INTRODUCTION INTO AYSEN CHILE OF PACIFIC SALMON

No. 5

Seasonal Occurrence of Fishes Collected in Ensenada Baja, Southern Chile, with Notes of Stomach Contents, Sex Ratio and Maturity

By

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and

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Dedicated to my wife and my first baby doughter born in Pto. Aysén Chile. (A.Z.)

Dedicado a mi familia y mis amigos. (E.C.G.)

Seasonal Occurrence of Fishes Collected in Ensenada Baja, Southern Chile, with Notes of Stomach Contents, Sex Ratio and Maturity.

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ABSTRACT

In 1980 and 1981 seasonal ichthyological studies were carried out in Ensenada Baja, near Pto. Chacabuco, southern Chile. Surface gill nets were used. A total of 1,330 fishes consisting of the following nine species were collected: *Oncrohynchus keta* (Walbaum), *Salmo trutta* Linnaeus, *Macruronus magellanicus* Lönnberg, *Merluccius australis* (Hutton), *M. gayi* (Guichenot), *Odontesthes smitti* (Lahille), *Trachurus murphyi* Nichols, *Eleginops maclovinus* (Valenciennes) and *Stromateus stellatus* Cuvier. Of these species, *S. trutta*, *O. smitti* and *E. maclovinus* seem to occur year-round in Ensenada Baja. Except for *O. keta* which are released artificially, other species enter the bay in periods of high salinity. Twenty-four kinds of food organisms were found in the stomachs of the fish collected. Of them, Polychaeta, Pisces and Gammaridea were the most common. There were as many or more females than males in all species except for *S. stellatus*. Other than *O. smitti* in which there were ripe eggs in October, the ovaries of the species observed were either immature or semi-mature. The present paper extends the ranges of *Engraulis ringens* Jenyns and *Normanichthys crockeri* Clark (which were both found in fish stomach) as far south as Pto. Chacabuco.

INTRODUCTION

Ensenada Baja (45° 27' S and 72° 49' W) is a small inlet, which is connected with a narrow channel to Aisén Fiord, is located at the innermost part of fiord where there is a strong influence from freshwater flowing from the Aisén (Simpson) River and other streams (Fig. 1). This bay has a muddy bottom, a depth of 4 to 8 m at the center part. Juveniles of chum salmon *Oncorhynchus keta* (the eggs of which were transported from Japan) have been reared in ponds and cages set in Ensenada Baja since 1979. They have been released into the bay each year thereafter.

Although some fishes do occur naturally in the bay, little has been known of their biology until now. In order to assess the food intake, growth and survival of the realeased salmon juveniles, it was necessary to determine what other fishes can be found in the bay, the predation rate of carnivorous fishes on the salmon juveniles, and the extent of competition for food between them and the other fishes. In this paper we dealt with the seasonal occurrence, stomach contents, sex ratio and maturity of the fishes collected in Ensenada Baja from October 1980 to October 1981.

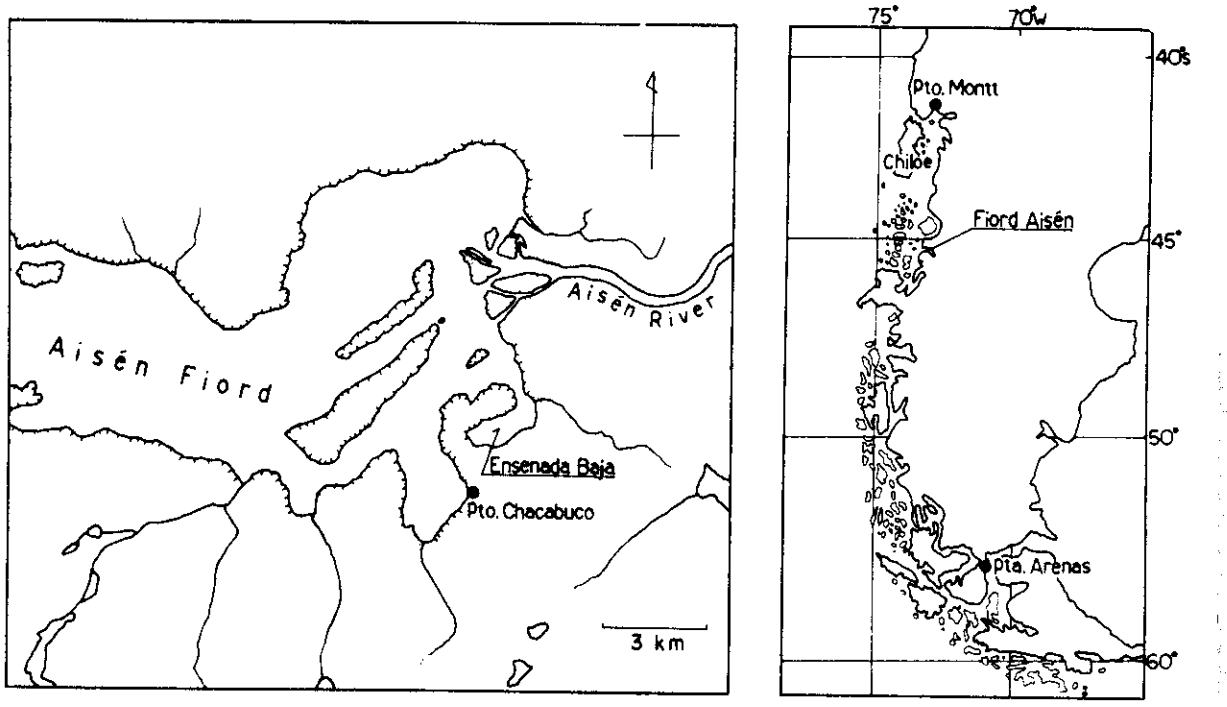

Fig. 1. Southern South America (right) and the inner part of Aisén Fiord (left).

MATERIALS AND METHODS

Fishes were collected in Ensenada Baja in seven periods of 3 to 15 days each between October 1980 and October 1981 (Table 1). Five surface gill nets were set all at once in the bay at depths of 5 to 8 m for each period. Three kinds of net were used: One net, 6.5 m high x 50 m long of 60 mm stretched mesh; two nets, 2.0 m x 30 m of 120 mm mesh; two nets, 2.0 m x 30 m of 135 mm mesh. The gill nets were checked once every day during each survey. The total length, standard length, body weight and ovary weight of the fish netted were measured under fresh condition. Stomach contents were examined except for a small number of fishes of *Odontesthes smitti* and *Stromateus stellatus*. A first straight portion of the digestive tract of *O. smitti* was regarded as a stomach because there is no clear distinction between the stomach and the intestine. The esophageal sac of *S. stellatus* was also checked for contents. No attempt was made to make identifications of the food organisms to species level except in the case of the fish. The gonads of all the fishes collected were inspected to determine sex and maturity. Only ovaries were weighed for all samples except for the females which were included in a small number of the fishes of the two species mentioned above. The gonad index (GI) for the ovaries was calculated with the following formula:

$$GI = \frac{\text{Ovary weight (g)}}{\text{Body weight (g)}} \times 100$$

Near the place where the gill nets were set, water temperature at the surface was taken most every day between 9:00 and 12:00. Salinity was observed monthly at the surface and at 5 m. A salinometer was used for this purpose between April and September 1981, and a specific gravimeter in the other months. For the values obtained by the latter instrument, there is a probable error of ± 1.0‰.

