

INTRODUCTION INTO A YSEN CHILE OF PACIFIC SALMON

No. 11

**Observations on the Japanese Cherry Salmon (*Oncorhynchus masoni*)
release trials with notes of a homing adult in the Simpson River**

By

Hisao Asai

and

Gustavo Araya G.

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Dedicated to my wife, my daughter and my friends. (H.A.)

Dedicado a mi esposa, mis hijos y mis amigos. (G.A.G.)

**“INTRODUCTION INTO AYSEN CHILE OF PACIFIC SALMON”
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CONTENTS

I.	INTRODUCTION	1
II.	MATERIALS AND METHODS	1
III.	RESULTS AND OBSERVATIONS	2
	1. Rearing of introduced cherry salmon	2
	(1) Eggs	2
	(2) Incubating and rearing	3
	2. Release	9
	(1) General conditions of the river for release	9
	(2) Release conditions	9
	3. Catching of released fish	11
	(1) Sampling in the river	11
	(2) Stomach contents of the Cherry salmon	13
	(3) Growth	14
	4. Adults fish catching	14
	(1) Catching of adult fish in the river	14
	(2) Morphological characteristics	15
	(3) Age	15
IV.	SUMMARY	18
V.	ACKNOWLEDGMENT	18
VI.	REFERENCES	19
	Plate I	20
	Plate II	21
	Appendix Table 1	22
	Appendix Table 2	24
	Appendix Figure	25

Observations on the Japanese Cherry Salmon (*Oncorhynchus masou*)
release trials with notes of a homing adult in the Simpson River

Hisao Asai and Gustavo Araya G.

I. INTRODUCTION

Cherry salmon (*Oncorhynchus masou*) lives only in the Asian ocean area, mainly the sea of Japan, in the Northern hemisphere. Due to its unique life history, much research has been done about its growth, distribution, etc. in fresh water and ocean stages.

Chile is the only place in the Southern hemisphere where the species has been introduced. In 1972, 150,000 eyed eggs were transported by air from Hokkaido, Japan. In 1973, 85,000 fry were released in the Claro River, a branch of the Simpson River system, in the Aysen Region of southern Chile. This is the only data which remains about that study. (Nagasawa, A. and Aguilera, P. 1984). After 1974, the Plan to introduce Pacific salmon into Chilean water was changed by the request the Chilean Government and form other reasons. A decision was to use Chum salmon. But in October, 1981, 200,000 eyed eggs of cherry salmon were introduced again into Chile in order to study the homing process. These eggs were bred in fresh water for almost one year in the Dr. Shiraishi Memorial Hatchery (henceforth called Coyhaique Hatchery). This was done because of a seasonal inversion between Japan and Chile, affecting the incubation period of this species, and the characteristics of living in fresh water one or two years, which is one of the custom of this species, and finally, in November 1982, 22,000 fry were released in the Claro, branch of the Simpson River. This was the first wintering breeding of cherry salmon in the Southern hemisphere. It was seen that the fry are divided into two types, a resident type and a sea migrate type. These were observed in the last 6 months of the breeding period of one year. Also, on April 18, 1984, one male cherry salmon was caught as an adult fish in the Simpson River, proving the return.

This report gives the observations about the dispersion and permanence of cherry salmon fry introduced in 1981. It also studies the results of the first spawner of cherry salmon to return in the Southern hemisphere.

II. MATERIALS AND METHODS

Cherry salmon eggs used in this study were collected in Hokkaido, Japan, in mid-September 1981 and transported by air to Chile as eyed eggs, which were received in the Coyhaique Hatchery, located at lat. 45° 30' W. (Fig. 1.). The water of the Claro River was used for the incubation of eggs and the rearing of fry. The Claro River comes from west of the mountains and is about 30 km in length. Usually its water is clear, but it follows a steep slope and the river is very sensitive to precipitation. The river's transparency can drop significantly with mud being mixed in.

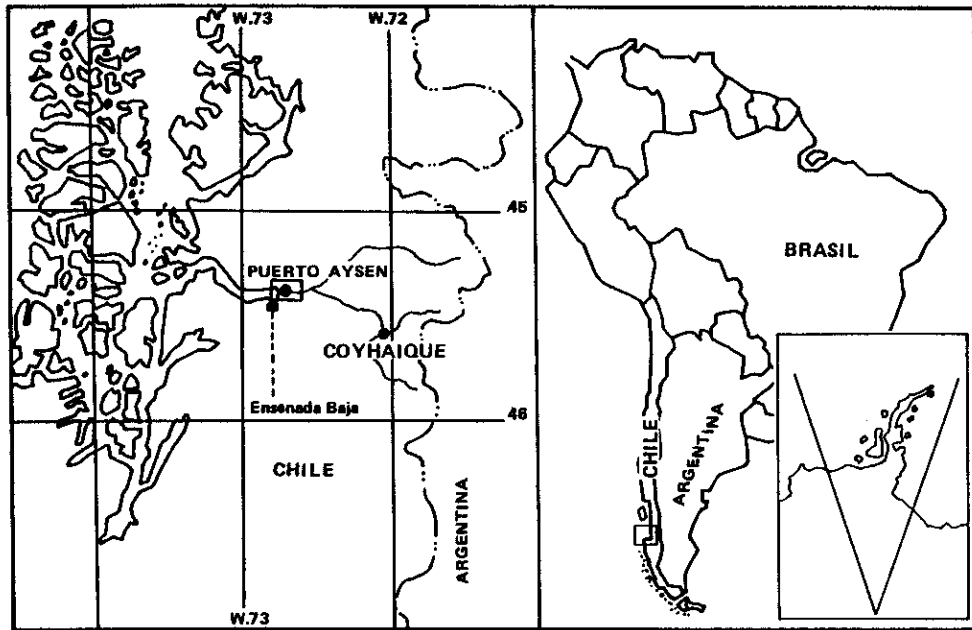


Fig. 1. Map Showing Location of Coyhaique Hatchery

After being bred in the Coyhaique Hatchery for about eleven months, fry converted into smolt were released in the Claro on Nov. 26, 1982. From that date to December of 1983, attempts to catch released cherry salmon by cast-net and by angling were made in order to study their levels of dispersion and concentration. The captured cherry salmon were weighed and fork length was determined, and also the contents of their stomach was studied.

Other species captured during the investigations were documented as well, determining the maximum and minimum weights and fork lengths of each species and the number of each.

III. RESULTS AND OBSERVATIONS

1. Rearing of introduced cherry salmon

(1) Eggs

Cherry salmon eggs brought from Japan to Chile were extracted from some of the salmon which were caught on Sep. 14, 1981, in the Nakoma River in the south of Hokkaido, Japan. First, they were controlled in the Shiribetsu National Hatchery in Hokkaido, and after being eyed, selected and inspected they were transferred to the Chitose National Hatchery and finally 200,000 eggs were shipped from Chitose Airport (Unit temperature was 329.1° C. U.T.). These eggs reached the Coyhaique Hatchery on Oct. 31 (Table 1). Received eggs were slightly soft and some of them seemed to have begun hatching.

Table 1. Origin, shipment and condition of cherry salmon eggs from Japan to Chile.

Origin	
Date of collection	Sep. 14. 1981
River source	Nakoma River
Hatchery	Shiribetsu
Date of egg eyed	Oct. 19. 1981
Temp. in incubation	7.4 °C
PH	6.8 - 7.0
Treatment	Malachite green 1/200,00 30 min. 2/Week
Egg condition	Slightly soft, not excellent but good
Shipment from Chitose Hatchery	
Date	Oct. 28. 1981.
Treatment	Iodine 1/200 15 min., before packing
Development (eyed stage)	329.1° C.U.T.
Arrival at Coyhaique	
Date	Oct. 31. 1981
Number of egg received	200,000
Temp. in incubation	10.4 °C
Number of dead eggs	1,200 (0.60%)
Egg condition	Somewhat softened
Code	MJ - 81

For the transportation of eggs, the special transportation boxes for salmon eggs were used; the same type of boxes as used in the first transportation (Nagasawa, A. and Aguilera, P. 1974). It took almost 90 hours from Chitose to Coyhaique, Via Frankfulk, but on their arrival at the site, about 60% of ice in the boxes remained. Therefore, it seems that there was no transportation problem.

