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On the Species Composition of Ichthyoplankton of the Walvis Ridge (South Atlantic)

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Abstract—Illustrated descriptions of the larval and/or prejuvenile fish of the following scarcely studied species are given: *Gonichthys barnesi*, *Lampadena chavesi*, *Lampanyctus australis*, *L. festivus*, *Nannobrachium* sp. 1, *Loweina interrupta* (Myctophidae), *Bathygadus cottoides* (Bathygadinae), *Penthericthys atratus* (Oneirodidae), and *Chiasmodon* sp. (Chiasmodontidae). Problems of identifying early development stages of these taxa are considered.

Keywords: ichthyoplankton, fish larvae, morphology, scarcely studied species, Walvis Ridge

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Special publications on the ichthyoplankton of Walvis Ridge are almost completely absent. There is only one work on the ichthyoplankton of the Valdivia bank (Gordina, 1991) and some information on the larvae of individual fish species in the open areas of the South Atlantic in the summary of Matsuura and Olivar (1999). At the same time, a significant number of works is devoted to studying the ichthyoplankton of coastal waters of South Africa (Brownell, 1979; Olivar and Rubiés, 1985; Olivar, 1987, 1988; Olivar and Fortuño, 1991); however, the composition of the ichthyofauna in this area is very different from that in open waters and underwater rises. There are a few works of Russian authors concerning the composition and vertical distribution of adult fish due to underwater rises of the Walvis Ridge (Pakhorukov, 1980, 1982; Trunov, 1981; Kobyliansky et al., 2010; Pakhorukov and Parin, 2012).

The publication being proposed is aimed at filling the existing gaps in the morphology of larvae of scarcely studied oceanic fish species belonging to Myctophidae, Macrouridae, Oneirodidae, and Chiasmodontidae. As for Myctophidae in the Walvis Ridge, there are no literature data with respect to their larval morphology, except for data on the ichthyoplankton of the southeastern Atlantic (Benguela Current) that were published by Olivar and Fortuño (Olivar and Fortuño, 1991) and by us (Bolshakova and Evseenko, 2015). This work is the direct continuation of the mentioned studies.

MATERIALS AND METHODS

The material for this work included early stages of the development of fishes from samples collected during the 29th cruise of the R/V *Akademik Ioffe*, which was performed on a polygon in the Walvis Ridge area between 29° S and 37° S in October 2009 (Table 1, Fig. 1) using a midwater Isaacs–Kidd trawl modified by Samyshev–Aseev (MWT 25 m long made of knotless netting with 5 mm mesh and apex insert of capron riddle no. 15; the mouth area was of 6 m^2). A number of stations also used a Savilov's pleustonic net. Samples were fixed and stored in a 4% formaldehyde solution. The larvae were cleared and stained in alizarin. All larva figures were performed by the first author.

This work uses the following abbreviations of the features: *TL*—total body length; *SL*—standard length; *c*— the head length; *H*—the greatest body height; *aA*, *aD*—anteanal and antedorsal distances; *ao*—snout length; *o*—horizontal diameter of the eye orbit; *D*, *A*, *P*, *V*, *C*—number of rays in the dorsal, anal, pectoral, ventral, and caudal fins, respectively; *br.*—number of branchiostegal rays; *sp. br.*—number of gill rakers in the upper and lower parts of the first gill arch; *vert.*—number of vertebrae; photophores: Br_2—branchiostegal; PO_{1-5}—pectoral; PVO_2—pectoventral; *SAO*—supraanal; *VO*—ventral; *AOa*—anal anterior; and *AOp*—anal posterior photophores; and Prc_{1-2}—distance between the first and second precaudal photophores.

Table 1. Coordinates of stations conducted during the 29th cruise of the R/V *Akademik Ioffe* in the Walvis Ridge area in October 2009

No. of station	Fishing gear	Station coordinates			
		S	E	W	fishing horizon, m
2183-1	PS	24°41.52′		02°20.10′	0
2183-2	MWT	25°42.65′		02°21.90′	250–0
2184-4	Same	29°30.57′	01°12.95′		300–0
2185	″	30°01.04′	02°49.55′		1000–0
2185-2	PS	30°04.73′	02°49.57′		0
2185-3	MWT	30°02.71′	02°51.98′		1105–0
2186	Same	30°17.97′	03°06.99′		400–0
2187-1	″	32°45.15′	01°50.03′		500–0
2187-2	″	32°47.91′	01°49.51′		1150–0
2187-4	″	32°56.68′	01°52.78′		1100–0
2188-1	″	33°40.00′	02°35.10′		400–0
2188-2	″	33°42.05′	02°37.15′		1500–0
2193-1	″	36°56.71′	07°19.28′		550–0

RESULTS

We found 485 specimens of larvae and juvenile fishes of 66 taxonomic forms in ichthyoplankton collection from waters of the Walvis Ridge, of which 53 forms were determined to the species level and the other ones were determined to the genus level (Table 2). A greater part of the ichthyoplankton collection is represented by meso- and bathypelagic fish species: Myctophidae (37.0% of the total number of caught larvae),

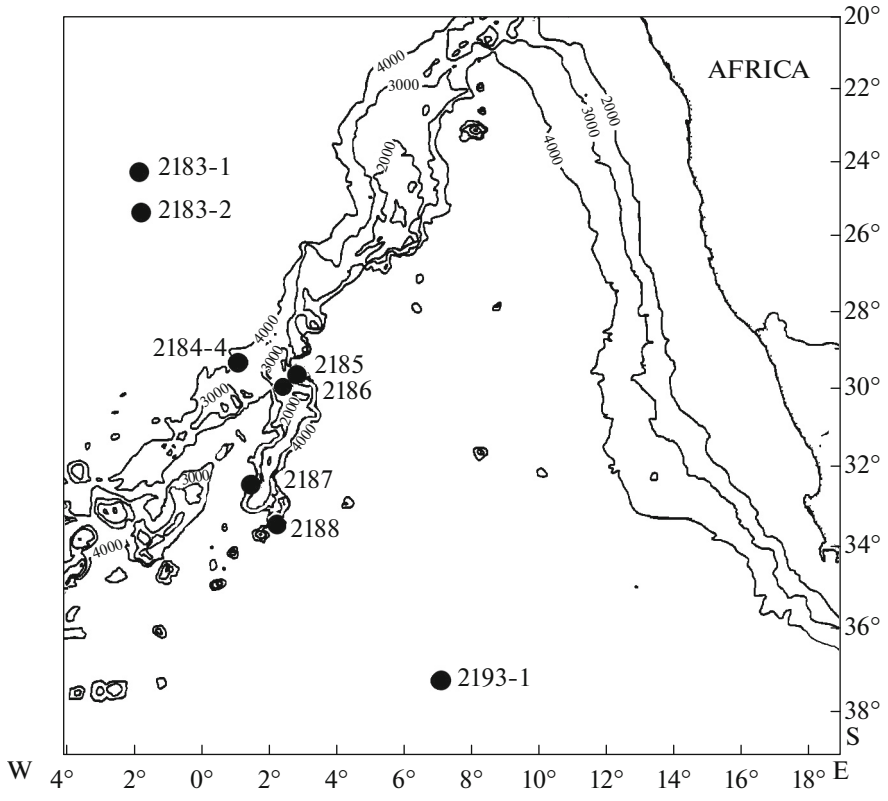

Fig. 1. Location of stations (●) in the 29th cruise of R/V *Akademik Ioffe* where catches were made in the Walvis Ridge area.