For the description of *O. smitti* given at the end of this text, the specimens obtained from the Ensenada Baja apart from this study were also examined.

RESULTS

Catch and species composition

A total of 1,330 fishes were collected in Ensenada Baja during the investigation. The fishes collected were composed of nine species, representing six families: *Oncorhynchus keta* (Walbaum) (Salmonidae), *Salmo trutta* Linnaeus (Salmonidae), *Macruronus magellanicus* Lönnberg (Merlucciidae), *Merluccius australis* (Hutton) (Merlucciidae), *M. gayi* (Guichenot) (Merlucciidae), *Odontesthes smitti* (Lahille) (Atherinidae), *Trachurus murphyi* Nichols (Carangidae), *Eleginops maclovinus* (Valenciennes) (Nototheniidae) and *Stromateus stellatus* Cuvier (Stromateidae) (See Pl. I as to each species). Of these species, *O. smitti* were the most numerous at 496 (37.2% of the total), followed by *S. stellatus* with 346 (26.0%) and *E. maclovinus* with 217 (16.3%) (Table 1). In the hakes, *M. australis* had a larger standard length of 643 and 670 mm, while *M. gayi* was composed of small fish ranging from 220 to 350 mm in standard length. The chum salmon *O. keta* were not from a natural population, but had been released each month from rearing cages in the bay.

The daily mean catch and total number of species found are shown in Fig. 2 for each month surveyed *(O. keta* is excluded for the reasons mentioned above). In January and August, the daily catches and the number of species amounted to fewer than in the other four months, and both showed a similar tendency of increase and decrease with a maximum in April. *S. trutta, O. smitti* and *E. maclovinus* were found in all surveys *(E. maclovinus* in the stomach of *S. trutta* in August). The other five species (omitting *O. keta)* appeared between March and October (Table 1 and Fig. 3). *T. murphyi* specimens were collected only in March and April. Fig. 3 also gives the number composition ratios of *O. smitti* and *S. stellatus,* showing a negative correlation between them. There was a great difference in the daily or monthly catch of the two species. The stromateid fish were grouped into two sizes according to the month in which they were collected: The smaller fish, with standard lengths of 122 to 165 mm, which composed the greatest part of the total, were captured in April, June and October (1981); the larger, with the standard lengths of 220 to 254 mm, were encountered only in August.

In January, the mean temperature of the surface water in Ensenada Baja reached 16.6°C, and then gradually decreased to 5.9°C in July (Fig. 2). Salinity reached their lowest values between November and January. It tended to increase thereafter until September, producing a halocline between the surface and 5 m in depth, although comparatively high fluctuations were seen from month to month (Fig. 2).

Table 1. Number, length, body weight and sex of fishes collected in Ensenada Baja between October of 1980 and October of 1981. The total number of females and males of each species was tested for a difference from a hypothetical sex ratio of 50 percent females by means of Chi-square. An asterish indicates a signficant difference at the 5% probability level.

Species	*Oncorhynchus keta*			*Salmo trutta*			*Macruronus magellanicus*			*Merluccius australis*			*Merluccius gayi*			*Odontesthes smitti*			*Trachurus murphyi*			*Eleginops maclovinus*			*Stromateus stellatus*		
No. of fishes taken	66			137			5			2			14			496			47			217			346		
Total length (mm)	260 ~ 360			230 ~ 582			232 ~ 365			298 ~ 740			255 ~ 346			265 ~ 405			490 ~ 640			212 ~ 320			148 ~ 313		
Standard length (mm)	220 ~ 306			198 ~ 508			217 ~ 344			643 ~ 670			220 ~ 315			230 ~ 356			423 ~ 545			173 ~ 295			122 ~ 254		
Body weight(g)	150 ~ 360			120 ~ 2,200			85 ~ 150			2,000 ~ 3,180			105 ~ 460			140 ~ 440			920 ~ 2,800			120 ~ 350			40 ~ 440		
Date	♀	♂	?	♀	♂	?	♀	♂	?	♀	♂	?	♀	♂	?	♀	♂	?	♀	♂	?	♀	♂	?	♀	♂	?
Oct. 7-20, 1980	–	–	–	19	2	3	1	0	0	–	–	–	1	0	0	5	2	1	–	–	–	19	14	2	–	–	–
Jan. 17-31, 1981	–	–	–	16	8	5	–	–	–	–	–	–	–	–	–	1	1	0	–	–	–	13	12	2	–	–	–
Mar. 9-20, 1981	9	13	0	28	5	8	0	0	1	–	–	–	1	0	0	108	23	4	14	5	3	45	40	21	–	–	–
Apr. 20-29, 1981	1	0	0	15	4	2	2	0	0	–	–	–	7	2	0	12	7	0	9	16	0	10	6	0	96	14	0
Jun. 17-28, 1981	1	2	0	6	2	0	1	0	0	–	–	–	1	1	0	216	110	0	–	–	–	5	14	0	3	6	0
Aug. 1-15, 1981	1	0	0	5	7	0	–	–	–	1	1	0	–	–	–	2	1	0	–	–	–	–	–	–	17	21	0
Oct. 1-3, 1981	15	14	0	1	1	0	–	–	–	–	–	–	1	0	0	2	1	0	–	–	–	9	5	0	36	26	0
TOTAL	37	29	0	90*	29	18	4*	0	1	1	1	0	11*	3	0	346*	145	5	23	21	3	101	91	25	152*	194	0