(2) Incubating and rearing

On arrival the eggs were placed in Atkins type incubator and they hatched 2 weeks later, that is, on Nov. 15, 1981. Because of the high temperature of the water in the summer season, the maturation was accelerated and the sac-fry absorbed the yolk in almost one month. On Dec. 10, 1981, the sac-fry began to emerge and swim (the rate of emerging was 97.2% for hatch out number). For one week from the 14th of December, the feeding training was done carefully in the incubators. After that, fullscale rearing steps were initiated in the outside rearing ponds (Table 2).

Table 2. Cherry salmon breeding in incubation process

Code	MJ - 81
Date of setting	Oct. 31. 1981
Setting egg (A)	200,000
Dead eyed egg	19,000
Date of hatch-out	Nov. 15. 1981
Produced sac-fry (B)	182,000 (90.5% for A)
Date of swim-up	Dec. 10. 1981;
Produced emerged fry (C)	176,000 (97.2% for B)
Fish size	B.W. 0.38g F.L. 3.5 cm, C.F. 8.8
Feeding training	7 days, from Dec. 14. 1981
50th-day observation	Jan. 31. 1982
Survival	103,000
Condition	Abnormal
Fish size	B.W. 076g, FL 4.3 cm C.F. 9.56
100th-day observation	Mar. 31. 1982
Survival	66,000
Condition	Normal
Fish size	B.W. 3.90, F.L. 7.3 cm C.F. 10.0

B.W. = Body Weight F.L. = Folk Lenght C.F. = Condition factor as $B.W. / F.L.^3 \times 1,000$

Table 3 shows the montly record of rearing until November of 1982. All food given during the rearing period came from Japan and the quantity and the types used are shown in the Table 4.

In January of 1982, a kind of disease, seemed columnaris, borke out in fry whose size was of 0.4 g and 3.7 cm. Bathing treatments in medicines such as salt, malachite green, furance didn't produce any effect, and before the end February almost half the initial number of fish was lost (Table 3). For 2 months from the initiation of the feeding it was summer in Coyhaique, and the average temperature of the water of this period was 12 or 13° C, the maximum being 21.8°C and the minimum being 6.0°C. (Fig. 2) The yield, after the disease subsided, was relatively satisfactory. From autumn (April) to winter (August), there was no great increase in weight or fork

Table 3. Monthly record of cherry salmon rearing in 1982, Coyhaique Hatchery, Chile.

Period of feeding	1982											
	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.
Days	18	31	28	31	30	31	30	31	31	30	31	25
Initial No. of fish	176,000	135,000	103,000	59,000	61,000	57,000	57,000	57,000	50,000	43,500	37,000	31,500
B.W. (g)	0.38	0.40	0.76	1.55	3.90	7.16	8.00	8.70	9.10	10.59	17.85	19.40
Total weight (kg)	67	54	78	123	257	437	472	496	461	461	660	601
F.L. (cm)	3.50	3.70	4.30	5.40	7.30	8.72	9.20	9.70	9.80	10.08	11.97	12.60
C.F.	-	7.90	9.56	9.84	10.03	10.80	10.27	9.53	9.67	10.34	10.41	9.70
Number of dead fish	41,000	32,000	24,000	13,000	5,000	5,000	2,000	7,000	6,500	6,500	6,000	500
Mortality	22.3	23.7	23.3	16.5	7.6	3.3	3.4	12.3	13.0	14.9	16.2	1.59
Final No. of fish	135,000	103,000	79,000	66,000	61,000	59,000	57,000	50,000	43,500	37,000	31,500	22,000
B.W. (g)	0.40	0.76	1.55	3.90	7.16	8.00	8.70	9.10	10.59	17.85	19.40	33.9
Total weight (kg)	54	78	123	257	437	472	496	455	461	660	611	1,051
F.L. (cm)	3.70	4.30	5.40	7.30	8.72	9.20	9.70	9.80	10.08	11.97	12.60	14.67
C.F.	7.90	9.56	9.84	10.03	10.80	10.27	9.53	9.67	10.34	10.41	9.70	10.74
Weight gain (kg)	-	24	45	134	180	35	24	-	-	-	-	-
Food amount (kg)	50	55	70	152	181	129	88	89	144	231	548	640
Growth rate	1.05	1.90	2.04	2.52	1.84	1.12	1.09	1.05	1.16	1.41	1.09	1.75
Food conversion	-	2.29	1.56	1.13	1.01	3.69	3.67	-	-	-	-	-
Water temperature (°C)	20.8~6.0	20.5~7.6	19.1~6.0	19.2~4.2	13.3~4.3	1.00~1.8	6.3~0.7	5.8~0.9	8.7~20	12.8~30	18.7~4.3	18.3~5.8

* Including predation by animals or birds

** 9,000 fish of parr type were released into Don Poli Lake in December 9, 1982.

Table 4. Composition of dry diet

Type	Dried mixed feed (made in Japan)	
Pellet size	Starter 0.5 mm – 1.0 mm (for 0.3 g – 0.5 g fish) Grower 1.0 mm – 1.5 mm (for 0.5 g – 1.0 fish)	
Composition	Crude Protein	48.0 – 54.0%
	Crude Lipid	4.0 – 7.0%
	Crude Fiber	0.2 – 1.5%
	Crude Ash	10.0 – 13.0%
	Moisture	7.0 – 10.0%
Material	White fish meal Liver powder Blood powder Yeast Defatted milk (powder) Wheat flour Starch Mixed vitamin Trace elements (Fe, P, Ca)	
Vitamin content (per kg)	A	4,400 IU
	B ₁ (Thiamine)	30 mg
	B ₂ (Riboflavin)	90 mg
	B ₆ (Pyridoxine)	30 mg
	B ₁₂ (Thianocobalamin)	0.05 mg
	C (Cholec aliciferol)	1,000 mg
		1,000 IU
	E (Tocopherol)	180 mg
	H (Biotin)	2.5 mg
	K ₃ (Menadion)	20 mg
	Niacin	450 mg
	Pantothenic acid	200 mg
	Para-amino banzoic acid	200 mg
	Choline	4,000 mg
	Inositol	600 mg
	Folic acid	10 mg

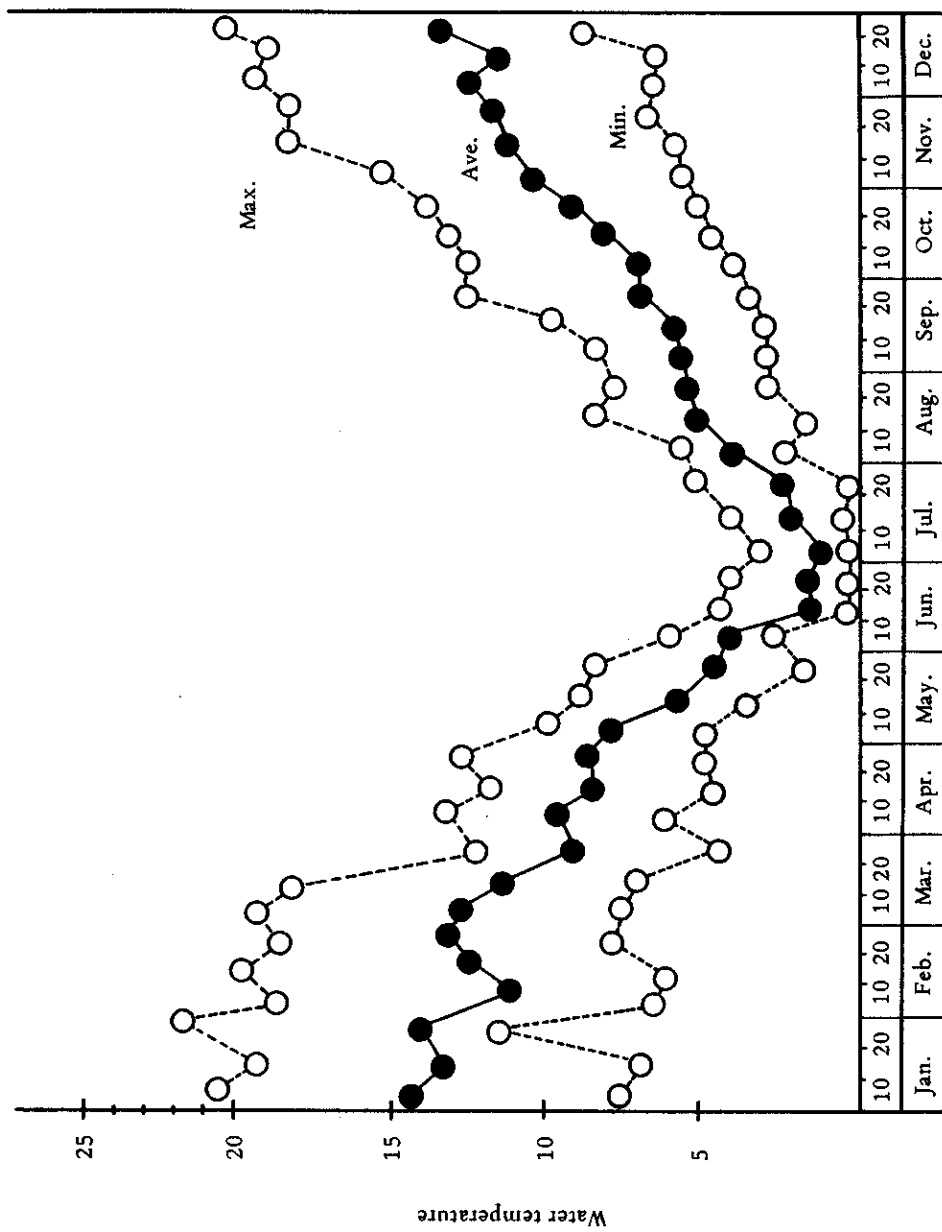


Fig. 2. Minimum, maximum, and average of water temperature every ten days in cherry salmon rearing in 1982, Coyhaique Hatchery, Chile.