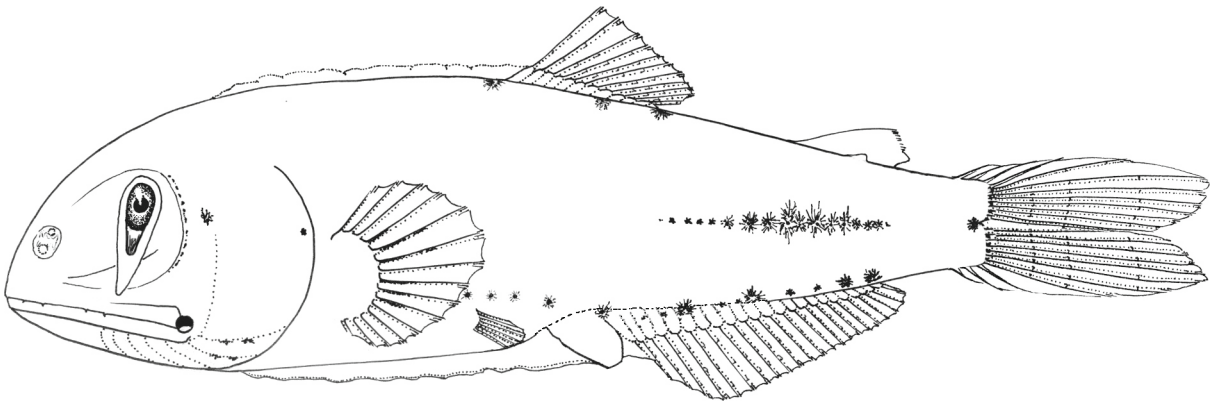

Fig. 2. *Gonichthys barnesi* larva, 13.0 mm *SL*.

Photichthyidae (10.4%), Sternoptychidae (8.3%), Gonostomatidae (7.5%), Scopelarchidae (7.1%), Paralepididae (4.7%), etc. We also recorded the larvae of fishes of epipelagic families: Scomberesocidae (2.0%), Hemiramphidae (2.0%), and Exocoetidae (1.5%). The descriptions of rare and scarcely studied forms are given below.

Family Myctophidae

Gonichthys barnesi Whitley, 1943

Description. Larvae 12.0, 13.0, and 17.4 mm *SL* (Fig. 2) (stations 2183-2 and 2184-4). *D* 11–12, *A* 21–22, *P* 15, *V* 8, *C* 6 + 9–10 + 5, *sp. br.* 5 + 1 + 8 = 14, and *vert.* 39. Larva with rather deep (*H* 26–29% *SL*), laterally compressed body and large head (*c* 26–29% *SL*). Snout long (*ao* 36–39% *c*) and rounded, eyes oval (*o* 13–14% *c*), with cone-shaped appendage from choroid tissue, almost reaching mouth. Jaws long; angle of mouth located behind to posterior margin of eye. Pectoral fins are paddle-shaped, with 15 rays formed in them. Gut wide and relatively straight; anus opens slightly posterior to midpoint of body (*aA* 56–59% *SL*). Dorsal fin origin at midpoint of body (*aD* 47–53% *SL*) and anal fin origin under eighth to ninth ray of dorsal fin. Larvae with well-pronounced predorsal and preanal fin folds. Head pigmentation includes point melanophores above nasal capsules, on branchiostegal rays, a series of point melanophores along posterior margin of eye orbit, and one or two melanophores on preoperculum. Preanal fin fold has a noticeable row of punctate melanophores that ends before anus. Row of five to six melanophores along base of anal fin, with two to three melanophores larger than other ones. Dorsal pigmentation consists of three unpaired melanophores: at beginning, in middle, and posterior to base of dorsal fin. Large larva with one more melanophore posterior to base of adipose fin. Mediolateral row from 16 to 17 large melanophores located on both sides of caudal peduncle above anal fin (in large larva, row ends before vertical of dorsal fin origin). One large melanophore at the end of caudal peduncle and another above anus. Row from four to five melanophores on intestinal. Bases of rays of pectoral fins pigmented; some pigment cells located on base of caudal fin rays. Only Br_2 formed.

Comparative notes. There are only two species of the genus *Gonichthys* that inhabit waters of the Walvis Ridge area. These are *G. cocco* and *G. barnesi*; at the same time, the description of larvae is available only with respect to the first of them (Tåning, 1918; Pertseva–Ostroumova, 1964). The larvae of *G. cocco* are different from the larvae available in our collections by the nature of pigmentation (given the same length, there is no mediolateral pigmentation of caudal peduncle; the pigmentation above the base of the anal fin is presented only by two melanophores). The early development stages of *G. barnesi* are unknown. It should be mentioned that the larvae, described as *G. barnesi* (Pertseva–Ostroumova, 1974), from waters of the Atlantic Ocean were identified later with *Myctophum selenops* (Moser and Ahlstrom, 1974; Evseenko, 1982). The meristic characters of the larva described by us correspond to those reported for adult *G. barnesi* individuals (*D* 11–13, *A* 21–23, *P* 15–16, *V* 8, *sp. br.* (6)5 + 1 + 8(9) = 14–16), which served as the basis for its identification with this species. The catch of an adult individual in the nearby station 2185 (Kobyliansky et al., 2010) is the evidence in favor of this definition.

