River approximately 9 km below the Chilliwack lake outlet (Fig. 1). The creek's discharge during October, 1976, was estimated at 0.3-0.4 m^3/sec (DFO, unpublished data).

Fifteen Mile Creek is a stable spring fed system. From its mouth to 1.6 km upstream, it is characterized by riffle-run development. The substrate is boulder and sand with patches of gravel. Beaver dams located 1.6 km from the outlet prevent further fish passage.

Chum, coho, pink salmon and cutthroat trout are present in Fifteen Mile Creek. Coho spawn mainly in the upper reaches, from December to January. The annual coho escapement to Fifteen Mile Creek during 1976 to 1980 averaged 99 fish (Table 1).

Ryder Creek: Ryder Creek flows from its source at Ryder Lake, southwest for 1.6 km and enters the north side of the Chilliwack River approximately 23 km from the confluence with the Fraser River (Fig. 1). The creek drains an area of 13 km^2, has a wetted area of 6,355 m^2, and average width of 3.9 m. Creek discharge in April, 1971, averaged 0.85 m^3/sec, and in February, 1977, it averaged 0.1-0.2 m^3/sec (DFO, unpublished data).

From its mouth to 0.4 km upstream, Ryder Creek forms a shallow exposed channel. Upstream, the gradient increases to 1.0% and the stream form becomes riffle-run with patches of gravel and isolated pools protected by overhanging vegetation. A log jam at 2 km from the outlet prevents further fish passage. The stream above the jam area has little potential for spawning or rearing because of other log jams, a steep gradient of 2.5%, and steep sloped clay banks.

Coho, chum and pink salmon utilize the creek. Coho spawn mainly in the upper reaches, from mid-November to late January; chum and pink salmon spawn

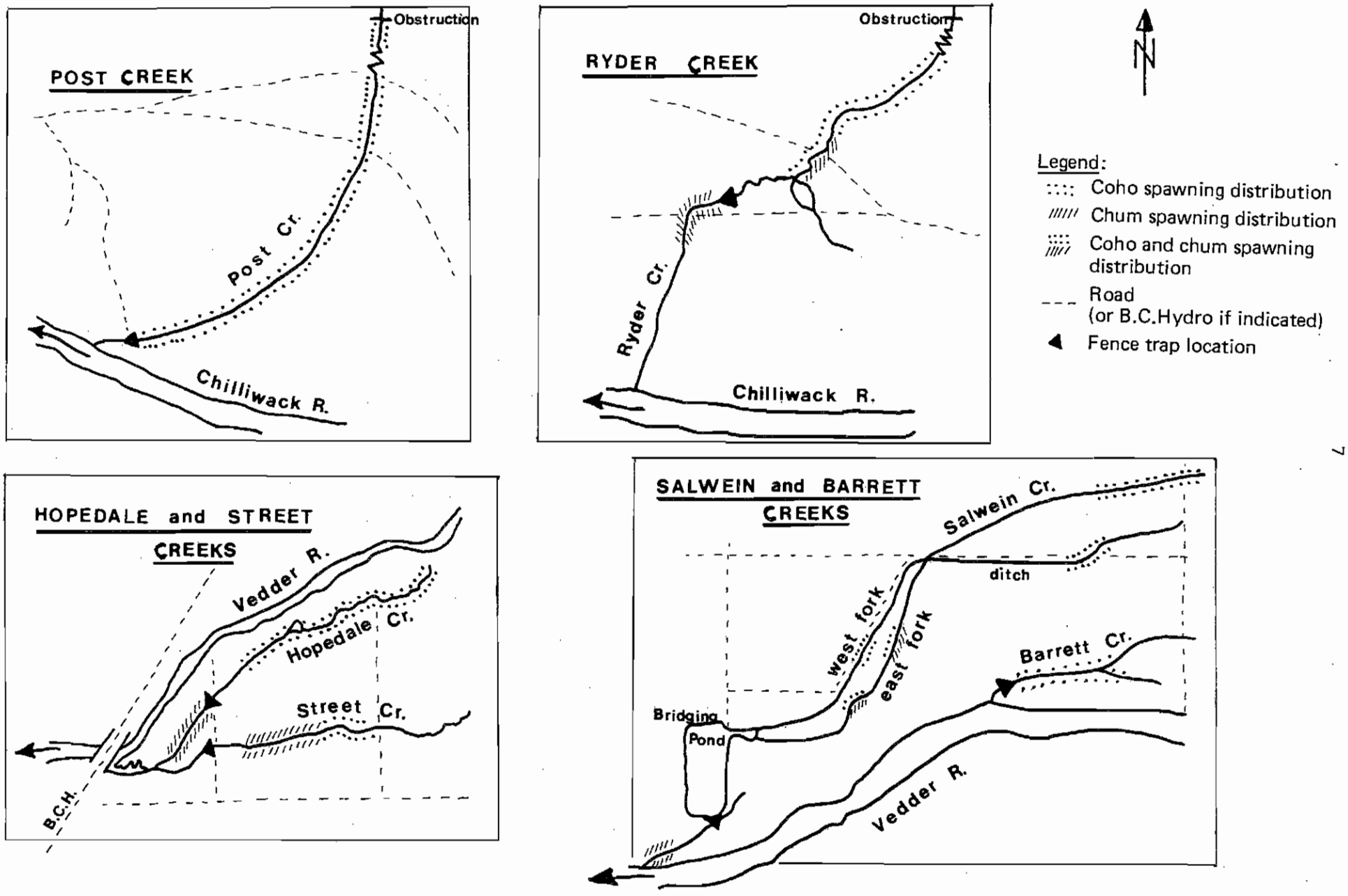

Fig. 2. Tributaries of the Vedder-Chilliwack River (Post, Ryder, Hopedale, Street, Salwein, Rust and Barrett Creeks) showing spawner distribution and fence trap location (diagrammatic).

in the lower reaches (Fig. 2). The annual coho escapement to Ryder Creek during 1976 to 1980 averaged 150 fish (Table 1).

Barrett Creek: Barrett Creek flows southwest for 1.6 km and enters the north side of the Vedder River approximately 10 km from the mainstem confluence with the Fraser River (Fig. 1). The creek's discharge during December, 1976, was estimated at approximately 0.1 m^3/sec (DFO, unpublished data).

Barrett Creek is a low gradient, spring fed system. Its stream form is mainly pool-run. The substrate consists of mud and sand with some gravel deposits. Overhanging vegetation protects all but the lower end of the channel and provides suitable rearing habitat for juveniles.

Coho and chum salmon utilize the creek. Coho spawn mainly in the extreme upper reaches, from mid-December to late January; chum spawn in the lower reaches. The annual coho escapement to Barrett Creek during 1976 to 1980 averaged 146 fish (Table 1).

Hopedale Creek: Hopedale Creek, a former side channel of the Vedder River, flows west for 2.4 km and enters the south side of the mainstem approximately 8 km from the confluence with the Fraser River (Fig. 1). The creek's discharge during October, 1976, was estimated to vary from 0.01 m^3/sec to 0.1 m^3/sec (DFO, unpublished data).

Hopedale Creek is a low gradient, spring fed system. Its flow is augmented by seepage through the Vedder River dyke. From its mouth to 0.4 km upstream, the creek consists of a wide shallow channel, with largely silt and sand substrate interspersed with pockets of gravel. Upstream, the creek becomes a narrow meandering channel with a riffle-run form, protected by overhanging vegetation. A beaver dam at 1.6 km from the outlet has produced extensive slack water areas with large gravel deposits suitable for spawning.

Coho and chum salmon utilize the creek. Coho spawn in the upper and chum in the lower reaches (Fig. 2). The annual coho escapement to Hopedale Creek during 1976 to 1980 averaged 290 fish (Table 1).

Street Creek: Street Creek flows west for 1.6 km and joins Hopedale Creek approximately 250 m upstream from the confluence with the Vedder River (Fig. 1). The creek drains an area of 5 km^2 and has a wetted area of 6,605 m^2. Average discharge in April, 1971, was estimated at 0.42 m^3/sec.

Street Creek is a stable, spring fed system. It meanders through agricultural land and is well protected by overhanging vegetation. The stream form is mainly riffle-run and the substrate consists of silt and sand with patches of gravel. Extensive slack water areas and abundant aquatic plant growth provide good rearing areas. A 0.6 m drop from a culvert at 3.5 km from the confluence with Hopedale Creek prevents further fish passage.

Coho and chum salmon utilize the creek. Coho spawn from mid-November to late January mainly in the upper reaches; chum spawn in the lower reaches (Fig. 2). The annual coho escapement to Street Creek during 1976 to 1980 averaged 65 fish (Table 1).

Salwein Creek: Salwein Creek flows southwest for 3.2 km and enters the north side of the Vedder River approximately 7 km from the confluence with the Fraser River (Fig. 1). Approximately 0.8 km upstream from the mainstem, the creek channel has been excavated to form a large pond. East and west branches of the creek join at the upper end of the pond. These branches originate from the upper creek which divides about 0.8 km upstream from the pond (Fig. 2). The creek drains an area of 2.6 km^2 and has a wetted area of 9,782 m^2. Average discharge in April, 1971, was 0.85 m^3/sec.

Salwein Creek is a stable, spring fed stream with a low gradient of 0.5% throughout its length. It flows in a meandering channel and is well protected by overhanging vegetation. The stream form is pool-run and the substrate consists of mixed silt and sand with patches of gravel. The west creek branch contains deep, well protected pool and run sections with good rearing areas; the east branch has been seriously disturbed by farming and road construction.

Coho, chum, pink salmon and cutthroat trout utilize the creek. Coho spawn from mid-November to late January, mainly in the upper reaches; chum and pink salmon spawn in the lower reaches (Fig. 2). The annual coho escapement to Salwein Creek during 1976 to 1980 averaged 470 fish (Table 1).

Rust Creek: Rust Creek, a small, 0% gradient, groundwater fed tributary to Salwein Creek, enters it 0.8 km upstream from the confluence with the Vedder River (Fig. 2). No fish have been observed spawning in Rust Creek; however, coho utilize the tributary for rearing.

METHODS

FISH CAPTURE

Fence traps similar to those described by Armstrong and Argue (1977) were the primary method used to capture smolts in tributaries during the spring tagging programs. Gee minnow traps were used to a limited extent to supplement smolt captures, and were the primary method for capturing underyearling coho in Chilliwack Lake during the fall tagging programs. A 4x4 (1.2 m x 1.2 m) inclined plane trap was used on one occasion to capture smolts in the Chilliwack River. Fish capture dates by area and method are presented in Tables 2 and 3.

Fence Traps

The fence traps consisted of a series of 0.8 m x 2.4 m wooden frame panels covered with 6.4 mm galvanized mesh screen. The panels were supported by sand bags and steel support stakes, and installed in a converging V pattern in the stream (Fig. 3) (Conlin and Tutty 1979). The traps diverted fish through a 4.9 m long sluice trough into a live holding box (2.4 m x 0.8 m x 0.8 m). Groups of fish could be separated in the live box by means of movable baffles.

Starting in 1976, fence traps operated on Ryder, Street, Hopedale, Rust and Salwein Creeks. In 1977, Post and Fifteen Mile Creeks were added; and in 1978, Barrett Creek was included (Figs. 1 and 2). The above tributaries were

Table 2. Trapping dates by year and method for each capture site in Vedder-Chilliwack River tributaries and below Chilliwack Lake outlet, 1976-1979.

Capture site	1976		1977			1978		1979
	Fence traps[a]	Minnow traps[a]	Fence traps[a]	Minnow traps[a]	4x4 Inclined plane trap	Fence traps[a]	Minnow traps[a]	Minnow traps[a]
Chilliwack L. outlet	--	--	--	--	March 21-May 22 Apr. 4,7,21,23, 27.	--	--	--
Post Cr.	--	--	Apr. 20-June 8 (May 1, 5).	--	--	Apr. 8-May 24.	--	--
Fifteen Mile Cr.	--	--	Apr. 17-June 9 (Apr. 18-20).	--	--	Apr. 3-June 6.	--	--
Ryder Cr.	Apr. 28-June 15 (May 1,2,4,5).	May 2-6.	Mar. 28-June 9 (Mar. 30,31, Apr. 5-7).	--	--	Apr. 3-June 12.	--	--
Barrett Cr.	--	--	--	--	--	Apr. 5-June 9.	Apr. 6-7.	Feb. 20-22.
Street Cr.	Apr. 29-June 16 (May 9-12, 17, 23, June 1).	May 2-6.	Mar. 28-June 13.	Apr. 1-2.	--	Mar. 31-June 16.	Apr. 5-7.	--
Hopedale Cr.	Apr. 16-June 25 (May 17-19).	--	Apr. 1-June 13 (Apr. 6,7,17-20, May 30).	Apr. 1-2, May 31, June 1.	--	Mar. 31-June 16 (Apr. 1,2,9,10).	Apr. 5-12. (Apr. 3-10).	Feb. 20-22.
Rust. Cr.	Apr. 28-June 15.	--	Apr. 5-June 9 (May 11-12).	--	--	Mar. 31-June 9.	Apr. 10-12.	Feb. 20-22.
Salwein Cr.	Apr. 16-June 22 (June 19-22).	Apr. 22-26, May 2-6, 17, 21.	Apr. 1-June 9.	--	--	Mar. 31-June 16.	Apr. 5-12 (Apr. 8, 9).	Feb. 20-22.

[a] Dates fence traps not fished or minnow traps not checked are indicated in parenthesis; fence trapping period includes dates traps were installed and removed.

Table 3. Minnow trapping dates for Chilliwack Lake and upper Chilliwack River, 1976-1979[a].

Capture site	1976	1977	1978	1979
Chilliwack Lake				
Zone 1	--[b]	Oct. 20-Dec. 6.	Oct. 6-Nov. 17.	Oct. 11-15.
Zone 2	--	Nov. 8-14.	Oct. 24-Nov. 21.	Oct. 10-11.
Zone 3	--	Oct. 18-Dec. 6.	Oct. 6-Nov. 21.	Aug. 24-Oct. 5.
Zone 4	--	Oct. 17-Dec. 6.	Oct. 6-Nov. 16.	Aug. 24-Sept. 28.
Zone 5	--	Nov. 17-Dec. 6.	Oct. 19-Nov. 21.	Sept. 26-Oct. 3.
Zone 6	--	Nov. 16-Dec. 6.	Oct. 17-Nov. 15.	Oct. 10-14.
Total	Oct. 26-Dec. 16.	Oct. 17-Dec. 6.	Oct. 6-Nov. 21.	Aug. 24-Oct. 15.
Upper Chilliwack River	--	--	--	Sept. 5-25.

[a] Dates traps not fished or checked are given in Appendix 2.

[b] Not available.

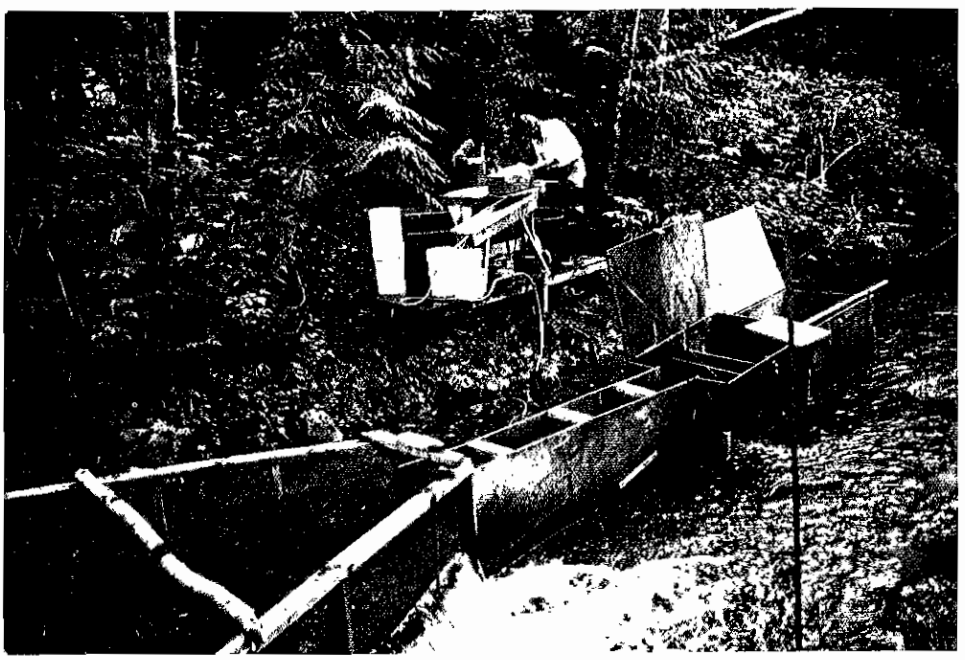

Fig. 3. Fence trap and stream side tagging operation on Ryder Creek, spring, 1977.

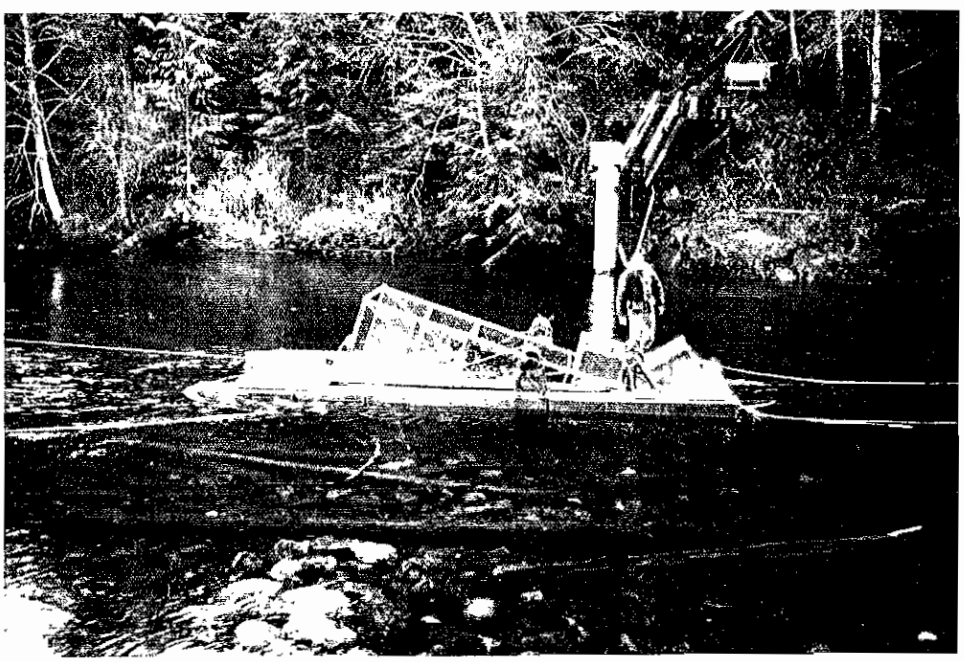

Fig. 4. The 4 x 4 inclined plane trap fishing below Chilliwack Lake outlet, spring, 1977.

chosen for their relatively low flow, known presence of rearing coho juveniles, and road access to trap sites. Fence trapping in each tributary was conducted at the same site each year, near the confluence with the mainstem.

Fish were removed daily from the live trap box, sorted to species and enumerated. Coho smolts and trout were transferred for tagging to nearby holding boxes located in the stream. Other species were released downstream of the trap. Newly emergent coho fry passed freely through the screen mesh panels and were generally not enumerated. Trap mortalities for all species were recorded, and fish were observed for signs of disease, stress, previous fin clips, deformed or naturally missing adipose fins, and other anomalies.

Inclined plane trap

A 4x4 inclined plane trap was operated on the Chilliwack River just below Chilliwack Lake outlet during March 21 to May 22, 1977 (Fig. 4, Table 2). The trap, attached by cables to both river banks, consisted of a floating platform, an inclined steel mesh trap (with a 1.2 m x 1.2 m opening) that could be raised and lowered, and a live box for holding fish (Conlin and Tutty 1979). Until April 22, the trap was reset several times just below the lake outlet in order to determine the most productive capture site. Coho juveniles trapped at this time were generally too small for tagging (<45 mm) and were released.

During trap operation, the screens were cleaned daily and the catch removed each morning since most fish were trapped at night. The catch was sorted to species and coho juveniles enumerated and transported to a holding pen located at the north end of Chilliwack Lake for tagging (Fig. 5). Other species were released immediately. Transport methods were similar to those employed during the lake minnow trapping. Captured fish were observed for signs of disease, stress, previous fin clips, deformed or naturally missing adipose fins, and other anomalies.

Minnow traps

During the spring tagging program, minnow traps baited with frozen chum or chinook roe were set in Ryder, Street and Salwein Creeks in 1976; in Street and Hopedale Creeks in 1977; and in Barrett, Street, Hopedale, Rust and Salwein Creeks in 1978 (Table 2). The traps were generally set downstream of the fence, around submerged logs and debris and under overhanging banks. Captured fish were removed from the traps at least once daily, sorted to species and enumerated. Coho juveniles and trout were transferred in buckets to holding boxes located in the stream at fence trap sites. Other species were released.

During the fall tagging program, minnow traps baited with frozen chum or chinook roe were set in Chilliwack Lake in 1976 to 1979 and in the upper Chilliwack River in 1979 (Table 2, Append. 2). From 1977 to 1979, Chilliwack Lake was divided into six zones (Fig. 5) in order to determine the relative abundance of juveniles in each lake area. Positioning of minnow traps around the lake periphery was governed by catch success and frequency of tag recovery. Generally, from 100 to 200 minnow traps were employed each year (Append. 4a-e). The mean annual number of traps used for total lake in 1976 was 102, and in 1977 to 1979 from 15 to 87 for each lake zone (Table 5).

