

## Descriptions of larvae of *Merluccius australis*, *Macruronus magellanicus*, and observations on a larva of *Micromesistius australis* from southern Chile (Pisces: Gadiformes)

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**Abstract** Larvae of two commercially important fish species, namely southern hake (*Merluccius australis*) and hoki (*Macruronus magellanicus*), are described for the first time from material collected in southern Chile. Observations on a third species, blue whiting (*Micromesistius australis*), are also provided. The three species demonstrate larval characteristics typical of gadiform fishes, including a short gut, and pigmentation distributed in blotches and bands. Characteristics of the larvae of *M. australis* from Chile are similar to those observed in sketches from New Zealand, such that the descriptions may be used to identify the larvae from other regions. The similarity of characteristics between *M. magellanicus* larvae from Chile and Argentina and larvae of *M. novaezelandiae* from Tasmanian and New Zealand waters demonstrate the taxonomic affinity between these species. The presence of three dorsal fins in a late postflexion *Micromesistius australis* larva allowed it to be easily recognised.

**Keywords** fish larval stages; *Merluccius*; *Macruronus*; *Micromesistius*; Patagonian region; New Zealand; Chile

## INTRODUCTION

The genera *Merluccius*, *Macruronus*, and *Micromesistius*, species commonly known as southern hake, hoki, and blue whiting, respectively, support important fisheries resources in Chile, Argentina, and New Zealand. The distribution of *Merluccius australis* (Hutton) includes eastern and western regions of southern Patagonia and New Zealand (Inada 1981). *Macruronus* is represented in Chile and Argentina by *M. magellanicus* Lönnberg, and in New Zealand by *M. novaezelandiae* (Hector) (Cohen et al. 1990). These two species are closely related, and *M. novaezelandiae* has been cited from southern Chile (Fowler 1945, 1951). With *Micromesistius australis* Norman, two separate populations have been described, one for the Falkland Islands region, Patagonia and subantarctic waters, and the other for New Zealand (Inada & Nakamura 1975).

There is only one study on the ontogeny of the fish species present in Chile's southern Patagonian region which includes illustrations of larvae from this area; that study did not, however, describe developmental sequences (Zama & Cárdenas 1984). For the south Atlantic, there exist descriptions of *Merluccius australis* (Ciechomski & Weiss 1974), *Macruronus magellanicus* (Machinandiarena & Ehrlich 1999), and *Micromesistius australis* (Weiss 1974; Lisovenko et al. 1980; Ciechomski & Booman 1981).

The objective of the present study is to describe the larvae of *Merluccius australis* and *Macruronus magellanicus* collected in southern Chile, and compare these two as well as *Micromesistius australis* with descriptions made for the same or related species collected in other regions.

## MATERIALS AND METHODS

Samples were collected on the Cimar Fjord oceanographic cruises in southern Chile in October and November 1995 and 1996. The area sampled extended from Reloncavi Sound (41°32'S) to the

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Smyth Channel (52°45'S). Trawls were carried out from 200 m depth to the surface using an obliquely-towed Bongo net of 0.35 mm mesh, 0.60 cm diameter and 280 cm length. The net was provided with a TSK flowmeter. Material collected was fixed in 5% buffered formalin-seawater.

Body measurements (Moser 1996) were carried out using a stereoscopic microscope fitted with an eyepiece micrometer; drawings were made with a camera lucida, selecting the best larvae to display the sequence of larval development. Larval body measurements were expressed as percentage of body length (BL), and head length (HL). Thirty *Merluccius australis* larvae (3.2–11.9 mm BL) and 31 *Macruronus magellanicus* larvae (4.1–15 mm BL) were selected. Only one *Micromesistius australis* larva (11.1 mm BL) was available for study. Meristic data and ossification were determined in 15 *Merluccius australis* and 15 *Macruronus magellanicus* larvae. Specimens were stained with Alizarin Red S in a 1% KOH solution, after maintenance in 4% KOH (Hollister 1934), and subsequently placed in different concentrations of glycerin and 1% KOH for clearing, using 100% glycerin as a final preservative (Potthoff 1984). Morphometric and meristic data from 10 to 12 larvae of each of the two more abundant species are summarised in the Tables. To provide meristic data for *Micromesistius australis*, rays and vertebrae were counted in six adults 310–510 mm BL, captured in Chile's southern region. Differences between morphometric data of *Macruronus* larvae from Chile and New Zealand were tested by univariate analyses of variance (ANOVA) and covariance (ANCOVA),

and by multivariate analysis of variance (MANOVA) and covariance (MANCOVA) (Sokal & Rohlf 1989), using the software PROC GLM (SAS 1996).