Lampadena chavesi Collett, 1905

Description. Larvae 8.6, 8.9, and 13.0 mm *SL*, prejuvenile fish 18.9 mm *SL* (Fig. 3) (stations 2184-3, 2184-4, and 2185). *D* 14, *A* 13–14, *C* 6 + 9–10 + 6, *V* 6, *P* 16–17, and *sp. br.* 7 + 1 + 14. Larvae with fusiform, laterally compressed body (*H* 13.5–19% *SL*) and small head (*c* 25.5–30.8% *SL*). Snout pointed and rather short (*ao* 27–31% *c*); eye rounded (*o* 25–30% *c*). Gut relatively straight; anus opens posterior to midpoint of body (*aA* 64–70% *SL*). Dorsal fin origin at midpoint of body (*aD* 46–52% *SL*), anal fin origin

Table 2. Species composition and number of fish larvae caught in Walvis Ridge

Family	Species	Number of individuals, spec.
Nemichthyidae	*Nemichthys curvirostris*	1
Congridae	*Gnathophis mystax*	6
Serrivomeridae	*Serrivomer* sp.	29
Synaphobranchidae	Gen. sp.	1
Gonostomatidae	*Cyclothone pallida*	10
	Margrethia obtusirostra	1
	Bonapartia pedaliota	5
Chauliodontidae	*Chauliodus sloani*	7
Notosudidae	*Scopelosaurus argenteus*	7
	S. mauli	1
	Scopelosaurus sp. 1	6
	Scopelosaurus sp. 2	3
Paralepididae	*Arctozenus risso*	6
	Lestidiops affinis	11
	Macroparalepis brevis	2
	Magnisudis atlantica	1
Phosichthyidae	*Vinciguerria attenuata*	23
	V. nimbaria	7
	V. poweriae	29
Scopelarchidae	*Scopelarchus guentheri*	36
	Scopelarchus sp.	7
Sternoptychidae	*Argyropelecus hemigymnus*	17
	Maurolicus sp.	1
	Sternoptyx sp.	9
	Valenciennellus tripunctulatus	22
Myctophidae	*Benthosema suborbitale*	2
	Ceratoscopelus warmingii	3
	Diogenichthys atlanticus	29
	Diaphus sp. 1	3
	Diaphus sp. 2	1
	Gonichthys barnesi	3
	Gymnoscopelus braueri	28
	Hygophum hygomii	5
	H. reinhardtii	5
	Lampanyctus australis	1
	L. intricarius	1
	L. festivus	1
	L. lepidolychnus	4
	L. pusillus	3
	Lampanyctus sp. 1	4
	Lampadena chavesi	4
	Lepidophanes guentheri	1
	Loweina interrupta	1
	Myctophum phengodes	5
	Nannobrachium achirus	9

Table 2. (Contd.)

Family	Species	Number of individuals, spec.
	N. atrum	3
	Nannobrachium sp. 1	1
	Notoscopelus resplendens	7
	Protomyctophum subparallelum	4
	P. parallelum	29
	Symbolophorus boops	4
	Taaningichthys minimus	3
	Gen. spp.	25
Macrouridae	*Bathygadus cottoides*	1
Chiasmodontidae	*Chiasmodon* sp.	5
Scomberesocidae	*Scomberesox scombroides*	24
Exocoetidae	*Hirundichthys rufipinnis*	1
Melamphaidae	*Melamphaes simus*	3
	Melamphaes sp.	2
	Poromitra megalops	1
	Scopelogadus mizolepis	3
	Scopeloberyx opisthopterus	1
Regalecidae	*Agrostichthys parkeri*	1
Gempylidae	*Diplospinus multistriatus*	1
Nomeidae	*Cubiceps pauciradiatus*	3
Bramidae	*Brama brama*	1
Oneirodidae	*Penthericthys atratus*	1
Total species/stations		70 / 14

under the end of dorsal fin. In larva with 8.6 mm *SL* (Fig. 3a), rays not yet formed in fins. Pigmentation of larvae with 8.6 and 8.9 mm *SL* (Figs. 3a and 3b) consists of large paired melanophore on dorsal side of terminal portion of intestinal tract and paired melanophore under the end of future dorsal fin; caudal peduncle with paired, highly branched melanophores located opposite to each other. In addition, larva with 8.6 mm *SL* with noticeable pigmentation of dorsal side of peritoneum above swim bladder. In larva with 13.0 mm *SL* (Fig. 3c), caudal pigment presented by series from five to six paired melanophores in ventral and dorsal parts of caudal peduncle; larva characterized by presence of formed PO_5 and PVO_2 photophores. Prejuvenile fish with 18.9 mm *SL* (Fig. 3d) preserved larval pigmentation; in addition, full complex of photophores and supracaudal gland, which are characteristic of adult individuals, already observed at this stage.

Comparative notes. At least six species of the genus *Lampadena* inhabit the region under study; early development stages were described only to one of them, namely, *L. luminosa* (Moser and Ahlstrom, 1974; Olivar et al., 1999), which are different from ours both with respect to the nature of their pigmentation and with respect to their meristic characters. The nature of the arrangement of photophores in prejuvenile fish (all *PO* in one line, *VO* + *SAO* 7–9, *AOa* 7, with the latter two–three being located posterior to the base of the anal fin and *AOp* 2 and Prc_{1-2} being more than three diameters of photophores of this series) allowed us to identify the larvae of this series with *L. chavesi* (Wisner, 1976; Bekker, 1983). In addition, the complex of meristic characteristics had already been formed in two large larvae, which is characteristic only of *L. chavesi*. (*L. chavesi* is different from *L. speculigera*, *L. notialis*, and *L. dea* by a lower number of rays in the pectoral fin (14 vs. 16–17)).

Lampanyctus australis Tåning, 1932

Description. Larvae 8.3, 9.3, 10.1, and 10.7 mm *SL* (Fig. 4) (station 2193-1). *D* 13–14, *A* 17, *C* 6 + 9–10 + 6, *V* 6, *P* 13, *br.* 8, and *sp. br.* 6 + 1(2) + 14. Larval body 10.7 mm *SL*, relatively deep (*H* 32% *SL*); head relatively small (29% *SL*), eyes round (*o* 34% *c*). Snout pointed (*ao* 34–36% *c*), jaws extending beyond vertical from posterior margin of eye. Pectoral fins paddle-shaped, rays reaching vertical of base of ventral fins. Gut wide, relatively straight; anus opens posterior to midpoint of body (*aA* 64% *SL*). Dorsal fin

