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Ichthyoplankton of the Southeastern Pacific Ocean

by T. A. Pertseva-Ostroumova and T. S. Rass

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Ichthyoplankton of the Southeastern Pacific Ocean

By

T.A. Pertseva-Ostroumova and T.S. Rass

The reproduction and development of the fish of the southeastern /7* Pacific Ocean have been studied only to a very limited extent, especially in comparison with what has been done for the ichthyofauna of the European seas (Ehrenbaum, 1905-1909; Bertolini et al., 1931-1956, and others) or for the waters of Japan (Mito, 1961-1963 and others). Out of the 300 and more fish species that have been indicated for the waters off Peru and Chile (Hildebrand, 1946; Fowler, 1945), the eggs and larvae of only 13 species have been described (Chirinos de Vildoso, 1955; Chirinos de Vildoso and Chuman, 1964; Einarsson and Rojas de Mendiola, 1963; Fischer, 1958, 1959 and 1963; Santander de Castillo, 1969 and 1971). Hence on the fourth voyage of the scientific research ship Akademik Kurchatov in the south-eastern waters of the Pacific Ocean special attention was directed to the

*Numbers in the right-hand margin indicate the corresponding pages in the original.

study of the ichthyoplankton and the state of the gonads of fish taken in order to fill in, as feasible, the considerable gap in our knowledge of the biology of the ichthyofauna of a region that is most important both ichthyologically and commercially.

K.N. Nesis, L.N. Musienko, G.N. Pokhil'skaya, G.I. Semina and V.M. Chuvasov rendered valuable assistance in collecting and sorting ichthyoplankton and in experiments on incubating eggs. N.V. Parin, V.E. Bekker, O.D. Borodulina and V.M. Chuvasov (see present collecting papers) caught and determined the species affiliation of fish with mature gonads. The illustrations prepared by T.A. Pertseva-Ostroumova were made ready for printing by G.N. Pokhil'skaya and in part by L.N. Petrushina. We are deeply grateful to all of the foregoing persons for their help.

Material and Methods

The Akademik Kurchatov voyaged in the southeastern Pacific Ocean from the middle of August to the middle of November 1968 and covered a region extending from the equator almost to the latitude of Valparaiso (32°30' S). We made 105 stations (Fig. 1) and caught ichthyoplankton at almost every one.

We caught ichthyoplankton using the following equipment:

a) a Juday ocean plankton net (DZhOM [suitable expansion not available], gauze No. 381, diameter of entrance opening 80 cm; area 0.5 m^2;

b) a perlon [synthetic fiber] ring trawl (PRT [presumably abbreviation of foregoing], diameter of entrance opening 160 cm, area 2 m^2;

c) a Savilov pleuston net (PS [presumably abbreviation of foregoing], 106 x 60 cm; area of entrance opening 0.72 m^2).

We made vertical catches with the Juday net in the 25-0-, 50-25-, 100-50- and 200-100-meter layers, and individual through catches with the Juday net in the 100-0-, 200-0- and 300-0-meter layers; we made catches with the perlon ringtrawl in the layer ranging from 1,000 to 0 meters. We collected a total of 492 samples with the Juday net and 6 samples with the perlon ringtrawl. Using the pleuston net we fished the layer near the surface at almost every station. The methods of collecting and fixing the material have been described by Rass and Kazanova (1966). The ichthyoplankton samples that we collected were fixed immediately in a two percent formalin solution and were in fact studied in a fixed state in order to avoid spoilage of the material. We took some of the eggs live and incubated them to term in order /9 to get the series of development. When we (very rarely) caught males and females of the same species with mature sex products at the same time, we carried out artificial fertilization and then incubated the eggs under laboratory conditions. When we caught females with mature eggs in their ovaries, we studied the structure of the eggs in order to get data on their taxonomic features. We fertilized the eggs artificially using the "dry" method. The fertilized eggs, the eggs from plankton samples incubated to term and the larvae hatched from them developed in crystallizing basins in partial darkness where we regularly freshened and cooled the water. The methods used in our observations have been described by Pertseva-Ostroumova (1961).

Our incubation of artificially fertilized eggs, and incubation to term of developing eggs taken from the plankton samples, enabled us to trace the embryonic and initial postembryonic development of 25 fish species and in a number of cases provided reliable species identification.