## RESULTS

### *Merluccius australis*

#### Literature

Larvae from the Atlantic coast off Argentina have been previously described (Ciechomski & Weiss 1974); the cited study maintained the original naming of the species (*M. polylepis*). A drawing of one larva collected in the Aysen fjord in southern Chile was published without description (Zama & Cárdenas 1984), and unpublished sketches of two larvae from New Zealand were obtained from personnel of the National Institute of Water and Atmospheric Research Limited (NIWA).

#### Morphology and morphometrics

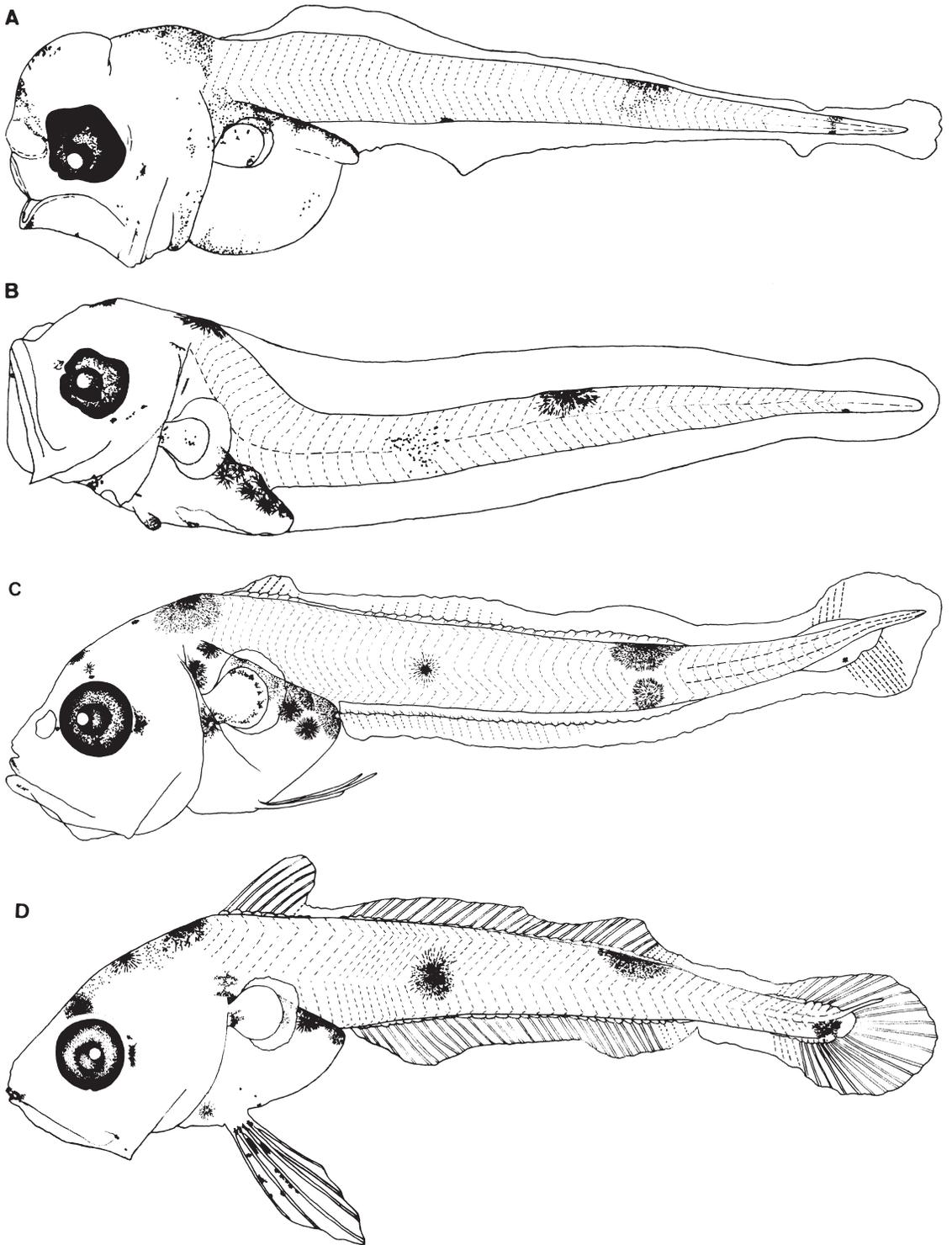
The majority of the larvae were in the preflexion stage (from 3.2 to 9.6 mm BL). Flexion initiated at 10–11 mm BL, observed in two specimens (Table 1). The gut is short (32–43% BL) (Fig. 1).