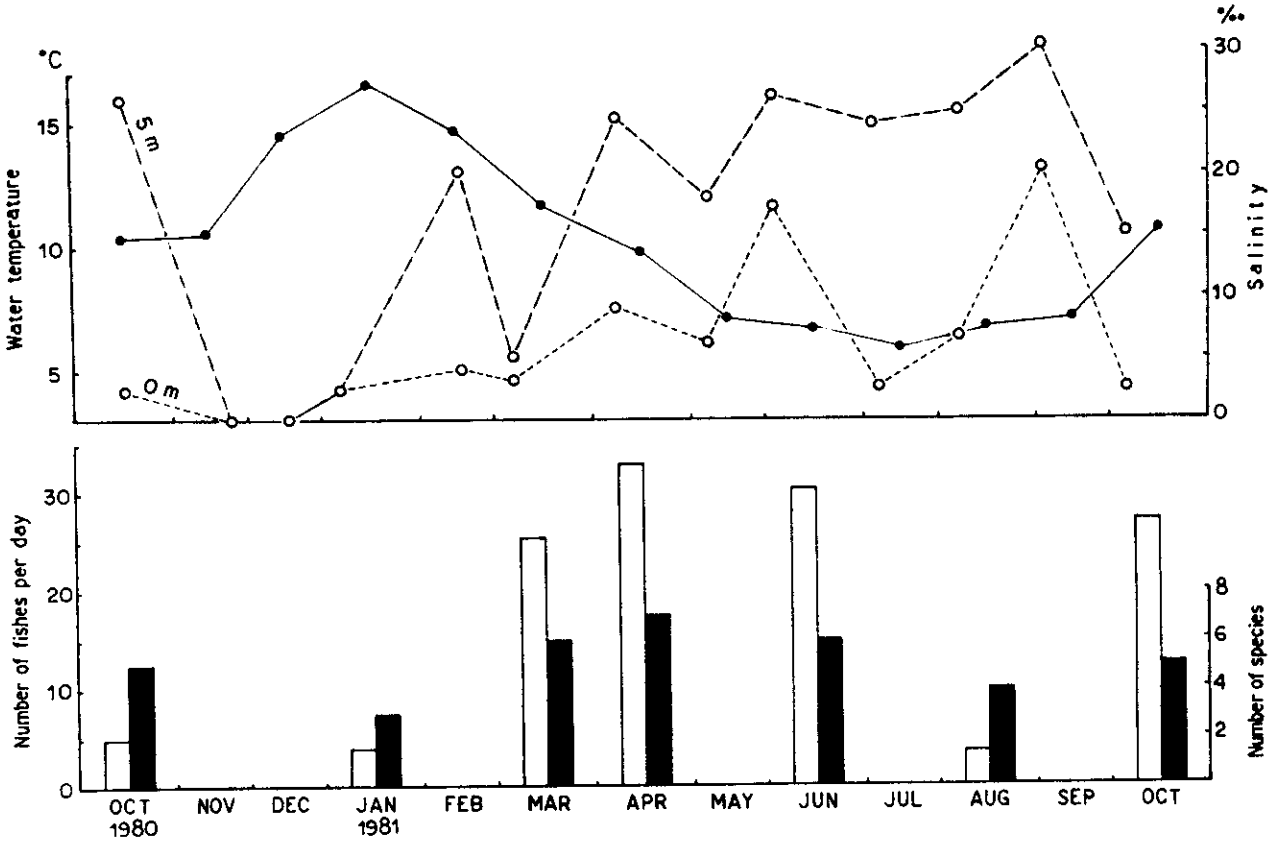

Fig. 2. Daily mean catch (opean bar) and total number of species (dark bar) (excepf for *Oncorhynchus keta)* collected in Esnsenada Baja in each month surveyed (lower figure) Mothly mean water temperatura (solid circle) and salinity (open circle) at the surface and at 5 m depth (upper figure).

The results suggest that *M. magellanicus, M. australis, M. gayi, T. murphyi* and *S. stellatus* can be found in Ensenada Baja from late summer (March) to spring (October) when salinities are higher. In summer (January), only such species are regularly found in the bay as *S. trutta, O. smitti* and *E. maclovinus*, which seem to occur year-round, during a period of low salinity. The lowest abundance of both individuals and species occurs in summer and winter (August). The apparent negative correlation between the abundance of *O. smitti* and *S. stellatus* and the difference of the standard length ranges of *S. stellatus* collected at different seasons need to be investigated farther.

Stomach contents

The stomach contents of the fishes sampled in the present study were classified into 24 food organisms in seven higher taxonomic categories (Table 2). Polychaeta, Pisces and Crustacea (especially Gammaridea) were encountered in almost all of the months surveyed, showing a frequency of occurrence of food organisms more than 60% for each month. From January to April, the food organisms found were comparatively abundant. Sixteen kinds occurred in March, while only four to five were counted in June and August when empty stomachs were more than 90% of these examined. No food organisms except for Pisces were found in August. Therefore,

Tabla 2. Stomach contents of fishes collected in Ensenada Baja, showing frequency of ocurrence percentage of monthly total in parentheses. In some fish the foods eaten were not identifiable due to advanced digestion.

Date	Oct. 7 - 20 1980	Jan. 17 - 31 1981	Mar. 9 - 20 1981	Apr. 20 - 29 1981	Jun. 17 - 28 1981	Aug. 1 - 15 1981	Oct. 1 - 3 1981	TOTAL
No. of fish examined	69	58	328	260	350	56	121	1,242
No. of stomachs: Some preys identified	39	31	80	40	17	5	18	230
No. of stomachs: All preys unidentified	1	1	1	26	3	0	6	38
No. of empty stomachs (% of monthly sample)	29(42.0)	26(44.8)	247(75.3)	194(74.6)	330(94.3)	51(91.1)	97(80.2)	974(78.4)
ALGAE	**5(10.6)**	**5(12.5)**	**13(13.3)**	**3(6.1)**	–	–	**4(14.8)**	**30(10.6)**
POLYCHAETA	**28(59.6)**	**16(40.0)**	**12(12.2)**	**8(16.3)**	**11(64.7)**	–	**8(29.6)**	**83(29.2)**
GASTROPODA	**2(4.3)**	**5(12.5)**	**5(5.1)**	–	–	–	–	**12(4.2)**
BIVALVIA	**2(4.3)**	–	**4(4.1)**	–	–	–	**1(3.7)**	**7(2.5)**
CRUSTACEA TOTAL	**5(10.6)**	**1(2.5)**	**30(30.6)**	**10(20.4)**	**1(5.9)**	–	**7(25.9)**	**54(19.0)**
Calanoida	–	–	–	2(4.1)	–	–	–	2(0.7)
Balanomorpha	–	–	–	1(2.0)	–	–	–	1(0.4)
Gammaridea	4(8.5)	1(2.5)	22(22.4)	6(12.2)	1(5.9)	–	7(25.9)	41(14.4)
Euphausidae	–	–	7(7.1)	–	–	–	–	7(2.5)
Galatheidea	1(2.1)	–	–	–	–	–	–	1(0.4)
Grapsidae	–	–	(1(1.0)	–	–	–	–	1(0.4)
Decapoda zoea	–	–	–	1(2.0)	–	–	–	1(0.4)
INSECTA TOTAL	**2(4.3)**	**4(10.0)**	**1(1.0)**	**4(8.2)**	–	–	**5(18.5)**	**16(5.6)**
Chironomidae larvae	–	–	–	–	–	–	5(18.5)	5(1.8)
Terrestrial insects	2(4.3)	4(10.0)	1(1.0)	4(8.2)	–	–	–	11(3.9)
PISCES TOTAL	**3(6.4)**	**9(22.5)**	**33(33.7)**	**24(49.0)**	**5(29.4)**	**6(100.0)**	**2(7.4)**	**82(28.9)**
Sprattus fuegensis	–	–	–	2(4.1)	–	–	–	2(0.7)
Engraulis ringens	–	–	1(1.0)	–	–	–	–	1(0.4)
Salmo trutta	–	–	–	–	–	1(16.7)	–	1(0.4)
Macruronus magellanicus	–	–	1(1.0)	–	–	–	–	1(0.4)
Odontesthes smitti	–	–	5(5.1)	–	–	2(33.3)	–	7(2.5)
Normanichthys crockeri	–	1(2.5)	3(3.1)	7(14.3)	1(5.9)	–	1(3.7)	12(4.2)
Eleginops maclovinus	–	3(7.5)	3(3.1)	–	2(11.8)	1(16.7)	–	9(3.2)
Notothenia tessellata	–	–	1(1.0)	–	–	–	–	1(0.4)
Stromateus stellatus	–	–	1(1.0)	–	–	–	–	1(0.4)
Fishes unidentified	2(4.3)	4(10.0)	19(19.4)	15(30.6)	2(11.8)	2(33.3)	1(3.7)	45(15.8)
Fish eggs	1(2.1)	1(2.5)	–	–	–	–	–	2(0.7)
Total number of food items	9	9	16	10	5	4	7	24
Total occurrence of foods	47	40	98	49	17	6	27	284