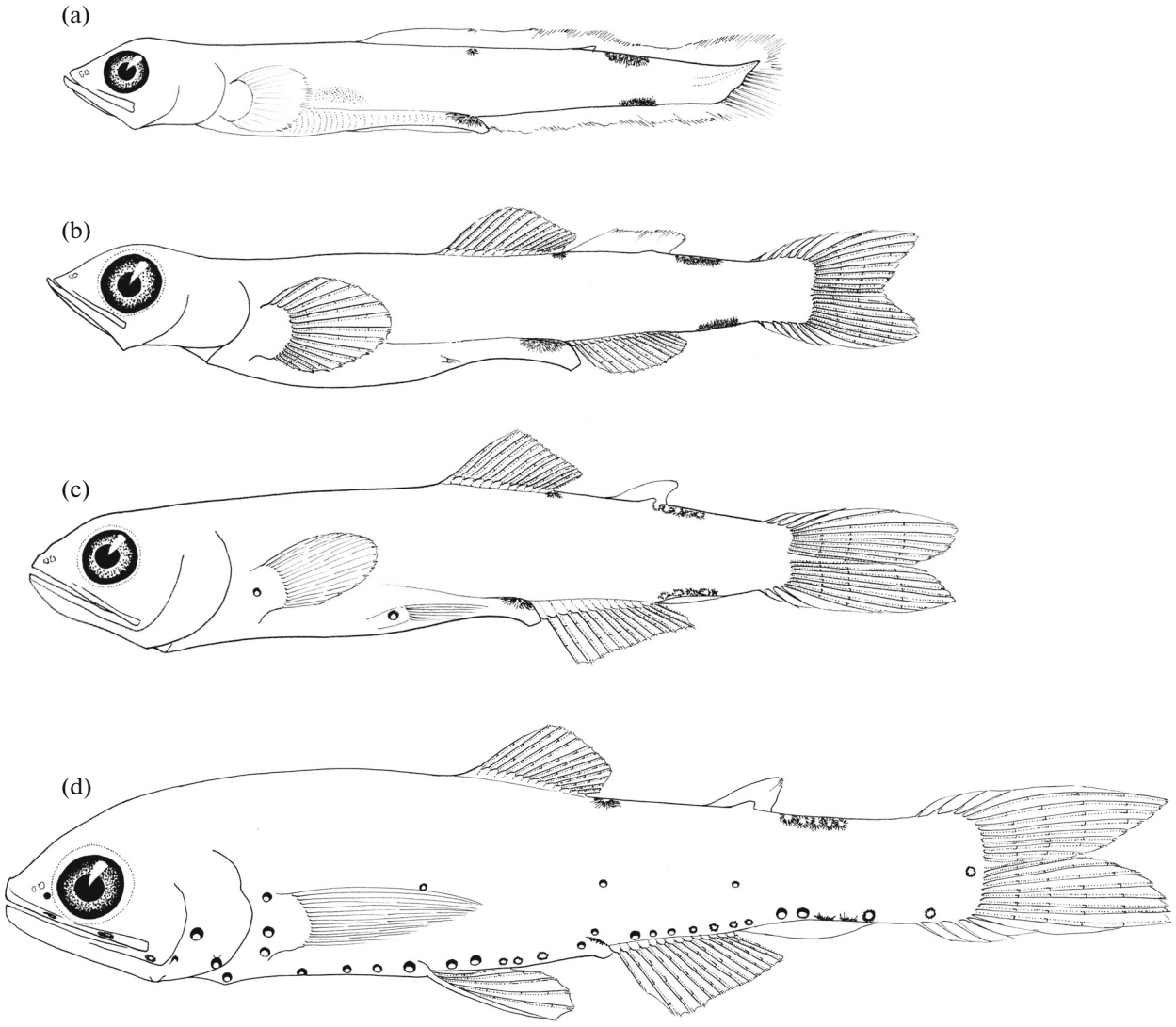

Fig. 3. (a–c) *Lampadena chavesi* larvae and (d) prejuvenile fish: (a) 8.6 mm *SL*, (b) 8.9 mm *SL*, (c) 13.0 mm *SL*, and (d) 18.9 mm *SL*.

origin at midpoint of body (*aD* 50% *SL*) and anal fin origin under the end of dorsal fin. Head pigmentation includes unpaired melanophore on symphysis of lower jaws, anterior to forebrain, and above hindbrain and melanophore on cleithrum. Myosepta under pectoral fins between bases of pectoral and ventral fins are most intensively pigmented. Two to four melanophores on inside of base of pectoral fins. Larvae with 10.1 and 8.3 mm *SL* with unpaired melanophore between dorsal and adipose fins (all larvae from southwestern Pacific with this melanophore). Peritoneum highly pigmented above terminal portion of gut. Br_2 formed.

Comparative notes. With respect to the features of pigmentation and meristic characters, these larvae are similar to the larvae that we found in samples from waters of the southwestern Pacific (34th cruise of R/V *Dmitry Mendeleev*) (Evseenko, 1988). Adult individuals of only seven lanternfish species (*L. alatus*, *L. lepidolychnus*, *L. intricarius*, *L. pusillus*, *L. australis*, *L. macdonaldi*, and *L. festivus*) are circumglobally spread in the southern hemisphere; among them, the larvae of *L. alatus*, *L. lepidolychnus* (Olivar and Beckley, 1997), *L. intricarius* (Bolshakova and Evseenko, 2015), and *L. pusillus* (Tåning, 1918) have been described and are significantly different by their morphological structure from the larvae available for us. *L. festivus* and *L. macdonaldi* can be excluded from consideration due to a significant difference in the number of gill rakers (14–15 in *L. festivus* and 25–28 in *L. macdonaldi* vs. 21–22 in larvae from our collections) and in the number of rays in pectoral fins (16–17 in *L. festivus* vs. 13). Therefore, the only possible species is *L. australis*. With respect to the nature of pigmentation, the larvae from waters of the Agulhas Current that were identified as *L. australis* (Olivar, 1988; Olivar and Beckley, 1997) are different from the larvae available in our samples by the pres-

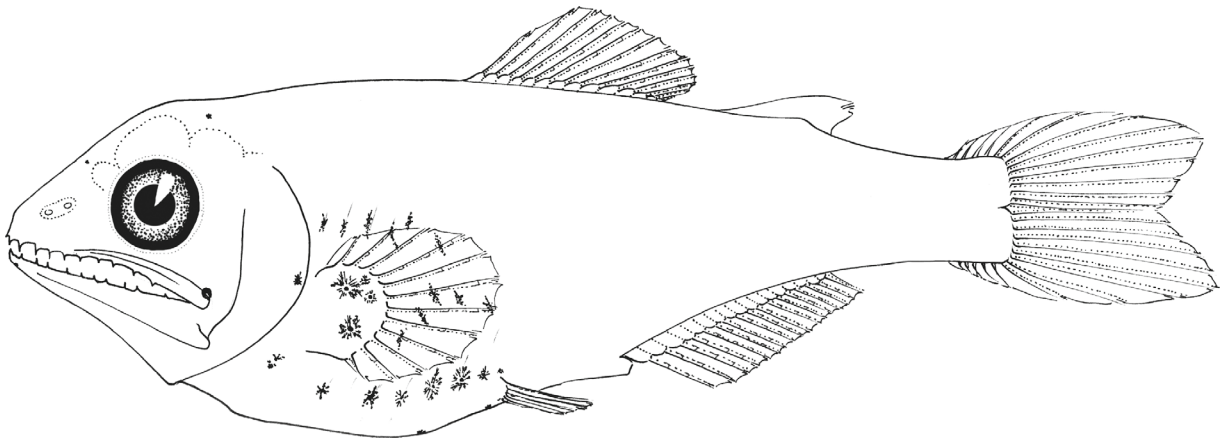

Fig. 4. *Lampanyctus australis* larva, 10.7 mm *SL*.