#### Pigmentation

Melanophores develop in a cephalic-dorsal position, also around the eye in most larvae, and at the tip of the snout. Pigmentation was observed between the preopercular and postopercular region. Gut pigmentation occurred on the upper margin of the gut and,

**Table 1** Selected body proportions of larvae of southern hake *Merluccius australis* from southern Chile. (BL, body length; HL, head length.)

	BL (mm)	HL (% BL)	Snout length (% HL)	Eye diam. (% HL)	Predorsal length (% BL)	Preanus length (% BL)	Prepelvic length (% BL)	Body depth (% BL)
Preflexion	3.2	18.8	16.7	50.0		40.6		25.0
	3.8	21.1	12.5	37.5		42.1		28.9
	4.8	22.9	27.3	36.4		39.6	18.8	25.0
	5.5	14.5	12.5	50.0		32.7	18.2	20.0
	6.5	21.5	28.6	35.7		41.5	23.1	24.6
	7.4	23.0	29.4	35.3	29.7	37.8	17.6	23.0
	7.7	22.1	29.4	35.3	24.7	37.7	28.6	23.4
	8.0	22.5	27.8	33.3	25.0	38.8	26.3	25.0
	8.4	21.4	33.3	33.3	23.8	38.1	21.4	22.6
	9.6	19.8	31.6	31.6	26.0	36.5	19.8	19.8
Flexion	11.2	24.1	33.3	33.3	26.8	39.3	24.1	24.1
	11.9	23.5	32.1	32.1	30.3	42.0	23.5	21.0



**Fig. 1** Larval stages of southern hake, *Merluccius australis*. **A**, 3.2 mm body length (BL); **B**, 6.1 mm BL; **C**, 11.2 mm BL; **D**, 11.9 mm BL.

in many specimens, on the lower margin and at the anus. Melanophores develop in variable positions on the pectoral fins; pigmentation was observed on the pelvic fins beginning at 5.4 mm BL. Melanophores develop ventrally in larvae of 3.2–5.4 mm BL and spread laterally in the body in larvae greater than 5.4 mm BL at the 17–19 myomere level. Another blotch occurs dorsally towards the posterior third of the larva and extends laterally. In a few specimens, the lateral pigment formed a distinct blotch near the ventral line. In the caudal region, melanophores were found in all larvae in hypural position, although in the larvae of 3.2 mm BL was also present in epural position.

#### Formation of fins and meristic data

Pectoral fins were present in the smallest larvae (3.2 mm BL), but showed no formation of rays. Pelvic fin anlage appeared in larvae between 4.1 and 4.8 mm BL as ventral protuberances on both sides of the body, with six rays at 9.6 mm BL. Rudiments of the first dorsal fin appeared at 7.4 mm BL as a zone of increased density of the basal elements at the 2–3 myomere level; in the second dorsal, this process was observed at 8.5 mm BL, with basal elements located at the 11–12 myomere level. Basal elements of the anal fin formed at 8.5 mm BL at the 21–22 myomere level. In larvae of 11.2 mm BL this fin had 28 rays located at myomeres 14–15. At 5.4 mm BL

the caudal fin anlage was observed, and at 7.4 mm BL six rays were in formation. The total number of ossified vertebrae was 53 in the most developed larva (Table 2).

#### *Macruronus magellanicus*

##### Literature

Two sketches of the larvae have been published in Chile (Zama & Cardenas 1984) and a descriptive study of these larvae has been produced in Argentina (Machinandiarena & Ehrlich 1999).

##### Morphology and morphometrics

The gut is short (35–49% BL), corresponding the higher values to the more developed larvae. The same tendency was observed in the HL (19–27%) (Table 3). Dorsal and anal fins join towards the caudal end. All the specimens were in a preflexion stage.