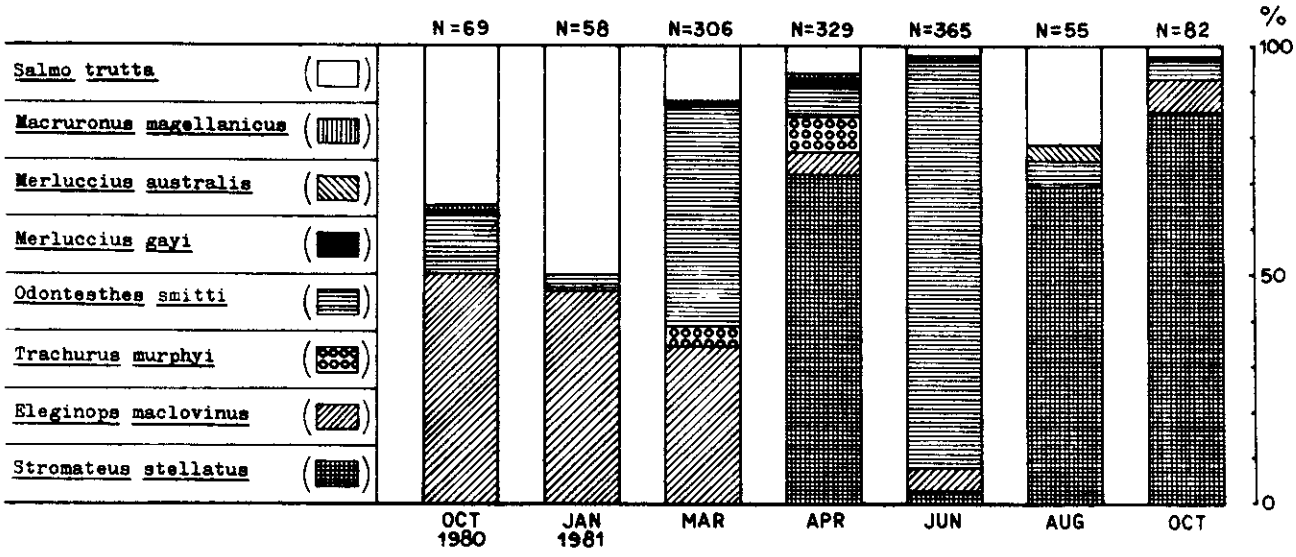

Fig. 3. Number and composition of fishes (excluding *Oncorhynchus keta)* collected in Ensenada Baja.

the small number of species and individuals among the fishes collected in August may be correlated with low water temperature and scanty of food organisms. Planktonic animals such as calanoids, euphausids and decapod larvae, which appeared only in March or April, were likely transported into Ensenada Baja with saline water.

The stomach contents of each species of the fish collected are shown in Table 3. The great variety of the food kind was found in the stomachs of *S. trutta* and *E. maclovinus.* Fish, insects and gastropods seemed to be the most important foods for *S. trutta;* polychaets, algae and gammarids for *E. maclovinus* in Ensenada Baja (Table 3 and Fig. 4). Although there were high ratios (89.4 to 95.8%) of empty stomachs in *O. keta, O. smitti* and *S. stellatus,* principal food is probably plankton. In *S. stellatus,* particularly, the food was probably small organisms (as noted by Oliver in 1943) or animals with soft bodies because almost all of the stomachs in which there were diets contained material in a well-advanced stage of digestion. Analysis of their stomachs indicated that *M. australis, M. gayi* and *T. murphyi* preyed exclusively on fishes.

Sex ratios and maturity

Of the nine species examined, five differed significantly at the 5% probability level from a hypothetical ratio of 50% females and males: There were more females of *S. trutta, M. magellanicus, M. gayi* and *O. smitti* than males; in *S. stellatus* the males were dominant (Table 1). The greater abundance of females was particularly remarkable in *S. trutta* and *O. smitti.*

Tabla 3. Stomach contents of each species found in Ensenada Baja, showing frequency of ocurrence and percentage of total in paretheses.