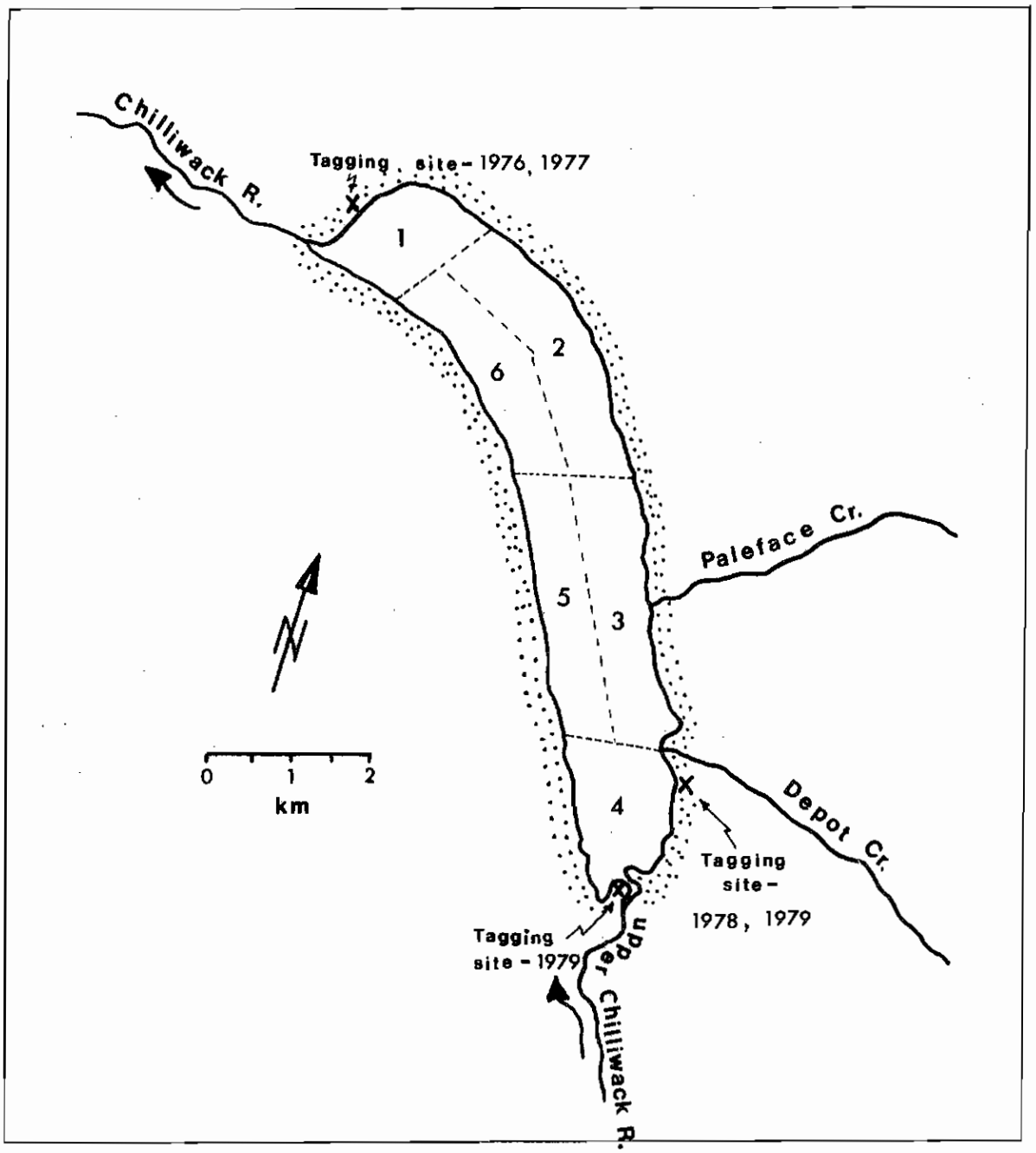

Fig. 5. Chilliwack Lake catch zones and tagging sites, 1976-1979.

Captured fish were removed daily in 1976 and 1977 (except when weather conditions prevented boat access), and after one or several days in 1977 and 1978, and sorted to species. Coho were transported in 91 liter plastic garbage pails to ABS holding pens (Conlin and Tutty 1979) or to 1.2 m x 1.2 m x 1.8 m deep net pens located in Chilliwack Lake, and held for up to a week prior to tagging. During transport, aeration was supplied by battery operated air pumps or from a compressed air cylinder.

All minnow trapped fish were observed for signs of disease, stress, previous fin clips, deformed or naturally missing adipose fins, and other anomalies.

BIOLOGICAL SAMPLING

During the 1976, 1977 and 1978 spring tagging programs on the tributaries, up to 50 coho juveniles were subsampled opportunistically from each trapping site for nose-fork length ($\pm$1 mm) and scales for age determination. Sampling generally occurred once a week during tagging. In 1978, 50 coho from tributaries were also weighed in aggregate ($\pm$0.1 g) and an average weight determined. Weights were measured during tagging while fish were anaesthetized.

During the 1976 to 1979 fall tagging programs on Chilliwack Lake, up to 100 coho juveniles were subsampled for nose-fork length ($\pm$1 mm) and scales for age determination. Sampling generally occurred once a week during tagging. In 1978 and 1979, coho from the lake were sampled randomly for aggregate weight ($\pm$0.1 g; n=50-100). Weights were measured during tagging while fish were anaesthetized.

In 1979, lengths, weights, and scale samples were also taken weekly from up to 100 coho juveniles captured by minnow traps in the upper Chilliwack River.

During 1976 to 1978, limited lengths and scale data were collected for rainbow trout, cutthroat trout and Dolly Varden captured in the tributaries and in Chilliwack Lake.

FISH TAGGING

Tagging was conducted throughout the trapping period, generally once a week. Coho captured in the tributaries were tagged at their respective fence trap sites (Fig. 3) (but Rust Creek fish were tagged at Salwein Creek site). Coho captured in Chilliwack Lake (and at the lake outlet in 1977) were tagged on shore at the north end of the lake in 1976 and 1977, and at the south end of the lake near Depot Creek outlet in 1978 and 1979 (Fig. 5). Coho captured in the upper Chilliwack River in 1979 were generally tagged at that creek's outlet (Fig. 5).

Coho were first anaesthetized with a solution of tricane methane sulfonate (TMS-222), then marked with an adipose fin clip, and tagged with binary coded wire nose tags. Subsamples of up to 200 tagged fish were held for 24 to 48 hours to test for tag rejection and post-tagging mortality. Juveniles less than 45 mm long were released untagged; juveniles longer than 90 mm were tagged separately, after adjusting the nose mold for deeper tag

placement. Methods and equipment are described more fully by Armstrong and Argue (1977).

Tagged fish were released downstream of fence traps in the tributaries and at the respective tagging sites in Chilliwack Lake and upper Chilliwack River. For tagging purposes, Rust and Salwein Creeks were treated as one system; as were upper Chilliwack River and Chilliwack Lake in 1979.

Rainbow trout smolts, captured in 1976 in Salwein and Hopedale Creeks, were adipose clipped and coded wire nose tagged. Cutthroat trout, captured in the tributaries in 1976, were adipose clipped and released without tags (at the request of the Provincial Fish and Wildlife Branch).

JUVENILE TAG RECOVERY

During the 1977 and 1978 spring tagging programs, several coho juveniles with adipose clips were captured, indicating that they were tagged the previous season. A portion of the recovered marked fish were sacrificed for scale sampling and tag identification. During February 20-22, 1979, coho juveniles were minnow trapped in Barrett, Hopedale, Rust and Salwein Creeks in order to determine if Chilliwack Lake juveniles overwinter in the lower tributaries. Captured fish with adipose clips were sacrificed for tag identification.

During the 1976 to 1979 fall tagging programs in Chilliwack Lake, captured coho were monitored for adipose clips throughout the minnow trapping program. Prior to release of these marked fish, most were run through the Quality Control Device to check for tag rejection.

PHYSICAL SAMPLING

Surface water temperatures were measured, usually daily, at the tributary trapping and tagging sites, and at the Chilliwack Lake tagging sites, using a pocket thermometer. In 1979, surface water temperatures were also measured at Chilliwack Lake minnow trapping sites and at upper Chilliwack River outlet.

RESULTS

FISH CAPTURE

Coho juveniles

Estimated catches of coho juveniles by capture site and method are summarized in Table 4. Daily fence trap catches for each tributary are presented in Appendix 3a and b, and daily minnow trap catches and effort for Chilliwack Lake and upper Chilliwack River are presented in Appendix 4a-e.

During the 1976 to 1978 spring programs, an estimated 19,654, 22,380 and 36,829 coho juveniles were captured in each consecutive year in Vedder-Chilliwack River tributaries. Weir traps accounted for approximately 95% to the annual catch, minnow traps 4% to 5%, and the inclined plane trap, operating in 1977, only 1%. Hopedale and Salwein Creeks were generally the most productive, contributing to the total annual catch in tributaries

Table 4. Estimated annual live catches of coho juveniles in Vedder-Chilliwack River system by capture site and method, 1976-1979 (numbers in parenthesis indicate % of total)[a].

Capture site	1976			1977				1978			1979
	Fence traps	Minnow traps	Total	Fence traps	Minnow traps	Inclined Plane traps	Total	Fence traps	Minnow traps	Total	Minnow traps
Chilliwack L. outlet	---[b]	---	---	---	---	279	279(1.2)	---	---	---	---
Post Cr.	---	---	---	1,204	---	---	1,204(5.4)	961	---	969(2.6)	---
Fifteen Mile Cr.	---	---	---	1,308	---	---	1,308(5.8)	789	---	789(2.1)	---
Ryder Cr.	1,413	56	1,469(7.5)	4,298	---	---	4,298(19.2)	5,058	---	5,058(13.7)	---
Barrett Cr.	---	---	---	---	---	---	---	5,006	99	5,105(13.9)	1,836
Street Cr.	1,152	38	1,190(6.0)	1,481	300	---	1,781(8.0)	1,803	100	1,903(5.2)	---
Hopedale Cr.	9,746	---	9,746(49.6)	3,411	738	---	4,149(18.5)	9,504	527	10,031(27.2)	1,038
Rust Cr.	1,185	---	1,185(6.0)	2,033	---	---	2,033(9.1)	667	231	898(2.4)	351
Salwein Cr.	5,287	777	6,064(30.9)	7,328	---	---	7,328(32.7)	11,521	555	12,076(32.8)	455
Total	18,783(95.6)	871(4.4)	19,654(100)	21,063(94.1)	1,038(4.6)	279(1.2)	22,380(100)	35,309(95.9)	1,512(4.1)	36,829(100)	3,680
Chilliwack L.	---	30,812	30,812	---	5,927	---	5,927	---	17,433	17,433	18,055
Upper Chilliwack R.	---	---	---	---	---	---	---	---	---	---	10,794
Overall Total	18,783	31,683	50,466	21,063	6,965	279	28,307	35,309	18,945	54,262	32,529

[a] Excludes number of dead (Append. 3).

[b] Not fished.

80.5% in 1976, 51.2% in 1977, and 60.0% in 1978. The above catch totals exclude weir trap mortalities which averaged 2.9% of the total three-year fence catch. Mortalities in minnow traps set in creeks were negligible.

During the 1976 to 1979 fall programs in Chilliwack Lake, an estimated 30,812, 5,927, 17,433, and 18,055 coho juveniles were minnow trapped in each consecutive year (Table 4). In addition, 10,794 coho juveniles were minnow trapped in 1979 in the upper Chilliwack River (Table 4).

The number of traps used and total set time for each lake zone, as well as the seasonal catch for each lake zone, varied greatly from year to year (Table 5, Append. 4a-d). Mean lake catch per trap-hour (CPUE) ranged from 0.044 in 1977 to 0.447 in 1979 (Table 4). Zone 4, located at the upstream end of the lake, had the highest CPUE in 1977 (0.060) and 1978 (0.295), while zone 1, located at the lake outlet, had the highest CPUE in 1979 (0.975) (Table 5, Append. 4a-d).

The CPUE in the upper Chilliwack River in 1979 averaged 0.389 (Append. 4e).

Other fish species

During the 1976 to 1979 capture programs in the Vedder-Chilliwack River system, chum fry, sockeye smolts, rainbow trout, cutthroat trout, Dolly Varden, chub, dace, lamprey, sculpins, redside shiners, squawfish, sticklebacks, suckers, and whitefish were caught incidentally to coho juveniles. Available catch data for these species are summarized in Appendix 5.

Migration timing

Migration timing of coho smolts (coho fry counts were negligible) is shown by tributary as cumulative 5-day catches in weir traps (Fig. 6). In general, similar emigration timing was observed in all three years of the study, with most of migration occurring from the start of May to first week of June. Migration generally peaked towards the end of May in Post, Barnett, Street, Salwein and Hopedale Creeks. Migration peaked somewhat earlier (early to mid-May) in Fifteen Mile and Ryder Creeks, while Rust Creek showed an extended migration with peaks in April and May. Migration timing at Chilliwack Lake outlet could not be determined due to low catches.

BIOLOGICAL SAMPLING

Tributaries

The age composition of coho emigrating from the tributaries is presented in Table 6 and Appendix 6. Over 90% of the emigrants from each tributary were age 1+ fish, except for Post Creek where 85.9% were age 1+ in 1977, and Fifteen Mile Creek where 76.7% were age 1+ in 1977. The remaining coho emigrants were age 2+. No significant seasonal trends or year-to-year variations in age composition per site were observed, except for Fifteen Mile Creek where 2+ coho were much more abundant in 1977 (23.3%) than in 1978 (8.7%).

Table 5. Mean number of minnow traps used, total coho captured, and catch per unit effort by zone in Chilliwack Lake and upper Chilliwack River, 1976-1979.

Zone	1976			1977			1978			1979		
	Mean No.traps	Coho catch	Catch/ trap-hr	Mean No.traps	Coho catch	Catch/ trap-hr	Mean No.traps	Coho catch	Catch/ trap-hr	Mean No.traps	Coho catch	Catch/ trap-hr
1	-[a]	-	-	64	2,153	0.048	37	3,770	0.128	77	7,485	0.975
2	-	-	-	15	119	0.055	28	1,184	0.098	63	1,605	0.564
3	-	-	-	41	1,262	0.032	37	4,602	0.166	87	2,233	0.200
4	-	-	-	33	1,366	0.060	24	1,520	0.295	40	1,507	0.153
5	-	-	-	19	267	0.035	32	2,653	0.159	31	455	0.100
6	-	-	-	46	760	0.036	35	3,704	0.216	57	4,770	0.691
Upper Chilliwack River	-	-	-	-	-	-	-	-	-	61	10,794	0.389
Total	-	30,812	-	-	5,927	-	-	17,433	-	-	18,055[b] 28,849[c]	-
Mean	102	-	0.203	-	-	0.044	-	-	0.177	-	-	0.447[b] 0.439[c]

[a]Not available.

[b]Lake only.

[c]Lake and upper Chilliwack River.

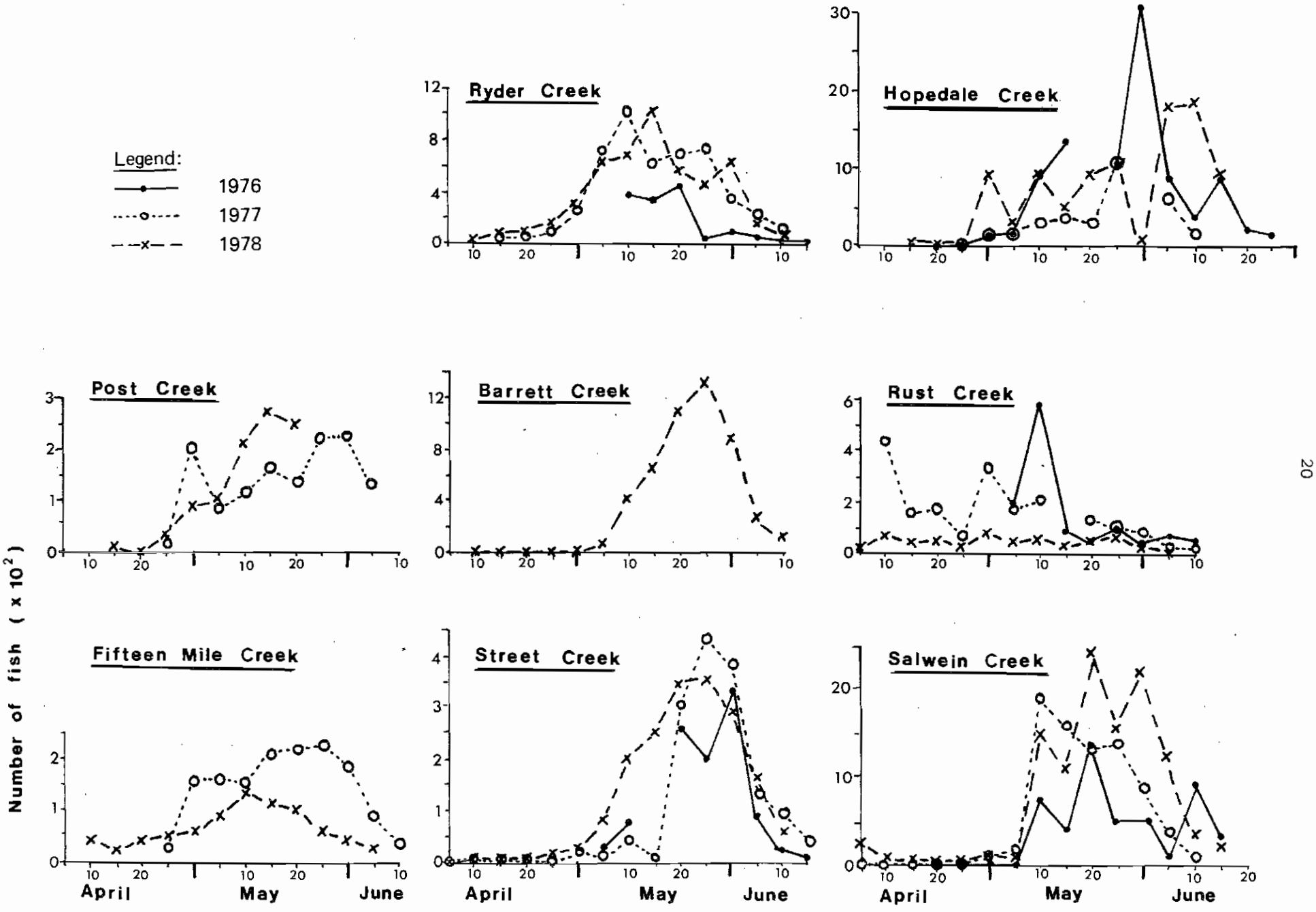

Fig. 6. Migration timing of coho juveniles in Vedder-Chilliwack River tributaries, April-June, 1976-1978.

Table 6. Age composition (%) of coho juveniles tagged in Vedder-Chilliwack River tributaries and Chilliwack Lake, 1976-1979 (n=sample size).

Year	Upper Chilliwack River			Chilliwack Lake			Chilliwack Lake outlet			Post Cr.			Fifteen Mile Cr.		
	n	0+	1+	n	0+	1+	n	1+	2+	n	1+	2+	n	1+	2+
1976		--------[a]		326	89.3	10.7		--------			---------			-------	
1977		-------		637	92.6	7.4	60	93.3	6.7	262	85.9	14.1	258	76.7	23.3
1978		--------		598	98.5	1.5		--------		169	91.1	8.9	264	91.3	8.7
1979	250	97.6	2.4	298	99.3	0.7		--------			---------				

Year	Ryder Cr.			Barrett Cr.			Street Cr.			Hopedale Cr.			Salwein/Rust Cr.		
	n	1+	2+	n	1+	2+	n	1+	2+	n	1+	2+	n	1+	2+
1976	75	93.3	6.7		--------		39	94.9	5.1	29	93.1	6.9	109	93.6	6.4
1977	159	95.0	5.0		--------		178	96.1	3.9	313	92.7	7.3	296	96.6	3.4
1978	338	96.2	3.8	47	97.9	2.1	67	98.5	1.5	100	100.0	0	94	96.8	3.2

[a] Not sampled.

Mean lengths of coho emigrating from the tributaries are presented in Figure 7 and Appendices 7 and 8. Mean lengths of age 1+ coho sampled during the spring in tributaries (1976-1978) and at the lake outlet (1977) showed a similar seasonal trend among capture sites. Generally, smolt size increased from approximately 70 mm or 80 mm in early April, to over 100 mm by early May, then remained steady or declined somewhat during June. Little year-to-year variation in length was observed per site, except for Fifteen Mile Creek where 1+ coho captured during 1977 were consistently and significantly ($p < .05$) smaller than coho captured in 1978, and in Street and Hopedale Creeks where juveniles captured in 1976 were considerably smaller than those captured in later years. Street Creek coho yearlings were the largest, up to 115.2 mm, when compared to yearlings from other tributaries.

Mean lengths of age 2+ coho juveniles sampled at the above sites, ranged from approximately 80 mm to 120 mm and were generally larger than the lengths of age 1+ coho sampled concurrently (Fig. 7, Append. 8). Due to scarcity of this age group (and therefore small sample size) no significant seasonal trends or annual variations could be discerned.

Mean weights of coho juveniles sampled in the tributaries during the spring of 1978 (mostly age 1+) are presented in Figure 8 and Appendix 9. The lowest weights were recorded for Post Creek where fish weighed from 6.2 g on May 3, 1978 to 8.8 g on May 17, 1978. The greatest weights were recorded for Street Creek juveniles which weighed as much as 14.8 g on May 9, 1978.

Chilliwack Lake and upper Chilliwack River

The age composition of coho captured in Chilliwack Lake and upper Chilliwack River is presented in Table 6 and Appendices 10 and 11. Age 0+ coho constituted from 89.3% of the catch in 1976 to 99.3% of the catch in 1979. The remaining coho were age 1+. Coho juveniles captured in the upper Chilliwack River in 1979 were also mostly age 0+ (97.6%). No significant seasonal trends or year-to-year variations in age composition were observed in Chilliwack Lake.

Mean lengths of coho sampled in Chilliwack Lake are presented in Figure 9 and Appendix 12). Mean lengths of 0+ coho juveniles sampled during the fall of 1976 to 1979 in Chilliwack Lake increased slightly from 61 mm in late September to 65 mm by mid-October (1979 data) but remained relatively uniform between 70 mm and 80 mm from late October to December (1976-1978 data). Lake juveniles were significantly ($p < .05$) longer in 1977 (seasonal mean of 79.8 mm) compared to other years (seasonal mean of 62.8 mm in 1979 to 72.8 mm in 1978).

Mean lengths of age 1+ coho juveniles sampled in Chilliwack Lake, ranged from approximately 80 mm to 110 mm and were generally greater than the length of age 0+ coho sampled concurrently (Fig. 9, Append. 12). Due to scarcity of this age group (and therefore small sample size) no significant seasonal trends or year-to-year variations could be discerned.

Juveniles captured in the upper Chilliwack River in 1979 averaged 56.6 mm (age 0+) and 88.3 mm (age 1+) (Fig. 9, Append. 11).