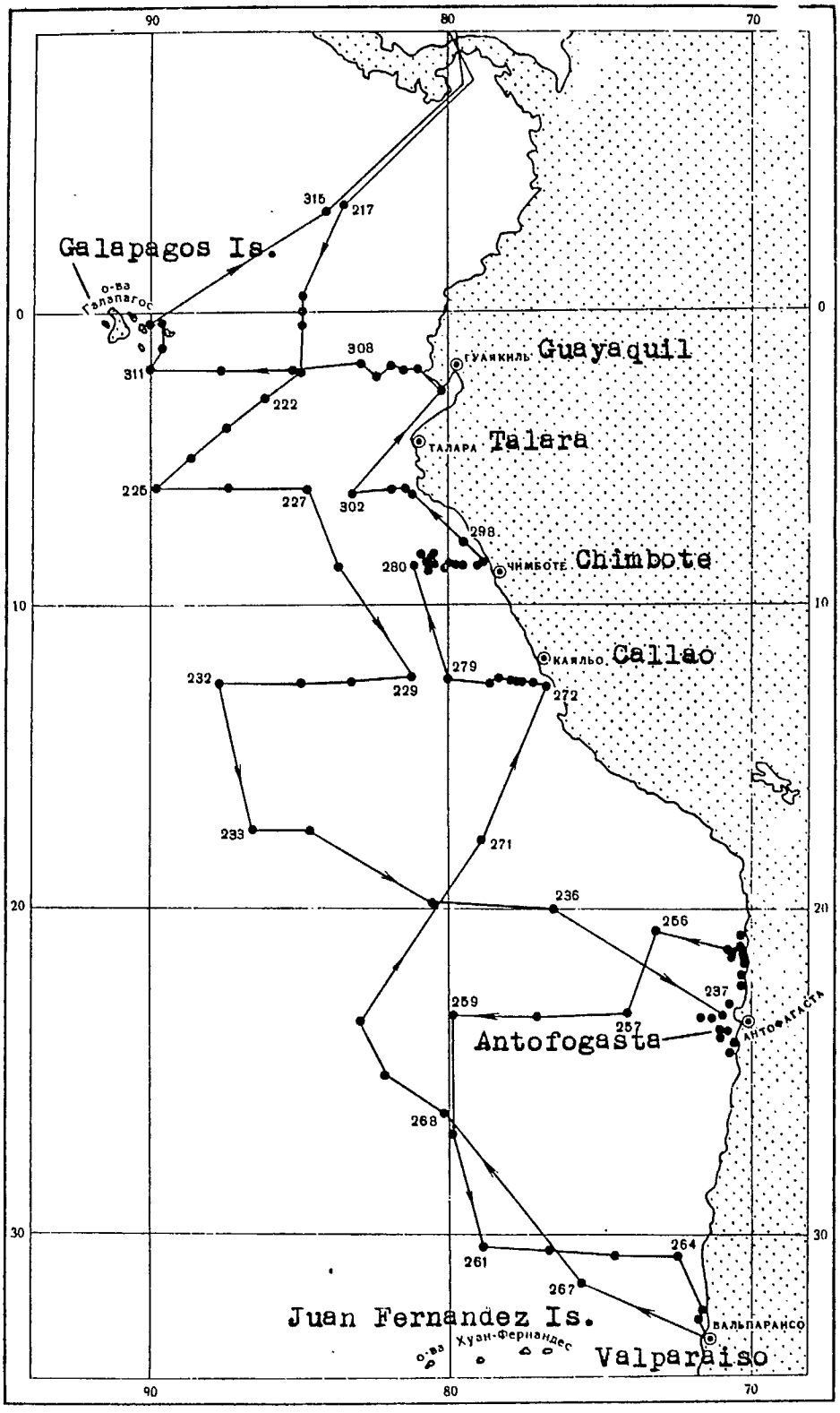

Рис. 1. Местоположение станций 4-го рейса нис «Академик Курчатов» в юго-восточной части Тихого океана

/8

Figure 1. Locations of stations on the fourth voyage of the scientific research ship Akademik Kurchatov in the southeastern Pacific Ocean.