Species	*Oncorhynchus keta*	*Salmo trutta*	*Macruronus magellanicus*	*Merluccius australis*	*Merluccius gayi*	*Odontesthes smitti*	*Trachurus murphyi*	*Eleginops maclovinus*	*Stromateus stellatus*
No. of sample examined	66	137	5	2	14	478	47	217	276
No. of stomachs: Some preys identified	6	64	2	2	6	13	8	127	1
No. of stomachs: All preys unidentified	1	0	0	0	0	7	0	4	26
No. of empty stomachs (% of total sample)	59(89.4)	73(53.3)	3(60.0)	0	8(57.1)	458(95.8)	39(83.0)	86(39.6)	249(90.2)
ALGAE	–	–	–	–	–	**2(13.3)**	–	**28(17.2)**	–
POLYCHAETA	–	**2(2.7)**	–	–	–	–	–	**81(49.7)**	–
GASTROPODA	–	**2(9.3)**	–	–	–	–	–	**5(3.1)**	–
BIVALVIA	–	–	–	–	–	–	–	**7(4.3)**	–
CRUSTACEA TOTAL	**4(50.0)**	**4(5.3)**	**1(50.0)**	–	–	**10(66.7)**	**1(10.0)**	**33(20.2)**	1(100.0)
Calanoida	–	–	–	–	–	2(13.3)	–	–	–
Balanomorpha	–	–	–	–	–	–	–	1(0.6)	–
Gammaridea	4(50.0)	2(2.7)	1(50.0)	–	–	6(40.0)	1(10.0)	26(16.0)	1(100.0)
Euphausidae	–	1(1.3)	–	–	–	1(6.7)	–	5(3.1)	–
Galatheidea	–	1(1.3)	–	–	–	–	–	–	–
Grapsidae	–	–	–	–	–	–	–	1(0.6)	–
Decapoda zoea	–	–	–	–	–	1(6.7)	–	–	–
INSECTA TOTAL	**4(50.0)**	**10(13.3)**	–	–	–	**1(6.7)**	–	**1(0.6)**	–
Chironomidae larvae	4(50.0)	1(1.3)	–	–	–	–	–	–	–
Terrestrial insects	–	9(12.0)	–	–	–	1(6.7)	–	1(0.6)	–
PISCES TOTAL	–	**52(69.3)**	**1(50.0)**	**3(100.0)**	**7(100.0)**	2(13.3)	**9(90.0)**	**8(4.9)**	–
Sprattus fuegensis	–	1(1.3)	–	–	–	–	1(10.0)	–	–
Engraulis ringens	–	–	–	–	–	–	1(10.0)	–	–
Salmo trutta	–	–	–	1(33.3)	–	–	–	–	–
Macruronus magellanicus	–	–	–	–	–	–	1(10.0)	–	–
Odontesthes smitti	–	1(1.3)	–	2(66.7)	–	–	4(40.0)	–	–
Normanichthys crockeri	–	12(16.0)	–	–	1(14.3)	–	–	–	–
Eleginops maclovinus	–	7(9.3)	1(50.0)	–	–	–	–	–	–
Notothenia tessellata	–	1(1.3)	–	–	–	–	–	–	–
Stromateus stellatus	–	–	–	–	–	–	1(10.0)	–	–
Fishes unidentified	–	30(40.0)	–	–	6(85.7)	2(13.3)	1(10.0)	6(3.7)	–
Fish eggs	–	–	–	–	–	–	–	2(1.2)	–
Total number of food items	2	13	2	2	3	7	7	11	1
Total occurrence of foods	8	75	2	3	7	15	10	163	1

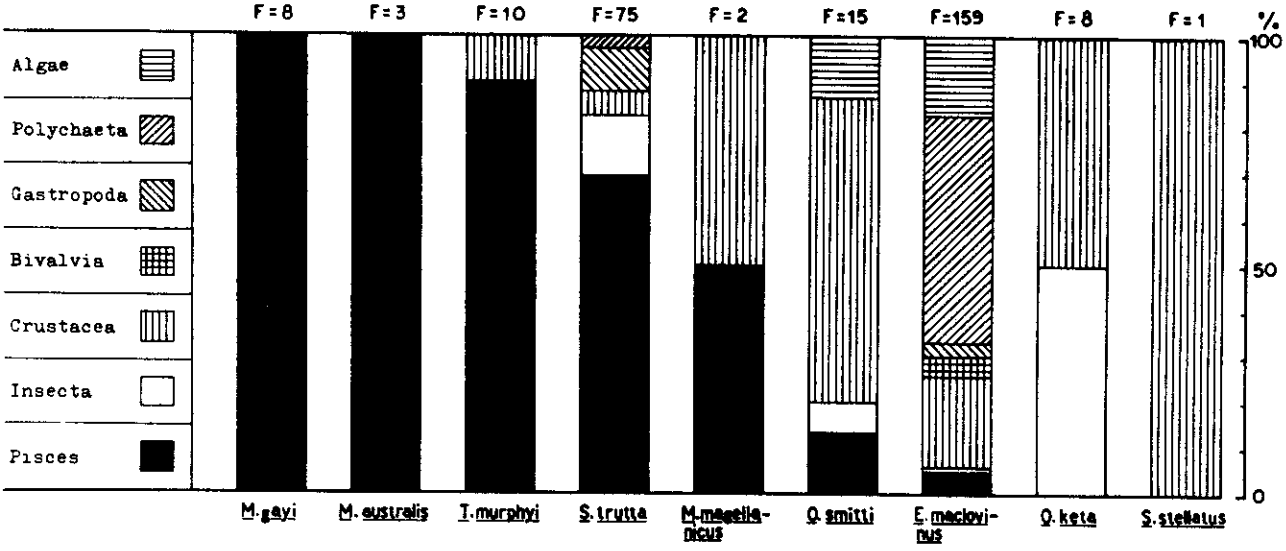

Fig. 4. Composition of stomach contents of each species collected in Ensenada Baja. Species names are arranged according the degree to which they are piscivorous. F indicates total frequency of occurrence.