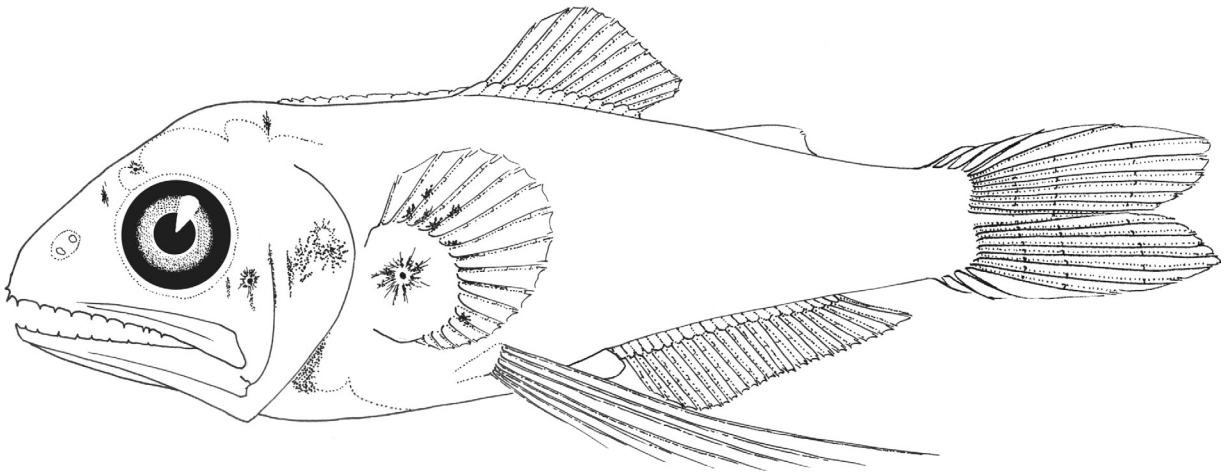

Fig. 5. *Lampanyctus festivus* larva, 9.5 mm *SL*.

ence of a melanophore on symphysis of the upper jaw and a melanophore above the hindbrain that are pigmented with pectoral fin rays and by the absence of melanophores on myosepta under the pectoral fin and a melanophore on cleithrum; at the same time, the characters general for them include the presence of pigment on the base of pectoral fins and on the terminal portion of the gut. Due to a small size (3.0–6.9 mm *SL*) of larvae described by Olivar and Beckley (Olivar, 1988; Olivar and Beckley, 1997), it is rather difficult to assess the significance of the above-specified differences in pigmentation; therefore, the identification of our larvae with *L. australis* is of a preliminary nature.

Lampanyctus festivus Tåning, 1928

Description. Larva 9.5 mm *SL* (Fig. 5) (station 2184-3). *D* 13, *A* 21, *C* 4 + 8–8 + 5, *V* 7+, *P* 16, *br.* 6, and *sp. br.* 3 + 7+. Larva with deep body (*H* 32% *SL*), large head with long jaws extending beyond vertical from posterior margin (*c* 31% *SL*). Eyes large and round (*o* 41% *c*). Large pectoral fins contain 16 rays each. Ventral fins located on vertical of dorsal fin origin; their rays reaching posterior end of anal fin. Dorsal fin origin at midpoint of body (*aD* 47% *SL*) and anal fin origin under ninth to tenth ray of dorsal fin (*aA* 63–65% *SL*). Larva with small predorsal fin fold. Pigmentation includes melanophores above brain (unpaired melanophore anterior to forebrain and posterior to hindbrain and paired melanophores above lobes of forebrain) and aggregations of melanophores on preoperculum and operculum, anterior to leaver. Highly branched melanophore on paddle of pectoral fin; most fin rays pigmented. Only Br_2 formed.

Comparative notes. Among species living in the Walvis Ridge area, only *L. festivus* has a complex of meristic characters that is similar to that specified for the larvae from our collections. Morphologically similar larvae from waters of the Benguela Current and Agulhas Current were described (Olivar and Beckley, 1997) as *Lampanyctus* and preliminarily identified

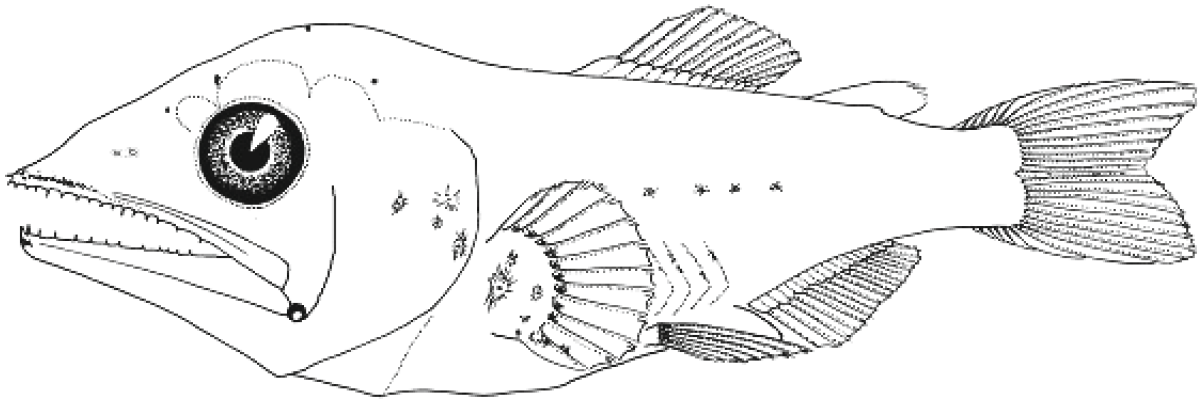

Fig. 6. *Nannobrachium* sp. 1 larva, 8.0 mm *SL*.

with *L. festivus* on the basis of a large number of rays (17) in the pectoral fins. According to the opinion of the authors (Olivar and Beckley, 1997), this character is not sufficient to refer the larva to a certain species. However, in collections from the southeastern Pacific (fifth cruise of R/V *Ikhtiandr*, Mesyatsev bank), we found two *L. festivus* larvae with 5.9 and 6.3 mm *SL*, which are not different from that described above with respect to their meristic characters and their pigment.pattern. This fact provides additional grounds for referring the above-described larva to *L. festivus*, since this species is known from peripheral water masses of the Atlantic and Pacific oceans.

Nannobrachium sp. 1

D e s c r i p t i o n. Larva 8.0 mm *SL* (Fig. 6) (station 2183-2). *D* 13, *A* 17, *P* 12, *V* 8, *C* 5 + 9–9 + 5, and *sp. br.* 10+. Larva deepbodied (*H* 31% *SL*). Head large, its size almost half the length of body (45% *SL*), with elongated pointed rostrum (*ao* 45% *c*); eyes round (*o* 24% *c*). Jaws long; angle of mouth beyond vertical of middle of eye. Pectoral fins paddle-shaped. Gut wide and relatively straight; anus opens beyond midpoint of body (*aA* 78% *SL*). Dorsal fin origin slightly beyond midpoint of body (*aD* 58% *SL*) and anal fin origin under end of dorsal fin. Head pigmentation includes punctate melanophores on ends of jaws, paired melanophore above anterior part of midbrain and unpaired melanophores above fore- and hindbrain and above posterior part of midbrain. Several melanophores on operculum and on cleithrum. Pectoral fin paddle densely pigmented on inside; melanophores at base of rays of pectoral and ventral fins. Internal melanophores noticeable in middle part of horizontal septum and on myosepta of abdominal oblique muscle. Only Br_2 formed.