length. (Fig. 3) This size coincides with the size of smolt in Japan (Kubo, 1974, 1980). As the size of the fish continued increasing, in October the smolts were divided into two groups according to their size by using "NEILSEN" selector machin made in U.S.A.

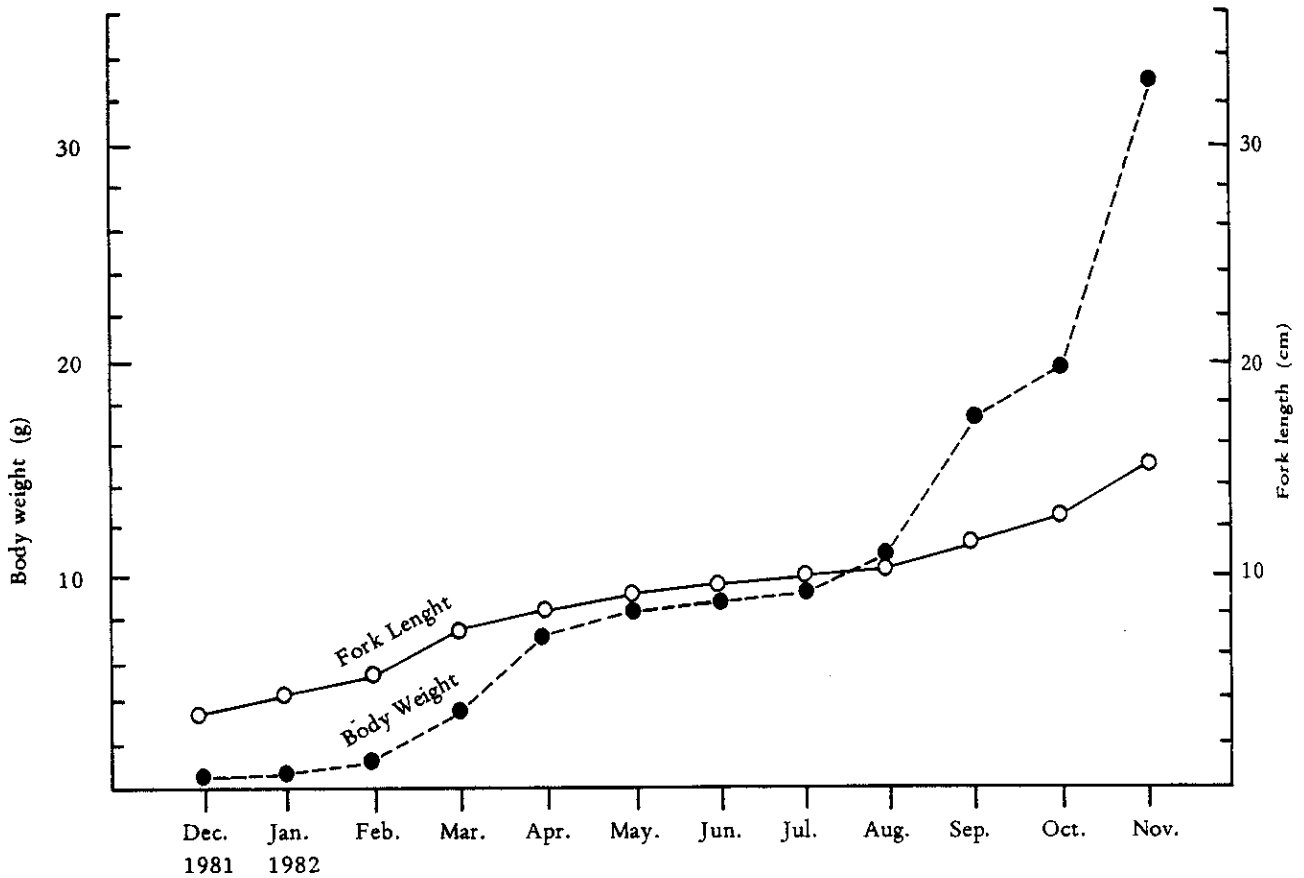


Fig. 3. Monthly growth in average body weight and fork length of juvenile cherry salmon reared at the Coyhaique Hatchery between December 1981 and November 1982; Chile.

The large group was between 12.9 cm and 16.8 cm and the small group was between 10.5 cm and 16.5 cm (Table 5). Later, more fish converted into smolt and gonad development was observed. It was possible to determine the sex with the naked eye. Table 4 shows the percentage of smolts at the time of release, Nov. 26, 1982. The large size group presented a higher percentage of smolts than the small size group, and 63% of that group was female.

Table 5 Average size, condition factor, and percentage of smolts in cherry salmon sampled on October 1982, Coyhaique Chile.

Group	Number of Samples	Fish Size				Percentage	
		Ave, B.W.	(Range) (g)	Ave, F.L. (Range) (cm)	C.F.	Smolt	Parr
Large	100	37.21	(24.8-51.5)	15.2 (12.9-16.8)	10.6	79.0*	21.0
Small	100	25.69	(12.4-46.2)	13.3 (10.5-16.5)	10.9	36.0	64.0

* Including females of 63%

2. Release

(1) General conditions of the river for release

The Coyhaique Hatchery is located near the confluence of the Simpson River and the Claro River. It is 80 km from the mouth of the Aysen River that connected Simpson River. Cherry salmon smolts were released at ST. 2 in the Claro River at a point 100 m away from the confluence (Fig. 4). At the release point, the width of the river is about 15 m and the riverbed is dotted with stones of about 30 cm in diameter, which protrude by the reashing current. The river contains water rapids in this area. Stones in the riverbed don't have much moss accumulation. In the upper stream, 150 m from the release point there is a dam (h=1 m) for hatchery water supply. Therefore it is impossible that released fish go far beyond this area. Besides, 1500 m. upstream there is a 10 m high waterfall. Down stream from the confluence on the Simpson River, ST 1 - ST 6 (except ST 2), is a mid-stream region, where the water is quite deep throughout.

(2) Release conditions.

On Nov. 26, 1982, 22,000 cherry salmon smolts were released into the Claro River from the rearing pond of the Coyhaique Hatchery (Table 6). These smolts were of the large size group selected in October. At the time of release, the average weight was 37.21 g, the average fork length was 15.2 cm (weight range 24.8 - 51.5g, fork length range 12.6 - 16.8 cm, C.F. 10.6) and their health was good. The day was cloudy with some rain. The temperature of the river water was 14.7° C. Of the 9,000 fish in the small group, 64% of them were parr type, therefore, they were transported and released in the Don Poli Lake located 100 km south of Coyhaique to experiment with the establishment of the land locked type. This report does not include any observations of that group in the Don Poli Lake.