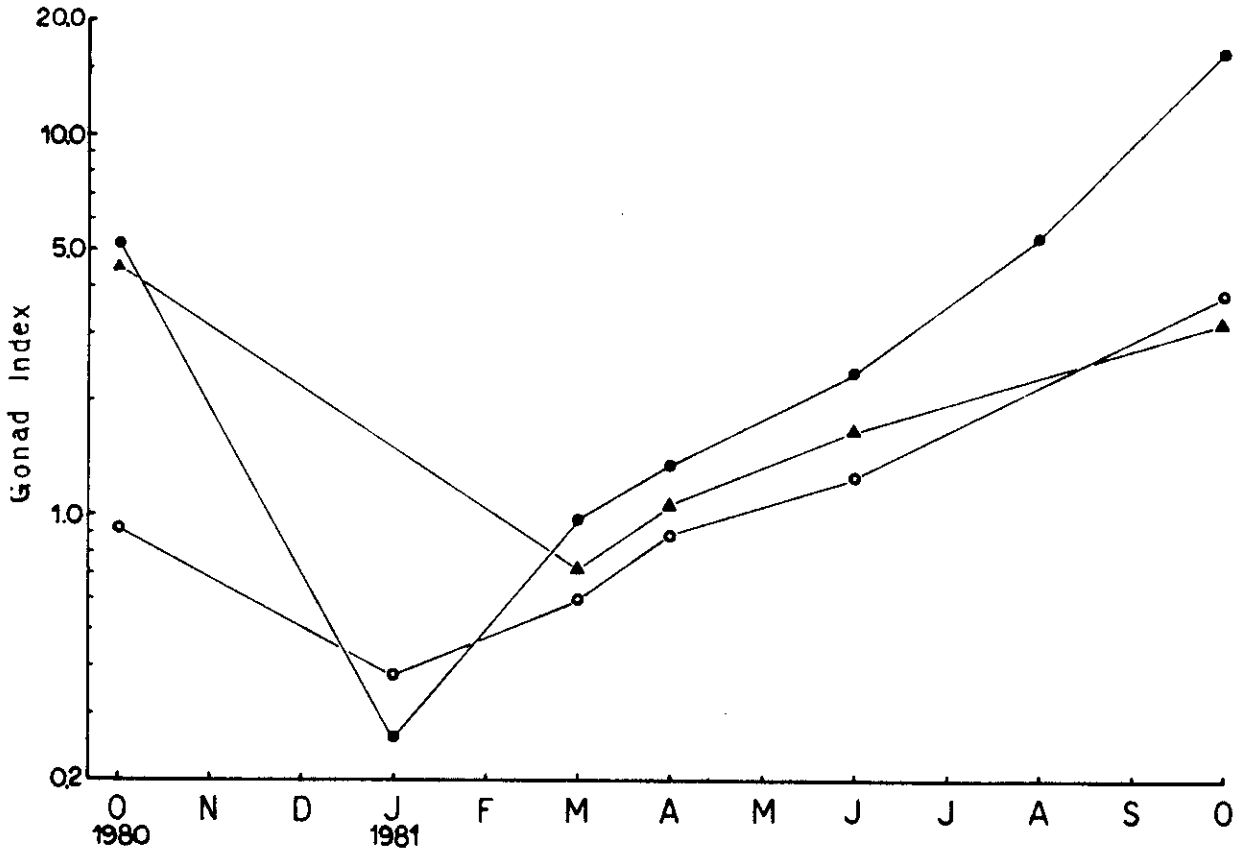

Fig. 5. Monthly mean of gonad indices in *Merluccius gayi* (triangle), *Odontesthes smitti* (solid cirlce) and *Eleginops maclovinus* (open circle).

Table 4. Monthly range and mean (in parentheses) of gonad indices of each species obtained from Ensenada Baja.

Species	Total No. examined	Oct. 7-20 1980	Jan. 17-31 1981	Mar. 9-20 1981	Apr. 20-29 1981	Jun. 17-28 1981	Aug. 1-15 1981	Oct. 1-3 1981
Oncorhynchus keta	37	–	–	0.04 ~ 0.21 (0.16)	0.20 (0.20)	0.21 (0.21)	0.47 (0.47)	0.22 ~ 1.02 (0.59)
Salmo trutta	90	0.11 ~ 0.53 (0.26)	0.06 ~ 1.14 (0.32)	0.20 ~ 0.28 (0.11)	0.03 ~ 0.47 (0.12)	0.05 ~ 0.14 (0.06)	0.20 ~ 0.74 (0.41)	0.14 (0.14)
Macruronus magellanicus	4	2.33 (2.33)	–	–	0.23 ~ 0.30 (0.27)	0.19 (0.19)	–	–
Merluccius australis	1	–	–	–	–	–	2.20 (2.20)	–
Merluccius gayi	11	4.52 (4.52)	–	0.72 (0.72)	0.24 ~ 3.92 (1.05)	1.63 (1.63)	– –	3.20 (3.20)
Odontesthes smitti	336	0.60 ~ 10.00* (5.17)	0.26 (0.26)	0.47 ~ 1.44 (0.96)	0.96 ~ 1.80 (1.34)	0.76 ~ 3.47 (2.34)	4.38 ~ 6.27 (5.33)	14.30 ~ 18.10 (16.2)
Trachurus murphyi	23	–	–	0.35 ~ 1.44 (0.83)	0.68 ~ 1.18 (0.82)	–	–	–
Eleginops maclovinus	101	0.04 ~ 8.82 (0.92)	0.04 ~ 0.55 (0.38)	0.13 ~ 1.33 (0.60)	0.10 ~ 4.24 (0.89)	0.23 ~ 3.60 (1.24)	–	0.40 ~ 11.16 (3.66)
Stromateus stellatus	122	–	–	–	0.11 ~ 0.25 (0.15)	0.14 ~ 0.33 (0.24)	1.67 ~ 4.51 (2.74)	0.50 ~ 1.00 (0.63)

* including specimens after spawning.

All the gonads were immature except for a few specimens of *M. gayi* and *O. smitti*. In most samples, the gonad index (GI) measured by ovaries was smaller than 3.00 (Table 4)However, monthly mean values of the GI of *M. gayi*, *O. smitti* and *E. maclovinus* increased gradually from January (or March) to October (Fig. 5). In October, in specimens of *O. smitti* with the *GI* larger than 10.00 the ovaries could have been producing ripe eggs, and post-spawning ovaries were observed in a few samples. The ovaries with the ripe eggs consisted of two parts containing small immature and large mature eggs as Moreno *et al.* (1977) pointed out in the case of a river atherinid *Basilichtys australis* Eigenmann. Three fish of *E. maclovinus* captured in October had ovaries of sufficient size to yield a GI between 8.00 and 11.16 in spite of immaturity. One fish of *M. gayi* caught in October 1980 had semi-mature ovaries with a GI of 4.52.

DISCUSSION

Of the nine species presently studied, eight except for *O. smitti* were easily distinguishable from other related species according to works made by various authors (Norman, 1937; Mann, 1954; de Buen, 1959; Haedrich, 1967; Lorenzen et al., 1979; Navarro and Pequeño, 1979, Inada, 1981; La Agencia de Cooperación Internacional del Japón, 1981, *etc.)*. Inada (1981) pointed out that *Merluccius polylepis* Ginsburg, which has been reported from southern Chile, is a junior synonym of *M. australis* According to Haedrich (1967), a stromateid fish from Peru and Chile should be identified with *Stromateus stellatus* which is a senior synonum of *S. maculatus* Cuvier and Valenciennes. Although many species or subspecies of the family Atherinidae have been observed in Chilean waters (Thompson, 1916; Eigenmann, 1928; Fowler; 1951 Mann, 1954; de Buen, 1955; Bahamonde and Pequeño, 1975), it is difficult to find a proper key for each form because of the overlap of characters and localities. de Buen (1955), Campos (1973), Lorenzen *et al.* (1979) and Navarro and Pequeño (1979) believe that the classification of atherinid fishes needs to be revised. We treated the atherinid collected in this study as *Odontesthes smitti* (Lahille) because it agrees well with the descriptions of *O. smitti* given by Lahille (1929) and Norman (1937). The morphological characters of this atherinid are described at the end of this text, including specimens obtained apart from the present investigation.