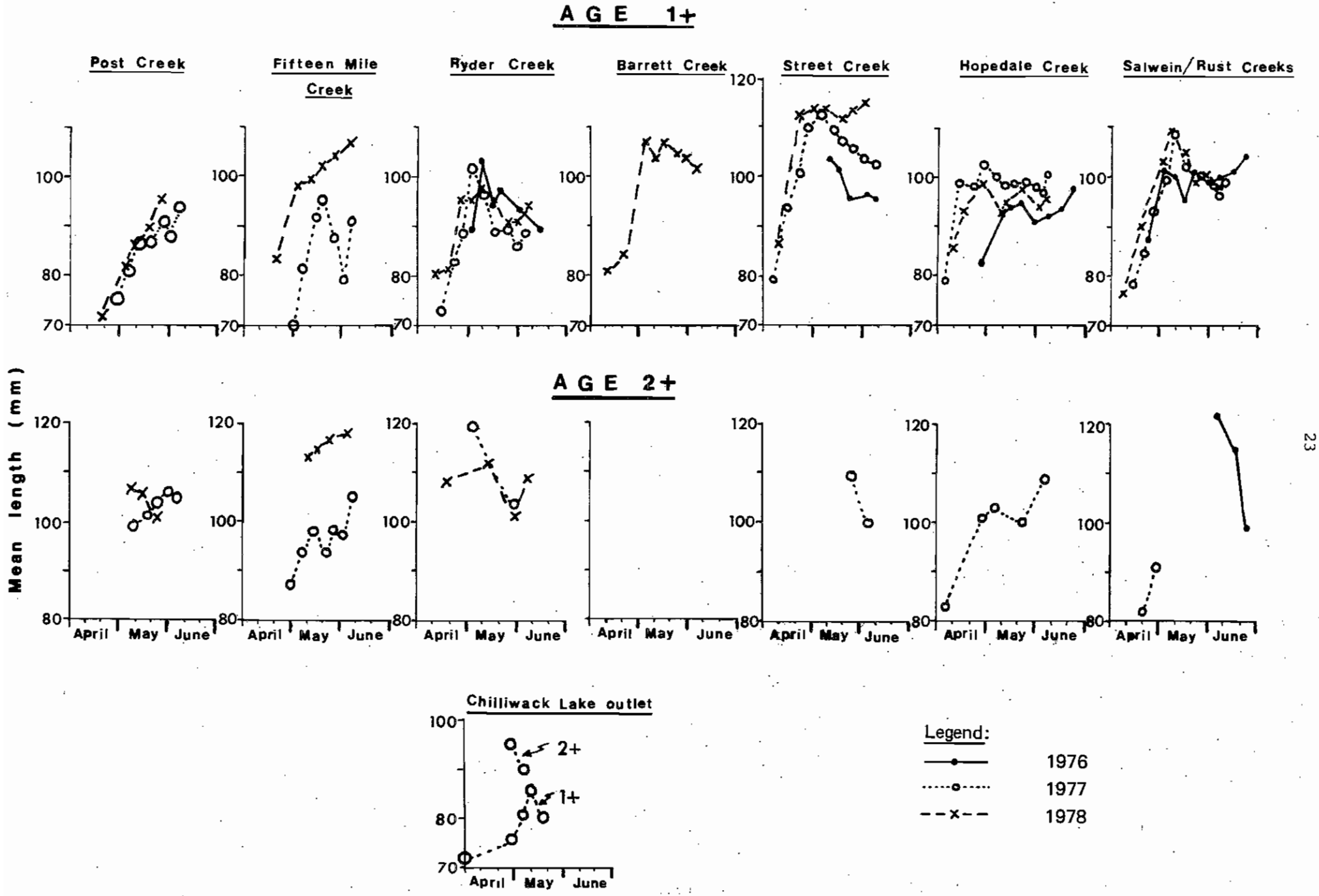

Fig. 7. Mean length of age 1+ and 2+ coho juveniles in Vedder-Chilliwack River system, 1976-1978.

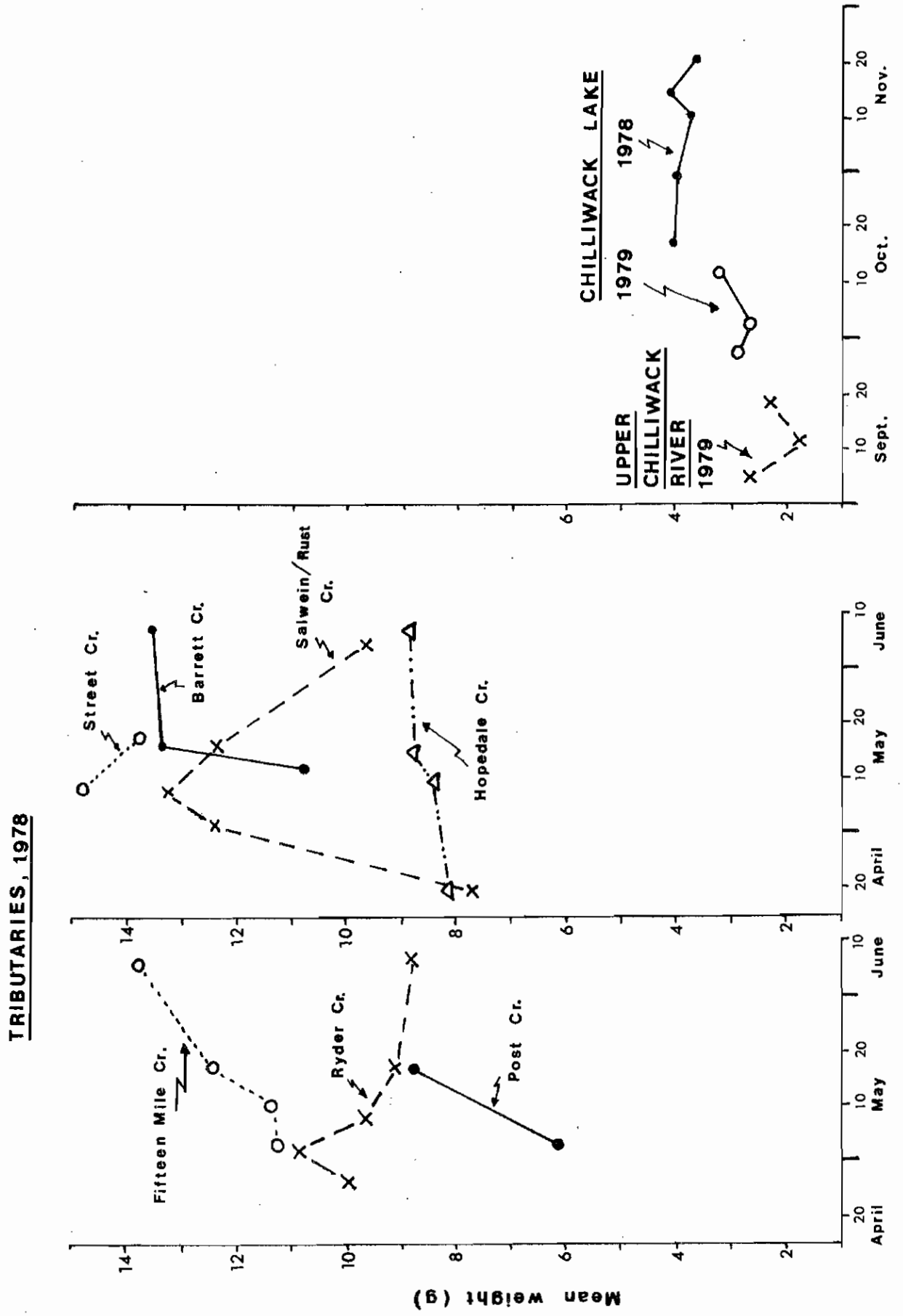

Fig. 8. Mean weight of coho juveniles in Vedder-Chilliwack River system, 1978-1979.

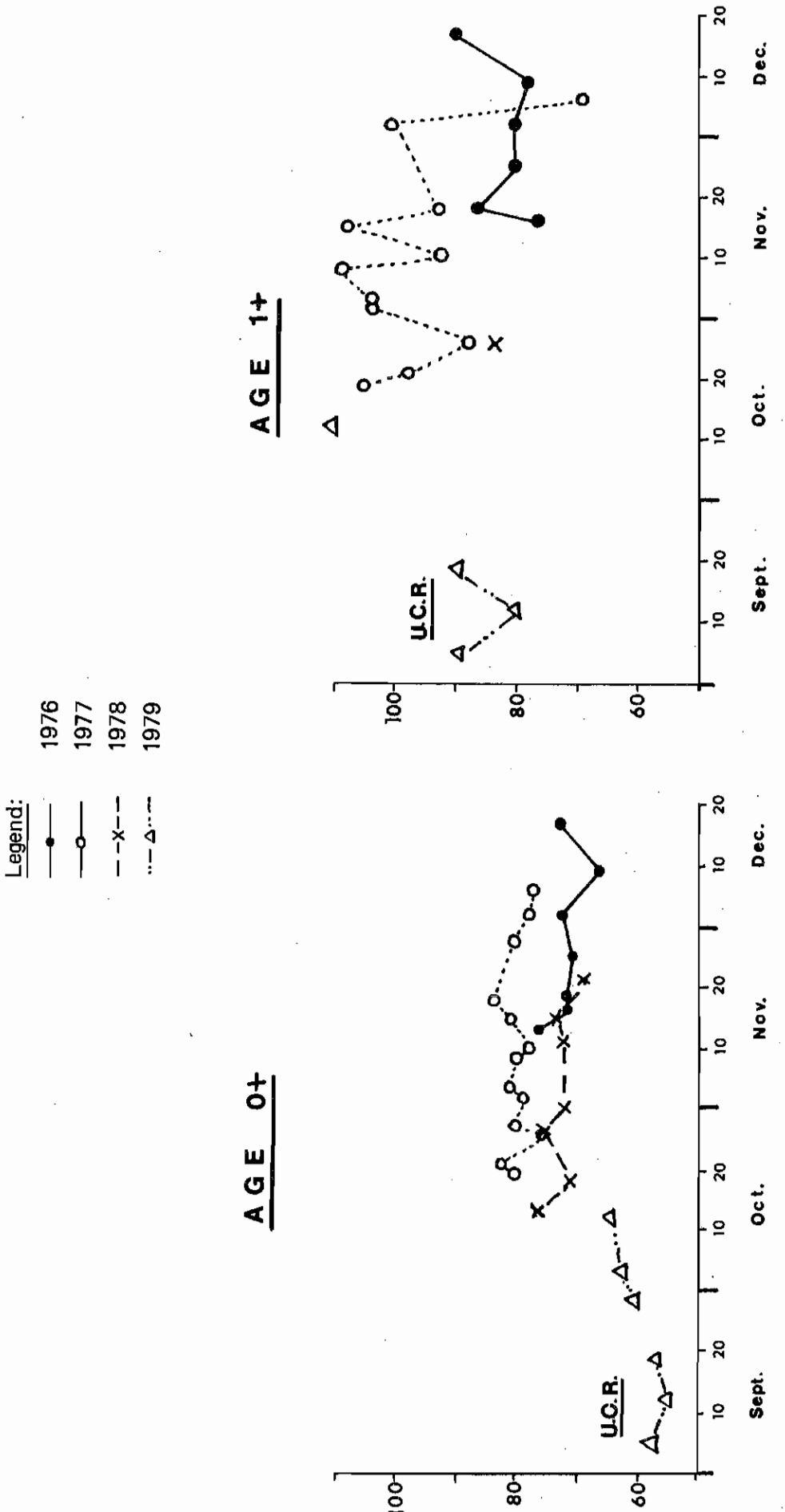

Fig. 9. Mean length of age 0+ and 1+ coho juveniles in Chilliwack Lake and upper Chilliwack River (U.C.R.), 1976-1979.

Mean weights of coho juveniles sampled in Chilliwack Lake during the fall of 1978 and 1979 (mostly age 0+) are presented in Figure 8 and Appendix 10. Mean weights ranged from 3.7 g to 4.2 g during the fall of 1978 and from 2.7 g to 3.3 g during the fall of 1979. Weights of coho juveniles captured in the upper Chilliwack River in September, 1979, ranged from 1.8 g to 2.7 g (Fig. 8, Append. 9).

The overall incidence of naturally missing or deformed adipose fins that when observed on an adult spawner could be mistaken for an adipose clip, averaged 1:1273 (range of 1:2272 - 1:847 (Append. 13).

The available size and age data per capture site for rainbow trout, cutthroat trout and Dolly Varden are shown in Appendix 14.

FISH TAGGING

Coho juveniles

The 1976 to 1979 tagging inventory for the Vedder-Chilliwack River system is presented in Table 7 and Appendices 15a-c and 16.

Tributaries: In 1976, 19,607 coho juveniles (corrected for tag rejection and post-tagging mortality) were adipose fin clipped, coded wire nose tagged using code 2-15-13, and released during April 27 to June 25. In 1977, 21,544 coho juveniles were tagged as above, using code 2-16-27 (Chilliwack Lake outlet fish, n=111) and code 2-4-13 (lower tributary fish, n=21,433), and released during April 5 to June 7. In 1978, 36,035 coho juveniles were tagged as above, using code 2-21-24, and released during April 10 to June 8.

During the three years of tributary tagging, 1+ coho were the dominant age group (generally over 90% of fish captured per site), their mean lengths ranging from 69.6 mm to 115.2 mm (1976-1978 data), and mean weights ranging from 6.2 g to 14.8 g (1978 data); the remaining fish were age 2+ coho (Append. 15a-c). Mean tag retention per capture site per year generally exceeded 99%; pre- and post-tagging mortalities were respectively less than 2% and less than 1% of total taggable fish; and numbers of undersized fish (<45 mm) released untagged were negigible (Append. 15a-c). Water temperatures at tagging sites over all years and capture sites ranged from 4.0°C to 18.0°C (Append.15a-c).

Chilliwack Lake: During 1976 to 1979, the annual numbers of coho juveniles adipose fin clipped, coded wire nose tagged and released between September 6 and December 16 were 28,491, 5,313, 14,800, and 25,306 respectively (corrected for tag rejection and post-tagging mortality) (Table 7). The codes used were 12-1-13 (n=6,189) and 2-15-11 (n=22,302) in 1976, 2-21-20 in 1977, 2-21-30 in 1978, and 2-17-60 in 1979. Of the coho tagged in 1979, 37% were captured in the upper Chilliwack River (Table 4).

During the four years of lake tagging (including upper Chilliwack River in 1979), 0+ coho were the dominant age group (over 89% of fish per tagging year), their mean lengths ranging from 54.8 mm to 84.1 mm, and mean weights ranging from 1.8 g to 4.2 g (1978 and 1979 data); the remaining fish were age 1+ coho (Append. 16). Mean tag retention per year was 99%; pre- and post-tagging mortalities were each less than 1% of total taggable fish; and

Table 7. Number of coho juveniles tagged by code and capture site in Vedder-Chilliwack River system, 1976-1979.

Capture site	1976 Code	1976 No. tagged[a] (%)	1977 Code	1977 No. tagged[a] (%)	1978 Code	1978 No. tagged[a] (%)	1979 Code	1979 No. tagged[a]
Chilliwack L. outlet	--[b]		2-16-27	111 (0.5)	—		--	
Post Cr.	--		2- 4-13	1,241 (5.8)	2-21-24	1,030 (2.9)	--	
Fifteen Mile Cr.	--		2- 4-13	1,252 (5.8)	2-21-24	886 (2.5)	--	
Ryder Cr.	2-15-13	1,396 (7.1)	2- 4-13	3,894 (18.1)	2-21-24	5,074 (14.1)	--	
Barrett Cr.	--		--		2-21-24	5,510 (15.3)	--	
Street Cr.	2-15-13	1,152 (5.9)	2- 4-13	1,400 (6.5)	2-21-24	1,881 (5.2)	--	
Hopedale Cr.	2-15-13	9,711 (49.5)	2- 4-13	4,202 (19.5)	2-21-24	8,899 (24.7)	--	
Salwein/Rust Cr.	2-15-13	7,348 (37.5)	2- 4-13	9,444 (43.8)	2-21-24	12,755 (35.4)	--	
Total	2-15-13	19,607 (100)	2-16-27 2- 4-13	111 21,433 21,544 (100)	2-21-24	36,035 (100)	--	
Chilliwack Lake	12- 1-13 2-15-11	6,189 -- 22,302 28,491	2-21-20	5,313 --	2-21-30	14,800 --	2-17-60	25,306[c]

[a] Corrected for tag retention and post-tagging mortality.

[b] Not tagged.

[c] Includes Upper Chilliwack River coho.

numbers of undersized fish (<45 mm) released untagged averaged 3.5% of the four-year total (Append. 16). Water temperatures at tagging sites over all years ranged from 4.0°C to 12.5°C (Append. 16).

Other species

In 1976, 85 cutthroat trout captured in the tributaries (75% in Ryder and Salwein Creeks) were adipose clipped and released without tags; in addition, 206 rainbow trout captured in Hopedale and Salwein Creeks, were adipose clipped and coded wire nose tagged with code 2-15-13 (n=35) and 12-1-1 (n=171) (corrected for tag rejection of 0.8%). The available size and age data for these species are shown in Appendix 14.

FISH DISEASE MONITORING

An apparent eye damage, manifested as a cloudiness of one or both eyes, was first observed in coho juveniles captured in 1976 in Salwein Creek, but was subsequently observed in coho captured in all the tributaries during 1976 to 1978. This condition varied from slight to severe and, in several cases, over 50% of the overnight coho catch from a given stream were so afflicted.

The cloudy eye symptom was monitored in 1977 and 1978, in order to determine its extent, severity, and possible cause. In addition, samples of different fish species from the river system were analyzed by the Diagnostic Service in Nanaimo.

Although no conclusive results were reached from the above studies, it was observed that (G.E. Hoskins, 1978 memo):

1. No infectious disease agent known to cause significant problems among stocks of cultured fish was encountered.

2. The prevalence of the eye fluke, Diplostomum sp., among the fish in the Vedder-Chilliwack River system was extremely low, and no other infectious agents were found that could possibly cause opacity of the eyes of coho smolts.

3. Observations strongly suggeted that the observed eye opacity in coho smolts was due to stressful environment within live boxes (such as oxygen depletion, crowding, and exhaustion).

4. There was no clear evidence that other species of fish or other age of coho (fry) in the system were similarly affected; these fish showed no definite opacity of the eye that was not associated with either eye fluke or a possible eye damage during capture.

In addition to the above "cloudy eye disease", fish scaling (sometimes severe) was observed in live boxes, and was attributed to fish overcrowding.

JUVENILE TAG RECOVERY

Tributaries

During the 1977 spring tagging program, 104 adipose clipped coho juveniles were recaptured in the tributaries and the lake outlet (Append. 17), giving a seasonal mark recovery rate of 0.46%, where

$$\text{Recovery rate} = \frac{\text{No. marks recovered}}{\text{No. tagged + Mortalities + Undersized (Append.16)}} \times 100\%$$

Of the 104 recaptures, 58 were sacrificed for tag identification. One fish (recaptured in Hopedale Creek) was tagged the previous spring in the tributaries; 37 fish (recaptured in the lower tributaries — Ryder Street, Hopedale, and Salwein, and at the lake outlet) were tagged the previous fall in Chilliwack Lake; and 17 fish (recaptured in the tributaries and at lake outlet) were recently tagged there (Table 8).

During the 1978 spring tagging program, 61 adipose clipped coho juveniles were recaptured in the tributaries (Append. 17), giving a seasonal mark recovery rate of 0.17% (calculated as above). Of the 61 recaptures, 36 were sacrificed for tag identification. One (age 2+) fish (recaptured in the Fifteen Mile Creek) was tagged the previous spring in the tributaries; 21 (age 1+) fish (recaptured in the lower tributaries — Barrett, Street, Hopedale, Rust, and Salwein) were tagged the previous fall at Chilliwack Lake; and 12 (age 1+) fish (recaptured in Ryder, Street and Salwein Creeks) were recently tagged there (Table 8).

During February, 1979, 3,680 coho juveniles were captured in Barrett, Hopedale, Rust, and Salwein Creeks (Table 4). Only one marked coho, tagged the previous fall in Chilliwack Lake, was recaptured (in Rust Creek) (Table 8).

Chilliwack Lake: During the 1976 to 1979 fall tagging programs in Chilliwack Lake, a total of 5,639 recoveries of recently marked coho juveniles were made, giving a seasonal mark recovery rate of 6.7%, 6.2%, 12.6%, and 5.1% for each consecutive year (Append. 18). In 1979, the tag recovery rate of coho juveniles in upper Chilliwack River was 2.9%, based on 322 mark recaptures.

Delayed tag loss (up to three weeks after initial release) from adipose clipped juveniles recovered from the lake during tagging was 1.6% in 1976, 8.1% in 1978, and 4.2% in 1979 (Append. 19).

PHYSICAL SAMPLING

Water temperatures for the study area are presented in Figures 10 and 11, and Appendices 20a-c and 21. Water surface temperatures at the Vedder-Chilliwack River trapping and tagging sites generally increased from April to June. Temperatures at the upstream sites were the lowest and showed only a slight seasonal increase, as at Chilliwack Lake outlet and Post Creek (from 4°C to 7°C), or remained low as at Fifteen Mile Creek (between 6°C and 8°C). By comparison, all the lower tributaries had higher spring temperatures, generally ranging from around 8°C in mid-April up to 12°C by mid-June. Highest temperatures, up to 18°C (daily records), were reported in June for

Table 8. Coho juveniles with tags identified, recovered in Vedder-Chilliwack River tributaries and at Chilliwack Lake outlet, 1977-1979 (fish age, where available, is given in parenthesis).

Capture site and year	Tagging year, site and code					
1977	Spring 1976 Tributaries 2-15-13	Fall 1976 Chilliwack Lake 2-15-11&12-1-13	Spring 1977 Tributaries 2-4-13	Spring 1977 Lake outlet 2-16-27	No pin	Lost pin
Chilliwack L. outlet	—[a]	10	--	1	--	--
Post Cr.	—	—	5	--	--	--
Ryder Cr.	--	1	1	--	--	--
Street Cr.	--	4(1+)	4	--	—	--
Hopedale Cr.	1	6(1+)	4	—	2	1
Salwein Cr.	--	16(1+)	2	--	--	—
Total	1	37	16	1	2	1

	Tagging year, site and code			
1978	Spring 1977 Tributaries 2-4-13	Fall 1977 Chilliwack Lake 2-21-20	Spring 1978 Tributaries 2-21-24	Lost pin
Fifteen Mile Cr.	1(2+)	--	--	--
Ryder Cr.	--	--	1(1+)	--
Barrett Cr.	--	5(1+)	--	—
Street Cr.	--	1(1+)	1(1+)	1
Hopedale Cr.	--	9(1+)	--	1
Rust Cr.	--	1(1+)	--	--
Salwein Cr.	--	5(1+)	10(1+)	--
Total	1(2+)	21(1+)	12(1+)	2

	Tagging year, site and code
1979	Fall 1978 Chilliwack Lake 2-21-30
Barrett Cr.	--
Hopedale Cr.	--
Rust Cr.	1
Salwein Cr.	—
Total	1

[a] No recoveries.