##### Pigmentation

Larvae develop stellated melanophores on the occipital and dorsal portions of the cephalic region, extending posteriorly over the dorsal contour to the middle of the body. Some specimens showed preopercular pigmentation over the snout and on the maxilla. Melanophores are distributed on the lower jaw and in some larvae, extended in a row, reaching

**Table 2** Meristic data of larvae and adults of southern hake *Merluccius australis*. Myomeres (preanus + postanus). (BL, body length.)

BL (mm)	Fin rays					Vertebrae	Myomeres
	Pectoral	Pelvic	First dorsal	Second dorsal	Anal		
4.0	–	–	–	–	–	47	10 + 39
4.8	–	–	–	–	–	50	13 + 38
5.5	–	–	–	–	–	49	14 + 36
6.2	–	4	–	–	–	42	13 + 37
7.4	–	5	–	–	–	48	16 + 35
8.0	–	5	–	–	–	47	14 + 37
8.8	–	5	–	–	–	49	16 + 35
9.6	–	6	–	–	–	51	15 + 37
11.2	–	6	6	12	28	52	15 + 36
11.9	–	6	7	29	34	53	15 + 38
Ciechomski & Weiss (1974)*							16–17 + 40–42
Ciechomski & Weiss (1974)†	13	13	11	43	43	56	
Norman (1937)†	13		11	36–43	36–42		
Inada (1986)†	13–16	7	9–12	39–45	40–46	53–58	
Cohen et al. (1990)†			1/9–12	39–45	40–46	53–58	

\*Larvae.

†Adults.

the isthmus. Irregularly distributed blotches were observed ventrally in the preanus region. In larvae greater than 6 mm BL, pigmentation on the upper part of the intestine extended to the anus, and generally at the bases of the pelvic fins. Pectoral, dorsal, and anal fins are unpigmented. Postanus pigmentation was observed ventrally in the smallest larvae, and concentrated on the body laterally, to later extend over a larger area. Beginning at 6 mm BL, pigment blotches became distributed dorsally, from the cephalic region to the second third of the body length, forming two rows in the more developed larvae (Fig. 2).

#### *Formation of fins and meristic data*

Pectoral fins were present in the smallest larvae (4.1 mm BL), but rays were not differentiated. Pelvic fin rudiments emerged at 7.3 mm BL as buds located at the fourth myomere level; at 15 mm BL they were located at the sixth myomere level, with seven rays. Rudiments of the rays of the first dorsal fin were observed at 8.5 mm BL, and in the second dorsal fin at 8.0 mm BL, at the level of myomeres 3 and 24, respectively. Only the first dorsal fin was completely formed at 15 mm BL, with 12 rays. At this size the initiation of these fins was located at myomeres 4 and 14. At 7.3 mm BL, basal elements of the anal fin rays were distinguished at the level of myomeres 19–20. The largest larvae (15 mm BL) had 76 rays, with their origin at myomere 27 (Table 4).

The caudal fin was the last to develop. The anlage of this fin was observed at 12.5 mm BL as a dense portion of tissue below the notochord, and as a

constriction near the caudal end at 13.8 mm BL. The most developed larvae had 75 vertebrae.