C o m p a r a t i v e n o t e s. Based on a number of characters (elongated jaws, long rostrum, large head, and large pectoral fins) (Zahuranec, 2000), we refer this larva to the genus *Nannobrachium*. At least six species of this genus live in the South Atlantic: *N. ater*, *N. achirus*, *N. cuprarium*, and *N. lineatus* (Moser and Ahlstrom, 1974; Moser et al., 1984; Moser and Watson, 2001), whose larvae are described and illustrated in the literature (and are different from the larva available for us), and *N. isaacsi* and *N. wisneri*. A greater portion of *N. isaacsi* findings is limited by 10° S (Hulley, 1981; Zahuranec, 2000), while the larva described by us was caught in the Walvis Ridge area at 25° S. Unlike *N. isaacsi*, *N. wisneri* is known from waters of subtropical convergence; therefore, it is this species with which we preliminarily identified the described larva.

Loweina interrupta (Tåning, 1928)

D e s c r i p t i o n. Larva 23.0 mm *SL* (Fig. 7) (station 2184-4). *D* 12, *A* 15, *P* (1)16, *V* 6+, *C* 6 + 10–9 + 5, *sp. br.* 4 + 1 + 9 = 14. Larval body fusiform (*H* 21% *SL*); head relatively small (*c* 26% *SL*). Snout short (*ao* 23% *c*), eyes oval (*o* 20% *c*). Lower jaw extending forward to upper jaw, angle of mouth located posterior to lower margin of eye. Pectoral fins fan-shaped, their lowest ray markedly elongated (broken in our specimen). Gut wide, terminal portion bulbously expanded. Dorsal and anal fins located opposite each other and have their origin in posterior quarter portion (*aD* 73% *SL, aA* 72% *SL*). Characteristic feature is presence of volume predorsal and preanal fin folds. Head pigmentation includes transverse bar between anterior and middle brain regions, diffused pigment between middle and posterior brain regions, and paired melanophore on anterior premaxillare margin. Larval body almost free of pigment: large melanophore in terminal portion of gut, melanophore on base of pectoral fin, and series of both branched and punctate melanophores within fin folds. Only Br_2 formed in larvae.

C o m p a r a t i v e n o t e s. Two species *Loweina*: *L. interrupta* and *L. rara*, occur in waters of Walvis Ridge, the latter having significantly fewer gill rakers

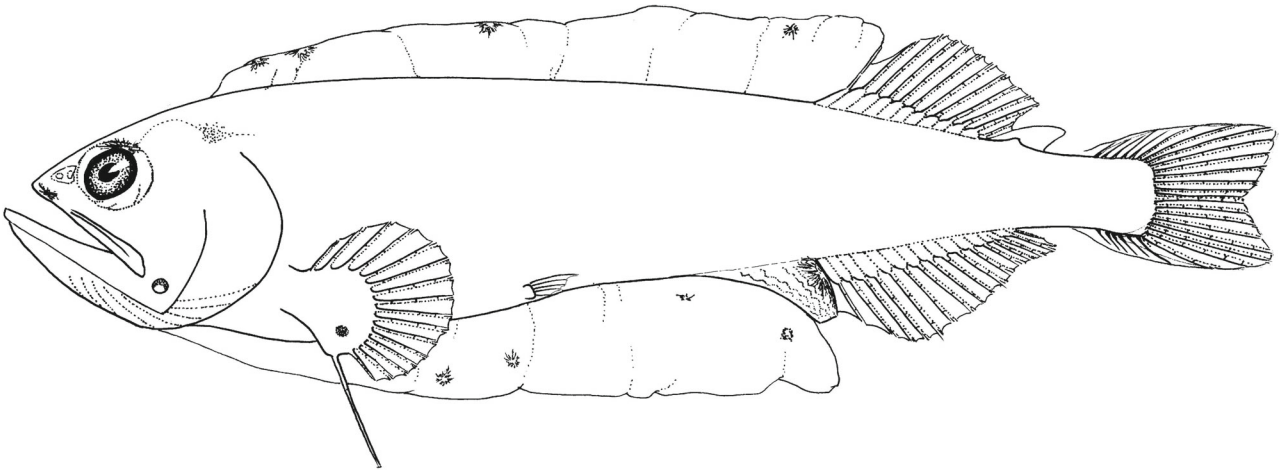

Fig. 7. *Loweina interrupta* larva, 23.0 mm *SL*.

(8–9 vs. 13–14 in the larva described by us) (Hulley, 1981; Becker, 1983). Therefore, we identify the larva from our samples with *L. interrupta*. The *L. interrupta* larvae were described based on their samples from waters of the southeast Pacific (Evseenko et al., 1998); however, the first description of morphologically similar larvae from the northeast Atlantic (regions of Canaries and Azores) that were falsely identified with *Talismania* sp. (Alepocephalidae) was given back in the last century (Roule and Angel, 1930). On the whole, both descriptions are similar: unlike *L. rara* larvae, the *L. interrupta* larvae are poorly pigmented and characterized by the absence of pigment on fin folds, posterior to the adipose and anal fins, and on the base of pectoral fin. Interestingly, the large larva described by us has pigmentation of fin folds, along with pigmentation of the pectoral fin. Possibly, these differences may be due to individual or geographic variation (all the more so since each previous description is presented only with respect to two specimens).

Subfamily Bathygadinae
Bathygadus cottoides Günther, 1878

D e s c r i p t i o n. Juvenile fish 22+ mm *TL* (end of tail part broken) (Fig. 8a) (station 2188-1). *D*1 II 6, *D*2 72+, *A* 71+, *P* 6+, *V* 9, *sp. br.* 5 + 1 + 18 = 24. Prejuvenile fish with deep body laterally compressed and smoothly narrowed in caudal direction; largest height at level of pectoral fins. Head deep; upper head profile with smooth bend. Eyes large, their diameter approximately ¼ *c*. Upper part of operculum with two large thorns located angularly to each other. Two small skinny processes on preoperculum. Mouth large, terminal; end of upper jaw extending beyond vertical of posterior margin of orbit. Teeth conical and identical by size on both jaws. Chin barbell absent. Long rakers in external row on first gill arch number 24 (Fig. 8b), six rakers on epibranchiale, and 18 rakers on ceratobranchiale. Two closely approximated dorsal fins, with boundary between them being well distinguished by different value of pterygophores of their rays. In addition, distance between *D*1 and *D*2 1.5 times larger than that between last and next-to-last rays of *D*1. First dorsal fin with origin above base of pectoral fin; *D*2 long, similarly to anal fin. Anus located slightly posterior to body; anal fin immediately posterior to anus; anal fin rays somewhat shorter than dorsal fin rays. Ventral fins laterally located, at level of vertical of *D*2 origin, and with nine rays, with longest of them reaching level of ninth ray in anal fin. Paddles of pectoral fins large and slightly pedunculated; formation of rays not yet completed in them: only six rays were formed. Larva intensely pigmented. Body covered both with stellate and punctate melanophores. Densest aggregations observed on belly, above ventral fin, and on gill cover.