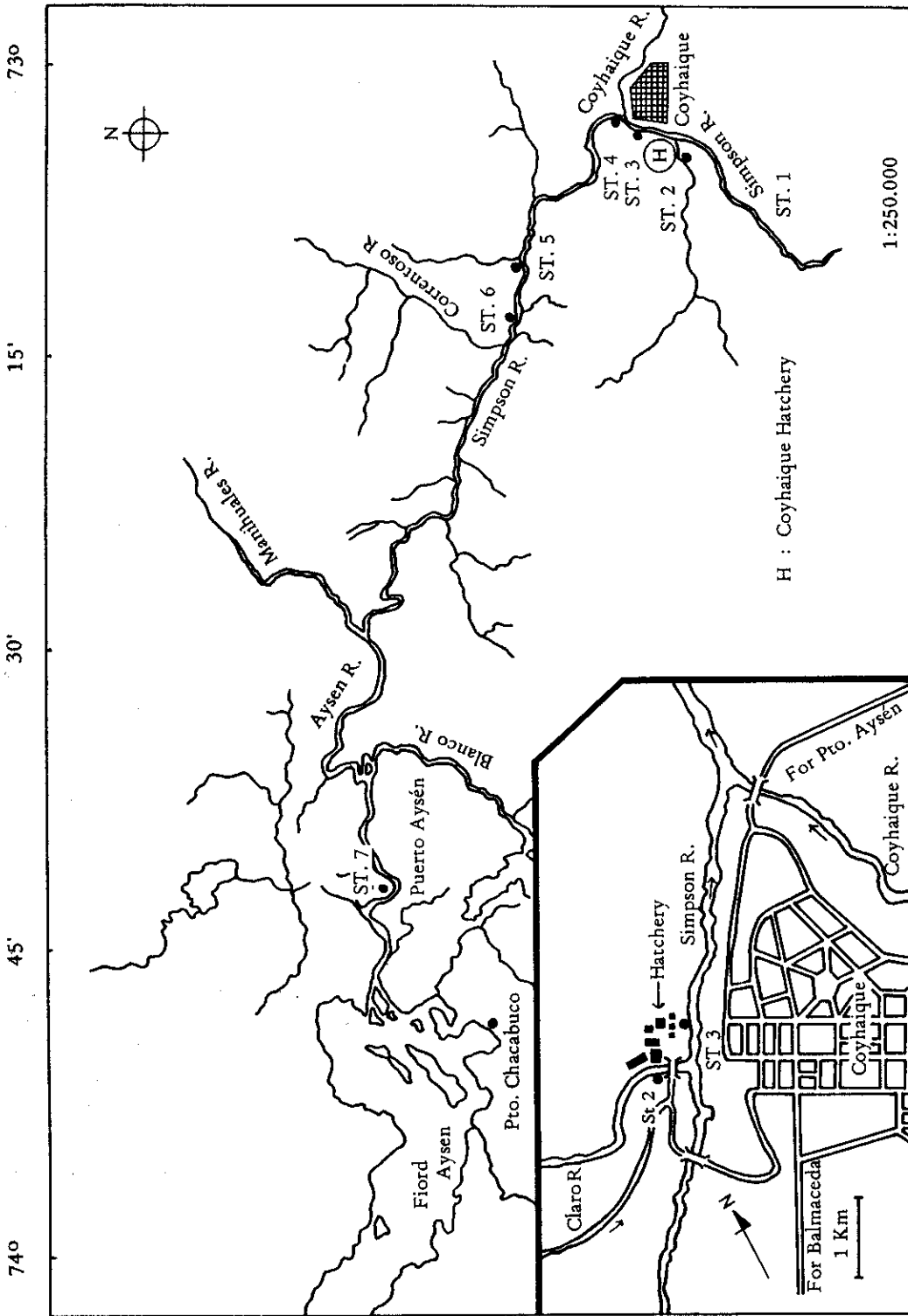


Fig. 4. Map of Simpson River system, Sampling station and the vicinity of Coyhaique Hatchery (inset map).

Table 6. Number and size of cherry salmon released into the Claro River and Don Poli Lake from Coyhaique Hatchery.

Code	Date of release	Number of fish	Size		Place of release
			B.W. (g)	F.L. (cm)	
MJ-81 (A)	Nov. 26. 1982	22,000	37.21	15.2	Claro River to Simpson R.
MJ-81 (B)	Dec. 09. 1982	9,000	25.69	13.3	Don Poli Lake
Total		31,000			

3. Catching of released fish

(1) Sampling in the river

From Nov. 27, 1982 to Dec. 9, 1983, trace survey of liberated cherry salmon by cast-net was realized in seven stations in the Simpson and Claro River (Fig. 2 and 5). At Stations 2 and 3, catching by angling was also attempted. The total number of salmon caught by cast-net was 82 in 11 tries and by angling 12 in 5 tries (Table 7). These fish were caught between Station 1 and 3. There were no fish caught in the down stream between Station 4 and 7. This was because the fish were dispersed widely in the river and they could not be caught effectively. At the end of February the sampling was discontinued for that reason. During the period of capture, except the 27th of Nov. of 1982, the day following the release, one fish of smolt type was caught on Dec. 30, 1982 and another on Aug. 3, 1983. During May and July of 1983 (late autumn and winter) there

Table 7. Number of cherry salmon samples at each station and total number of fishes collected in the sampling

Day	Method	Cherry Salmon Sampling station							Obtained Samples			
		St. 1	St. 2	St. 3	St. 4	St.5	St. 6	St. 7	Cherry salmon	Brown trout	Rainbow trout	Total
1982												
Nov. 27	Casting net	-	-	18	0	0	0	-	18	18	7	43
Dec. 01	Casting net	2	-	-	-	-	-	-	2	30	17	49
13	Casting net	0	0	3	0	0	0	0	3	48	12	63
30	Casting net	1	18	13	0	0	0	0	32	34	14	80
1983												
Feb. 02	Casting net	-	-	-	0	0	0	0	0	21	18	39
03	Casting net	1	9	0	-	-	-	-	10			10
21	Angling	-	1	-	-	-	-	-	1			1
Mar. 01	Angling	-	-	1	-	-	-	-	1			1
02	Angling	-	2	1	-	-	-	-	3			3
Apr. 08	Casting net	-	5	0	-	-	-	-	5	52	60	156
21	Angling net	-	1	-	-	-	-	-	1			1
May. 30	Casting net	-	0	0	-	-	-	-	0			0
Jun. 16	Casting net	-	0	0	-	-	-	-	0			0
Jul. 04	Casting net	-	0	0	-	-	-	-	0			0
Aug. 03	Casting net	-	12	-	-	-	-	-	12	1	9	22
Dec. 09	Angling	-	6	-	-	-	-	-	6			6
Total		4	54	36	0	0	0	0	94	204	137	

was no sign of cherry salmon at Stations 2 and 3, but after August fish were again caught. During the investigation period, 204 brown trouts and 137 rainbow trouts were also caught. It was confirmed that parr fish were remaining and living in the depths (1.5 m) for a long time (more than one year) between Stations 1 and 3, especially in the area of the Hatchery drain at Station 2. It is assumed that the fish stayed there as a result of favorable food conditions because escaped fish, residual food, etc. entered there.

From sampling activities of this time, the following information was obtained.

1) Many samples were obtained between the dam in the Claro River and the confluence, and between the new Simpson Bridge and 1.500 m downstream.

2) The information is based on a limited number of samples. More detailed surveys will be needed.

3) There was no capture in downstream areas in front of Station 4. Therefore, it was impossible to determine the downstream migration time.

4) It is not clear why the cherry salmon disappeared from the area around Station 2 from late autumn to early winter. But, after August fish were again caught in that area. Therefore, it was confirmed that this species passed the winter in the river.

5) In May (autumn) of 1983, the gonad of parr fish were sufficiently developed (Table 8).

6) In the Claro and Simpson Rivers there are brown and rainbow trout. Sometimes, parr fish were caught first when angling. It seems that the resident type parr fish compete strongly with the other two species for habitat and food. The degree of competition for food will become clearer if the stomach contents of cherry salmon are compared on the stomach contents of released fry.

Table 8. Gonad index of male cherry salmon (dark parr) samples at the Station 2 in February and March, 1982.

Date of sampled	Fish weight (g)	Gonad weight (g)	G.I.
Feb. 02. 1982	108.8	16.1	14.9
Mar. 01. 1982	82.5	11.9	14.4
02 1982	146.8	15.0	10.2
02 1982	80.0	13.2	16.5
02 1982	52.5	8.0	15.2

(2) Stomach contents of the Cherry salmon

Of 94 fish captures in the Simpson and Claro Rivers, the stomach contents of 39 (11 to 16 cm FL) were examined. These fish were sampled at random from six collections obtained between November 27, 1982 and April 8, 1983. Aquatic and terrestrial insects and others (mainly Gastropoda) were found in the stomachs of the fish. Aquatic insects consisted of larvae of Diptera, Ephemeroptera, Plectoptera, and Trichoptera.