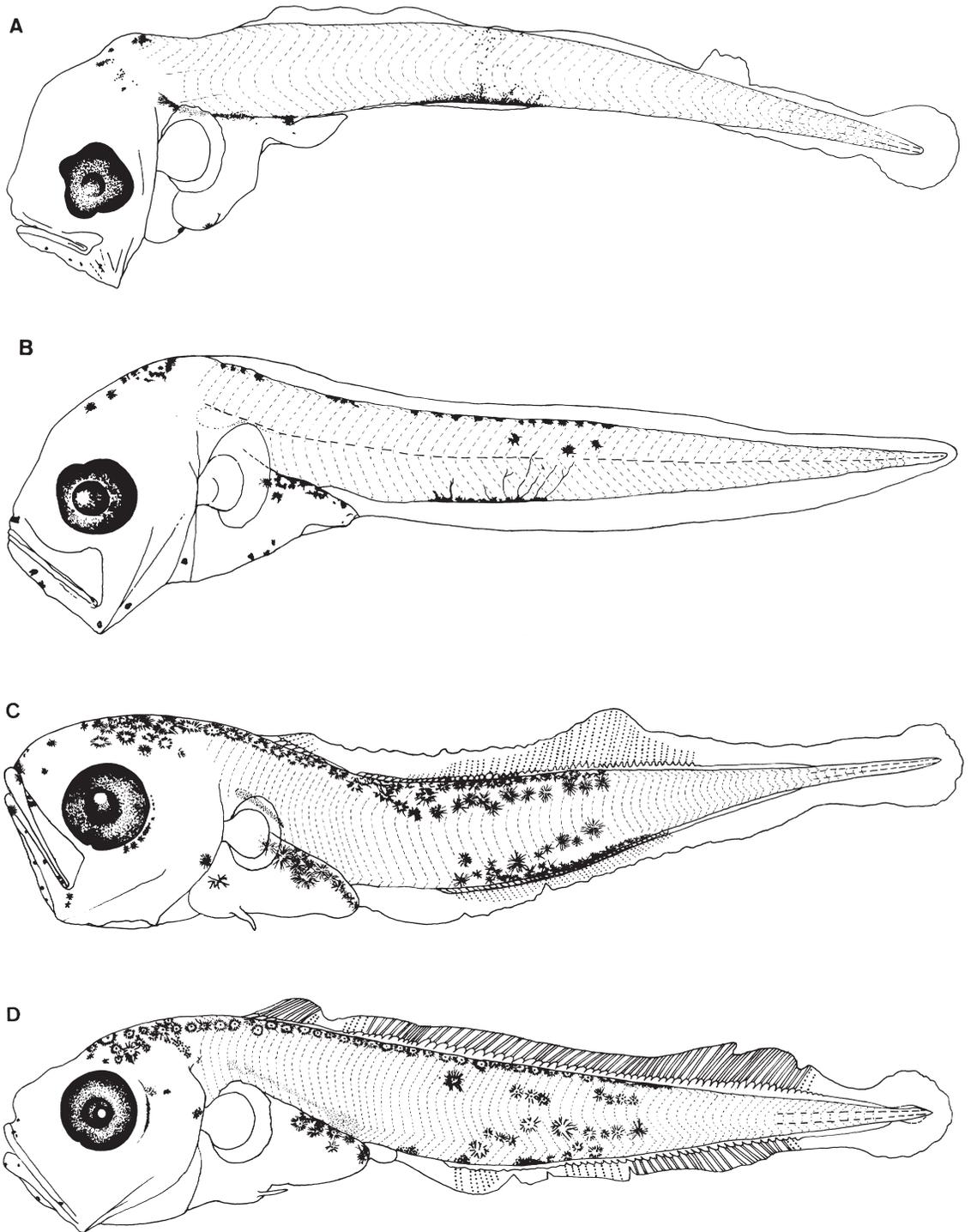
#### **Observations on a 11.1 mm BL *Micromesistius australis* larva, and adults**

References on the larvae of this species are from the Argentinian Patagonia and the Falkland Islands (Weiss 1974; Lisovenko et al. 1980; Ciechomski & Booman 1981). The only larva captured measured 11.1 mm BL (Fig. 3). The larva was in the post-flexion stage, showing three dorsal, and two anal fins. Expressed as a percentage of the BL, the preanus length was 50%, body depth 24%, and length of the head 33%. The eye diameter was 29% HL and snout length 32% HL. Small expanded melanophores lightly covered the entire body, including the intestine and head. This does not extend to the fins. The pigment was more concentrated in the occipital head region and in the dorsal contour of the body, in contrast with the less pigmented area located ventrally in the preanus region.

At 11.1 mm BL, pectoral fins were without rays; numbering 20–21 in adults; pelvic fins as buds, 6–7 rays in adults; the first to the third dorsal fins had 6, 8, and 17 rays, respectively. In adult specimens, these values were 12–13, 11–12, and 21–23 rays, respectively. In the larva, the first and second anal fin with 17 and 14 rays formed in each; in adults there were 32–38 and 23–26 rays in these same fins. The caudal fin of the larva had a majority of its rays already formed (36); in the adults, the total rays were 36–42. The larva had 50 vertebrae, which was less than in adults (54–56).

**Table 3** Selected body proportions of larvae of hoki *Macruronus magellanicus* from southern Chile. All the larvae are in a preflexion stage. (BL, body length; HL, head length.)