In order to identify the eggs and larvae caught in the sea we made wide use of descriptions in the literature of closely related fish species and genera, as well as of data that we got from catching mature specimens. In our descriptions of the fish eggs and larvae we indicated the phases and stages of development after Rass (1946) and used generally accepted nomenclature.

l - [standard] body length; aA - preanal distance [distance from the end of the snout to the insertion of the anal fin]; aD - predorsal distance [the distance from the end of the snout to the insertion of the dorsal fin, measured in a straight line]; c - the length of the head; ao - the length of the snout; o - the diameter of the eye; H - the greatest height* of the body; H_1 - the height of the beginning of the tail (the height of the body immediately behind the anus); h - the height of the caudal peduncle; D, A, C, P and V - the dorsal, anal, caudal [tail], pectoral and ventral fins.

All told, on the fourth voyage of the Akademik Kurchatov we collected the eggs and larvae of more than 120 fish species. In this paper we describe the material covering 75 species and propose to give the remainder separately.

List of Species of Fish, Eggs (E) and Larvae (L) Described in this Paper

Clupeidae: *Sardinops sagax* (и, л). (E & L)
Engraulidae: *Engraulis ringens* (и, л). (E & L)
Bathylagidae: *Bathylagus nigrigenys* (и, л)[1], *Leuroglossus urotranus* (и, л)[2].

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*Translator's note: Here and elsewhere in this translation "height" has been given as the usual rendition of the original Russian vysota. An alternative equivalent in this type of context can be "depth".

[1]We also got mature eggs from the ovaries of females close to spawning.

[2]We got maturing egg from the ovaries.

Gonostomatidae: *Vinciguerria lucetia* (и, л), *Gonostoma longipinnis* (л), *Cyclothone* sp. (л), *Ichthyococcus* sp. (л), *Maurolicus muelleri* (и, л).
Sternoptychidae: *Sternoptyx diaphana* (л), *Argyropelecus* sp. (л).
Astronesthidae: *Borostomias panamensis* (л). **(L)**
Chauliodontidae: *Chauliodus barbatus* (и, л).
Stomiatidae: *Stomias colubrinus* (и, л).
Melanostomiatidae: *Bathophilus filifer* (л). **(L)**
Idiacanthidae: *Idiacanthus* sp. *(antrostomus?, panamensis?)* (л).
Synodontidae: *Synodus* sp. (и, л). **(L & L)**
Chlorophthalmidae: *Chlorophthalmus mento* (л).
Scopelosauridae: *Scopelosaurus* sp. (л). **(L)**
Myctophidae: *Protomyctophum crockeri* (л), *Hygophum hygomi* (л), *H. proximum* (л), *H. reinhardti* (л), *Hygophum* sp. (и, л)[1], *Diogenichthys laternatus* (л), *D. atlanticus* (л), *Symbolophorus evermanni* (и, л)[2], *S. boops* (л), *Myctophum nitidulum* (л), *Gonichthys tenuiculus* (л), *Diaphus spp.* (л), *Notolychnus valdiviae* (л), *Triphoturus mexicanus* (и, л)[1], *Lampanyctus* spp. (и), *Ceratoscopelus townsendi* (л), *Notoscopelus resplendens* (л), *Lampichthys rectangularis* (л), *Lampanyctus ritteri* (л). Footnotes 1 & 2 p 5
Myctophidae? **(L)** Footnote 1, p 5
/10
Paralepididae: *Stemonosudis macrura* (л), *Lestidiops pacificum* (л).
Scopelarchidae: *Scopelarchoides nicholsi* (л); *Scopelarchus* sp. (л).
Ophichthidae: Gen. sp. (*Myrichthys tigrinus*?).
Scomberesocidae: *Scomberesox saurus* (и, л)[1]. **(I&L)** Footnote 1 below.
Atherinidae: *Odontheshes regia laticlavia* (л)?
Bregmacerotidae: *Bregmaceros atlanticus* (и, л), *B. bathymaster* (л).
Merluccidae: *Merluccius gayi* (и, л). **(I & L)**
Moridae: *Physiculus* sp. (л).
Brotulidae: Gen. sp. (л).
Carapidae: *Encheliophis jordani* (л). **(L)**
Melamphaidae: *Scopelogadus mizolepis bispinosus* (л), *Scopeloberyx opisthopterus*? (л), *S. robustus* (л), *Melamphaes janae* (л), *M. spinifer*? (л).
Trachipteridae: *Desmodema polysticta*? (и, л). **(I & L)**
Mugilidae: *Mugil* sp. (л)?
Apogonidae: *Apogon* sp. (л)? **(L)**
Carangidae: *Naucrates ductor* (и, л), *Seriola* sp. (и, л)?, *Trachurus symmetricus murphyi* (л), *Selar crumenophthalmus* (л), *Decapterus afuerae* (л)?
Sciaenidae: *Stellifer* sp. (л)?
Girellidae: *Doydixodon laevifrons* (л).
Scombridae: *Sarda sarda chiliensis* (и, л.). **(I & L)**
Nomeidae: *Nomeus albula* (и, л)?
Amarsipidae: *Amarsipus carlsbergi* (л).
Scorpaenidae: *Scorpaena* spp. (л). **(L)**
Bothidae: *Bothus constellatus* (л), *Citharichthys gilberti* (л), *Etropus* sp. (л)?
Cynoglossidae: *Symphurus elongatus* (л).