In the months other than February, the Diptera were the most numerous constituents, occupying 66% or more (Fig. 5). The terrestrial insects increased in percentage from December to February, and in February became most important as food, followed by the Diptera and Trichoptera. The Ephemeroptera were regarded as one of the important foods in March. In comparison with the aquatic insect fauna of the Simpson River (Aguirrebeña, 1983), the stomach contents of cherry salmon were similar in numeral composition to drifting animals rather than to the benthic fauna. This suggests that the cherry salmon eats mainly drifting foods in the rivers.

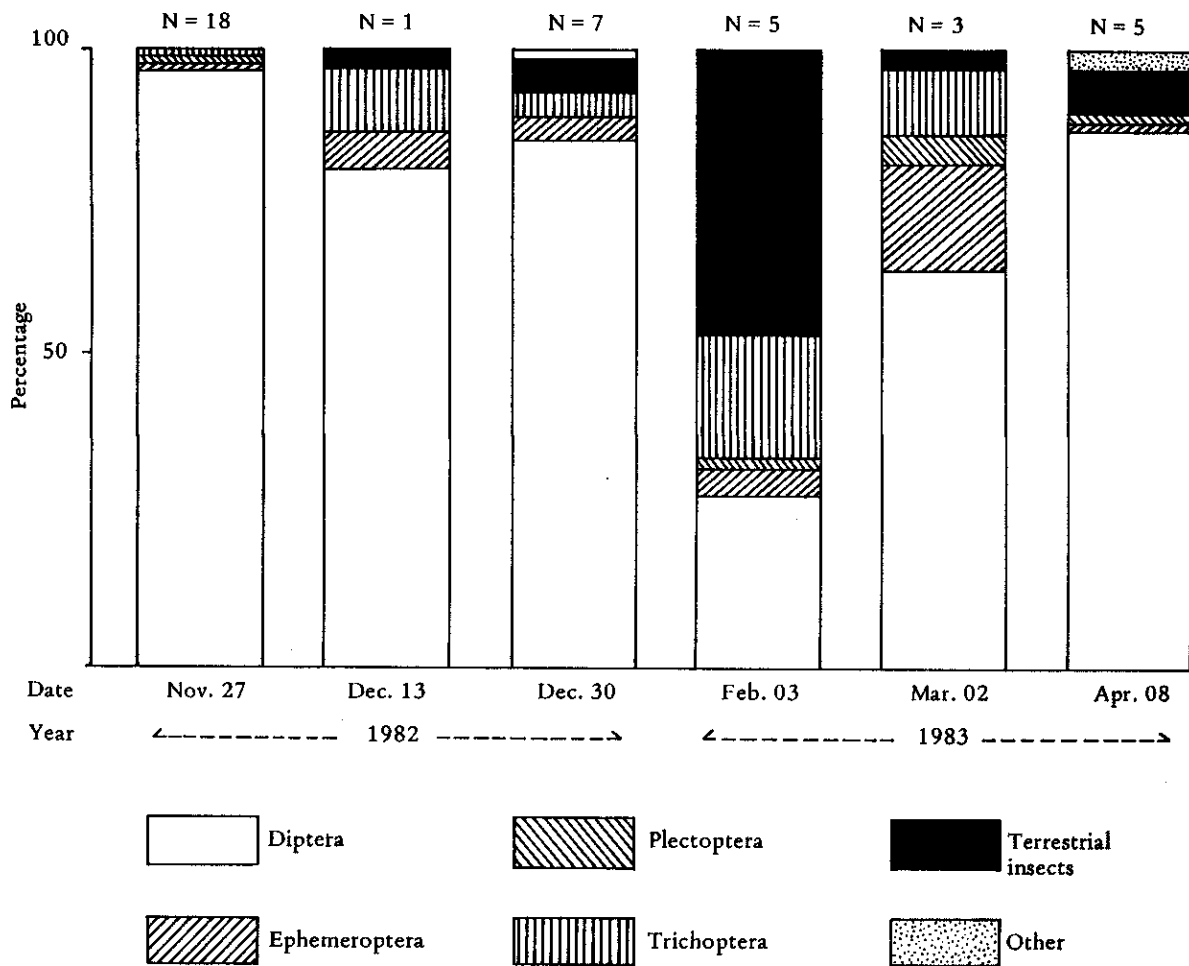


Fig. 5. Numerical composition of stomach contents of cherry salmon recaptured in the Simpson and Claro Rivers between November 1982 and April 1983. N, number of Samples.

(3) Growth.

Figure 6 shows the growth of resident type parr fish. The size range was relatively small for the first month after the release. But from summer to autumn (January to April) the size range widened rapidly and differences from one fish to another became remarkable. Among the large size fish recaptured during 1983, some fish had highly developed gonad. This phenomenon was more pronounced from February to May. They were considered to be mature fish in the autumn of the same year. The gonad index of these fish (G.I) was between 10.2 and 16.5. During the sampling with angling in December of 1983, 5 fish of the large size were caught. The average weight was 195 g, the average fork length was 24.1 cm and the C.F. was 13.9.

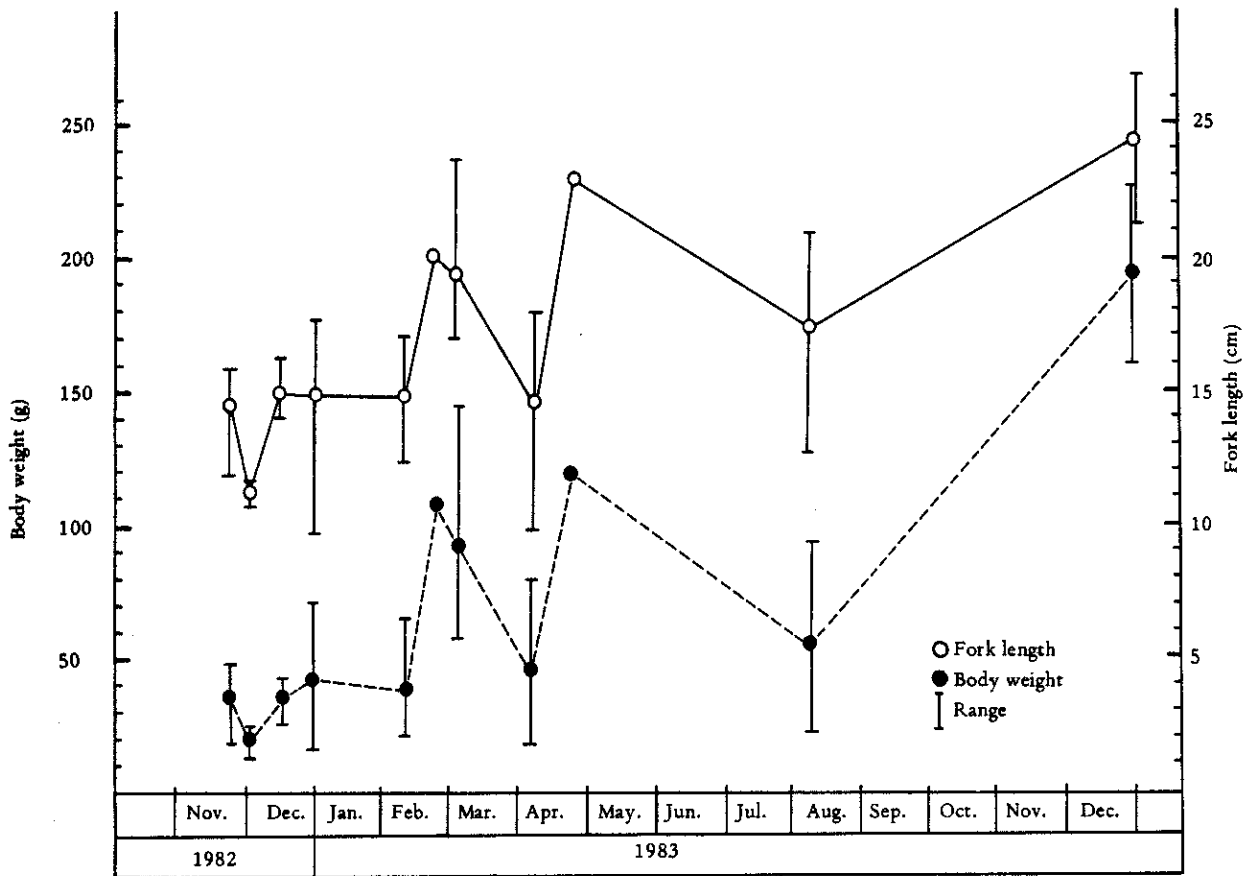


Fig. 6 Growth in average body weight and fork length of cherry salmon samples in the Claro and Simpson Rivers during Nov. 1982 and Dec. 1983.