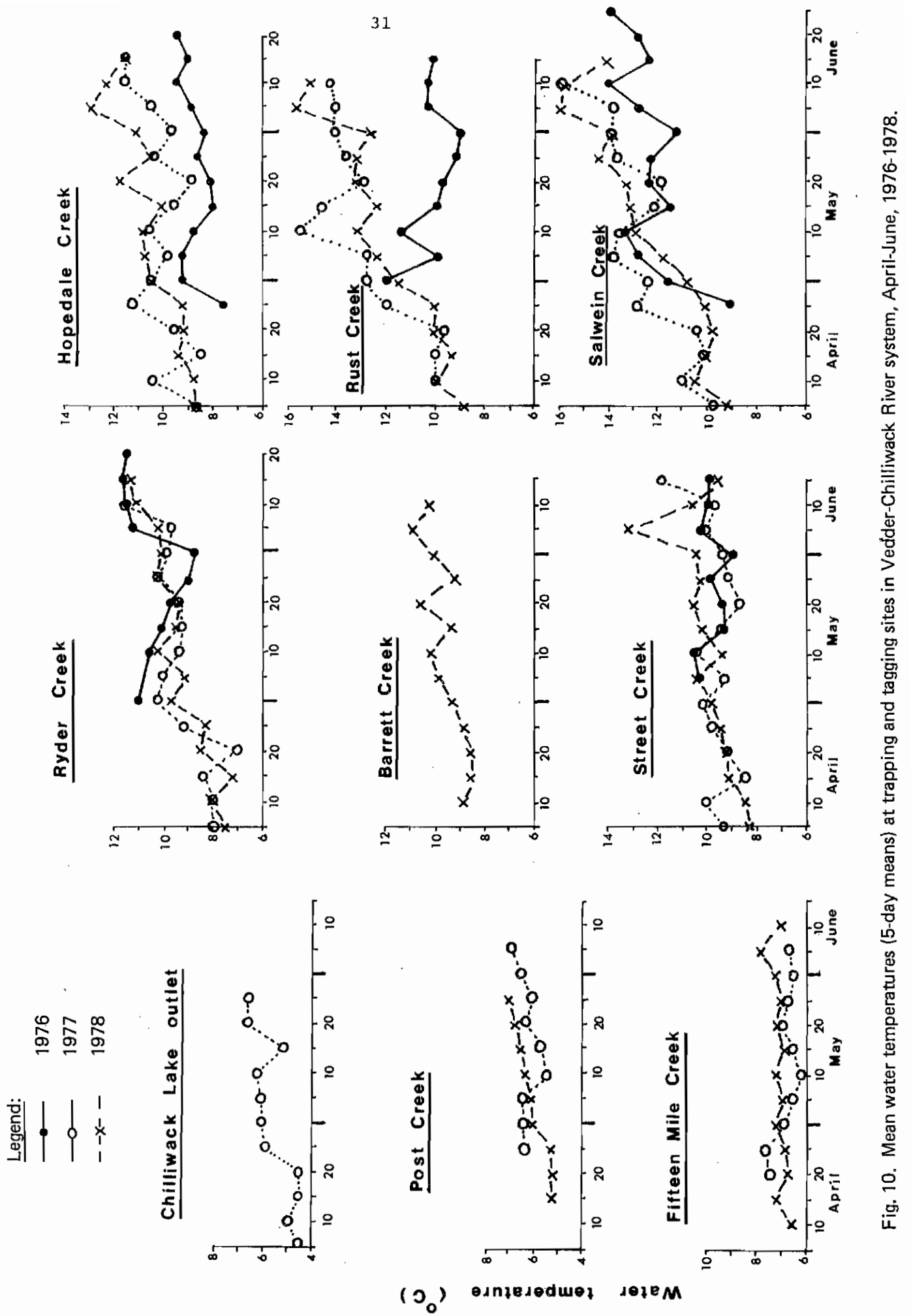

Fig. 10. Mean water temperatures (5-day means) at trapping and tagging sites in Vedder-Chilliwack River system, April-June, 1976-1978.

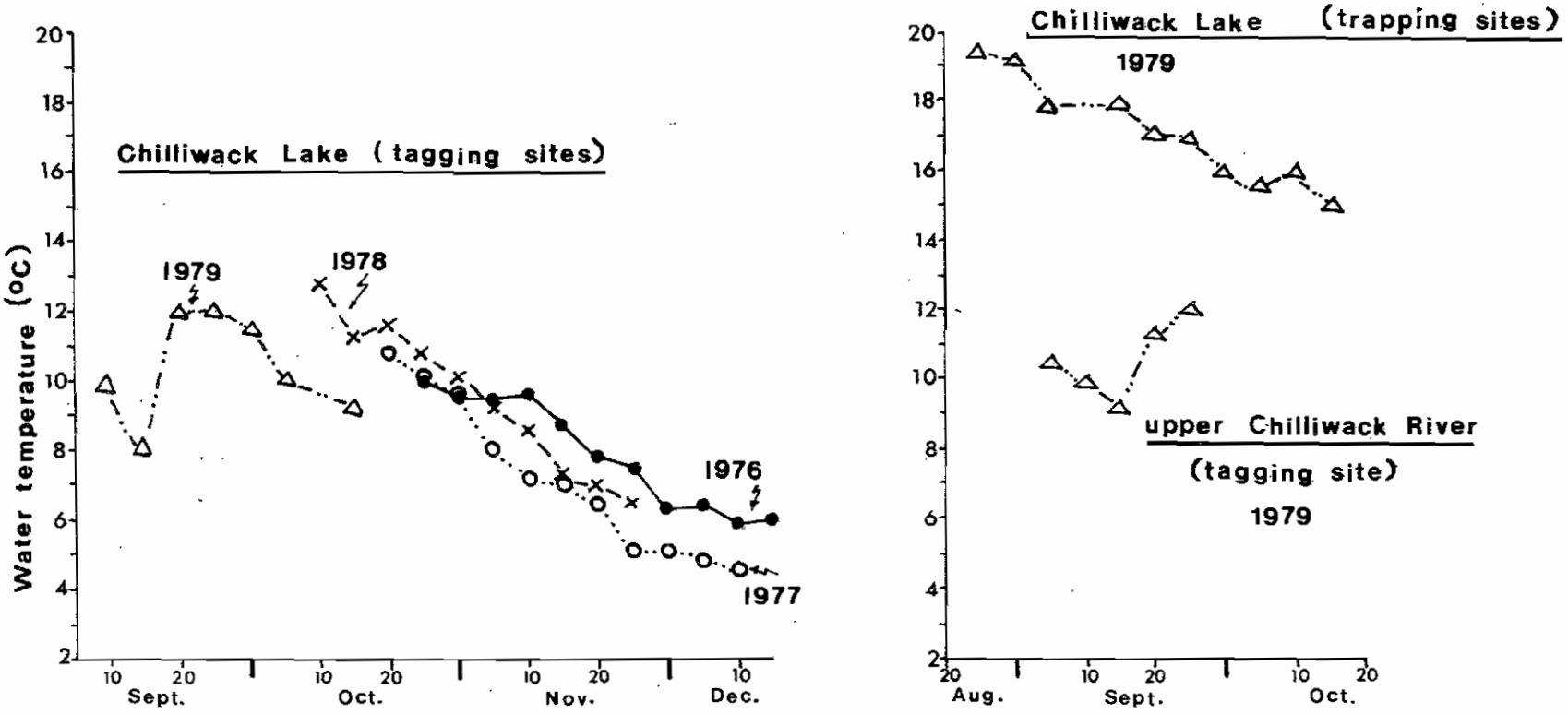

Fig. 11. Mean water temperatures (5-day means) at Chilliwack Lake and upper Chilliwack River trapping and tagging sites, 1976-1979.

Rust and Salwein Creeks. The lower tributaries (Hopedale, Rust and Salwein) also showed the largest seasonal fluctuations and year-to-year variations in temperature, compared to other sites, with the 1976 temperatures being several degrees lower than those reported in 1977 and 1978.

Water surface temperatures at the Chilliwack Lake tagging sites generally decreased from around 12°C in September to around 4°C-6°C by December, with little year-to-year variation (Fig. 11, Append. 21). Mean water temperatures at the Chilliwack Lake minnow trapping sites (1979 data) decreased from 19.5°C in late August to 15.0°C by October 10. On any given date, temperatures in different lake zones varied by less than 1°C (daily records).

Mean water temperatures at the upper Chilliwack River minnow trapping sites in September, 1979, ranged from 9.2°C to 12.0°C (Fig.11, Append. 21).

DISCUSSION

EVALUATION OF TRAPPING METHODS

Of the three methods used for capturing coho juveniles in the Vedder-Chilliwack river system, fence trapping at tributaries was the most effective, requiring relatively little effort per unit catch. Minnow trapping required a much higher effort and was used in tributaries for only brief periods each year despite a relatively high catch rate. The inclined plane trap, installed below Chilliwack Lake outlet in 1977, produced very poor catch possibly due to late trap installation combined with earlier juvenile migration that year. In addition, inclined plane traps are generally not effective in capturing smolts which are sufficiently strong swimmers to avoid or swim out of the trap.

Fence traps occasionally malfunctioned because of undermining or trap inundation for several days during high water levels (for example, June, 1976, at Salwein and Hopedale Creeks). Coho mortality at fence traps was highest during periods of high flow and was related to turbulent water conditions and debris accumulation in live boxes resulting in injury to captured fish. Highest mortality was observed in Ryder Creek in 1977 (505 coho dead) and was attributed to high silt content and severe turbulence in holding boxes. Eye damage, observed throughout the fence trapping program, was associated with stress and abrasion in holding pens.

Minnow trapping in Chilliwack Lake was affected by poor weather conditions, predators, and vandalism. High winds and turbulence displaced traps and hindered their retrieval by boat. Siltation from heavy rains reduced visibility of traps to fish, and predators removed the bait and some of the coho catch. Salamanders and suckers were a problem in some instances as they entered the minnow traps and ate the roe or sucked it through the mesh. The efficiency of the minnow trapping program in the lake was also occasionally reduced by long set times. Catch per unit effort was observed to decline sharply when traps were left unchecked for more than 24 hours. There are several reasons for this: 1) once the bait has gone, coho are no longer attracted to the traps; 2) larger fish, such as trout and sculpins, occasionally eat trapped juveniles; and 3) some coho escape over the long periods between retrieval. Delayed trap retrieval in 1977 and 1978 when some traps were

left unattended up to four days may explain in part the lower mean seasonal CPUE during those two years compared to 1976 and 1979 (Table 4).

Storms, predators, and vandals were also a problem during the holding of coho in Chilliwack Lake.

FISH CAPTURE

Tributaries

Mean annual coho escapements during 1971 to 1980 indicate that the most productive coho streams in the Vedder-Chilliwack River system in order of importance are the mainstem river (6,350 adults), upper Chilliwack River (2,145 adults), Salwein Creek (415 adults), and Hopedale Creek (290 adults) (Table 1). The two latter creeks also yielded the largest numbers of coho juveniles during fence trapping in the tributaries(Table 4).

Coho smolt production in the studied tributaries was not estimated due to insufficient data on the length and area of streams available to rearing coho, and incomplete catch data during smolt outmigration (start and end of migrations were generally not monitored; traps occasionally malfunctioned; and some coho reared below fence traps). In addition, tag recoveries indicated significant intrasystem migration of juveniles.

Chilliwack Lake

Generally, the most productive trapping sites in Chilliwack Lake were the moderately steep shorelines (30°-45°) where rubble, branches and underwater debris (such as logs and stumps) provided shelter for the rearing coho. The shallow low gradient beaches on either end of the lake and at creek outlets were less productive. Unfortunately, lake productivity for each zone could not be evaluated due to non-rigorous minnow trapping methodology.

The most successful catch period was at night. Catches usually peaked in a given area after a day or two of trapping, then declined indicating overfishing of locally rearing populations.

The main source of coho juveniles in Chilliwack Lake is the upper Chilliwack River (Dolly Varden Creek), with Depot and Paleface Creeks (Fig. 1) contributing smaller numbers. Estimated annual coho escapements to the three tributaries during 1975 to 1978 ranged from 400 in 1975 to 5,095 in 1977 (Table 9). Assuming a sex ratio of 50%, a fecundity of 2,300 eggs per female (Chilliwack hatchery, 1980 data) and coho egg-to-fry survival rate of 15% (DFO, 1980, SEP design criteria), a total of 69,000 to 879,000 coho fry were estimated to emerge annually from the above tributaries (Table 9). A portion of these reared in Chilliwack Lake where they were minnow trapped.

Limitations in escapement data, fry emigrations and immigrations, inconsistencies in trapping effort (for example, only 725 trapping hours expended in 1979 compared to 3,398 hours in 1977 (Table 9)), and a possible annual variation in the proportion of coho fry leaving the tributaries to rear in the lake, preclude a rigorous comparison between sizes of brood stock and of rearing populations.

Table 9. Annual coho escapements, estimated coho fry production, total juveniles captured, trapping effort and CPUE for Chilliwack Lake, 1976-1979.

Brood Year	Escapement[a] upper Chilliwack River	Depot Creek	Paleface Creek	Total	Estimated coho fry production[b]	Capture year	Total captured in Chilliwack Lake	Total set time (hrs)	CPUE[c]
1975	400	N/O[d]	N/O	400	69,000	1976	30,812	1049	0.203
1976	3,000	25	25	3,050	526,000	1977	5,927	3398	0.044
1977	5,000	20	75	5,095	879,000	1978	17,433	3122	0.177
1978	3,000	25	25	3,050	526,000	1979	18,055	725	0.447

[a] From Table 1.

[b] Coho fry production = No. females (at 50% sex ratio) x fecundity (2,300 eggs/female) x egg-to-fry survival (15%).

[c] Catch/trap-hour (from Table 5).

[d] None observed.

A Schnabel population estimate (Ricker 1975) of coho juveniles rearing in Chilliwack Lake, using the lake mark recovery data, gave calculated populations of 208,422 fry for 1976, 40,333 fry for 1977, and 58,537 fry for 1978. This method was abandoned since the calculated estimates showed no relation to size of brood stock. In addition, the tagged juveniles were probably non-randomly distributed after their release, as suggested by the very high mark recovery rates (up to 12.6% in 1978, see below), rendering this method unsuitable for estimating populations.

There was no rigorous assessment of the redistribution of tagged fish in the lake. However, the available mark recapture data from 1977 showed that recoveries of tagged fish first appeared in zone 1 (near the tagging site) shortly after the first release, and appeared in significant numbers in zone 4 (the opposite end of the lake) after three weeks (Append. 22). This suggests that approximately two weeks were required for mark redistribution in the lake. However, the above interpretation should be viewed with caution since areas with high mark recovery rates were generally avoided during trapping.

Migration timing

Migration timing of coho juveniles out of the Vedder-Chilliwack River tributaries (mostly during May to early June) was similar to that observed in the Fraser River and other B.C. rivers, where migrations generally occur from mid-April to mid-June with a peak observed around mid-May (Fraser et al. 1982, MS in prep'n.). In the present program, 50% migration timing could not be established due to incomplete catch records resulting from setting of traps after the onset of migration (especially in 1976), and trap malfunctioning during freshet conditions.

There appears to be little correlation between migration timing of coho juveniles out of the tributaries and water temperature. For example, Post, Fifteen Mile, Barrett and Street Creeks showed little or no temperature rise during the spring trapping periods, but all showed distinct juvenile migration peaks during that time (Figs. 6 and 10). Argue and Armstrong (1977) also found no such correlation in their Squamish River coho tagging program. It is more likely that migration timing reflects the combined effects of water temperature, discharge, and day length, and other physical and physiological factors.

BIOLOGICAL SAMPLING

Emigrants from the Vedder-Chilliwack River tributaries were primarily yearlings (1+); however, some two year old (2+) fish were also captured. This residualism was highest in Post Creek (14.1% of age 2+ coho in 1977 catch) and in Fifteen Mile Creek (23.3% of age 2+ coho in 1977 catch) (Table 6) and may be related to the cold water temperatures observed in those tributaries compared to the warmer downstream creeks (Fig. 10). Similar residualism was also observed in the northern Taku River in Alaska (Meehan and Siniff 1962), in the cold, unproductive Pitt River system (Schubert 1982, MS in prep'n), and in the Coldwater River (Wrightman, MS 1979).

Primarily underyearling (0+) coho were captured in the Chilliwack Lake during the fall period. The yearling (1+) coho have previously emigrated to sea or to downstream rearing areas. However, some yearlings were captured in

the lake during fall, while in spring of 1977, some age 2+ coho were captured emigrating out of the lake, indicating that a small number of coho spend two winters in the lake or the upper Chilliwack River.

Scale analysis of juveniles (mostly 0+) captured in Chilliwack Lake (1976-1979) and in upper Chilliwack River (1979) revealed a frequent occurrence of stress marks (but less frequent in 1978) (Y. Yole, DFO, pers. comm.), possibly related to harsher conditions in the upstream river areas and the influence of lake rearing on fish growth. By comparison, coho juveniles captured in downstream tributaries showed relatively few stress marks suggesting more uniform rearing conditions (Y. Yole, pers.comm.). These lower tributary fish also showed relative good early growth, as indicted by high numbers of well spaced freshwater circuli. This contrasted with the apparently poorer growth among juveniles from Fifteen Mile and Post Creeks where scales had fewer and more closely spaced freshwater circuli and more stress marks (Y. Yole, pers.comm.). The apparent slower growth in the latter two creeks is probably related to their considerably lower water temperatures compared to the downstream tributaries. Length data support the above growth trends except for Fifteen Mile Creek in 1978. (Fig. 7).

Seasonal weight changes of coho juveniles per capture site generally reflected seasonal length changes. Two distinct length/weight regression lines were obtained for coho juveniles sampled in the spring (from tributaries) and in the fall (from Chilliwack Lake and upper Chilliwack River), with correlation coefficients of 0.95 and 0.98 respectively (Fig. 12, Append. 23). The yearling tributary coho gained more weight per unit length than underyearling coho, as indicated by slopes of the regression lines. The above regression lines were based on the total sample per date (i.e., all age groups combined).

Comparing the seasonal increase in length of 1+ coho migrating out of the tributaries in the spring with spring migration timing, indicates that smaller fish moved out first and were relatively few, while larger, longer rearing juveniles dominated the peak migration (Figs. 6 and 7).

There was some correlation between water temperature and fish size. Temperature is known to be a major environmental parameter affecting fish growth (Burrows 1963; Brett et al. 1969). Glova and Mason (MS 1976) found that during summer, given excess food ration, the highest growth acceleration for coho occurred at water temperatures of 15°C and photoperiods of 16 hours.

Assuming that the available spring temperature records in the present study reflected the overall temperature regimes per capture site, it was found that streams with lower water temperatures generally produced smaller fish. Lowest seasonal sizes were recorded for coho yearlings captured at Chilliwack Lake outlet (probably migrating out of Chilliwack Lake) and at Post Creek, and appear to be related to the low temperatures observed at those sites (Figs. 7 and 10). However, catches with inclined plane traps may have been biased towards smaller fish. Highest seasonal sizes were recorded at Street Creek, and at Salwein and Rust Creeks, the latter having the highest spring temperatures recorded (Figs. 7 and 10). The large size of juveniles observed at Street Creek could not be attributed to temperature alone since mean spring temperatures in Street Creek were similar or lower than those in Hopedale and

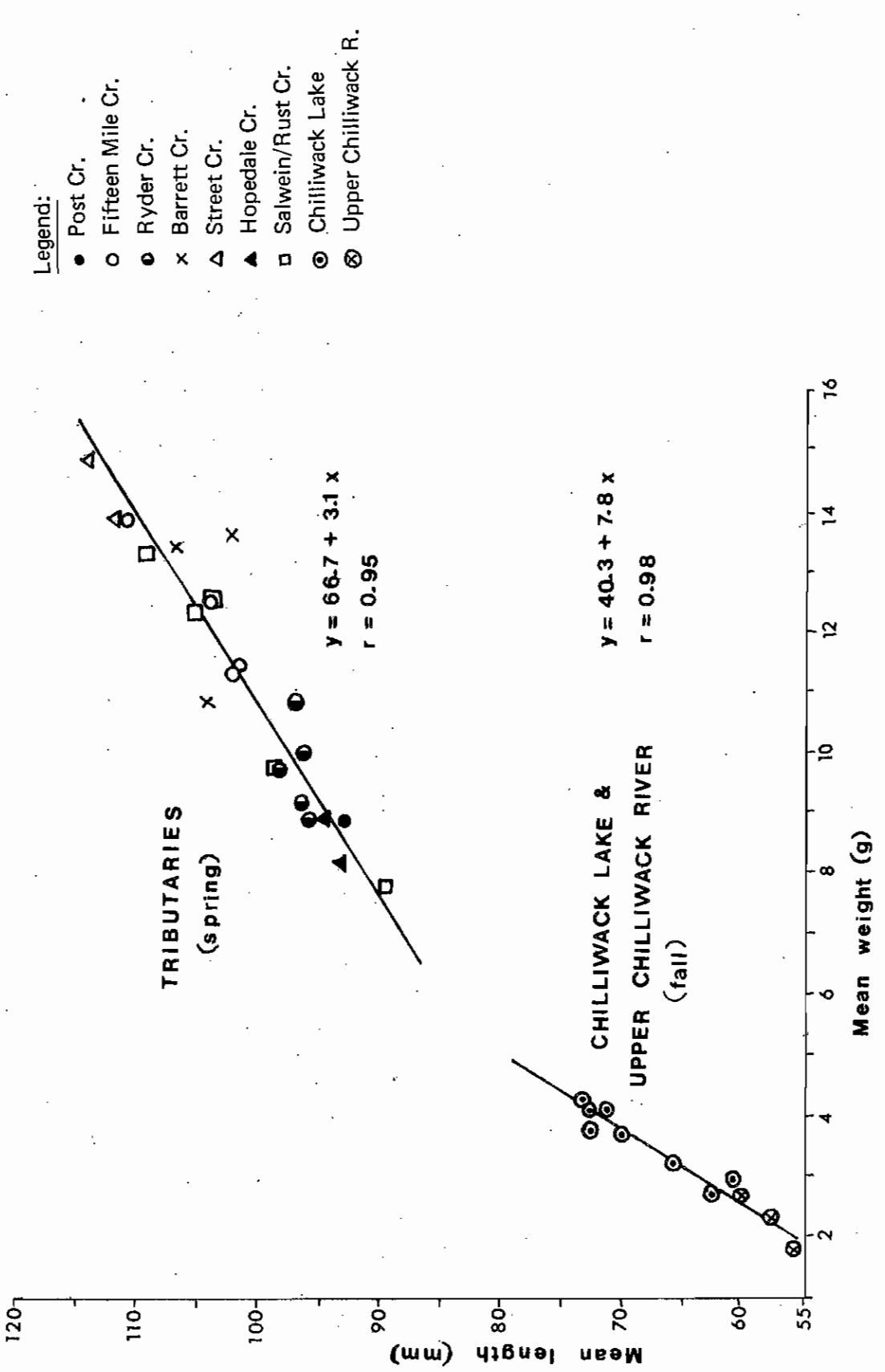

Fig. 12. Relationship between mean length and mean weight of coho juveniles in Vedder Chilliwack River system, 1978, 1979.