BL (mm)	HL (% BL)	Snout length (% HL)	Eye diam. (% HL)	Predorsal length (% BL)	Preanus length (% BL)	Prepelvic length (% BL)	Body depth (% BL)
4.1	19.5	25.0	50.0		39.0		24.4
4.8	18.8	22.2	44.4		37.5		20.8
5.7	19.3	36.4	45.5		35.1		21.1
6.5	23.1	26.7	40.0	29.2	38.5		21.5
7.5	24.0	33.3	38.9	30.7	42.7	26.7	24.0
8.6	24.4	28.6	38.1	30.2	41.9	27.9	22.1
9.8	23.5	30.4	39.1	28.6	44.9	27.6	22.4
10.6	25.5	33.3	40.7	31.1	46.2	29.2	23.6
11.3	27.4	32.3	38.7	29.2	48.7	27.4	22.1
12.5	22.4	21.4	42.9	26.4	46.4	25.6	21.6
13.8	26.1	35.0	36.1	29.7	44.2	26.1	19.6
15.0	26.7	30.0	40.0	26.7	45.3	30.0	21.3



**Fig. 2** Larval stages of hoki, *Macruronus magellanicus*. **A**, 4.1 mm body length (BL); **B**, 6.3 mm BL; **C**, 9.8 mm BL; **D**, 12.5 mm BL.

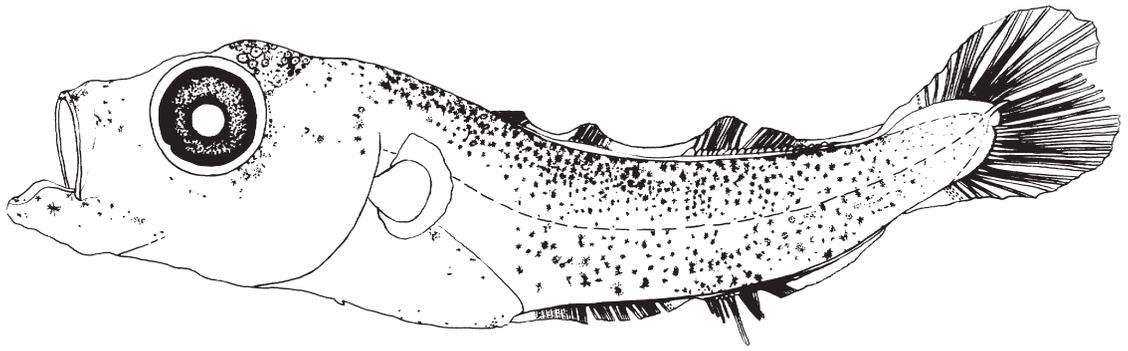


Fig. 3 Larva of 11.1 mm body length of whiting, *Micromesistius australis*. Myomeres omitted.

Table 4 Meristic data of larval and adult hoki *Macruronus magellanicus*. Myomeres (preanus + postanus). (BL, body length.)

BL (mm)	Fin rays					Vertebrae	Myomeres
	Pectoral	Pelvic	First dorsal	Second dorsal	Anal		
4.7	—	—	—	—	—	—	15 + 45
5.8	—	—	—	—	—	39	14 + 47
6.4	—	—	—	—	—	52	13 + 48
7.3	—	—	—	—	—	60	18 + 51
8.4	—	—	4	17	22	62	19 + 54
9.8	—	3	5	47	45	62	19 + 55
11.3	—	6	10	67	57	69	22 + 52
12.5	—	6	8	67	58	66	23 + 52
13.8	—	6	10	78	72	68	23 + 52
15.0	—	7	12	79	76	75	23 + 51
Machinandiarena & Ehrlich (1999)*							75 to 80
Norman (1937)†	17–19	8	12	98	95		
Angelescu & Gneri (1960)†	16–20	8	11–15			79	
Arana (1970)†	17–19	8	11–13				
Inada (1986)†	17–19	8	11–14	90–100	83–90		
Cohen et al. (1990)†	17–19	8	I/10–13	90–100	83–90		
Lloris & Rucabado (1991)†	17–18	8	12–13	94–102	84–92		

\*Larvae.

†Adults.