4. Adults fish catching

(1) Catching of adult fish in the river

In addition to the present survey, attempts to catch returned fish in the Simpson River and some tributaries were carried out from the beginning of April 1984. On April 18, one small adult fish was caught in a gill net installed in the Manihuales River, a branch of the Simpson River System. The following data obtained on the fish.

Catching data of Homing Cherry salmon spawner

1. Place of catch
Manihuales River, 50m up stream from the confluence with Simpson River, 30 km approx. from mouth of Aysen River, 45 km downstream from Coyhaique Hatchery.
2. Catching method
Gill-net, Nylon, 120 mm mesh, 15 m long, 3 m depth.
3. Date of catch
April. 18, 1984, AM 11:00, brightly
4. Sampler
Sr. Gustavo Araya G.
Manager of Coyhaique Hatchery.
5. Netting condition
The fish was already dead when the collector found it. It seemed to have been netted at night or early in the morning.

Female brown trout of 2.7 kg was caught together.
Brown trout was netted on upper side, cherry salmon near the bottom.

(2) Morphological characteristics

The fish was a perfect mature male. It had a long and somehow hooked snout. The body was generally black with pink colored vertical stripes. The fins were also black. The anal fin and of the caudal were pinkish and of the caudal was white. The meat color was reddish pink. The gonard was completely mature and its weight was 4.9% of the body weight. Table 9 shows the morphological characteristics. For comparison, Table 9 also shows the data of the sea-run immature cherry salmon, caught in the Costa Channel (45°34' W) in the fiord on July 7, 1984 and two dark parr fish. Compared with a parr fish, the sea-run cherry salmon showed low figures in body width and dorsal fin height with respect to body length. It is not clear whether these were morphological differences between the types of cherry salmon, because the sampling number was small. The morphological characteristics of these four samples agree with those of cherry salmon in Japan, except that the number of ventral fin rays is small (Hikita, 1962). Generally parr fish fork length is less than 30 cm (Matsubara, Ochiai, 1977). Therefore, it is considered that the caught adult cherry salmon went through the ocean life period.

(3) Age.

Two annual rings (winter bands) formed during the fresh water life were observed in the scales of the returned fish (pl II). The first year winter band was found near the 15th ring between the first and second winter bands the intervals of annual rings were narrow and after the second winter band to edge widened. Therefore, it is considered that the fish stayed one year, through the second winter (August), in the river and then migrated to the sea. Therefore, the age was determined to be 2+, three years old fish (group of 1981, Code MJ - 81). Table 10 shows the scale data of other samples.

Table 9. Comparison of morphological characters of homing adult, sea-run immature and dark parr cherry salmon.

Phase	Sea resident		Stream resident	
	Mañihuales River	Costa Channel	Claro River	Claro River
	Apr. 18, 1984	Jul. 7, 1984	Mar. 2, 1983	Dec. 9, 1983
Method	Gill net	Gill net	Angling	Angling
Stage	Ripe (spawner)	Immature	Dark parr	Dark parr
Sex	Male	Female	Male	Male
Fork length (mm)	380	358	229	283
Standard length (SL) (mm)	336	319	205	255
Body weight (g)	630	500	146.8	(No data)
Gonad weight (1. + r.) (g)	19 + 14	1.1 + 0.8	15.0 (total)	(No data)
Stomach contents	Absent	Fish (1)	(No data)	(No data)
As % of SL.:				
Predorsal length	50.6	47.8	46.3	47.8
Preanal length	76.8	74.6	72.2	72.9
Prepectoral length	29.2	23.1	24.6	24.0
Prepelvic length	59.8	56.4	56.1	55.3
Body depth	27.4	26.2	25.4	26.3
Body width	11.3	11.0	12.4	14.9
Head length	29.3	24.5	24.0	25.9
Postorbital length	14.9	13.5	13.8	14.4
Snout length	10.7	6.9	6.8	8.2
Eye diameter	3.4	3.3	4.1	4.2
Upper jaw length	19.1	13.7	13.8	14.9
Interorbital width	8.6	8.5	8.1	8.8
Caudal peduncle depth	7.8	7.6	9.1	8.9
Caudal peduncle length	14.3	16.1	17.8	16.7
Pectoral length	17.0	15.0	17.1	15.2
Pelvic length	13.7	12.2	12.4	12.4
Dorsal base length	15.4	14.0	14.5	13.3
Dorsal fin height	14.9	13.6	15.1	14.7
Anal base length	13.1	11.3	13.3	12.7
Anal fin height	12.1	10.2	12.2	12.5
Dorsal fin rays	iii + 12	iii + 14	iii + 13	iii + 12
Anal fin rays	ii + 12	iii + 13	iii + 14	iii + 12
Pectoral fin rays	13	13	13	13
Pelvic fin rays	9	9	8	8
Lateral line scales	126	124	129	128
Gill rakers	7 + 11	7 + 11	7 + 11	6 + 12
Branchiostegal rays	12	13	13	12
Pyloric caeca	46	46	(No data)	(No data)

Table 10. Comparison on the scales of the cherry salmon from sea and stream residents

Phase	Sea resident		Stream resident	
	Ripe	Immature	Dark parr	Dark parr
Standard length (mm)	336	319	205	255
No. of scale samples	2	3	5	5
Age	2 +	1 +	1 +	2 +
Radius (mm)				
1st year	0.47	0.64	0.56	0.45
2nd year	0.92	(1.51)	(1.18)	0.178
3rd year	(1.46)			(1.20)
Annual increment (mm)				
1st year	0.47	0.64	0.56	0.45
2nd year	0.45	(0.87)	(0.65)	0.33
3rd year	(0.55)			(0.42)
No. of circuli				
1st year	17.5	19.7	15.8	15.8
2nd year	15.5	(21.7)	(15.6)	14.0
3rd year	(14.5)			(11.8)
Interspace of circuli (mm)				
1st year	0.027	0.032	0.035	0.028
2nd year	0.029	(0.040)	(0.042)	0.024
3rd year	(0.038)			(0.036)

IV. SUMMARY

(1) 200,000 cherry salmon eggs, collected in Hokkaido on September 14, 1981, were placed in the Coyhaique Hatchery on October 31, 1981 and there they were incubated and reared.

(2) After the rearing period of 11 months, 31,000 cherry salmon juveniles were finally bred. 22,000 juveniles were released in the Claro River, on November 26, 1982.

(3) From November 1982 to December 1983, a trace survey of liberated juveniles by gill-net and angling was carried out in the rivers.

(4) It was confirmed that cherry salmon juveniles released in November were dispersed between the area of the Hatchery and 1.3 km upstream in the Simpson River.

(5) It was also confirmed that the cherry salmon juveniles passed the winter in the Claro River.

(6) The downstream migration period of the smolt could not be confirmed during the investigation because no samples could be obtained in the down stream of the Simpson River.

(7) On April 18, 1984, one adult cherry salmon with a fork length of 38 cm as spawner was caught in the Manihuales River, a branch of the Simpson River system.