C o m p a r a t i v e n o t e s. The characteristic features of Bathygadinae include closely approximated dorsal fins, laterally arranged ventral fins, preopercular skin processes, and longer rays of dorsal fin (than those of anal fin). The prejuvenile fish, which was preliminary included in the genus *Gadomus*, was described by Fahay and Markle (1984). This is actually the only juvenile specimen from Bathygadinae subfamily that has been described and illustrated. Habitually, it is similar to the above-described juvenile fish, being different only by the presence of chin barbell. Since the presence or absence of barbell is the main character for differentiating the two genera of the subfamily, i.e., *Gadomus* and *Bathygadus*, we referred the juvenile fish described by us to *Bathygadus*. A total of three species of this genus are spread in the Walvis Ridge area: *B. cottoides*, *B. favosus*, and *B. melanobranchus*. (Iwamoto and Anderson, 1994). The latter has a lower number of rays in the ventral fin (8(7) vs. 9 in the above-described specimen) and a greater number of rays in the second dorsal fin (II 9–11 vs. II 7).

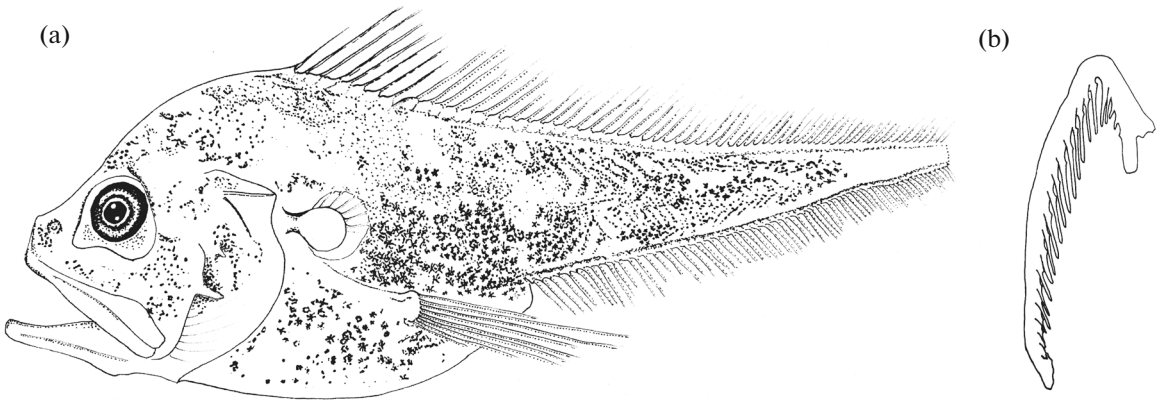

Fig. 8. *Bathygadus cottoides* juvenile fish, (a) 22+ mm *TL* and (b) its first gill arch.

B. cottoides and *B. favosus* are not different in the number of rays in their ventral fins and in the number of gill rakers; therefore, species identification is based on the number of rays in pectoral fins (which had not yet been completely formed in our specimen) and on the number of rays in the first dorsal fin. Based on the fact that *B. favosus* has a greater number of rays in the first dorsal fin (II 8–11 vs. II 6–8 in *B. cottoides*), we exclude it from consideration and identify the above-described juvenile fish as *B. cottoides*.

Family Oneirodidae

Penthericthys atratus (Regan et Trewavas, 1932)

Description. Larva 13 mm *SL* (Fig. 9) (station 2185-3). *D* 6, *A* 7, *P* 25, *C* 9. Larva with deep body submerged into semitransparent jelly-like capsule; body height anterior to pectoral fins 58% *SL*. Body rather elongated in posterior part; head large (*c* 42% *SL*). Larva with very large olfactory organs comparable with eye in size (*o* 28% *c*). Dorsal fin origin in posterior third of body (*aD* 68% *SL*) and anal fin origin slightly anteriad of vertical of base of dorsal fin (*aA* 62% *SL*). Ventral fins absent; pectoral fin rays not extending beyond base of dorsal and anal fins. Melanophores located within shell on each side of body, on gill cover, and on end of caudal peduncle; group of melanophores anteriorly of dorsal fin. Peritoneum intensively pigmented in dorsal part, while ventral part free of pigment. In addition, larva with pigmented rays of caudal fin.

Comparative notes. Along with the above-specified complex of meristic characters, the presence of internal pigment on caudal fin rays distinguishes the larvae of the genus *Penthericthys* from all the other Ceratioidei (Bertelsen, 1951; Pietsch, 2009). In addition, pigmentation of the larva from our collections is exactly the same as that described by Bertelsen for the larvae of this genus. At the present time, the genus *Penthericthys* is recognized to be monotypic: the *P. venustus* species is synonymized with *P. atratus* due to the absence of clear differences between the species. Therefore, we identified the larva with *P. atratus*.

Family Chiasmodontidae

Chiasmodon sp.

Description. Four larvae, 19–27 mm *SL* (Fig. 10) (stations 2183-2 and 2184-4). *D*1 X, *D*2 27–28, *A* I 26–28, *P* 13, *V* I5, *C* 9 + 9–8 + 9. Larva with oblong body; largest height at level of pectoral fins (*H* 15–16% *SL*). Head large (26% *SL*), with relatively short snout (*oa* 29% *c*) and large eyes (*o* 28% *c*); lower jaw extending forward to upper jaw; angle of mouth located posterior to posterior margin of eye. Teeth conical, somewhat recurved, and different by size on both jaws. Spines on preoperculum. First dorsal fin with ten spinous rays (*aD* 37% *SL*); second dorsal and anal fins located opposite each other. Anus opens in first fourth of body (*aA* 21–25% *SL*); distance between anus and anal fin origin 7.5% *SL*. Ventral fins located ventrally under pectoral fins. Entire larval body and small areas on operculum and preoperculum covered with tiny dermal spinules.. Larva intensively segmented: aggregations of melanophores recorded in dorsolateral part of body and on cleithrum, and ventrolateral aggregations recorded in tail part above anal fin and above anus. Dorsal side of peritoneum and rays of pectoral and caudal fins pigmented.

Comparative notes. The larval body is evenly covered with tiny dermal spinules that are recorded in *Chiasmodon*, *Dysalotus*, and *Pseudoscopelus* larvae. The larvae of the genus *Chiasmodon* are different from the other two genera by a lower relative snout-to-vent length (16–21 vs. >30% *SL*). In addition, representatives of the genus *Chiasmodon* have a noticeably larger number of soft rays in the dorsal (26–29 vs. 22–26 in *Pseudoscopelus*) and anal (26–29 vs. 21–26 in *Pseudoscopelus*) fins (Hardy, 1978; Watson and Sandknop, 1996). These features indicate that the larvae from our collections belong to *Chiasmodon*.