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[1]We got mature eggs and sperm and artificially fertilized and incubated the eggs.

Descriptive Portion /10

As we indicated above, our knowledge of the eggs and larvae of the fish of the southeastern Pacific Ocean is very limited; hence we should describe as large a number as possible of the forms of ichthyoplankton.

This will be necessary in order to significantly expand research on ichthyoplankton, which is essential for a knowledge of ichthyofauna biology, composition and resources. The main task of this paper is therefore to describe the eggs and larvae of the species that are of the greatest theoretical and practical interest, mainly deepwater and important[1] species.

Family Clupeidae

Sardinops sagax sagax (Jenyns), and S. Sagax musica (Girard)

Two subspecies of sardine (De Buen, 1958; Chirichigno, 1969) are distinguished off the Pacific coast of South America: the Peruvian (S. sagax sagax) and the Chilean (S. sagax musica).

Material. Eggs: stations 254-1; st. 298-560; larvae: st. 251-50; st. 254-2; st. 304-23.

The literature contains descriptions of the eggs and larvae of the closely related subspecies of sardines: the Californian S. sagax coerulea (Scofield, 1934) and the Far Eastern S. sagax melanosticta (Mito, 1961-1963). /11 The eggs and larvae that we collected virtually do not differ from those described for these subspecies, and their identification leaves no room for doubt.

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[1] Our material is insufficient for comparison with the collections of EASTROPAC (Ahlstrom, 1971).

Description. The eggs of this sardine are typically fairly large (1.7 to 2.0 mm); they have a large perivitelline space, a vesicular/lobate golden-yellow yolk and one small fat drop (0.15 mm); typical of the larvae is a low, elongated/filiform body with a short tail that is less than 1/4 of the length of the body, and 29 to 31 + 15 to 18 myotomes.

We caught the eggs at a surface water temperature of 15.5 to 17.0° [C] and over a depth of 1,680 meters off the coast of Chile (1 egg) and over depths of 100 to 60 m off the coast of Peru (550 eggs). In our experiments Peruvian sardine eggs took about 2.5 to 3 days to develop at a water temperature of 19 to 20°. A prolarva that had just hatched was 3.9 mm long, and its yolk sac was 1.35 mm long. Resorption of the yolk sac occurred in the course of 3 days.

To judge from the large catch of eggs on 3 November 1968 (1,120 eggs [taken] per square meter of surface, station 298) sardine spawning was taking place at this time off the coast of Peru over depths ranging from 60 to 100 meters and at a [water temperature] of 15.5°. The eggs that we caught were in the initial (I) stage of development and had evidently been spawned 2 to 3 hours before they were caught, i.e., at about 7 o'clock in the morning. We got fairly large larva catches off the coast of Chile over a depth of 220 meters (100 larvae per square meter on 2 October 1968, station 251), and in the region of Guayaquil over depths of 196 to 240 meters (46 larvae per square meter on 7 November 1968, station 304). Far from the coast and over considerable depths we found isolated eggs and larvae that had been carried away by currents from the shores.

Family Engraulidae

Engraulis ringens L.

Material. Eggs: stations 280, 285 to 292 and 294; larvae: stations 243, 245, 272 to 274, 276 and 280 to 296.

The eggs and larvae of the Peruvian anchovy had been described by Einarsson and Rojas de Mendiola (1963), and their identification presented no difficulty. The period of our studies covered the anchovy spawning season (August to March) (Jordan and Chirinos de Vildoso, 1965).