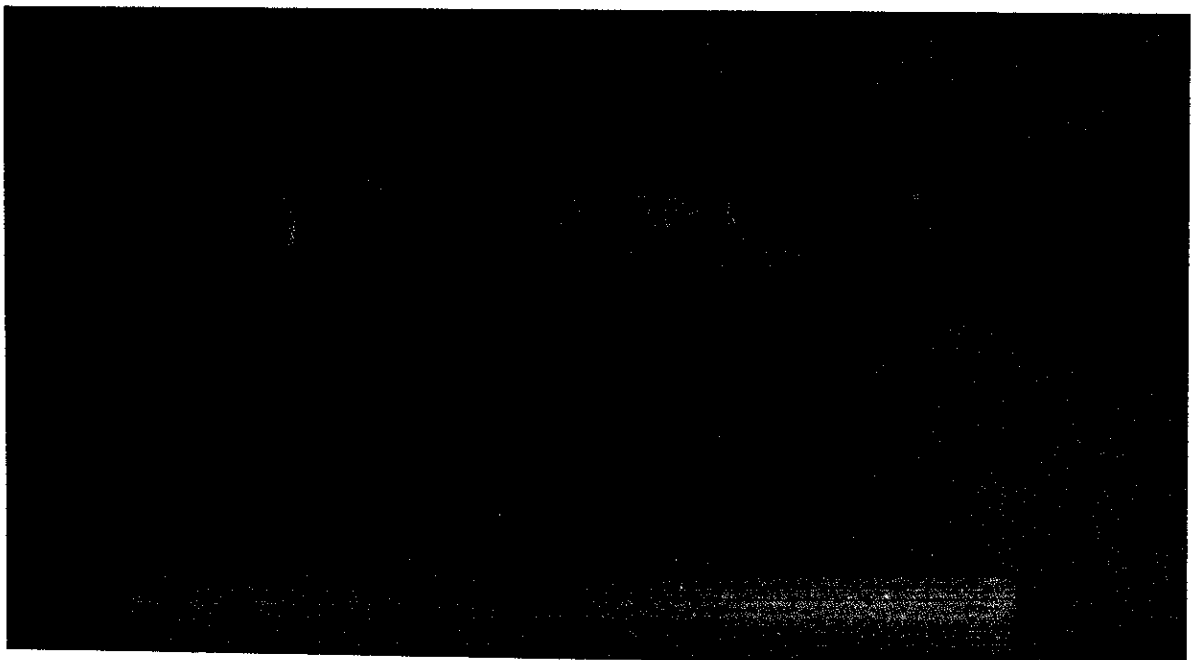
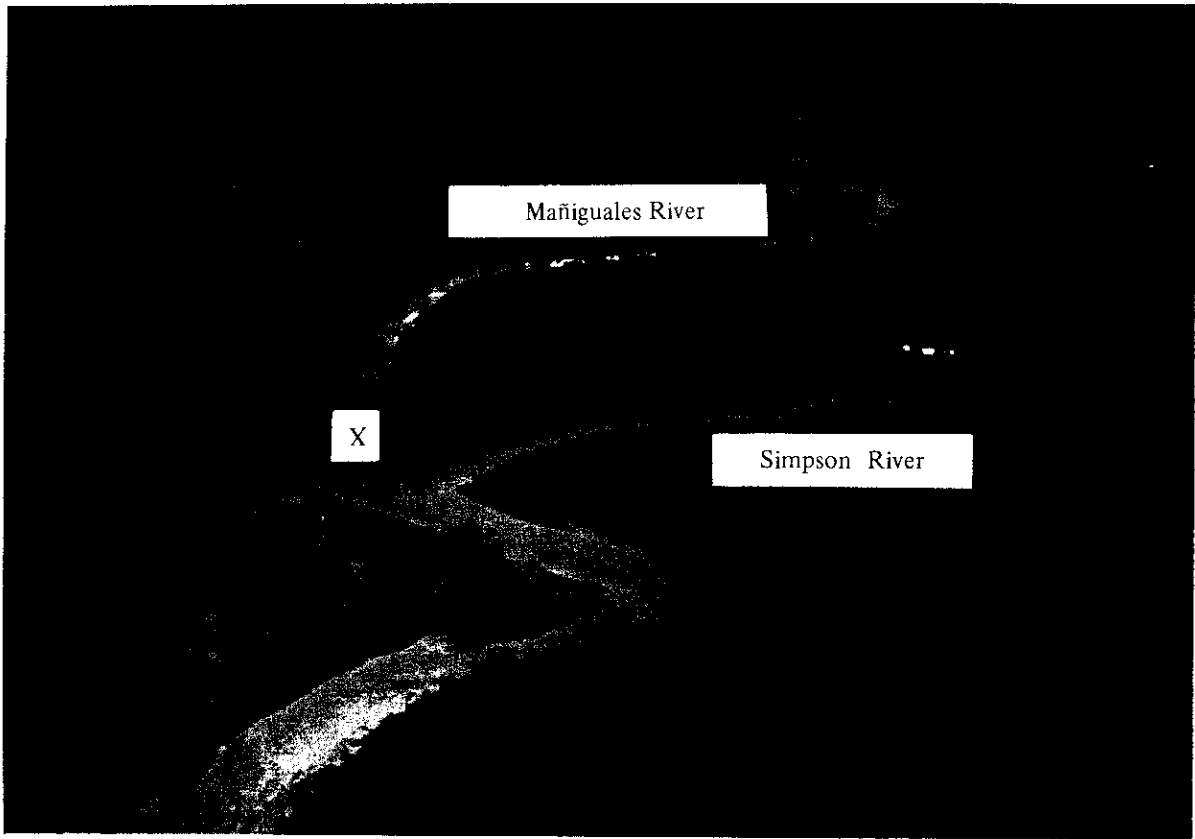
(8) The caught cherry salmon adult was a three year old fish which had returned to the river. It had lived two years in fresh water, and some months spend in the sea. It was determined that the fish was released in November of 1982.

V. ACKNOWLEDGMENT

We express our deep gratitude to Mr. Aliaky Nagasawa, the team leader of the Project who has given us the opportunity to write this report, to Mr. Zama, an expert in the project who accepted the analisis of the returned fish, to Mr. Rodolfo Aguirrebeña, the chief of the investigation in the Coyhaique Hatchery who cooperated with us in analyzing stomach contents, to Mr. Akio Nakazawa, the Project coordinator who offered us samples by angling and advice.

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A. Collecting point (cross mark) of a homing cherry adult on April 18, 1984.

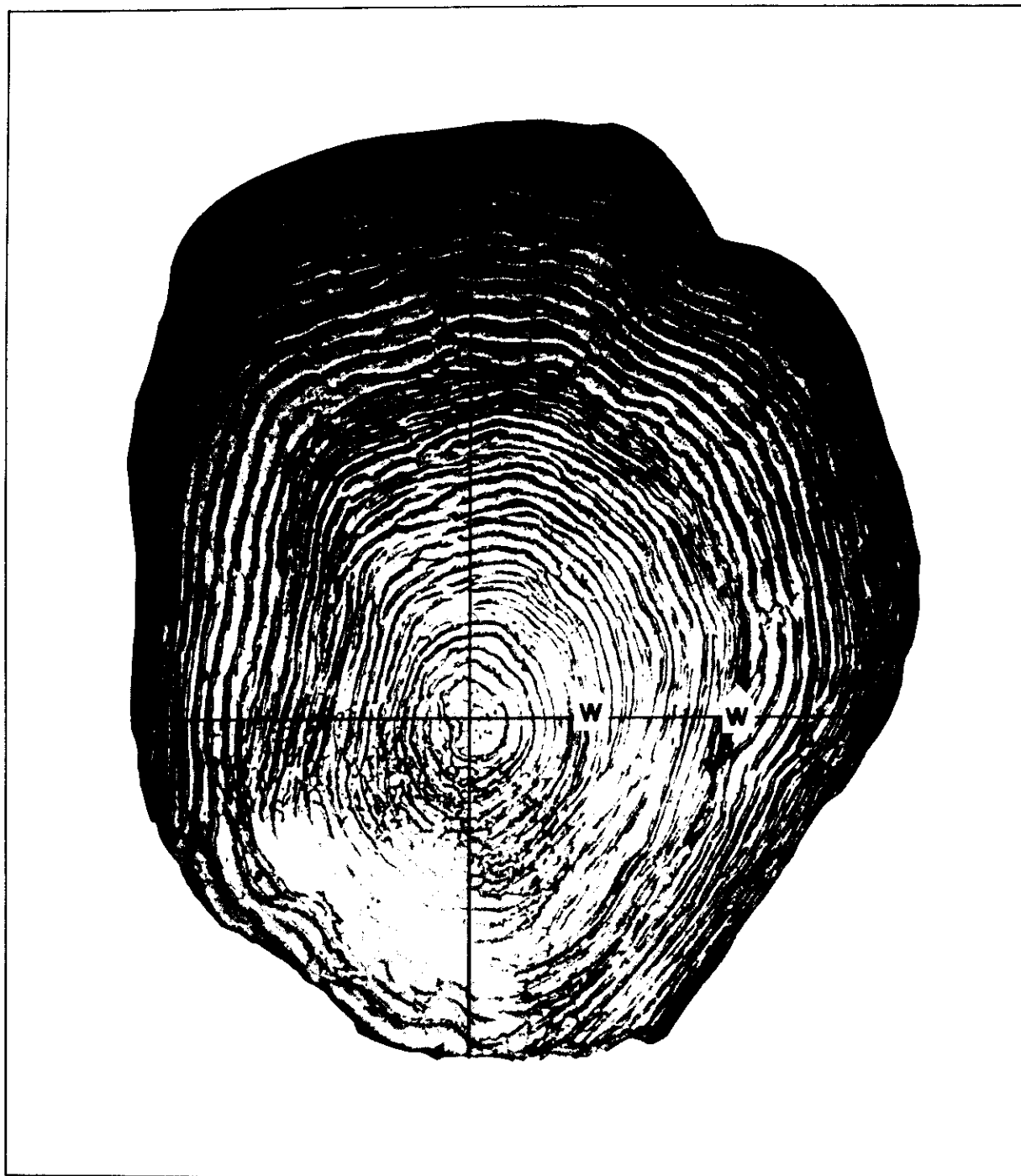
B. A cherry salmon spawner.