M. magellancius, M. australis and *E. maclovinus* are more common along the coast south of Chiloe and the southern Argentine coast than they are north of Chiloe (Norman, 1937; Mann, 1954; López, 1964; Lorenzen *et al.*, 1979; Boré *et al.*, 1980). *S. trutta* has become acclimated to central and southern Chile since 1905, when it was introduced from Germany (MacCrimmon and Marshall, 1968). At present, this trout occurs abundantly in the region south of Pto. Montt (personal communication obtained in Pto. Montt). *M. gayi* and *T. murphyi* are commonly known in central and northern Chile (Mann, 1954; Trujillo, 1972; Lorenzen *et al.*, 1979; Boré *et al.*, 1980) and have been reported in the Patagonian region (Trujillo, 1972; Bahamonde, 1977; Bahamonde, 1978). The range of *S.stellatus* is from Peru throughout Chile (Hildebrand, 1946; Navarro and Pequeño, 1979). Thus the fishes collected in Ensenada Baja were composed of species for which the distributional patterns are different. Navarro and Pequeño (1979) pointed out that the distribution of fishes of the Chiloe and Chonos Archipelagos can not be placed in a single category.

S. trutta, O. smitti and *E. maclovinus*, which may be found in Ensenada Baja the year round, are able to inhabit in both saline and fluvial waters. *M. magellanicus, M. australis, M. gayi, T. murphyi* and *S. stellatus* as well as a clupeid *Sprattus fuegensis* (Jenyns) and an anchovy *Engraulis ringens* Jenyns, which we discovered while analyzing stomach contents in March or April, are usually found in the sea. Therefore, the latter marine fishes came into Ensenada Baja between March and October at time of higher salinity. According to a personal observations by a fisherman in Pto. Chacabuco, a gempylid *Thyrsites atun* (Euphrasen) has migrated in Aisén Fiord in late summer to autumn, but in recent years large number of *T. murphyi* have appeared instead of *T. atun*.

Although Mysidacea, Isopoda and Decapoda are generally common food items for coastal fishes (Bahamonde, 1950; Bahamonde. 1953; Bahamonde and Cárcamo, 1959; Guzmán and Campodónico, 1973; Tomicic, 1973; Pequeño, 1979; Fuentes, 1981), they were rarely encountered in the stomach contents of the fishes of this collection. Guzmán and Campodónico (1973) suggested that *E. maclovinus* with standard lengths between 160 and 410 mm feeds preferentially on algae in Pto. Edén. From our observation, this nototheniid subsisted polychaets rather than algae. This probably resulted from the fact that intertidal and benthic communities in Ensenada Baja are very low and only moss-like algae are found in the intertidal zone because of a strong influence of the freshwater flowing from the rivers.

A normanichthyid *Normanichthys crockeri* Clark has been frequently reported as the prey of various coastal fishes, *e.g. M. gayi*, a ophidiid *Genypterus maculatus* (Tschudi), *T. atun* and a bothid *Hippoglossina macrops* Steindachner (Bahamonde and Cárcamo, 1959; Henríquez and Bahamonde, 1964; Movillo and Bahamonde, 1971; Tomicic, 1973). A total of 45 fish of this species were encountered in stomach contents in this study. We found 38 in *S. trutta* and 7 in *M. gayi*. *N. crockeri* has been recorded from Peru to Mehuín, Chile (Hildebrand, 1946; Pequeño, 1977; Balbontín and Pérez, 1980). *E. ringens* has also been found from Peru to Chiloe (Hildebrand, 1946; Boré *et al.*, 1980). This study extends the ranges of these two species as far south as Pto. Chacabuco.

Juveniles of *O. keta* occurring in inshore waters eat plankton such as copepods, amphipods, euphausids and fish larvae (Okada and Taniguchi, 1971). In Ensenada Baja, *O. keta* juvenieles must compete for food with *O. smitti* and *S. stellatus*. La Agencia de Cooperación Internacional del Japón (1981) indicated that *S. trutta* and *E. maclovinus* prey on juvenile salmon in Ensenada Baja. On the basis of the stomach content analysis of the *T. murphyi* specimens (30.5 to 61.0 cm in total length) obtained from Valparaiso and San Antonio, Rosario (1970) reported that *T. murphyi* is an eminently carnivorous fish. It is likely that *M. magellanicus, M. australis, M. gayi* and *T. murphyi* are also predators of the juvenile salmon.

Pequeño (1979) showed that there are more females of *E. maclovinus* from Mehuín than males in the summer, but the numbers of each sex are equal in the winter when reproductive activities begin. Oliver (1943) and Mann (1954) claimed that *E. maclovinus* spawns in estuarine water in spring. Pequeño (1979) collected almost-mature females of this species at the mouth of the Linque River, Mehuín, in September and October. Although the information which we obtained in this study is not sufficient for us to add inferences from these observations, the following, which were available apart from this study, are noted informally: In three specimens of *E. maclovinus* collected in the Moraleda Channel (45° 20' S and 73° 35' W) on July 23, 1981, the ovaries

were developed, but immature with gonadal indices of 7.1 to 11.0; in the middle of October (both in 1980 and 1981), juveniles of about 50 mm in total length appeared in shoals along the shore of Ensenada Baja; a fish taken from this bay on November 9, 1981 had the ovaries (GI: 17.1) containing scattered, small numbers of transparent, mature eggs.

Moreno *et al.* (1977) revealed that the spawning season of the river atherinid *B. australis* in the Maipo River near Santiago lasts from August to November, when there is a maximum GI of about 7.5. In Aisén Fiord, *O. smitti* probably begins to spawn in September when the GI is about 10.0.

DESCRIPTION OF *O. Smitti*

Odontesthes smitti (Lahille)

Basilichthys smitti Lahille, 1929:84 (locality: Bay of San Matías and Quequén).
Basilichthys smitti var. *australis* Lahille, 1929: 89, pl. 3 (locality: Fiord of Ultima Esperanza and Río Gallegos).
Austromenidia smitti; Norman, 1937: 120, fig 66, A (locality: Straits of Magellan to Argentine-Patagonia and Folkland Islands).
?Odontesthes cf. *regia* (not Humbolt); Navarro and Pequeño, 1979: 264 (locality: Chiloé and Chonos Archipelagos).
?Odontesthes regia laticlavia (not Valenciennes); Lorenzen et al., 1979: 105, fig. 63, A (locality: Talcahuano to Straits of Magellan).