Rust and Salwein Creeks. Other environmental factors such as better food and shelter may be responsible for the larger sized fish in Street Creek.

The significantly smaller size of 1+ coho juveniles observed in Fifteen Mile Creek in 1977 compared to 1978, and in Street and Hopedale Creeks in 1976 compared to the two later years, could be related to cooler water temperatures in the years of smaller fish growth. However, limited temperature records preclude a stronger confirmation of this relationship.

Lengths of coho juveniles captured in Chilliwack Lake (mostly 0+) during October to December (1976-1978) showed little or no seasonal change, probably largely due to declining water temperatures during that period (Figs. 9 and 11). However, emigration of larger juveniles and immigration of smaller fish from the lake tributaries may have contributed to this trend.

Smallest coho fry during the fall tagging program were observed in the upper Chilliwack River (September, 1979) where water temperatures ranged between 9°C and 12°C, and were considerably lower than the concurrently measured temperatures at lake capture sites (16°C-18°C) (Fig. 11).

Lengths of 1+ coho sampled during fall in Chilliwack Lake were comparable to lengths of 1+ coho sampled during peak spring migrations in the downstream tributaries (Figs. 7 and 9), indicating that the rearing conditions in the two sub-regions allowed for a similar size increase.

Compared to coho from other systems in southern British Columbia, coho juveniles sampled in the present study were larger. Coho fry captured in Pitt River tributaries during fall, 1979, averaged only 50 mm to 60 mm (Schubert 1982, MS in prep'n), compared to Chilliwack Lake coho fry which averaged 60 mm to 80 mm. Similarly, 1+ coho smolts sampled in Salmon River and its tributary, Coghlan Creek, during spring 1979 and 1980, averaged from 93 mm to 98 mm (Schubert 1982) compared to Vedder-Chilliwack River tributaries where 1+ coho generally averaged over 100 mm.

TAGGING

Immediate tag loss in Chilliwack Lake juveniles held for approximately 24 hours to 48 hours after tagging (range of 0.38% in 1976 to 1.29% in 1979), was several times lower compared to delayed tag loss in fish that were recaptured up to several weeks after tagging (range of 1.6% in 1976 to 8.1% in 1978 (Append. 19)). It is possible that the above delayed tag loss rates are more representative of the actual rates, particularly if the pin was shallowly imbedded in nose tissue (recaptured coho were often missing the outer nose tissue, indicating abrasion from minnow traps and holding pens which may have facilitated tag loss). However, it must be cautioned that the marked fish recovered in the present program may have suffered twice the amount of handling and abrasion as the unrecovered marks, resulting possibly in an unrepresentatively high delayed tag loss. Increase in tag loss with time was also observed among the upper Pitt River coho juveniles where underyearlings tagged and released in 1979 showed an immediate tag loss of 0.6%, a delayed tag loss (recaptures after several weeks) of 2.5%, and a long-term tag loss (recaptures after overwintering) of 9.2% (N. Schubert, pers.comm.).

The incidence of naturally missing adipose fins (deformed fins that may on subsequent recovery be mistaken for a clipped fin) among the Vedder-Chilliwack River system juveniles (1:1273) is probably somewhat over-estimated since it is possible that some of the clipped recovered juveniles have lost their nose pin and healed the fin clip without an obvious scar (recoveries were relatively common and delayed tag loss was observed in the program). Even so, the above incidence is similar to that obtained in other studies. Pritchard (1939) found an incidence of naturally missing adipose fins among pink fry in McClinton Creek of 1:2,200 (n=26,394). Fraser River chum adults showed an incidence of 1:2,000 (n=100,000), and Big Qualicum River chum fry examined in 1971 and 1972 showed an incidence of 1:1,818 (Fraser et al. 1982, MS in prep'n). Coho smolts from Salmon River and Coghlin Creek had an incidence of naturally missing adipose fins of 1:2,740 in 1978 (n=13,700), 0 in 1979 (n=32,269), and 1:7,707 in 1980 (n=30,828) (Schubert 1982).

JUVENILE TAG RECOVERY AND INTRASYSTEM MIGRATION

Tag recovery in the present study revealed an extensive intrasystem migration of rearing coho juveniles. The 1977 to 1979 mark recovery data at the tributaries indicate that some of the 0+ coho juveniles tagged in Chilliwack Lake in the fall moved into the lower tributaries during the ensuing months, then emigrated in the spring at age 1+. Limited data also indicate that some coho tagged in the tributaries at age 1+ remained there for another year, then emigrated the following spring at age 2+.

Bustard and Narver (1975) listed a number of studies where juvenile salmonids, including coho, moved during autumn into tributaries which provided good winter cover. The same authors cited examples indicating that small tributaries and flooded side channels are probably areas of highest coho overwinter survival while main streams are generally more exposed to freshet influence and presumably have lower coho survival.

TEMPERATURE

Most of the studied tributaries are fed by spring and ground water, except for Post and Ryder Creeks which flow out of a lake. The upstream capture sites (Post Creek and Fifteen Mile Creek) were at higher elevations receiving snowmelt, and consequently had relatively low spring temperatures compared to downstream sites. The lower creeks on the other hand, were generally slower flowing and probably responded more to environmental changes such as air temperature, as indicated by their relatively large seasonal and year-to-year temperature variations.

The low temperatures recorded at the Chilliwack Lake outlet indicate that, at least in the spring, the Chilliwack Lake waters are colder than waters in the lower tributaries. This is largely due to the cold spring runoff into Chilliwack Lake from its tributaries. In particular, Depot Creek has glacier-fed waters which also account for the low water temperatures reported at the Chilliwack Lake tagging site (near Depot Creek) in September, 1979 (12°C and less), compared to the much higher concurrently measured lake temperatures at capture sites (up to 18°C).

SUMMARY

1. During 1976 to 1979, adipose fin clipping and coded wire nose tagging programs were carried out on coho juveniles in the Vedder-Chilliwack River system.

2. Between April and June of 1976, 1977 and 1978, an estimated 19,654, 22,380 and 36,829 coho juveniles respectively were captured at the system tributaries (and also below Chilliwack Lake outlet in 1977), using mostly fence traps. The creeks trapped in one or more years of the program were: Post Creek, Fifteen Mile Creek, Ryder Creek, Barrett Creek, Street Creek, Hopedale Creek, Salwein Creek, and Rust Creek. Hopedale and Salwein Creeks yielded the largest numbers of coho juveniles.

3. Between August and December of 1976 to 1979, an estimated 30,812, 5,927, 17,433, and 18,055 coho juveniles respectively were captured in Chilliwack Lake (and also in upper Chilliwack River in 1979) using minnow traps. Catch per trap hour averaged 0.203 in 1976, 0.044 in 1977, 0.177 in 1978, and 0.447 in 1979. No lake zone appeared to be consistently more productive than others.

4. Major coho migrations out of tributaries generally occurred from the start of May to the first week of June, with migration peaks varying among tributaries.

5. Coho juveniles captured in tributaries were mostly age 1+ (over 90% of the fish); the remaining coho were age 2+ (Fifteen Mile Creek had the largest population of age 2+ coho [23.3% in 1977]).

6. Coho juveniles captured in Chilliwack Lake and upper Chilliwack River were mostly age 0+ (over 90% of fish); the remaining coho were age 1+.

7. Mean lengths of 1+ tributary coho generally increased from approximately 70 mm to 80 mm in early April, to over 100 mm by early May (indicating that larger fish migrate later), then remained steady or declined somewhat during June. Mean lengths of 2+ tributary coho ranged from approximately 80 mm to 120 mm. Overall mean weights of tributary coho ranged from 6.2 g to 14.8 g. Street Creek coho juveniles had the greatest lengths and weights.

8. Mean lengths of 0+ Chilliwack Lake coho increased from 61 mm in late September, but remained relatively uniform between 70 mm and 80 mm from late October to December. Mean lengths of 1+ lake coho ranged from approximtely 80 mm to 110 mm. Overall mean weights of lake coho increased from 2.7 g in early October to 4.2 g by mid-November.

   Length of coho juveniles captured in upper Chilliwack River in September 1979, averaged 56.6 mm (age 0+) and 88.3 mm (age 1+); their overall weight averaged 2.2 g.

9. The tagged numbers and codes of tributary coho (mostly age 1+) (corrected for tag rejection and post-tagging mortality), released annually from April to June were as follows: in 1976, 19,607 coho with code 2-15-13; in 1977, 111 coho with code 2-16-27 (lake outlet fish) and 21,433 coho with code 2-4-13 (tributary fish); and in 1978, 36,036 coho with code 2-21-24.

   Mean tag retention per tributary capture site per year generally exceeded 99%; pre- and post-tagging mortalities were less than 2% and less than 1% respectively of total taggable fish; and number of undersized fish (<45 mm) released untagged was negligible. Water temperatures at tagging sites ranged from 4.0°C to 18.0°C.

10. The tagged numbers and codes of Chilliwack Lake coho (mostly age 0+) (corrected for tag rejection and post-tagging mortality) released annually from September to December were as follows: in 1976, 6,189 coho with code 12-1-13 and 22,302 coho with code 2-15-11; in 1977, 5,313 coho with code 2-21-20; in 1978, 14,800 coho with code 2-21-30; and in 1979, 25,306 coho with code 2-17-60 (of the 1979 fish, 37% were captured in upper Chilliwack River).

    Mean tag retention for lake fish per year was 99%; pre- and post- tagging mortalities were each less than 1% of total taggable fish; and numbers of undersized fish (<45 mm) released untagged averaged 3.5% of the four-year total. Water temperatures at tagging sites ranged from 4.0°C to 12.5°C.

11. In 1976, cutthroat trout (n=85) and rainbow trout (n=206) captured in the tributaries were also marked, using adipose clip only for the former species, and codes 12-1-1 and 2-15-13 for the latter species.

12. The incidence of naturally missing adipose fins among coho juveniles captured in the tributaries and Chilliwack Lake averaged 1:1,273.

13. During the spring tagging programs, seasonal mark recoveries in tributaries were 0.46% (n=104) in 1977, and 0.17% (n=61) in 1978. Of these, a portion were Chilliwack Lake fish marked the previous fall, indicating intrasystem migration of juveniles; a portion were tributary fish marked the previous spring, indicating overwintering the second winter in tributaries; and the rest were tributary marks from recent tagging.

14. During the fall tagging programs, seasonal mark recoveries in Chilliwack Lake were 6.7% in 1976, 6.2% in 1977, 12.6% in 1978, and 5.1% in 1979. Recovery rate in upper Chilliwack River in 1979 averaged 2.9%.

15. Delayed tag loss (after one or more weeks) ranged from 1.6% to 8.1% and was several times higher than short-term tag loss (after one or two days) that ranged from 0.4% to 1.3%.

16. Surface water temperatures at tributary capture and tagging sites generally increased from April to June and were highest in the lower tributaries (up to 18°C in Rust/Salwein Creeks). Upstream tributaries (Post Creek and Fifteen Mile Creek) had the lowest spring temperatures (4°C-8°C).

    Surface water temperatures at the Chilliwack Lake tagging sites generally decreased from around 12°C in September to around 4°C-6°C by December.

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Appendix 1. Annual escapements of salmon to Vedder-Chilliwack River mainstem, 1951-1981[a].

Year	Coho	Chum	Chinook	Pink	Sockeye
1951	16,500	22,500	1,500	107,500	75
1952	18,500	50,000	750	-	1,000
1953	15,750	18,500	400	78,500	75
1954	9,000	9,000	750	-	25
1955	16,500	11,000	750	115,000	200
1956	15,400	7,900	750	-	75
1957	15,200	16,500	400	205,000	200
1958	35,750	8,250	750	-	75
1959	15,400	16,500	750	137,500	400
1960	7,700	15,750	400	-	200
1961	15,400	38,500	400	240,000	200
1962	76,500	42,500	400	-	200
1963	75,750	38,500	400	235,000	400
1964	35,750	50,000	400	-	200
1965	7,900	15,000	200	207,500	400
1966	15,400	50,000	75	-	75
1967	5,000	90,000	25	250,000	200
1968	7,000	80,000	25	-	200
1969	7,000	31,000	300	65,000[b]	75
1970	7,000	30,000	200	-	200
1971	6,000	45,000	25	150,000	200
1972	4,000	70,000	200	-	150
1973	10,000	27,000	100	180,000	100
1974	9,500	24,500	100	-	300
1975	8,000	26,000	100	80,000	2,000
1976	3,000	50,000	25	-	2,000
1977	6,000	85,000	25	25,000	25
1978	5,000	43,000	100	-	200
1979	9,000	18,000	50	50,000	300
1980	3,000	45,000	50	-	300
1981	4,000	81,000	25	69,000	100

[a] Coho and chinook data from Starr et al. MS 1982 (in prep'n); other data to 1979 from Marshall et al. 1980; data after 1979 from DFO files for chum salmon and from IPSFC files for pink and sockeye salmon.

[b] IPSFC record for pink salmon was 92,000.

Appendix 2. Dates minnow traps not fished or checked during trapping program in Chilliwack Lake and upper Chilliwack River, 1976-1979.

Capture site	1976		1977		1978		1979	
	Not fished	Not checked	Not fished	Not checked	Not fished	Not checked	Not fished	Not checked
Chilliwack Lake								
All zones	0	Nov. 20-21, 27-29 Dec. 4-6, 8.	—[a]		--		--	
Zone 1	--		Nov. 17-Dec. 5.	Oct. 22-23, 29 30, Nov. 5, 6, 11-13.	Oct. 19-24.	Oct. 7-9, 14-15, 28-29, Nov. 4-5, 12, 13.	0	0
Zone 2	--		0	Nov. 11-13.	Nov. 2-15.	Oct. 28-29, Nov. 18-20.	0	0
Zone 3	--		Nov. 1-9.	Oct. 19, 22-23, 25 29, 30, Nov. 11-13, 19-23, 26, 27, 29, Dec. 3-4.	Oct. 7-11, 19-25.	Oct. 14-15, 28-29, Nov. 4-5, 9, 12, 13, 16, 18-20.	Aug. 25-30, Sept. 1-Oct. 1.	0
Zone 4	--		Nov. 17-30.	Oct. 22-23, 26, 29, 30, Nov. 1, 5-6, 11-13, Dec. 3, 4.	Oct. 7-10, 18-25, 28-31, Nov. 2-14.	Oct. 14-15.	Aug. 25-29, Sept. 1-4, 6-20, 22-24.	0
Zone 5	--		0	Nov. 19-23, 26, 27, Dec. 3, 4.	Oct. 26-31, Nov. 1, 15-16.	Oct. 21-22, 24, Nov. 4-5, 12-13, 17-20.	Sept. 29-Oct. 1.	0
Zone 6	--		0	Nov. 19-23, 26-27, Dec. 3, 4.	Oct. 26-Nov. 1.	Oct. 21-23, Nov. 4-5, 8, 10, 12-13.	0	0
Upper Chilliwack R.	--		--		--		0	Sept. 8-9.

[a] Not applicable.

Appendix 3b. Daily estimated numbers of coho juveniles captured by fence trap in Street, Hopedale, Rust and Salwein Creeks, 1976-1978 (total daily catch includes dead fish — in parenthesis).

Date	Capture Site											
	Street Creek			Hopedale Creek			Rust Creek			Salwein Creek		
	'76	'77	'78	'76	'77	'78	'76	'77	'78	'76	'77	'78
3/29	–[a]	4	–	–	–	–	–	–	–	–	–	–
3/30	–	0	–	–	–	–	–	–	–	–	–	–
3/31	–	1	–	–	–	–	–	–	–	–	–	–
4/1	–	–	–	–	–	–	–	–	–	–	–	102
4/2	–	1	2	–	6	–	–	–	4	–	1	12
4/3	–	3	0	–	1	3	–	–	3	–	1	11
4/4	–	3	0	–	4	8(1)	–	–	11	–	0	8
4/5	–	2	0(2)	–	1	7(1)	–	–	6	–	3	145(1)
4/6	–	1	2	–	–	3	–	7	3	–	1	19
4/7	–	3	0	–	–	8	–	200	6	–	1	3
4/8	–	1	2	–	0	2	–	100[b]	3	–	6	37
4/9	–	2	2	–	2	–	–	100[b]	20	–	3	9
4/10	–	2	1	–	2	–	–	40	43	–	2	22(3)
4/11	–	1	1	–	0	15	–	20[b]	14	–	2	34(1)
4/12	–	0	3	–	0	14	–	20[b]	17	–	2	3
4/13	–	2	2	–	0	8	–	48	10	–	2	4
4/14	–	2	4	–	0	5	–	60	4	–	3	8
4/15	–	1	1	–	0	2	–	13	4	–	1	3
4/16	–	3(1)	2	–	3	3	–	26	11	–	2	4
4/17	–	1	1	3	–	13	–	35	9	3	0	1
4/18	–	1	1	10(1)	–	7	–	18	13	0	0	3
4/19	–	2	1	5	–	5	–	66	13	2	2	3
4/20	–	1	2	3(1)	–	6	–	42	8	4	0	2
4/21	–	0	4	4(8)	2	9	–	22	5	0	0	4
4/22	–	0	1	4	1	17	–	24	5	4(1)	0	5
4/23	–	2	1	1	0	2	–	5	7	0	0	3
4/24	–	–	4	6(1)	0	9	–	1	14	1	0	1
4/25	–	–	9	10	11(3)	1	–	34	1	6	2	0
4/26	–	1(4)	3	111	20	8	–	28	8	0	20	65
4/27	–	3	3	27	62	321	–	152	36	4	9	19
4/28	–	6	2	16(2)	11	350	–	10	19	0	9	3
4/29	–	5	9	13	24	47	24	72	14	2	26	0
4/30	9	1	8	8	32	220	24	75	13	7	51	13
5/1	0	8	12	20	18	75	27	6	12	2	18	2
5/2	2	1	10	7	2	30(1)	27	40	10	1	29	12
5/3	10	1	5	60	47(1)	185(2)	37	51	20	2	46(4)	15
5/4	9	3	18	78(1)	17	51(1)	58	47	11	4	66(1)	33(1)
5/5	3	1	33	45	57(1)	18	51	29	0	17	36(1)	89
5/6	14	14(5)	21	155(2)	37	29	66	14	1	7	20	48(2)
5/7	16	16(3)	82(1)	176	62	42	108	26	0	54	462(3)	145(3)
5/8	23	2	40	272(3)	64(1)	29	155	38	8	167	598(7)	250
5/9	7	6	18	266(3)	108(1)	25	215(7)	49	27	289	187(1)	314(3)
5/10	–	0	37(2)	63	39(1)	825	11(17)	78(1)	31	168(80)	535(98)	785(2)
5/11	–	3	35	271(2)	12	75	0(19)	–	17	88	304(2)	73
5/12	–	1	47	285	63(2)	28(1)	0	–	12	74	191(4)	255
5/13	104	9	29	287(4)	31(1)	17	17(4)	17	3	28	256(1)	105

Appendix 3b. (cont'd).

Date	Capture Site											
	Street Creek			Hopedale Creek			Rust Creek			Salwein Creek		
	'76	'77	'78	'76	'77	'78	'76	'77	'78	'76	'77	'78
5/14	34	0	48	266	81(3)	63	11	13	3	200	360(2)	380
5/15	95	0	95	242	158(2)	323	40	12	3	100	495(7)	323(1)
5/16	74	27(1)	47	237(4)	53	551	27(17)	23	7	263	216	258
5/17	-	160(8)	72	-	180	242	1	47	12	88	449	381
5/18	26	46(2)	56	-	17	57	1	23	11	150	313(2)	623
5/19	73	37	91	-	34	37	1	29	16	326	69	572
5/20	37	26	80	130	26	63	5	21	12	424(148)	262[b](17)	650
5/21	35	-	54	161(1)	9	455	-	31	31	383	263[b](17)	700
5/22	10	133	40(1)	317	122	441	2	22	12	11	375(6)	480(1)
5/23	-	86	107	198	28(2)	184	38	26	12	62	359(55)	148
5/24	31	56	103	88	744	36	47	12	10	58	50	225(2)
5/25	86	158(1)	52(2)	294	217	17	14	14(1)	5	16	212(12)	24
5/20	11	104	33(1)	360	-	47	5	7	3	122	208	369(1)
5/27	165	77	67	601(10)	252	22	9	23	7	75	126	148
5/28	5	31	27	1183	41	19	3(9)	13	19	48	175	423(1)
5/29	70	77	76(2)	413(5)	-	17	3	18	5	397(1)	68	623
5/30	76	65	53(1)	285(6)	-	37	1	16	4	9	137	226
5/31	8	30	31	266	-	8	17	3	0	19	102(19)	402(1)
6/1	-	6	62	202(10)	115(34)	18	2	16	6	25	76(296)	225(7)
6/2	39(1)	70	29(1)	268(3)	57	479	12	6	3	54(2)	12	248(3)
6/3	6	28	22	172(2)	42	456	8	3	2	11	42	231
6/4	12(1)	8	21	74(2)	250	283(1)	28(2)	7	7	29	10	293
6/5	18(1)	20	17(12)	138(2)	107	490(1)	33(1)	7	1	39	7	241
6/6	5(1)	15	17	56(1)	-	225	23	10	0	303(1)	13(1)	55
6/7	10	24	12	63	59(3)	148	23	0	0	141	0	72
6/8	6	16	18(2)	65(1)	27	156	2	6	0	182(1)	28(10)	135
6/9	1	32	1	148(1)	19	226	6	10	0	250	4(3)	61(1)
6/10	6	6	12	125(1)	30	1100	1	-	-	43(1)	-	54(1)
6/11	7	13	0	359	2	480	2	-	-	149(10)	-	51(2)
6/12	4	5	0	202(2)	0	150	0	-	-	33	-	143(2)
6/13	1	5	2	143(1)	2	90	0	-	-	168	-	32
6/14	4	-	-	59(1)	-	62	0	-	-	24	-	53
6/15	0	-	-	35(1)	-	-	-	-	-	17	-	-
6/16	-	-	-	95(1)	-	-	-	-	-	1(1)	-	-
6/17	-	-	-	70(3)	-	-	-	-	-	53(2)	-	-
6/18	-	-	-	34(1)	-	-	-	-	-	80(1)	-	-
6/19	-	-	-	20	-	-	-	-	-	-	-	-
6/20	-	-	-	20	-	-	-	-	-	-	-	-
6/21	-	-	-	19	-	-	-	-	-	-	-	-
6/22	-	-	-	68	-	-	-	-	-	-	-	-
6/23	-	-	-	12	-	-	-	-	-	-	-	-
6/24	-	-	-	17	-	-	-	-	-	-	-	-
6/25	-	-	-	35	-	-	-	-	-	-	-	-
Total (No. dead)	1,152 (4)	1,481 (25)	1,803 (27)	9,746 (87)	3,411 (55)	9,504 (9)	1,185 (76)	2,033 (2)	667 (0)	5,287 (249)	7,328 (569)	11,521 (39)

[a] No trapping.