Oncorhynchus masou, Cherry Salmon. MJ-81

Catch: Rio Mañiguales. Aysen, Chile. 18 Apr. 1984

Fish size: BW 0.63 kg. TL 39.7 cm. FL 38.0 cm. ♂ matured

Release: 26 Nov. 1982. Smolt Stag, Coyhaique Hatchery, Aysen, Chile.



Scale of homing cherry salmon caught in 18 April 1984.

W: Winter band

Cherry salmon (*O. masou*) MJ-81

Catch: 18 April 1984, Rio Mañiguales, Aysén - Chile.

Fish size: BW 0.63 kg, TL 39.7 cm, FL 38.0 cm.

Egg origin: Shiribetsu R. Hokkaido, JAPAN, 14 Sept. 1981

Release: 26 Nov. 1982, Coyhaique Hatchery into Rio Simpson, Aysén, Chile.

Appendix Table 1. Size, sex and stage of cherry salmon samples in the Rivers and cost. November 1982 and July 1984.

Sm, smolt; Pr, parr; Dp, dark parr; Ad. adult. Sp. Spawner
 GW, gonad weight.

Date	Sampling Station	Size		Sex	Stage
		B.W. (g)	F.L. (cm)		
Nov. 27. 1982	St. 3	33.5	14.2	F.	Sm
		44.0	15.5	F.	Sm
		37.6	15.0	F.	Sm
		40.4	15.2	F.	Sm
		37.9	14.8	F.	Sm
		45.1	15.8	M.	Sm
		26.8	14.7	F.	Sm
		42.0	15.5	M.	Sm
		28.8	13.5	M.	Sm
		18.6	12.6	F.	Sm
		25.9	12.9	M.	Sm
		28.3	13.6	F.	Sm
		32.4	14.0	M.	Sm
		24.6	12.9	F.	Sm
		33.3	14.4	M.	Sm
		30.0	13.2	M.	Pr
		28.8	12.7	M.	Pr
		47.6	15.7	M.	Pr
Dec. 01. 1982	St. 1	15.7	10.7	M.	Pr
		20.4	11.6	M.	Pr
Dec. 13. 1982	St. 3	29.5	14.1	M.	Pr
		28.6	14.6	M.	Pr
		42.5	16.4	M.	Pr
Dec. 30. 1982	St. 1	28.8	12.6	M.	Pr
Dec. 30, 1982	St. 2	49.4	15.8	M.	Pr
		37.0	14.5	M.	Pr
		44.4	15.3	M.	Pr
		28.7	12.9	M.	Pr
		57.4	15.7	M.	Pr
		70.0	17.4	M.	Pr
		57.4	16.3	M.	Pr
		38.2	16.2	M.	Pr
		55.8	16.5	M.	Pr
		56.4	16.6	M.	Pr
		46.7	16.0	M.	Pr
		55.8	16.5	M.	Pr
		36.5	14.3	M.	Pr
		53.9	15.6	M.	Pr
		52.2	15.8	M.	Pr
34.8	14.1	M.	Pr		
13.3	9.6	M.	Pr		
16.5	10.5	M.	Pr		

(continued)

Appendix Table 1

Date	Station	Size		Sex	stage
		B.W. (g)	F.L. (cm)		
Dec. 09. 1983	St. 2	225.0	26.5	M.	Dp (GW 2.5 g)
		210.0	24.0	M.	Dp
		170.0	25.0	M.	Dp
		210.0	21.0	M.	Dp
		160.0	24.0	M.	Dp
Apr. 18. 1984	Mañihuales River	630.0	380.0	M.	Sp (GN 33.0 g)
Jul. 07. 1984	Canal Costa	500.0	358.0	F.	Ad (GW 1.9 g)

Appendix Table 2. Number and size of brown and rainbow trout collected at each station in the Claro and Simpson River between November 1982 and August 1983.

Date	Sampling Station	Brown trout			Rainbow trout		
		No. of sampled	B.W. (g)	F.L. (cm)	No. of sampled	B.W. (g)	F.L. (cm)
Nov. 27. 1982		18	— No data —	—	7	— No data —	—
Dec. 01. 1982	1	30	10.1 - 38.3	9.5 - 14.5	17	7.8 - 48.9	8.5 - 17.0
Dec. 13. 1982	1	3	14.8 - 25.1	11.3 - 13.6	2	14.8 - 19.8	11.0 - 12.1
	3	3	23.2 - 48.0	12.7 - 15.8	0		
	4	6	16.3 - 140.0	11.3 - 24.3	2	17.1 - 25.5	11.5 - 12.8
	5	10	8.3 - 28.8	8.7 - 13.5	1	17.5	11.5
	6	26	12.7 - 39.5	10.2 - 14.5	7	19.0 - 60.0	11.5 - 17.0
	Dec. 30. 1982	1	4	18.9 - 30.7	11.3 - 13.0	4	17.4 - 24.4
	2	2	28.3 - 34.8	13.0 - 14.8	2	50.8 - 70.0	16.0 - 18.0
	3	7	14.9 - 35.3	10.6 - 14.1	2	29.1 - 34.3	13.8 - 14.0
	4	10	22.6 - 38.4	11.5 - 14.2	2	32.4 - 41.7	13.5 - 14.5
	5	3	31.3 - 49.8	13.0 - 15.5	1	14.8	10.0
Feb. 02. 1983	4,5,6	21	— No data —	—	18	— No data —	—
Apr. 08. 1983	2,3	52	— No data —	—	60	— No data —	—
Aug. 03. 1983	2	1	70.0	20.1	9	19.8 - 95.0	12.0 - 21.0

Appendix Table 1.

Date	Station	Size		Sex	Stage		
		B.W. (g)	F.L. (cm)				
Dec. 30 1982	St. 3	48.5	16.5	F.	Sm		
		52.8	16.6	M.	Pr		
		28.9	13.3	M.	Pr		
		31.2	14.8	M.	Pr		
		31.0	13.5	M.	Pr		
		41.6	16.0	M.	Pr		
		41.9	15.0	M.	Pr		
		41.7	15.3	M.	Pr		
		41.5	15.5	M.	Pr		
		27.2	13.6	M.	Pr		
		26.2	12.8	M.	Pr		
		40.3	15.3	M.	Pr		
		39.0	15.2	M.	Pr		
		Feb. 03. 1983	St. 1	59.0	16.5	M.	Pr
			St. 2	63.0	17.0	M.	Pr
	26.5		13.0	M.	Pr		
	38.5		15.5	M.	Pr		
	21.6		12.5	M.	Pr		
	42.8		15.8	M.	Pr		
	37.5		15.0	M.	Pr		
	28.7		14.5	M.	Pr		
	26.8		13.6	M.	Pr		
	29.0		13.5	M.	Pr		
Feb. 21. 1983	St. 2	108.0	20.0	M.	Dp (GW 16.1g)		
Mar. 01. 1983	St. 3	82.5	18.0	M.	Dp (GW 11.9g)		
Mar. 02. 1983	St. 2	146.8	23.3	M.	Dp (GW 15.0g)		
		80.0	18.4	M.	Dp (GW 13.2g)		
	St. 3	52.2	16.8	M.	Dp (GW 8.0g)		
Apr. 08. 1983	St. 2	79.6	17.6	M.	Dp		
		60.8	17.0	M.	Dp		
		39.7	14.8	M.	Dp		
		33.5	13.9	F.	Dp		
		13.3	9.7	M.	Dp		
Apr. 21. 1983	St. 2	120.0	23.0	M.	Dp		
Ago. 03. 1983	St. 2	44.7	16.5	M.	Dp		
		86.5	20.5	M.	Dp		
		62.3	18.5	F.	Sm.		
		72.0	19.5	M.	Dp		
		56.4	18.0	M.	Dp		
		56.0	17.8	M.	Dp		
		56.5	17.2	M.	Dp		
		45.5	16.4	M.	Dp		
		49.0	17.0	M.	Dp		
		62.2	18.5	M.	Dp		
		35.7	15.6	M.	Dp		
		21.8	12.8	M.	Dp		

(continued)

Appendix Figure