Material examined: One specimen, 206.0 mm in standard length (SL), by hook and line, Sep. 14, 1980, not catalogued; one, 338.0 mm SL, by gill net, Oct. 7, 1980, Cat. No. Servicio Nacional de Pesca (Pto. Aisén) (SNP(PA)) 2; 3, 227.0 to 271.0 mm SL, by gill net, Mar. 27, 1981, SNP(PA) 45-1~3; 3, 246.0 to 279.0 mm SL, by gill net, Jun. 3, 1982, SNP(PA) 99-1~3; 3, 246.0 to 284.0 mm SL, by gill net, Jun. 7, 1982, SNP(PA) 104-1~3; 2, 303.0 and 310.0 mm SL by gill net, Jul. 11, 1982,SNP(PA) 107-1~2.

Description: Dorsal rays V~IX - I, 10~11; anal rays I, 15~19; pectoral rays 14~15; pelvic rays 1,5. Vertical scale rows from upper end of gill opening to caudal base 85~99; horizontal scale rows between 2nd dorsal and anal origins about 16. Gill rakers 8~10 + 25~30 = 34~ 38.

Proportional measurements expressed as a percentage of SL: Predorsal (1st) length 50.5~55.4; predorsal (2nd) length 69.2~72.2; preanal length 63.2~67.9; prepectoral length 20.3~22.6; prepelvic length 42.6~48.0; body depth 15.0~18.5; head length 19.7~22.8; snout length 6.7~7.7; eye diameter 3.7~4.5; upper jaw length 6.5~7.3; interorbital length 6.8~8.5; caudal peduncle depth 5.6~6.7; caudal peduncle length 19.7~22.0; pectoral length 14.2~15.7; pelvic length 8.3~10.3; 3rd dorsal spine length 4.4~7.0; 1st dorsal base length 5.0~6.8; 2nd dorsal base length 8.3~10.2; anal base length 14.6~17.6; greatest width of lateral band 3.4~4.5; longest gill raker lenghth 2.7~3.1.

First dorsal origin nearer to caudal base than to tip of snout, and situated above (before or behind in a few specimens) pelvic tip. Premaxillary protractile; maxillary not or reaching just below anterior margin of eye. Posterior margin of scale smooth. Jaws with two rows of small conical teeth; vomerine teeth present, sometimes indistinct; no teeth on palatine and tongue. Gill rakers slender, 6.9~7.8 times in head.

When alive, dorsal side of body dark greenish blue, the ventral side silver; body with a longitudinal band, of which upper forth to third is dark blue and the rest darkish silver. First dorsal, pectoral, pelvic and anal fins transparent; upper end of pectoral fin dark. Second dorsal and caudal fins darkish or yellowish dark; caudal fin with a dark posterior margin.

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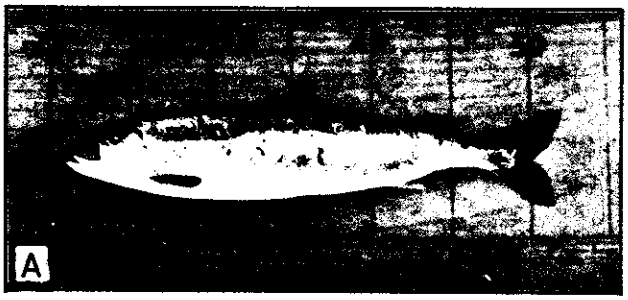
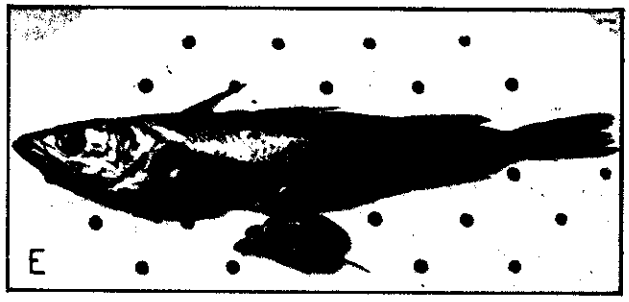
Explanation of Pl I (in this plate other specimens obtained apart from the present study were included).

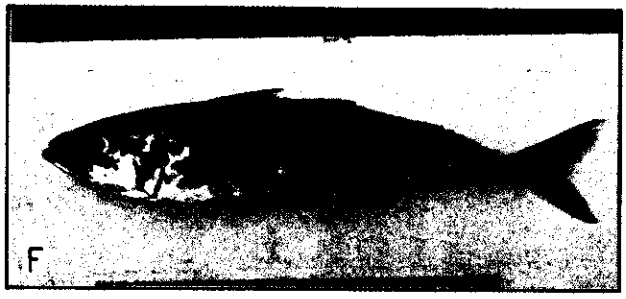


Oncorhynchus keta (Walbaum), 27.6 cm in standard length.

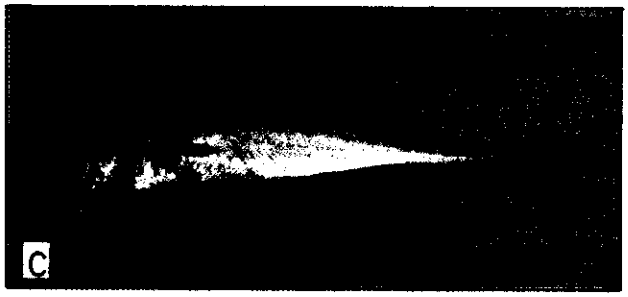


Merluccius gayi (Guichenot), 31.5 cm in standard length.

Top, *Odontesthes smitti* (Lahille), 34.5 cm in standard length.
Bottom, *Salmo trutta* Linnaeus, 24.0 cm in standard length.



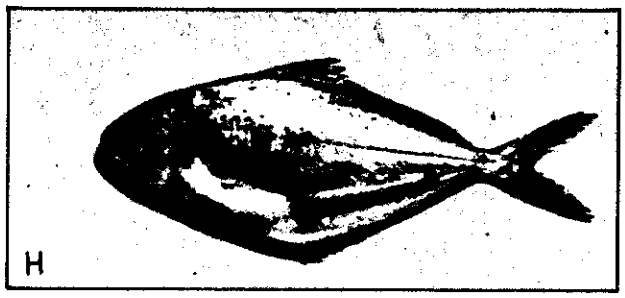
Trachurus murphyi Nichols, 49.0 cm in standard length.



Macruronus magellanicus Lönnberg, 34.4 cm in standard length.

Eleginops maclovinus (Valenciennes), 25.0 cm in standard length (vertebrae abnomal).

Merluccius australis (Hutton), 28.4 cm in standard length.



Stromateus stellatus Cuvier, 20.8 cm in standard length.

Nelson Santander
Printed in Santiago-Chile