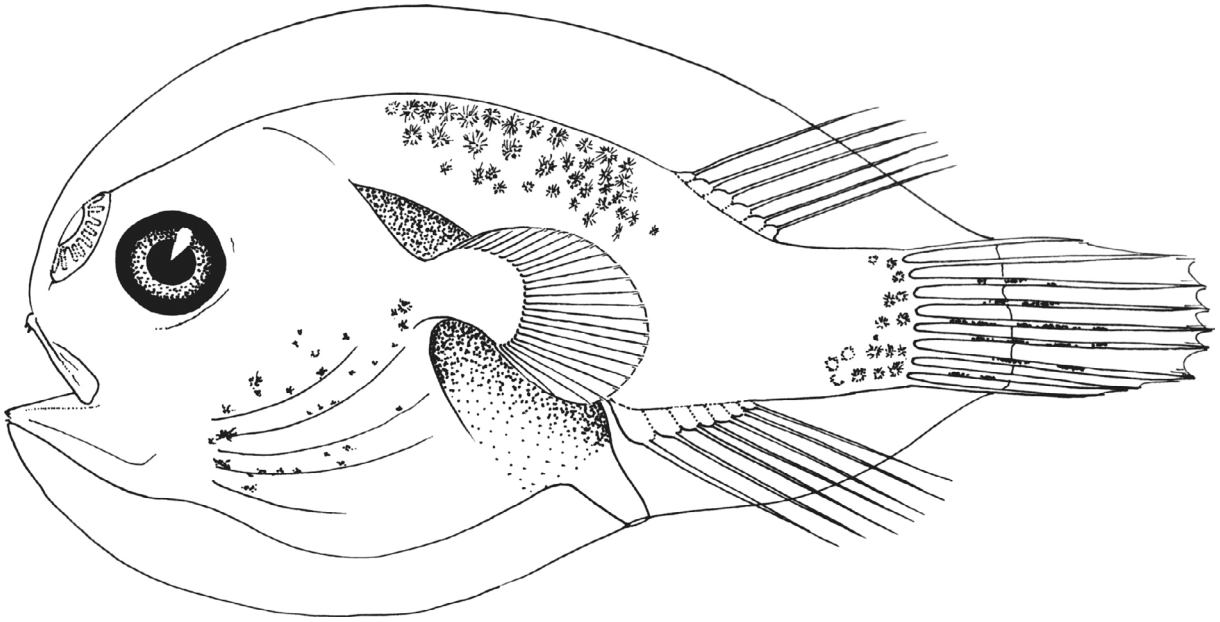

Fig. 9. *Penthericthys atratus* larva, 13.0 mm *SL*.

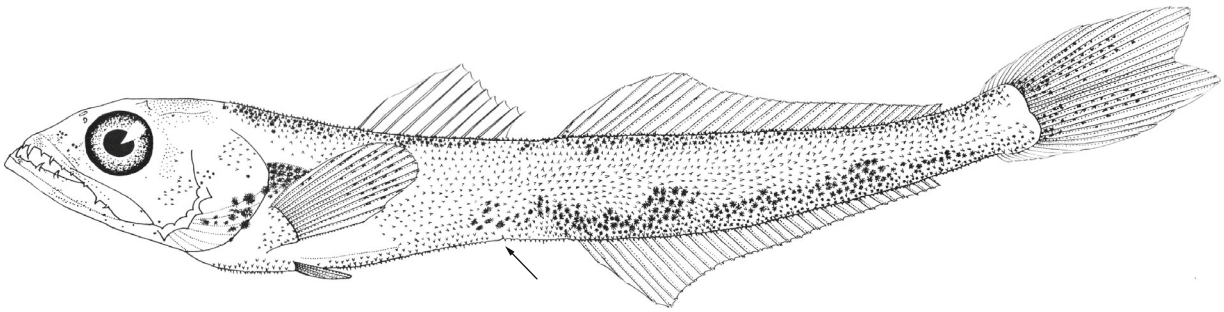

Fig. 10. *Chiasmodon* sp. Larva, 26.0 mm *SL*, (→) anus position.

Due to the fact that the systematics of this genus has been insufficiently studied at the moment, it is still difficult to identify the larvae to the species level. There are currently two diametrically opposite views with respect to the composition of the genus *Chiasmodon*: according to Melo (2009), *Chiasmodon* is represented by seven species in the World Ocean, which are mostly allopatrically distributed, while Prokofiev and Kukuev (2009) and Prokofiev (2010) recognize only two species to be valid. In addition, both works indicate forms that can be considered as independent species or may represent marginal variants of the variability of already known species. Therefore, the species composition of the genus *Chiasmodon* has not yet been finally established. We believe that the study of the morphology and pigmentation characters of chiasmodon larvae from different areas of the World Ocean may confirm one of the existing views, and their detailed research will be carried out in a separate work.

DISCUSSION

The polygon conducted to the east of the Mid-Atlantic Ridge in the Walvis Ridge area is located in subtropical waters and is influenced by subarctic and Antarctic cold waters, which has significant effect on the composition of ichthyoplankton.

An analysis of the zoogeographical affiliation of the species of Myctophidae family, which is represented most abundantly on the polygon, shows the predominance of fishes with the southern peripheral (*Gonichthys barnesi*, *Lampanyctus lepidolychnus/intricarius*, *Myctophum phengodes*, and *Symbolophorus boops*) (here and elsewhere, typification of ranges is made according to Becker, 1983), peripheral bicentral (*Hygophum reinhardtii*, *Lampanyctus festivus*, and *L. pussilus*), and notal (*Protomyctophum subparallelum*, *Nannobrachium achirus*, and *Lampanyctus australis*) types of ranges. The southernmost station of the polygon (2193) was dominated by the larvae of notal *Gymnoscopelus* sp. and notal–subtropical *Protomyc-*

tophum parallelum. Probably, there was a boundary between these stations separating subtropical and notal waters, i.e., there was a subtropical convergence zone between the stations.

On the whole, the species composition of the deepsea fish larvae caught on the polygon is analogical to the species composition of adult fishes (Kobyliansky et al., 2010) that were revealed in the catches of the same trawls from which the larvae investigated by us were obtained. Larvae and juvenile fishes of rare meso- and bathypelagic species of Congridae, Macrouridae, Chiasmodontidae, Regalecidae, Nomeidae, and Notosudidae families are the exceptions, which singly occurred in the samples. In addition, the species composition of Walvis Ridge is supplemented by larvae of epipelagic species (two species of Beloniformes order), whose adult representatives were absent in trawl collections, according to the data of Kobyliansky et al. (2010).

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