[b] Half of a two-day catch.

Appendix 4a. Daily estimated catch and catch per unit effort of coho juveniles minnow trapped in Chilliwack Lake, Oct.-Nov., 1976.

Checking date	No. traps	Set time (hrs)	Catch	Catch/ trap - hr.
10/26	-[a]	-	103[b]	-
10/28	-	-	539[b]	-
11/1	-	-	902[b]	-
11/2	-	-	1124[b]	-
11/3	-	-	3601	-
11/4	53	24.0	300	0.236
11/4	53	3.5	125	0.674
11/5	105	24.0	540	0.214
11/5	50	4.0	306	1.53
11/6	110	24.0	1325	0.502
11/7	93	24.0	1175	0.526
11/7	12	5.0	30	0.5
11/8	74	24.0	700	0.394
11/8	19	18.0	700	2.047
11/9	75	24.0	450	0.25
11/9	63	19.5	275	0.224
11/10	138	22.0	1100	0.362
11/10	20	3.0	65	1.083
11/11	52	29.0	400	0.265
11/11	134	25.0	875	0.261
11/12	201	23.0	1525	0.33
11/13	141	23.0	945	0.291
11/13	100	3.0	225	0.75
11/14	179	22.0	700	0.178
11/14	52	3.0	8	0.051
11/15	179	24.0	650	0.151
11/16	174	23.5	430	0.105
11/17	91	24.5	450	0.202
11/18	62	49.0	375	0.123
11/18	100	21.0	550	0.262
11/18	152	2.5	625	1.645
11/19	153	23.0	825	0.234
11/19	68	3.0	225	1.103
11/22	146	71.0	85	0.008
11/22	28	4.5	75	0.595
11/23	130	24.0	247	0.079
11/23	28	19.5	75	0.137
11/23	130	2.0	140	0.538
11/24	162	22.5	197	0.054
11/25	190	24.0	1300	0.285
11/26	184	24.0	1700	0.385
11/30	100	96.0	525	0.055
12/1	110	24.0	400	0.152
12/2	85	23.0	325	0.166
12/2	85	2.5	550	2.588
12/3	110	22.0	1000	0.413
12/7	109	94.5	350	0.034
12/7	109	3.5	100	0.262
12/9	109	48.0	300	0.057
12/10	109	24.0	375	0.143
12/10	55	2.5	55	0.4
12/13	-	-	235[b]	-
12/14	-	-	208[b]	-
12/15	-	-	135[b]	-
12/16	-	-	267[b]	-
Total	-	-	30812	-
Mean	102	22.8	-	0.203

[a] Not available.
[b] Catch data not available; "catch" based on numbers tagged.

Appendix 4b. Daily estimated catch and catch per unit effort of coho juveniles minnow trapped per zone in Chilliwack Lake, Oct.-Dec., 1977.

Checking date	No. traps	Set time (hrs)	Catch	Catch/ trap-hr
		ZONE 1		
10/20	40	24.5	196	0.200
10/21	40	24.0	101	0.105
10/24	37	74.0	6	0.002
10/25	35	23.5	58	0.071
10/26	20	25.0	30	0.060
10/27	83	23.0	121	0.063
10/28	83	22.0	205	0.112
10/31	83	73.0	10	0.002
11/2	106	49.5	318	0.061
11/3	103	24.0	252	0.102
11/4	93	24.0	240	0.108
11/7	104	72.0	15	0.002
11/8	88	22.5	223	0.113
11/9	88	23.5	150	0.073
11/10	61	24.5	100	0.067
11/14	56	74.0	10	0.002
11/15	56	24.0	38	0.028
11/16	14	24.0	6	0.020
12/6	24	24.0	74	0.128
Total	-	-	2153	-
Mean	64	35.5	-	0.048
		ZONE 2		
11/8	15	23.0	30	0.087
11/9	15	24.0	64	0.178
11/10	15	23.5	20	0.057
11/14	15	72.5	5	0.005
Total	-	-	119	-
Mean	15	36.0	-	0.055
		ZONE 3		
10/18	34	23.5	15	0.019
10/20	51	42.5	40	0.018
10/21	51	24.0	122	0.100
10/24	49	72.5	5	0.001
10/26	50	51.0	15	0.006
10/27	20	22.0	43	0.098
10/28	20	21.5	24	0.056
10/31	22	69.0	5	0.003
11/10	32	25.5	81	0.099
11/14	30	72.0	8	0.004
11/15	43	24.0	150	0.145
11/16	42	23.0	232	0.240
11/17	60	21.5	87	0.067
11/18	60	24.0	139	0.097
11/24	56	143.0	--[a]	--
11/25	52	28.0	82	0.056
11/28	53	71.5	--	--
11/30	40	46.0	35	0.019
12/1	42	23.0	80	0.083
12/2	37	24.5	65	0.072
12/5	37	22.5	30	0.036
12/6	30	24.0	4	0.006
Total	-	-	1262	-
Mean	41	41.0	-	0.032

[a] Not available.

Checking date	No. traps	Set time (hrs)	Catch	Catch/ trap-hr
		ZONE 4		
10/17	105	2.5	10	0.038
10/18	71	21.0	42	0.028
10/19	54	23.0	136	0.110
10/20	54	26.0	128	0.091
10/21	54	23.0	102	0.082
10/24	51	67.5	15	0.004
10/25	47	24.5	136	0.118
10/27	34	48.5	159	0.096
10/28	28	26.5	108	0.146
10/31	25	68.5	3	0.002
11/2	25	51.5	95	0.074
11/3	25	22.5	108	0.192
11/4	30	24.0	69	0.096
11/7	19	72.0	8	0.006
11/8	20	26.5	61	0.115
11/9	19	23.5	23	0.052
11/10	20	24.5	12	0.024
11/14	15	72.5	--	--
11/15	13	23.0	28	0.094
11/16	13	21.0	18	0.066
12/1	16	24.0	32	0.083
12/2	15	24.0	30	0.083
12/5	13	23.5	28	0.092
12/6	14	24.5	15	0.044
Total	-	-	1366	-
Mean	33	33.0	-	0.060
		ZONE 5		
11/17	15	26.0	44	0.113
11/18	15	24.0	26	0.072
11/24	15	144.5	10	0.005
11/25	15	24.0	20	0.056
11/28	14	71.5	21	0.021
11/29	33	25.5	21	0.025
11/30	29	23.0	30	0.045
12/1	20	24.0	15	0.031
12/2	20	24.0	40	0.083
12/5	19	23.5	30	0.067
12/6	16	24.5	10	0.026
Total	-	-	267	-
Mean	19	39.5	-	0.035
		ZONE 6		
11/16	26	24.0	70	0.112
11/17	48	26.0	146	0.117
11/18	48	24.5	91	0.077
11/24	45	144.5	15	0.002
11/25	50	19.5	128	0.131
11/28	49	72.0	24	0.007
11/29	42	27.0	30	0.026
11/30	52	26.0	80	0.059
12/1	49	23.0	65	0.058
12/2	49	24.0	43	0.037
12/5	49	24.0	45	0.038
12/6	39	24.5	23	0.024
Total	-	-	760	-
Mean	46	38.0	-	0.036

Appendix 4c. Daily estimated catch and catch per unit effort of coho juveniles minnow trapped per zone in Chilliwack Lake, Oct.-Nov., 1978.

Checking date	No. traps	Set time (hrs)	Catch	Catch/ trap/hr
		ZONE 1		
10/6	25	19.0	260	0.547
10/10	25	98.0	50	0.020
10/11	72	24.0	239	0.138
10/12	44	27.0	181	0.152
10/13	43	23.0	212	0.214
10/16	42	22.0	134	0.145
10/17	47	23.0	316	0.292
10/18	48	21.0	109	0.108
10/25	30	25.0	147	0.196
10/26	41	23.0	131	0.139
10/27	42	23.0	264	0.273
10/30	45	69.0	232	0.045
10/31	33	21.0	149	0.215
11/1	21	23.0	101	0.209
11/2	65	24.0	40	0.026
11/3	17	24.0	130	0.319
11/6	14	28.0	42	0.107
11/7	14	24.0	41	0.122
11/9	14	46.0	56	0.087
11/10	17	10.0	157	0.924
11/11	53	48.0	200	0.079
11/14	53	73.0	177	0.046
11/15	65	24.0	148	0.095
11/16	25	22.0	127	0.231
11/17	25	24.0	127	0.212
Total	-	-	3770	-
Mean	37	31.5	-	0.128
		ZONE 2		
10/24	35	96.0	18	0.035
10/25	35	21.0	351	0.478
10/26	35	22.0	138	0.179
10/27	29	23.0	174	0.261
10/30	8	69.0	39	0.071
10/31	12	20.0	24	0.100
11/1	11	22.0	45	0.186
11/16	40	24.0	114	0.119
11/17	40	20.0	134	0.168
11/21	39	95.0	47	0.013
Total	-	-	1184	-
Mean	28	41.0	-	0.098
		ZONE 3		
10/6	25	19.0	2	0.004
10/12	22	27.0	25	0.042
10/13	16	24.0	59	0.154
10/16	15	22.0	83	0.252
10/17	43	25.0	536	0.499
10/18	42	23.0	216	0.224
10/26	32	28.0	221	0.247
10/27	44	23.0	210	0.208
10/30	67	71.0	510	0.107
10/31	76	21.0	380	0.238
11/1	68	21.0	436	0.305
11/2	34	20.0	311	0.457
11/3	36	25.0	191	0.212
11/6	35	28.0	156	0.159
11/7	31	24.0	186	0.250
11/8	29	21.0	132	0.217
11/10	30	47.0	73	0.052
11/11	24	49.0	217	0.185
11/14	24	69.0	184	0.111
11/15	23	25.0	118	0.205
11/17	45	19.0	203	0.237
11/21	47	97.0	153	0.034
Total	-	-	4602	-
Mean	37	33.0	-	0.166
		ZONE 4		
10/6	31	19.0	160	0.272
10/11	23	24.0	34	0.062
10/12	10	27.0	14	0.052
10/13	22	18.0	32	0.081
10/16	20	28.0	81	0.145
10/17	28	23.0	62	0.096
10/26	18	20.0	110	0.306
10/27	9	24.0	69	0.319
11/1	20	20.0	333	0.833
11/15	43	4.0	447	2.599
11/16	43	23.0	178	0.180
Total	-	-	1520	-
Mean	24	21.0	-	0.295
		ZONE 5		
10/19	43	18.0	541	0.699
10/20	42	24.0	339	0.336
10/23	42	70.0	260	0.088
10/25	31	45.0	123	0.088
11/2	46	--[a]	281	--
11/3	47	21.0	295	0.299
11/6	47	26.0	163	0.133
11/7	46	22.0	347	0.343
11/8	5	24.0	6	0.050
11/9	44	48.0	93	0.044
11/10	7	6.0	31	0.738
11/11	7	5.0	28	0.800
11/14	11	72.0	62	0.078
11/21	25	98.0	84	0.034
Total	-	-	2653	-
Mean	32	34.0	-	0.159
		ZONE 6		
10/17	15	6.0	198	2.200
10/18	48	18.0	777	0.899
10/19	90	26.0	944	0.403
10/20	88	25.0	650	0.295
10/24	48	96.0	216	0.047
10/25	27	24.0	142	0.219
11/2	20	26.0	97	0.187
11/3	20	23.0	87	0.189
11/6	20	27.0	60	0.111
11/7	19	22.0	101	0.242
11/9	21	48.0	61	0.061
11/11	24	50.0	145	0.121
11/14	24	72.0	177	0.102
11/15	24	22.0	49	0.093
Total	-	-	3704	-
Mean	35	35.0	-	0.216

[a] Not available.

Appendix 4d. Daily estimated catch and catch per unit effort of coho juveniles minnow trapped per zone in Chilliwack Lake, Aug.-Oct., 1979.

Checking date	No. traps	Set time (hrs)	Catch	Catch/ trap-hr
		ZONE 1		
10/11	63	1.5	830	8.783
10/12	63	21.0	965	0.729
10/13	63	24.0	780	0.516
10/14	70	24.0	1900	1.131
10/14	73	2.5	1010	5.534
10/15	131	22.0	2000	0.694
Total	-	-	7485	-
Mean	77	16.0	-	0.975
		ZONE 2		
10/10	62	22.5	1080	0.774
10/11	63	23.0	525	0.362
Total	-	-	1605	-
Mean	63	23.0	-	0.564
		ZONE 3		
8/24	4	41.5	9	0.054
8/31	35	17.5	7	0.011
10/2	99	24.0	505	0.213
10/2	99	4.5	215	0.483
10/3	99	20.5	375	0.185
10/4	110	24.5	395	0.147
10/5	124	22.5	720	0.258
10/5	123	--[a]	7	--
Total	-	-	2233	-
Mean	87	22.0	-	0.200

[a] Not available.

Checking date	No. traps	Set time (hrs)	Catch	Catch/ trap-hr
		ZONE 4		
8/24	16	42.0	1	0.001
8/30	47	16.5	2	0.003
8/31	42	24.0	74	0.073
9/5	62	20.0	26	0.021
9/21	10	23.5	59	0.251
9/25	54	19.0	315	0.307
9/25	54	6.0	300	0.926
9/26	54	19.0	200	0.195
9/27	54	24.5	280	0.212
9/28	25	24.0	0	0
9/28	25	--[a]	250	--
Total	-	-	1507	-
Mean	40	20.0	-	0.153
		ZONE 5		
9/26	35	20.5	150	0.209
9/27	35	24.5	100	0.117
9/28	65	24.0	0	0
9/28	16	--	100	--
10/2	16	6.0	50	0.521
10/3	16	20.0	55	0.172
Total	-	-	455	-
Mean	31	19.0	-	0.100
		ZONE 6		
10/10	70	23.0	740	0.460
10/10	70	5.0	1080	3.086
10/11	70	18.0	780	0.619
10/11	11	6.5	145	2.028
10/12	70	17.5	535	0.437
10/13	70	24.0	760	0.452
10/13	70	3.0	450	2.143
10/14	26	19.0	280	0.567
Total	-	-	4770	-
Mean	57	14.5	-	0.691

Appendix 4e. Daily estimated catch and catch per unit effort of coho juveniles minnow trapped in upper Chilliwack River, Sept., 1979.

Checking date	No. traps	Set time (hrs)	Catch	Catch/ trap-hr
9/5	17	22.5	394	1.030
9/6	79	19.0	1054	0.702
9/7	85	25.0	1357	0.639
9/7	16	3.0	137	2.854
9/10	72	3.0	843	3.903
9/11	78	20.0	750	0.481
9/12	78	24.0	508	0.271
9/13	77	14.0	824	0.446
9/14	78	24.0	400	0.214
9/15	65	24.0	295	0.189
9/16	43	24.0	441	0.427

Checking date	No. traps	Set time (hrs)	Catch	Catch/ trap-hr
9/17	51	25.0	806	0.632
9/17	24	4.5	290	2.685
9/18	75	23.0	705	0.409
9/19	75	24.0	525	0.292
9/20	75	24.0	250	0.139
9/21	65	24.0	525	0.337
9/22	65	23.5	200	0.131
9/23	65	24.0	90	0.058
9/24	65	26.0	150	0.089
9/25	29	24.5	250	0.352
Total	-	-	10794	-
Mean	61	21.0	-	0.389

Appendix 5. Estimated annual catches (live and dead) of fish other than coho juveniles in Vedder-Chilliwack River system, 1976-1979[a].

Capture site	Year	FISH SPECIES												
		Chum fry	Sockeye smolts	Trout[b]	Dolly Varden	Chub	Dace	Lamprey	Sculpin	Shiner	Squawfish	Stickleback	Sucker	Whitefish
Upper Chilliwack River	1979	0	0	55	147	0	0	0	0	0	21	0	7	1
Chilliwack Lake	1977	0	0	122	177	0	0	0	0	0	0	0	185	6
	1978	0	0	82	92	0	0	0	0	0	0	0	391	1
	1979	0	0	294	173	0	0	0	0	0	186	0	1,221	2
Chilliwack Lake Outlet	1977	19	1,703	3	6	0	0	0	0	0	0	0	1	0
Post Creek	1977	2	0	98	9	0	0	0	0	0	0	0	0	1
	1978	0	0	76	23	0	0	0	0	0	0	0	0	0
Fifteen Mile Creek	1977	0	0	28	0	0	0	0	0	0	0	0	0	0
	1978	0	0	14	0	0	0	1	2	0	0	0	0	0
Ryder Creek	1976	6	0	68	1	0	0	3	4	0	0	0	24	0
	1977	0	0	248	0	0	0	10	8	0	16	0	23	0
	1978	0	0	263	0	0	0	47	4	0	0	0	2	0
Barrett Creek	1978	8,843	8	453	0	0	0	74	110	0	0	242	0	0
Street Creek	1976	33	0	85	0	0	0	4	107	0	0	0	2	0
	1977	331	31	291	0	0	0	13	165	0	0	1	0	0
	1978	2,772	0	755	0	0	0	39	318	11	0	11	0	0
Hopedale Creek	1976	38	0	188	1	0	0	4	132	0	0	0	0	1
	1977	1	0	104	0	1	0	51	196	0	4	95	0	0
	1978	56	0	392	0	0	0	57	281	2	1	514	0	0
Rust Creek	1976	3	0	5	1	47	0	3	16	2	110	3	3	1
	1977	5	0	8	0	15	0	4	252	116	22	717	43	0
	1978	0	0	0	0	21	51	4	153	54	9	841	20	0
Salwein Creek	1976	29	0	165	0	0	0	4	265	0	67	0	21	24
	1977	182	0	315	0	14	0	254	394	0	12	24	11	1
	1978	1,197	0	212	0	10	6	439	406	3	3	528	184	8

[a] 'Other' species not counted during 1976 minnow trapping.

[b] Includes rainbow and cutthroat trout since not clearly identified to species.

Appendix 6. Age composition (% of total) of coho juveniles by capture site in Vedder-Chilliwack River system, 1976-1978 (n=sample size).

Date	Chilliwack Lake outlet			Post Creek			Fifteen Mile Creek			Ryder Creek			Barrett Creek			Street Creek			Hopedale Creek			Salwein/Rust Creeks		
	n	1+	2+	n	1+	2+	n	1+	2+	n	1+	2+	n	1+	2+	n	1+	2+	n	1+	2+	n	1+	2+
1976																								
April 27		--[a]			--			--			--			--			--		6	83.3	16.7	10	90.0	10.0
May 17		--			--			--			--			--		19	94.7	5.3	23	95.7	4.3		--	
May 21		--			--			--		37	91.9	8.1		--		20	95.0	5.0		--			--	
May 29		---			--			--			--			--			--			--			--	
June 2		--			--			--		28	96.4	3.6		--			--			--			--	
June 8		--			--			--			--			--			--			--		47	95.7	4.3
June 16		--			--			--		10	90.0	10.0		--			--			--		38	94.7	5.3
June 23		--			--			--			--			--			--			--		14	85.7	14.3
Overall mean		--			--			--		75	93.3	6.7		--		39	94.9	5.1	29	93.1	6.9	109	93.6	6.4
1977																								
April 6		--			--			--			--			--			--		44	90.9	9.1		--	
April 14		--			--			--			--			--		12	91.7	8.3		--			--	
April 21		--			--			--		33	97.0	3.0		--			--			--		44	93.2	6.8
April 28		--			--			--			--			--			--		49	89.8	10.2	46	95.7	4.3
April 29	41	95.1	4.9		--		43	88.4	11.6		--			--			--			--			--	
May 4		--			--			--		44	90.9	9.1		--			--			--		50	98.0	2.0
May 5		--		47	97.9	2.1		--			--			--			--		49	93.9	6.1		--	
May 6	19	89.5	10.5		--		41	78.0	22.0		--			--			--			--			--	
May 10		--			--			--			--			--			--			--		41	97.6	2.4
May 11		--			--			--		42	97.6	2.4		--		33	97.0	3.0		--			--	
May 12		--		40	82.5	17.5	38	71.1	28.9		--			--			--			--			--	
May 17		--			--			--			--			--			--			--		47	97.7	2.1
May 18		--			--			--			--			--			--		50	98.0	2.0		--	
May 19		--		42	85.7	14.3	37	67.6	32.4		--			--			--			--			--	
May 24		--			--			--			--			--			--		49	95.9	4.1		--	
May 25		--			--			--			--			--		46	95.7	4.3		--			--	
May 26		--		41	82.9	17.1	37	70.3	29.7		--			--			--			--			--	
May 30		--			--			--			--			--		45	97.8	2.2		--			--	
May 31		--		44	84.1	15.9	39	79.5	20.5	40	95.0	5.0		--			--			--			--	
June 2		--			--			--			--			--			--		25	96.0	4.0	46	97.8	2.2
June 6		--			--			--			--			--		42	95.2	4.8	47	82.5	17.5	22	95.5	4.5
June 7		--		48	81.3[b]	18.7	23	82.6	17.4		--			--			--			--			--	
Overall mean	60	93.3	6.7	262	85.9	14.1	258	76.7	23.3	159	95.0	5.0		--		178	96.1	3.9	313	92.7	7.3	296	96.6	3.4
1978																								
April 18		--		25	100.0	0.0	47	95.7	4.3	49	91.8	8.2		--			--			--			--	
April 20		--			--			--			--			--		18	100.0	0.0	50	100.0	0.0		--	
April 28		--			--			--			--			--			--		50	100.0	0.0		--	
May 2		--			--			--		47	97.9	2.1		--			--			--			--	
May 3		--			--		36	97.2	2.8		--			--			--			--			--	
May 8		--			--			--		48	97.9	2.1		--			--			--			--	
May 10		--		48	91.7	8.3	46	95.7	4.3		--			--			--			--			--	
May 16		--			--			--			--			--			--			--		46	95.7	4.3
May 17		--		48	87.5	12.5	46	93.5	6.5	48	95.8	4.2		--			--			--			--	
May 18		--			--			--			--			--		49	98.0	2.0		--			--	
May 23		--		48	89.6	10.4		--			--			--			--			--			--	
May 26		--			--		46	87.0	13.0	48	97.9	2.1		--			--			--			--	
May 29		--			--			--			--		47	97.9	2.1		--			--		48	97.9	2.1
May 30		--			--			--		49	95.9	4.1		--			--			--			--	
June 6		--			--		43	79.1	20.9		--			--			--			--			--	
June 7		--			--			--		49	95.9	4.1		--			--			--			--	
Overall mean		--		169	91.1	8.9	264	91.3	8.7	338	96.2	3.8	47	97.9	2.1	67	98.5	1.5	100	100.0	0.0	94	96.8	3.2

[a] No sample available.