## DISCUSSION

The preanus length of southern hake, *Merluccius australis* (33–42% BL) was comparable to larvae from the Atlantic coast (37–39% BL) (Ciechomski & Weiss 1974). The number of vertebrae in the most developed larva (53) was within the range of 53–58 vertebrae mentioned for adults (Inada 1986; Cohen et al. 1990), but lower than the 56 vertebrae cited for a larva from the Atlantic (Ciechomski & Weiss 1974). Six rays were counted in the pelvic fins, less than the seven rays of adults (Inada 1986), and it was not possible to determine whether another ray was

forming. Thirteen rays were reported for a larva from the Atlantic coast (Ciechomski & Weiss 1974). The pigmentary pattern is concordant in both descriptions, but the pigment located over the first dorsal fin (Ciechomski & Weiss 1974) was absent in larvae from the south of Chile. The pattern is similar to a sketch of a larva originating in the same study area of the Chilean coast (Zama & Cardenas 1984).

The pigment distribution in the drawings of two larvae of *Merluccius australis* from New Zealand is similar to that described for larvae from southern

Chile. Notes accompanying the drawings mention the absence of the melanophore in the ventral or ventro-lateral position in some larvae (located slightly anterior to the middle of the body), as well as absence of pigment in the caudal region in the epural position. This variability in pigmentation was also observed in samples originating in Chile. Larvae of southern hake *M. australis* and the common hake *M. gayi gayi* (Fischer 1959) have an overlapping distribution in southern Chile (Inada 1986; Bernal et al. 1997), but differ slightly in their general appearance. The anlage of the pelvic fins was visible in *M. australis* between 4 and 5 mm BL, whereas in *M. gayi gayi* they initiated at 6.5 mm BL. In larvae <7 mm BL the two species can be distinguished by the presence of pigment in the tip of the caudal region in *M. australis*, which is absent in *M. gayi gayi*. The pigment on the tip of the snout observed in *M. australis* is also absent in *M. gayi gayi*. Pelvic fins are pigmented in *M. australis*. In *M. gayi gayi*, observations on larvae of up to 10.1 mm BL, representing material collected by the authors on other expeditions made to central Chile, showed no pigment in these fins. Furthermore, there were no differences in the preanus length, which was 32–43% BL in *M. australis* and 28.7–43% BL in larvae of *M. gayi gayi* fixed live in the laboratory (Fischer 1959).

The total number of ossified vertebrae of a 15 mm BL larvae of *Macruronus magellanicus* from southern Chile (75) was within the range of myomeres cited for larvae from the Argentine Atlantic (Machinandiarena & Ehrlich 1999), but less than the 79 vertebrae of adults (Angelescu & Gneri 1960). Only the 12 rays of the first dorsal fin of the most advanced larva were completely formed. This value fell within the range described in adults (Norman 1937; Angelescu & Gneri 1960; Arana 1970; Inada 1986; Cohen et al. 1990; Lloris & Rucabado 1991).

Strong similarities were observed between the larval characters of *M. magellanicus* and *M. novaezelandiae* (Patchell et al. 1987; Bruce 1988), whose adults have been cited from Chile (Fowler 1945, 1951). Presently, only *M. magellanicus* is considered a valid species for the Atlantic and Pacific coast of South America (Cohen et al. 1990). The morphometric data of 12 larvae of both species showed similar mean values and the ranges mostly overlap (Table 5). The one-way univariate ANOVA and multivariate MANOVA performed with data of larvae from New Zealand (Patchell et al. 1987) and Chile revealed no significant differences in the mean values ( $P > 0.158$ ). Differences in the slopes of the regressions of each one of the variables, using BL as a covariate, were tested with a one-way ANOVA

**Table 5** Mean value and range of morphometric data, expressed as percentage of body length, and range of meristic data of hoki, *Macruronus magellanicus* from southern Chile and *M. novaezelandiae* from New Zealand and Tasmania, Australia. Morphometrics corresponds to larvae in a preflexion stage (Patchell et al. 1987; Bruce 1988). Meristic counts of adults of *M. magellanicus* and juveniles of *M. novaezelandiae* are extracted from Table 4 and from Bruce (1988), respectively.