[b] Includes 2.1% of age 0+ fish.

Appendix 7. Mean length ($L \pm 95\%$C.L.) of age 1+ coho juveniles by capture site in Vedder-Chilliwack River system, 1976-1978 (n=sample size).

Date	Chilliwack Lake outlet		Post Creek		Fifteen Mile Creek		Ryder Creek		Barrett Creek		Street Creek		Hopedale Creek		Salwein/Rust Creek	
	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)
1976																
Apr. 27		--[a]		—		—		--		--		--	5	83.4^{+} 11.0	9	86.9^{+} 6.7
May 4		--		--		—		--		—		--		—	29	101.1^{+} 3.5
May 5		--		--		—	7	90.0^{+} 6.8		--		—		—		--
May 10		--		—		--	8	103.5^{+} 3.0		--	3	103.7^{+} 12.3	21	92.8^{+} 3.2	11	99.6^{+} 3.5
May 17		—		--		--	14	95.1^{+} 3.5		—	18	102.1^{+} 3.7	22	93.5^{+} 2.6	8	95.1^{+} 2.6
May 21		—		--		--	34	98.3^{+} 4.3		--	19	96.1^{+} 5.1	22	94.6^{+} 4.0	28	101.0^{+} 3.2
May 31		--		—		--		—		--		--	25	90.6^{+} 3.5	35	98.9^{+} 2.2
June 2		—		—		--	27	94.4^{+} 5.3		—	44	96.7^{+} 3.2		--		--
June 8		--		--		--		--		--		—		—	45	99.5^{+} 2.3
June 9		--		—		--		--		—	16	96.2^{+} 3.9	37	92.3^{+} 3.2		--
June 16		--		—		--	9	90.1^{+} 7.2		--		--	39	94.3^{+} 2.9	36	101.1^{+} 2.1
June 23		--		--		--		--		--		--	14	98.4^{+} 2.4	12	104.1^{+} 3.9
1977																
Mar. 30	8	71.5^{+} 5.4		--		--		--		--		--		--		--
Apr. 6		--		--		--		--		--		--	40	79.3^{+} 2.6		—
Apr. 7		--		--		--		--		--	50	79.1^{+} 2.3		--		--
Apr. 14		--		--		--	22	72.8^{+} 4.1		--	11	94.1^{+} 6.9	3	99.3^{+} 13.7	47	78.3^{+} 2.6
Apr. 21		--		--		--	32	83.3^{+} 5.0		--	9	101.2^{+} 13.4	2	98.0^{+} 25.4	41	84.4^{+} 3.6
Apr. 28		—		—		--	44	89.4^{+} 4.1		--	10	110.1^{+} 9.6	44	103.4^{+} 1.8	44	93.2^{+} 5.0
Apr. 29	39	75.9^{+} 2.9	46	74.7^{+} 1.9	38	69.6^{+} 3.9		--		--		--		--		--
May 4		—		--		--	40	101.8^{+} 5.9		--		--		--	49	98.7^{+} 5.6
May 5		—	46	81.6^{+} 1.9		--		—		--	16	113.1^{+} 5.8	46	100.3^{+} 6.7		—
May 6	17	81.2^{+} 6.4		--	32	82.3^{+} 5.4		--		—		--		--		--
May 10		--		--		--		--		--		--		—	40	108.4^{+} 3.1
May 11		--		--		--	41	97.2^{+} 3.0		—	32	109.7^{+} 4.7	47	98.0^{+} 1.9		—
May 12	35	85.8^{+} 4.7	33	87.0^{+} 3.4	27	91.7^{+} 5.2		--		--		--		—		—
May 17		--		--		--	47	88.5^{+} 3.0		--		--		--	46	102.2^{+} 2.8
May 18		--		--		--		--		--	41	108.4^{+} 2.9	49	98.5^{+} 1.8		--
May 19	18	80.1^{+} 4.1	36	86.5^{+} 2.5	25	96.3^{+} 5.4		--		—		--		--		--
May 24		--		--		--		--		--		--	47	98.9^{+} 2.1	48	99.6^{+} 2.0
May 25		--		--		—	45	90.0^{+} 4.1		--	44	105.8^{+} 2.4		--		--
May 26		--	34	91.2^{+} 3.2	26	88.2^{+} 4.5		--		--		--		--		--
May 30		--		--		--		—		—	44	103.7^{+} 3.9	20	97.8^{+} 3.4		--

Appendix 7. (cont'd).

Date	Chilliwack Lake outlet		Post Creek		Fifteen Mile Creek		Ryder Creek		Barrett Creek		Street Creek		Hopedale Creek		Salwein/Rust Creek	
	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)
May 31	—		37	88.4 ± 3.3	31	79.4 ± 7.3	38	86.3 ± 2.7		--		--		—		--
June 2	--			--		--		--		--		--	24	96.8 ± 2.1	45	97.6 ± 2.3
June 6	--			--		--		--		--	40	102.8 ± 2.3	40	100.5 ± 1.8	21	96.1 ± 2.8
June 7	—		38	94.1 ± 2.8	19	91.5 ± 8.9	48	88.7 ± 2.0		--		--		--		--
June 9	--			--		--		--		--		—		—	25	100.0 ± 2.6
1978																
Apr. 10	--			--		--		--		--	46	86.5 ± 2.5		--	50	75.6 ± 2.3
Apr. 11	—			--		--		--		--		—	47	85.9 ± 2.7		--
Apr. 12	—			—		--	48	80.7 ± 3.5	45	81.3 ± 2.9		—		—		--
Apr. 18	--		25	72.0 ± 2.6	45	83.5 ± 4.5	45	82.0 ± 4.6		--		--		--		--
Apr. 20	—			—		--		--		--	18	111.3 ± 6.3	50	93.4 ± 2.8	46	90.1 ± 3.6
Apr. 21	--			--		—		--	36	83.9 ± 4.8		--		--		--
Apr. 26	--			—		--	49	96.0 ± 3.8		--		--		--		--
Apr. 28	--			--		--		--		—	23	114.6 ± 3.9	50	99.3 ± 2.3		--
May 2	--			--		--	46	96.2 ± 3.0		--		--		--	49	103.3 ± 5.8
May 3	--		47	81.6 ± 2.4	35	98.9 ± 6.2		--	43	107.4 ± 4.6		--		--		--
May 8	--			--		--	47	98.0 ± 3.6		--		--		--	47	109.4 ± 3.6
May 9	--			--		--		--		--	45	113.9 ± 2.5		--		--
May 10	--		44	86.2 ± 3.0	44	99.5 ± 4.0		--		—		--	48	93.2 ± 2.0		--
May 12	--			--		--		--	45	104.1 ± 2.9		--		--		--
May 15	--			--		--		—		--		--	48	95.0 ± 2.8		--
May 16	--			--		--		--	46	106.9 ± 2.6		--		--	44	104.6 ± 2.7
May 17	--		42	90.3 ± 3.1	43	103.0 ± 4.1	46	95.9 ± 3.3		--		--		--		
May 18	--			--		--		--		—	48	112.2 ± 2.4		--		—
May 23	—		43	95.5 ± 3.0		--		--		--		--	48	97.6 ± 2.3	49	98.5 ± 2.5
May 24	--			—		--		--	43	104.7 ± 2.5		--		--		--
May 25	--			--		—		--		--	44	113.7 ± 2.2		--		--
May 26	—			--	40	105.3 ± 3.8	47	90.7 ± 2.0		--		--		--		--
May 29	--			--		--		--	46	103.7 ± 3.0		—		—	47	100.2 ± 2.5
May 30	--			--		--	47	92.0 ± 2.5		--		--		--		--
June 1	--			--		--		--		--	48	115.2 ± 2.2		--		--
June 2	--			--		--		--		—		--	49	93.6 ± 2.5		--
June 5	--			--		--		--		--		--		—	44	98.0 ± 1.7
June 6	--			--	34	107.7 ± 4.3		--		--		--		--		--
June 7	--			--		--	47	94.7 ± 2.0	48	102.0 ± 2.2		--	50	95.8 ± 2.4		--

[a] No sample available.

Appendix 8. Mean length ($L \pm 95\%$C.L.) of age 2+ coho juveniles by capture site in Vedder-Chilliwack River system, 1976-1978 (n=sample size).

Date	Chilliwack Lake outlet		Post Creek		Fifteen Mile Creek		Ryder Creek		Street Creek		Hopedale Creek		Salwein/Rust Creek	
	n	L(mm)	n	L(mm)	n	L(mm)	n	L(mm)	n	L(mm)	n	L(mm)	n	L(mm)
1976														
May 21		--[a]		--		--	3	123.7 ± 64.8		--		--		--
June 8		--		--		--		--		--		--	2	122.0 ± 38.1
June 16		--		--		--		--		--		--	2	115.5 ± 19.1
June 23		--		--		--		--		--		--	2	99.0 ± 63.5
1977														
April 6		--		--		--		--		--	4	82.5 ± 15.9		--
April 21		--		--		--		--		--		--	3	82.3 ± 8.0
April 28		--		--		--		--		--	5	101.4 ± 9.2	2	91.0 ± 12.7
April 29	2	95.0 ± 89.0		--	5	87.6 ± 9.3		--		--		--		--
May 4		--		--		--	4	120.3 ± 25.3		--		--		--
May 5		--		--		--		--		--	3	103.0 ± 28.2		--
May 6	2	90.0 ± 76.3		--	9	94.4 ± 6.6		--		--		--		--
May 12		--	7	99.0 ± 8.1	11	97.6 ± 7.6		--		--		--		--
May 19		--	6	101.3 ± 7.7	12	94.1 ± 6.5		--		--		--		--
May 24		--		--		--		--		--	2	99.5 ± 44.5		--
May 25		--		--		--		--	2	110.5 ± 31.8		--		--
May 26		--	7	103.6 ± 5.5	11	98.5 ± 4.7		--		--		--		--
May 31		--	7	106.0 ± 6.4	8	97.6 ± 3.1	2	104.5 ± 95.3		--		--		--
June 6		--		--		--		--	2	99.5 ± 19.1	7	109.3 ± 6.6		--
June 7		--	9	104.9 ± 6.3	4	105.8 ± 19.5		--		--		--		--
1978														
April 18		--		--		--	4	109.3 ± 39.5		--		--		--
May 10		--	4	107.0 ± 15.3	2	114.0 ± 63.5		--		--		--		--
May 17		--	6	106.3 ± 5.9	3	115.3 ± 7.6	2	112.5 ± 95.3		--		--		--
May 23		--	5	110.6 ± 11.0		--		--		--		--		--
May 26		--		--	6	117.0 ± 3.0		--		--		--		--
May 30		--		--		--	2	111.5 ± 19.1		--		--		--
June 6		--		--	9	118.3 ± 7.0		--		--		--		--
June 7		--		--		--	2	109.5 ± 6.4		--		--		--

[a] No sample available.

Appendix 9. Mean weight (W) of coho juveniles by capture site in Vedder-Chilliwack River system, 1978 and 1979 (n=sample size).

Date	n	W(g)	% Age 0+[a]
Upper Chilliwack River			
Sept. 5/79	50	2.70	94.0
Sept.12/79	100	1.79	99.0
Sept.19/79	100	2.34	98.0
Chilliwack Lake			
Oct.18/78	100	4.13	100
Oct.31/78	100	4.08	98.0(2.0)
Nov.11/78	50	3.78	100
Nov.15/78	50	4.24	100
Nov.21/78	100	3.67	94.0(4.0)
Sept.28/79	100	2.91	100
Oct. 3/79	100	2.73	98.0(2.0)
Oct.12/79	100	3.25	98.0

Date	n	(W(g)	% Age 1+[b]
Post Creek			
May 3/78	50	6.15	94.0(6.0)
May 17/78	50	8.77	84.0(4.0)
Fifteen Mile Creek			
May 3/78	50	11.32	70.0(28.0)
May 10/78	50	11.40	88.0(8.0)
May 17/78	50	12.46	86.0(8.0)
June 6/78	50	13.79	68.0(14.0)
Ryder Creek			
Apr. 26/78	50	9.98	98.0(2.0)
May 2/78	50	10.86	92.0(6.0)
May 8/78	50	9.72	94.0(4.0)
May 17/78	50	9.15	92.0(4.0)
June 7/78	50	8.89	94.0(2.0)
Barrett Creek			
May 12/78	50	10.83	90.0(10.0)
May 16/78	50	13.38	92.0(8.0)
June 7/78	50	13.56	96.0(4.0)
Street Creek			
May 9/78	50	14.83	90.0(10.0)
May 18/78	50	13.82	96.0(2.0)
Hopedale Creek			
Apr.20/78	50	8.12	100
May 10/78	50	8.37	100
May 15/78	50	8.82	96.0(4.0)
June 7/78	50	8.94	100
Salwein/Rust Cr.			
Apr.20/78	50	7.67	92.0(8.0)
May 2/78	50	12.41	98.0(2.0)
May 8/78	50	13.32	94.0(6.0)
May 16/78	50	12.27	88.0(8.0)
June 5/78	50	9.72	88.0(12.0)

[a] Remaining fish are age 1+ or, if in parenthesis, unaged fish (regenerate scales).

[b] Remaining fish are age 2+ or, if in parenthesis, unaged fish (regenerate scales).

Appendix 10. Age composition (% of total) of coho juveniles in Chilliwack Lake, 1976-1979 (n=sample size).

Date	1976			1977			1978			1979		
	n	0+	1+	n	0+	1+	n	0+	1+	n	0+	1+
Sept. 28	----------	[a]		----------			----------			100	100	0
Oct. 3	----------			----------			----------			98	100	0
Oct. 12	----------			----------			----------			100	98.0	2.0
Oct. 13	----------			----------			100	100.0	0.0	----------		
Oct. 18	----------			----------			101	100.0	0.0	----------		
Oct. 19	----------			50	86.0	14.0	----------			----------		
Oct. 21	----------			49	83.7	16.3	----------			----------		
Oct. 26	----------			49	89.8	10.2	100	92.0	8.0	----------		
Oct. 27	----------			49	100.0	0.0	----------			----------		
Oct. 31	----------			----------			99	100.0	0.0	----------		
Nov. 2	----------			48	95.8	4.2	----------			----------		
Nov. 3	----------			49	89.8	10.2	----------			----------		
Nov. 8	----------			50	94.0	6.0	----------			----------		
Nov. 10	----------			45	91.1	8.9	----------			----------		
Nov. 11	----------			----------			100	100.0	0.0	----------		
Nov. 13	47	97.9	2.1	----------			----------			----------		
Nov. 15	----------			49	91.8	8.2	----------			----------		
Nov. 16	47	87.2	12.8	----------			----------			----------		
Nov. 18	49	87.8	12.2	49	95.9	4.1	----------			----------		
Nov. 21	----------			----------			98	99.0	1.0	----------		
Nov. 25	50	94.0	6.0	----------			----------			----------		
Nov. 28	----------			50	98.0	2.0	----------			----------		
Dec. 2	41	85.4	14.6	50	92.0	8.0	----------			----------		
Dec. 6	----------			50	96.0	4.0	----------			----------		
Dec. 9	46	80.4	19.6	----------			----------			----------		
Dec. 17	46	91.3	8.7	----------			----------			----------		
Overall mean	326	89.3	10.7	637	92.6	7.4	598	98.5	1.5	298	99.3	0.7

[a] No sample available.

Appendix 11. Age composition (% of total), mean length ($L \pm 95\%$C.L.) per age group, and weight of coho juveniles in upper Chilliwack River, 1979 (n=sample size).

Date	% Age composition			Length (mm)				Weight	
	n	0+	1+	n	0+	n	1+	n	(g)
Sept. 5	50	94.0	6.0	47	58.3 ± 2.4	3	89.7 ± 52.4	50	2.70
Sept. 12	100	99.0	1.0	99	54.8 ± 1.4	1	80.0	100	1.79
Sept. 19	100	98.0	2.0	98	57.1 ± 2.4	2	90.5 ± 120.7	100	2.34
Mean[a]	250	97.6	2.4	244	56.6	6	88.3 ± 15.9	250	2.19

[a] Weighted mean.

Appendix 12. Mean length ($L \pm 95\%$C.L.) of age 0+ and 1+ coho juveniles in Chilliwack Lake, 1976-1979 (n=sample size).

Date	1976				1977				1978				1979			
	0+		1+		0+		1+		0+		1+		0+		1+	
	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)	n	L (mm)
Sept. 28		--[a]		—		--		--		--		--	100	60.7 ± 1.9		--
Oct. 3		--		--		--		--		--		--	98	62.8 ± 1.8		--
Oct. 12		--		--		--		--		--		--	98	64.9 ± 1.9	2	$111.0 \pm$ 89.0
Oct. 13		—		--		—		--	100	76.0 ± 2.0		--		--		—
Oct. 18		--		--		--		—	103	71.3 ± 1.7		--		—		--
Oct. 19		--		--	43	80.0 ± 3.4	7	105.4 ± 8.1		—		--		--		—
Oct. 21		--		--	41	82.4 ± 2.7	8	97.9 ± 6.5		--		--		--		--
Oct. 26		--		--	44	75.8 ± 4.2	5	88.0 ± 27.2	92	75.6 ± 2.0	8	83.5 ± 12.9		--		—
Oct. 27		--		--	49	79.8 ± 1.8		--		--		--		—		--
Oct. 31		--		--		--		--	99	72.3 ± 2.0		--		—		--
Nov. 2		--		--	46	79.3 ± 2.6	2	104.0 ± 25.4		--		--		--		--
Nov. 3		--		--	44	81.2 ± 2.7	5	104.4 ± 19.0		—		--		--		--
Nov. 8		--		--	47	79.9 ± 3.5	3	109.3 ± 20.2		--		--		--		--
Nov. 10		--		—	41	78.2 ± 2.5	4	93.0 ± 34.0		--		--		--		--
Nov. 11		--		—		--		—	100	72.5 ± 1.7		--		--		--
Nov. 13	46	76.1 ± 2.6		--		--		--		--	-	--		--		--
Nov. 15		—		--	45	81.2 ± 3.3	4	108.0 ± 7.5	100	73.0 ± 2.3		--		--		--
Nov. 16	41	71.6 ± 1.8	6	76.0 ± 4.2		--		--		--		--		--		--
Nov. 18	43	72.0 ± 2.9	6	86.8 ± 15.5	47	84.1 ± 3.0	2	93.0 ± 89.0		--		--		--		--
Nov. 21		--		--		--		—	97	69.3 ± 1.9		--		--		--
Nov. 25	47	70.1 ± 2.9	3	79.7 ± 16.2		--		--		--		--		--		--
Nov. 28		--		--	49	80.3 ± 2.8		--		--		--		—		--
Dec. 2	35	72.6 ± 4.5	6	80.7 ± 17.8	46	78.2 ± 2.0	4	100.8 ± 5.6		--		--		--		--
Dec. 6		--		--	48	76.9 ± 2.7	2	68.5 ± 57.1		--		--		—		--
Dec. 9	37	66.3 ± 2.8	9	77.9 ± 3.7		—		--		--		--		—		--
Dec. 17	42	73.2 ± 3.2	4	89.8 ± 33.5		--		--		—		--		--		--
Mean[b]	291	71.2	34	74.9	590	79.8	46	98.9	691	72.8	8	83.5	296	62.8	2	111.0

[a] Not sampled.

[b] Weighted mean.

Appendix 13. Incidence of naturally missing adipose fins (NMAF) among coho juveniles in Vedder-Chilliwack River system, 1976-1978.

Year	Tributaries			Chilliwack Lake		
	Total captured[a]	No. NMAF	Incidence of NMAF	Total captured	No. NMAF	Incidence of NMAF
1976	20,162	18	1:1120	32,395	30	1:1080
1977	22,263	21	1:1060	5,928	7	1:847
1978	36,347	16	1:2272	No data		
Overall total[b]	117,095	92	1:1273			

[a] Sum of (pre-tag mortalities + undersized released + tags recovered + numbers tagged).

[b] Tributaries and Chilliwack Lake.

Appendix 14. Mean length (and age where available) of rainbow trout, cutthroat trout and Dolly Varden in Vedder-Chilliwack River system, 1976-1978 (n=sample size).

Date	Capture site	RAINBOW TROUT								CUTTHROAT TROUT			DOLLY VARDEN		
		Length ± 1S.E.			% Age					Length ± 1S.E.			Length ± 1S.E.		
		(mm)	Range	(n)	1+	2+	3+	4+	(n)[a]	(mm)	Range	(n)	(mm)	Range	(n)
1976															
Apr.28-June 15	Ryder Cr.		—[b]			--				118.0	--	(12)		—	
Apr.16-June 22	Salwein Cr.	202.1	(161-278)	(15)	0	0	60	40	(5)	85.9	--	(8)		--	
Oct.26-Dec.13	Chilliwack L.	87.8 ± 5.3	(52-147)	(40)		--					--		150.4 ± 2.1	(84-243)	(170)
1977															
Apr.6	Hopedale Cr.	85.8 ± 2.0	(60-118)	(46)		--					--			--	
Oct.18-Nov.28	Chilliwack L.	114.7 ± 2.7	(64-165)	(112)		--					--		145.0 ± 1.1	(101-169)	(159)
1978															
Apr.12	Ryder Cr.	181.3 ± 9.4	(156-201)	(4)	0	100	0	0	(2)		--			--	
Apr.10-June 2	Street Cr.	157.9 ± 2.2	(125-223)	(76)	24.6	68.9	6.6	0	(61)		--			--	
Apr.10-May 8	Salwein Cr.	203.0 ± 4.4	(154-296)	(49)	11.1	69.4	19.4	0	(36)		--			—	

[a] Difference between length sample size and age sample size is due to regenerate scales.

[b] Not available.

Appendix 15a. Coho juvenile tagging summary by capture site for Vedder-Chilliwack River system, 1976.

Capture site	Mean age[a]	Mean size range of age 1+[b]	Tagging period	Temperature range[c]	Pre-tagging mortality	No. undersized fish released
Ryder Cr.	1+(93.3%)	90.0-103.5mm	May 5- June 15	8.0-12.5°C	56	--[d]
Street Cr.	1+(94.9%)	96.1-103.7mm	May 4-June 15	8.0-12.0°C	4	--
Hopedale Cr.	1+(93.1%)	83.4-98.4mm	Apr.27-June 25	7.5-11.5°C	87	--
Salwein/Rust Cr.	1+(93.6%)	86.9-104.1mm	Apr.27-June 22	11.0-14.5°C	177	--

	Tagging code	Total No. tagged	Post-tagging mortality	Mean tag retention (and range)[e]	No. tags released[f]
Ryder Cr.	2-15-13	1,413	3	99.0%	1,396
Street Cr.	2-15-13	1,153	1	100%	1,152
Hopedale Cr.	2-15-13	9,852	30	91.1%(98.2-100%)	9,711
Salwein/Rust Cr.	2-15-13	7,420	35	99.4%(98.5-100%)	7,348
Total	2-15-13	19,838	69	97.4%	19,607

[a] From Appendix 6; remaining fish are age 2+.

[b] From Appendix 7; for size of age 2+ fish see Appendix 8.

[c] From daily records.

[d] Not available.

[e] Daily tag totals corrected with appropriate retention rates.

[f] Corrected for tag retention and post-tagging mortality.

Appendix 15b. Coho juvenile tagging summary by capture site for Vedder-Chilliwack River system, 1977.

Capture site	Mean age[a]	Mean size range of age 1+[b]	Tagging period	Temperature range[c]	Pre-tagging mortality	No. undersized fish released
Chilliwack L. outlet	1+(93.3%)	71.5- 85.8mm	Apr. 29-May 19	4.0- 7.0°C	8	1
Post Cr.	1+(85.9%)	74.7- 94.1mm	Apr. 29-June 7	5.0- 8.0°C.	11	0
Fifteen Mile Cr.	1+(76.7%)	69.6- 96.3mm	Apr. 29-June 7	6.0- 8.0°C	15	26
Ryder Cr.	1+(95.0%)	72.8-101.8mm	Apr. 14-June 7	7.0-11.8°C	38	0
Street Cr.	1+(96.1%)	79.1-113.1mm	Apr. 5-June 6	8.0-12.0°C	13	0
Hopedale Cr.	1+(92.7%)	79.3-103.4mm	Apr. 6-June 6	8.0-12.3°C	10	5
Salwein/Rust Cr.	1+(96.6%)	78.3-108.4mm	Apr. 14-June 6	10.0-16.0°C	170	1

	Tagging code	Total No. tagged	Post-tagging mortality	Mean tag retention (and range)[e]	No. tags released[f]
Chilliwack L. outlet	2-16-27	113	2	100%	111
Post Cr.	2- 4-13	1,266	11	99.0%	1,241
Fifteen Mile Cr.	2- 4-13	1,260	0	99.2%(99.0-100%)	1,252
Ryder Cr.	2- 4-13	3,985	42	99.0%(97.0-100%)	3,894
Street Cr.	2- 4-13	1,639	76	95.3%(88.0-100%)	1,400
Hopedale Cr.	2- 4-13	4,212	4	99.7%(98.0-100%)	4,202
Salwein/Rust Cr.	2- 4-13	9,497	28	99.6%(97.0-100%)	9,444
Total	2-16-27	113	2		111
	2- 4-13	21,859	161		21,433
		21,972	163	98.8%	21,544

[a-f] See Appendix 15a.

Appendix 15c. Coho juvenile tagging summary by capture site for Vedder-Chilliwack River system, 1978.

Capture site	Mean age[a]	Mean size range of age 1+[b]	Tagging period	Temperature range[c]	Pre-tagging mortality	No. undersized fish released
Post Cr.	1+(91.1%)	72.0- 95.5mm	Apr.18-May 23	4.0- 7.0°C	--[d]	2
Fifteen Mile Cr.	1+(91.3%)	83.5-107.7mm	Apr.16-June 6	6.0- 8.5°C	--	0
Ryder Cr.	1+(96.2%)	80.7- 98.0mm	Apr.12-June 7	6.5-12.0°C	--	0
Barrett Cr.	1+(97.8%)	81.3-107.4mm	Apr.12-June 7	7.2-12.5°C	--	7
Street Cr.	1+(98.5%)	86.5-115.2mm	Apr.10-June 1	8.0-14.0°C	--	0
Hopedale Cr.	1+(100%)	85.9- 99.3mm	Apr.11-June 8	7.5-14.5°C	--	1
Salwein/Rust Cr.	1+(96.8%)	75.6-109.4mm	Apr.10-June 7	9.5-18.0°C	--	41

	Tagging code	Total No. tagged	Post-tagging mortality	Mean tag retention (and range)[e]	No. tags released[f]
Post Cr.	2-21-24	1,034	1	99.8%(99.0-100%)	1,030
Fifteen Mile Cr.	2-21-24	889	0	99.7%(97.9-100%)	886
Ryder Cr.	2-21-24	5,084	2	99.8%(98.0-100%)	5,074
Barrett Cr.	2-21-24	5,535	25	100%	5,510
Street Cr.	2-21-24	1,900	0	98.6%(92.0-100%)	1,881
Hopedale Cr.	2-21-24	8,967	19	99.5%(98.0-100%)	8,899
Salwein/Rust Cr.	2-21-24	12,826	38	99.8%(98.0-100%)	12,755
Total	2-21-24	36,235	85	99.6%	36,035

[a-f] See Appendix 15a.

Appendix 16. Coho juvenile tagging summary for Chilliwack Lake, 1976-1979.

Year	Mean age[a]	Mean size range[b] of age 0+	Tagging period	Temperature range[c]	Pre-tagging mortality	No. undersized fish released
1976	0+(89.3%)	66.3-76.1mm	Nov.5-9	8.0-11.7°C	18	145
1976	0+(89.3%)	66.3-76.1mm	Oct.26-Dec.16	4.0-11.7°C	79	1,217
1977	0+(92.6%)	75.8-84.1mm	Oct.18-Dec.16	4.5-11.0°C	20	14
1978[d]	0+(98.5%)	69.3-76.0mm	Oct.13-Nov.21	6.5-12.5°C	45	414
1979[d]	0+(98.7%)	54.8-84.1mm	Sept.6-Oct.15	8.0-12.0°C	306	947

	Tagging code	Total No. tagged	Post-tagging mortality	Mean tag retention (and range)[f]	No. tags released[g]
1976	12-1-13[e]	6,207	1	99.7% (99.0-100%)	6,189
1976	2-15-11	22,546	122	99.6% (96.0-100%)	22,302
Total		28,753	123		28,491
1977	2-21-20	5,488	125[h]	99.0% (98.8-100%)	5,313
1978[d]	2-21-30	15,046	181	99.5% (96.0-100%)	14,800
1979[d]	2-17-60	25,708	74	98.7% (98.0-100%)	25,306
Total	--	74,995	503	99.3%	73,910

[a] From Appendix 10; remaining fish are age 1+.

[b] From Appendix 12; for size of age 1+ fish see also Appendix 12.

[c] From daily records.

[d] Includes Upper Chilliwack River coho.

[e] This code was accidentally left in tagging machine after marking rainbow trout.

[f] Daily tag totals corrected with appropriate retention rates.

[g] Corrected for tag retention and post-tagging mortality.

[h] Includes accidental mortality of 162 coho due to a collapsed holding pen.

Appendix 17. Coho juvenile mark recoveries in Vedder-Chilliwack River tributaries and at Chilliwack Lake outlet, 1977-1979.

Recapture Site	No. recovered in 1977	in 1978	in 1979
Chilliwack Lake outlet	6	-[a]	-
Post Creek	21	7	-
Fifteen Mile Creek	5	1	-
Ryder Creek	4	1	-
Barrett Creek	-	5	-
Street Creek	28	2	-
Hopedale Creek	12	11	-
Salwein/Rust Creeks	28	34	1
Total	104	61	1

[a]Not sampled.

Appendix 18. Coho juvenile mark recoveries in Chilliwack Lake, 1976-1979.

Year	Total Captured[a]	No. marks[b]	% Recovery rate
1976	32,395	2,183	6.7
1977	5,927	406	6.9
1978	17,735	2,230	12.6
1979	16,942	864	5.1
Total	72,956	5,639	7.7

[a] Sum of (pre-tagging mortalities + undersized released + tags recovered + numbers tagged).

[b] Includes clipped fish without pins.

Appendix 19. Comparison of short-term and delayed tag loss in recovered marks in Chilliwack Lake, 1976-1979[a].

Year	Short-term tag loss[b]			Delayed tag loss[c]		
	Total marks held	No. tags lost	% Tag loss	Total marks recovered	No. tags lost	% Tag loss
1976	800	3	0.38%	2,183	35	1.6%
1977	563	4	0.71%	406	N.A.	N.A.
1978	1,108	7	0.63%	2,185	176	8.1%
1979	2,100	27	1.29%	1,033	43	4.2%

[a] Includes upper Chilliwack River data in 1979.

[b] Holding period usually 24 hr. to 48 hr.

[c] Recapture up to over a week after tagging.

Appendix 20a. Five-day mean water temperatures (°C) at trapping and tagging sites in Vedder-Chilliwack River system, April-June, 1976.

Date	Trap Site				
	Ryder Creek	Street Creek	Hopedale Creek	Rust Creek	Salwein Creek
Apr. 25	--[a]	--	7.5[b]	--	9.0[b]
Apr. 30	11.0[b]	--	9.2	12.0[b]	11.6
May 5	--	10.3	9.3[b]	9.9[b]	12.8[b]
May 10	10.6	10.6	8.8	11.4	13.4[b]
May 15	10.1	9.3[b]	8.0[b]	9.9	11.5
May 20	9.8	9.4[b]	8.1[b]	9.7	12.4
May 25	9.0	9.9	8.6	9.1[b]	12.3
May 31	8.7[b]	9.0[b]	8.4[b]	9.0[b]	11.2[b]
June 5	11.3[b]	10.3[b]	8.9	10.3[b]	12.8[b]
June 10	11.5[b]	10.0[b]	9.5[b]	10.3[b]	14.0[c]
June 15	11.7	9.9[b]	9.0	10.1	12.3
June 20	11.5[c]	--	9.5[b]	--	12.8[b]
June 25	--	--	9.5	--	14.0[c]
Range of daily recorded temperatures	8.0-12.5	8.0-12.0	7.0-11.5	8.0-13.0	8.0-14.5

[a] Not recorded.

[b] Two-to-four days' data.

[c] One day's data.

Appendix 20b. Five-day mean water temperatures (°C) at trapping and tagging sites in Vedder-Chilliwack River system, March-June, 1977.

Date	Trap site							
	Chilliwack L. outlet	Post Creek	Fifteen Mile Creek	Ryder Creek	Street Creek	Hopedale Creek	Rust Creek	Salwein Creek
Mar. 25	4.5[b]	--[a]	--	--	--	--	--	--
Mar. 31	4.5[b]	--	--	7.2[b]	7.6[b]	--	--	--
Apr. 5	4.5[c]	--	--	8.0[b]	9.3[b]	8.7[b]	--	9.8[b]
Apr. 10	5.0[b]	--	--	8.0[b]	10.0[b]	10.5[b]	10.0[b]	11.0[b]
Apr. 15	4.5[c]	--	--	8.4[b]	8.4	8.5	10.0[b]	10.2
Apr. 20	4.5	--	7.5[c]	7.0[b]	9.2	9.6	9.7[b]	10.4
Apr. 25	5.9	6.4[b]	7.6	9.2	9.8	11.3[b]	12.0	12.9
Apr. 30	6.0	6.4	6.9[b]	10.2	10.1	10.5	12.8	12.4
May 5	6.0[b]	6.4	6.5	10.0	9.3	9.8	12.8	13.9
May 10	6.2	5.5	6.2	9.5	10.4	10.6	15.5	13.6
May 15	5.1	5.7	6.6	9.3	9.5	9.6	14.7	12.1
May 20	6.6	6.3	7.0	9.5	8.7	8.9	12.9	11.9
May 25	6.5[b]	6.0	6.7	10.3	9.2	10.4	13.6	13.7
May 31	--	6.5	6.5	9.9	9.4	9.7	14.1	13.9[b]
June 5	--	6.8[b]	6.7[b]	9.7	10.1[b]	10.5[b]	14.1	13.8[b]
June 10	--	--	--	11.6[b]	9.7	11.6	14.3[b]	16.0[b]
June 15	--	--	--	--	11.8[b]	11.5[b]	--	--
Range of daily recorded temperatures	4.0-8.0	5.0-8.0	6.0-8.0	6.5-11.8	7.0-12.5	7.5-12.8	9.5-18.0	9.0-16.0

[a] Not recorded.

[b] Two- to four-day's data.

[c] One day's data.

Appendix 20c. Five-day mean water temperatures (°C) at trapping and tagging sites in Vedder-Chilliwack River system, April-June, 1978.

Date	Trap Site							
	Post Cr.	Fifteen Mile Cr.	Ryder Cr.	Barrett Cr.	Street Cr.	Hopedale Cr.	Rust Cr.	Salwein Cr.
Apr. 5	--[a]	--	7.6[b]	--	8.3[b]	8.8[b]	8.9[b]	9.2[b]
Apr. 10	--	6.6[b]	8.1[b]	8.9[b]	8.5[b]	8.8[b]	9.9[b]	10.6[b]
Apr. 15	5.3[6]	7.2[b]	7.3	8.6	9.1	9.5[b]	9.4[b]	10.1
Apr. 20	5.3	6.8	8.6	8.6	9.2	9.3	10.1[b]	9.8
Apr. 25	5.3	6.9	8.4	8.9	9.5	9.3	10.1	10.1
Apr. 30	6.1	7.3	9.8	9.4	9.9	10.5	11.5	10.9
May 5	6.2	7.0	9.2	9.9	10.4	10.8	12.4	11.8
May 10	6.4	7.3	10.3	10.2	9.4	10.9	13.2	13.0
May 15	6.6	6.9	9.5[b]	9.4	10.2[b]	10.1	12.4	13.1
May 20	6.8[c]	7.2	9.5[b]	10.6	10.6[b]	11.8	13.2	13.3
May 25	7.0[c]	7.0	10.3	9.2	10.3	10.6	13.2	14.4
May 31	--	7.3	10.1	10.1	10.4	11.1	12.7	13.9
June 5	--	7.9	10.3	11.0[b]	13.3	13.0	15.7[b]	16.0[b]
June 10	--	7.0[c]	11.2[b]	10.3[b]	10.6[b]	12.3[b]	15.1[b]	15.8[b]
June 15	--	--	11.5[c]	--	9.7[b]	11.5[b]	--	14.0[b]
Range of daily recorded temperatures	4.0-7.0	6.0-8.5	6.5-13.0	7.2-12.5	8.0-14.0	7.5-14.5	8.2-17.0	8.9-18.0

[a] Not recorded.

[b] Two- to four-day's data.

[c] One day's data.

Appendix 21. Five-day mean water temperatures (°C) at tagging sites in Chilliwack Lake (1976-1979), at lake trapping sites (1979), and at upper Chilliwack River outlet (1979).

Date	1976	1977	1978	1979	1979-lake (trapping)	Upper Chilliwack River
Aug. 25	--[a]	--	--	--	19.5[b]	--
Aug. 31	--	--	--	--	19.2[b]	--
Sept. 5	--	--	--	--	18.0[c]	10.5[b]
Sept. 10	--	--	--	10.0[b]	--	10.0[b]
Sept. 15	--	--	--	8.0[b]	18.0[c]	9.2
Sept. 20	--	--	--	12.0[b]	17.0[c]	11.4
Sept. 25	--	--	--	12.0[c]	17.0[b]	12.0[b]
Sept. 30	--	--	--	11.5[b]	16.0[b]	--
Oct. 5	--	--	--	10.0[c]	15.7	--
Oct. 10	--	--	12.8[b]	--	16.0[b]	--
Oct. 15	--	--	11.3[b]	9.3[b]	15.0[b]	--
Oct. 20	--	10.8[b]	11.6[b]	--	--	--
Oct. 25	10.0[c]	10.0[b]	10.8[b]	--	--	--
Oct. 31	9.6	9.5[b]	10.1[b]	--	--	--
Nov. 5	9.5	8.0[b]	9.3[b]	--	--	--
Nov. 10	9.6	7.1[b]	8.6[b]	--	--	--
Nov. 15	8.7[b]	7.0[b]	7.3[b]	--	--	--
Nov. 20	7.8	6.4[b]	7.0[c]	--	--	--
Nov. 25	7.5[b]	5.0[b]	6.5[c]	--	--	--
Nov. 30	6.3[b]	5.0[b]	--	--	--	--
Dec. 5	6.4[b]	4.8[b]	--	--	--	--
Dec. 10	5.9	4.5[c]	--	--	--	--
Dec. 15	6.0[b]	--	--	--	--	--
Range of daily recorded temperatures	5.0-11.8	4.5-11.0	6.5-13.5	8.0-12.0	15.0-19.5	8.0-12.0

[a] Not recorded.

[b] Two-to-four-days' data.

[c] One day's data.

Appendix 22. Daily coho juvenile trapping and mark recovery in Chilliwack Lake, 1977.

Capture date	Areas trapped	Total catch	Total recoveries		Recoveries/area (% of zonal catch)					
			No.	%	Area 1	2	3	4	5	6
Oct. 17	4	10	0	0				0		
Oct. 18	3,4	57	1	1.7			6.7	0		
Oct. 19	4	136	0	0				0		
Oct. 20	1,3,4	364	0	0	0		0	0		
Oct. 21	1,3,4	325	4	1.2	4.0		0	0		
Oct. 24[a]	1,3,4	26	0	0	0		0	0		
Oct. 25	1,4	194	5	2.5	8.6			0		
Oct. 26	1,3	137	2	1.5	3.3		0.9			
Oct. 27	1,3,4	323	11	3.4	9.1		0	0		
Oct. 28	1,3,4	337	16	4.7	6.3		0	2.8		
Oct. 31[a]	1,3,4	18	0	0	0		0	0		
Nov. 2	1,4	413	36	8.7	16.0			1.1		
Nov. 3	1,4	360	29	8.1	9.5			1.6		
Nov. 4	1,4	309	24	7.8	9.6			1.4		
Nov. 7[a]	1,4	23	1	4.3	6.7			0		
Nov. 8	1,2,4	437	73	16.7	28.7	16.7		6.6		
Nov. 9	1,2,4	237	34	14.3	16.6	10.9		8.7		
Nov. 10	1,2,3,4	213	29	13.6	20.0	10.0	8.6	0		
Nov. 14[a]	1,2,3,4	23	3	13.0	30.0	0	0	0		
Nov. 15	1,3,4	216	14	6.5	10.5		6.7	14.3		
Nov. 16	1,3,4,6	186	16	8.6	0		4.7	0		7.1
Nov. 17	3,5,6	277	13	4.7			8.0		6.8	2.1
Nov. 18	3,5,6	256	15	5.9			7.2		3.8	4.4
Nov. 24[a]	3,5,6	25	-	0			0		0	0
Nov. 25	3,5,6	230	16	7.0			9.8		15.0	3.9
Nov. 28[a]	3,5,6	44		5.9			0		0	0
Nov. 29[b]	5,6	51	26	5.9					7.7	7.7
Nov. 30	3,5,6	145		5.9			7.7		7.7	7.7
Dec. 1	3,4,5,6	202		5.9			7.7	7.7	7.7	7.7
Dec. 2	3,4,5,6	137	16	5.9			16.7	4.9	4.9	4.9
Dec. 5[a]	3,4,5,6	133		5.9			4.9	4.9	4.9	4.9
Dec. 6	1,3,4,5,6	126	22	17.5			0	2.1	2.1	2.1
Total	--	5,970	406	6.8	9.9	9.4	4.1	2.3	5.5	4.4

[a] Traps left unbaited since previous check.

[b] After this date, fry from all catch zones held together; recovery rates averaged.

Appendix 23. Relationship between mean length and weight of coho juveniles in Vedder-Chilliwack River system, 1978 and 1979 (n=sample size).

Date	Length[a] n	Length[a] (mm)	Weight[a] n	Weight[a] (g)
Upper Chilliwack River				
Sept. 5/79	50	60.2	50	2.70
Sept.12/79	100	55.6	100	1.79
Sept.19/79	100	57.8	100	2.34
Chilliwack Lake				
Oct.18/78	103	71.3	100	4.13
Oct.31/78	99	72.3	100	4.08
Nov.11/78	100	72.5	50	3.78
Nov.15/78	100	73.0	50	4.24
Nov.21/78	100	70.0	100	3.67
Sept.28/79	100	60.7	100	2.91
Oct. 3/79	100	62.7	100	2.73
Oct.12/79	100	65.9	100	3.25
Post Creek				
May 3/78	50	82.5	50	6.15
May 17/78	50	92.7	50	8.77
Fifteen Mile Creek				
May 3/78	50	102.1	50	11.32
May 10/78	50	101.2	50	11.40
May 17/78	50	103.9	50	12.46
June 6/78	50	110.9	50	13.79
Ryder Creek				
Apr.26/78	50	96.2	50	9.98
May 2/78	50	96.8	50	10.86
May 8/78	50	98.2	50	9.72
May 17/78	50	96.3	50	9.15
June 7/78	50	95.5	50	8.89
Barrett Creek				
May 12/78	50	104.2	50	10.83
May 16/78	50	106.8	50	13.38
June 7/78	50	102.0	50	13.56
Street Creek				
May 9/78	50	114.0	50	14.83
May 18/78	50	111.9	50	13.82
Hopedale Creek				
Apr.20/78	50	93.4	50	8.12
May 15/78	50	95.2	50	8.82
June 7/78	50	95.8	50	8.94
Salwein/Rust Creeks				
Apr.20/78	50	89.5	50	7.67
May 2/78	50	103.6	50	12.41
May 8/78	50	109.8	50	13.32
May 16/78	50	105.1	50	12.27
June 5/78	50	98.7	50	9.72

[a] All ages combined.