	<i>M. magellanicus</i>	<i>M. novaezelandiae</i>	
	Chile	New Zealand	Tasmania
Body length (mm)	9.2 (4.1–15.0)	8.5 (3.8–14.6)	8.9 (3.6–19.0)
<b>Proportions</b>			
Head length	23.4 (18.8–27.4)	22.4 (19.6–26.0)	22.7 (18.3–24.7)
Snout length	6.7 (4.2–8.8)	6.4 (4.3–8.3)	6.1 (4.6–7.7)
Eye diam.	9.5 (8.3–10.7)	8.6 (6.9–10.0)	9.2 (8.1–10.3)
Predorsal length	29.1 (26.4–31.1)	28.2 (25.2–32.0)	27.5 (25.2–29.3)
Preanus length	42.5 (35.1–48.7)	41.9 (28.5–51.5)	
Body depth	22.0 (19.6–24.4)	22.9 (20.2–24.8)	22.3 (21.0–24.4)
<b>Counts</b>			
Pectoral fin rays	16–20		20
Pelvic fin rays	8		8
First dorsal fin rays	11–15		12–13
Second dorsal fin rays	90–102		94–100
Anal fin rays	83–95		90–91
Vertebrae	79		76–78

and MANCOVA. Statistically significant differences were found in the allometry of the morphometric data of the two species ( $P = 0.034$ ), being the eye diameter and to a lesser extent, the predorsal length, the variables explaining the differences. The small sample size does not allow a clear explanation about the source of the variability. No individual data were available from Tasmanian waters (Bruce 1988).

The distribution of pigment was similar in the two species. It has been stated that larvae of *M. magellanicus* from the Argentine coast differ from the larvae of *M. novaezelandiae* in the absence of pigment from the ventral region of the gut in the latter species (Machinandiarena & Ehrlich 1999). This pigment is, however, visible in the Figures of the larvae as well as in the descriptions (Patchell et al. 1987; Bruce 1988), and as such, the preceding difference is not valid. The sequence of formation of the fin-rays was the same in the larvae of both species, at similar sizes, with some differences in ray counts attributable to laboratory staining procedure. It is of interest that the 15 mm BL larva had 7 rays on the pelvic fins, compared with 8 rays in the adults. In contrast, the 16.3 mm BL larva of *M. novaezelandiae* had 8 rays, suggesting that in *M. magellanicus* the rays of these fins complete formation at a size greater than 15 mm BL.

The full complement of fin-rays in juveniles of *M. novaezelandiae* (Bruce 1988) was within the range of values reported for adults of *M. magellanicus* (Norman 1937; Angelescu & Gneri 1960; Arana 1970; Inada 1986; Cohen et al. 1990; Lloris & Rucabado 1991) (Table 5). To clarify the degree of species level differentiation in *Macruronus*, another kind of analysis should be performed, such as genetic homogeneity. This approach has been used to study the divergence of disjunct populations of *Merluccius* and *Micromesistius* from southern South America and New Zealand (Grant & Leslie 2001; Ryan et al. 2002).

The 11.1 mm BL larva of *Micromesistius australis*, the single species of the genus distributed in the south-western Atlantic and south-eastern Pacific oceans (Cohen et al. 1990), fits the morphological descriptions and pigmentation given for a 10 mm BL larva from the Argentine Atlantic (Weiss 1974). Outstanding differences included the more advanced state of flexion, earlier appearance of the pelvic fins, and the formation of some rays in the dorsal and anal fins of the larva from southern Chile. Most body proportions are within the values given in the literature, except for a greater HL (33% versus 25–27% BL) and smaller eye diameter (29%

versus 32–35% HL) in the larva from the Pacific in comparison with specimens from the Atlantic (Weiss 1974; Lisovenko 1980; Ciechowski & Booman 1981). The number of fin rays and vertebrae in the larva from Chile, with the exception of the caudal fin, were less than those recorded for the 16 mm BL larva from the Atlantic (Weiss 1974), or from adults of the species, suggesting that these structures were not fully formed in the larval specimen. The adult specimens observed in the present study agreed with all the meristic characters described for the species (Inada & Nakamura 1975; Shpak 1975; Shust 1978; Wiececzek 1988; Chiu & Markle 1990).

In conclusion, the larval characteristics of *Merluccius australis* obtained in Chilean waters were similar to those based on unpublished sketches of specimens originating in New Zealand, suggesting that the present descriptions are valid for identification of larvae collected in New Zealand. The similarity between the characteristics of *Macruronus* larvae from Chile and Argentina, and when compared with specimens collected in Tasmania and New Zealand, suggests a high taxonomic affinity between these species. The only *Micromesistius australis* larva analysed agreed in terms of its main characteristics with previous descriptions of south Atlantic larvae, with minor differences attributable to natural larval variability or to the author's observational methodology. This study forms the first reporting on the description and determination of the larvae of *Merluccius australis* and *Macruronus magellanicus*, and preliminary observations of *Micromesistius australis* from waters of the southern Chilean coast.

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