Eggs in all stages of development were caught at the time of our studies off the coast of Peru, in the region of Chimbote and somewhat further north from 27 October (Station 280) to 1 November (station 294) over depths ranging from 40 and 50 meters (station 285) to 6,160 meters (station 294) in amounts of 2,610 to 3,200 per square meter (stations 286 and 287). The eggs were distributed within a 75-mile coastal strip, but were absent further out to sea, and were also found at the coast proper (at station 285 we found only 6 eggs per square meter over depths of 40 to 50 meters). We caught the eggs in the upper 100-meter layer of the water, mainly in the 25-0-meter layer. Accumulations of eggs were found at water temperatures of 15.1 to 17.9°. In our experiments the eggs developed normally at temperatures of 18 to 19°, and their development took about two days. Large egg catches indicate fairly heavy spawning, but the peak of spawning had evidently already passed, since at the peak time catches reach 32,000 eggs per square meter (from a personal communication of B. Rojas de Mendiola).

We caught anchovy larvae both off the coast of Chile (stations 243 and 245; 24 and 30 September; only 3 larvae) and off the coast of Peru (remaining catches). The sizes of the anchovy larvae in our catches ranged from 5.2 to 20.5 mm. The larvae were taken over depths of 40 to 6,240 meters, in offshore waters and as far as 165 miles from the coast. We took the smallest larvae over depths of 97 to 101 meters (station 272). Larvae catches reached 1,380 specimens per square meter of sea surface (station 288, over a depth of 330 meters). Small larvae were taken in the layer near the surface, while larger ones were found in deeper waters (Fig. 2).

Thus from the distribution of eggs and larvae we noted anchovy /12
spawning from the region of Antofagasta (station 245, 22°50' S) to the parallel north of Chimbote (station 296, 8°19' S). We came upon mass spawning off the coast of Peru on the shelf on 29 October at a latitude of 8°30' S over depths ranging from 98 to 204 meters (stations 286 and 287). Published data (Jordan and Chirinos de Vildoso, 1965) indicate that the spawning grounds of the anchovy extend even farther north to 6° S (in August), while in the south spawning has been noted as far as Valparaiso (Fischer, 1958).

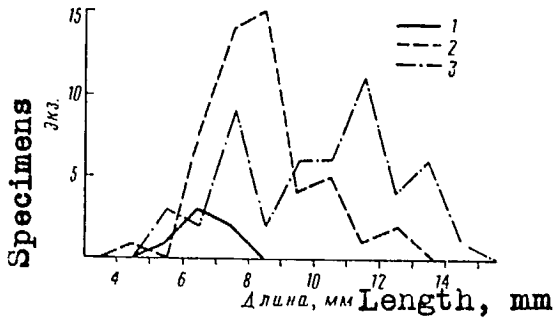

Рис. 2. Вертикальное распределение личинок анчоуса (*Engraulis ringens*)
1 — в слое 0—25 *м*; *2* — в слое 25—50 *м*; *3* — в слое 50—100 *м*

Figure 2. Vertical distribution of anchovy larvae (Engraulis ringens). 1 - in the 0-25-meter layer; 2 - in the 25-50-meter layer; 3 - in the 50-100-meter layer.

Family Bathylagidae

Bathylagus nigrigenys Parr

Material. Mature eggs from the ovaries of females close to spawning; eggs in the early stages of development from plankton catches at almost all stations between 3°44' N (stations 217, 218, 220, 224 to 227, 236, 239, and 247) and 23°20' S (stations 257 to 259 and 309); prolarvae and larvae obtained from the incubation to term of eggs in 18 series; larvae totalling 139 from 3.0 to 18.0 mm in length (stations 218, 220, 224 to 227, 236, 239, 247, 309 and others).

Description. The diameter of the eggs ranged from 0.9 to 1.1 mm (the measurements were made on freshly fixed material). The inner surface of the membrane was ornamented with scattered small light-colored droplets, which gave the membrane a spotty/punctate texture. The perivitelline space represented from 11.3 to 15.9% of the diameter of the eggs, and the diameter of the yolk varied from 0.70 to 0.85 mm. The yolk was lobate, and its surface was reticulate/cellular, the sizes of the cells being about 0.05 mm. The yolk contained 10 to 20 small fat drops that were at first scattered through the yolk and were then located in the form of a necklace along the periphery of the blastodisc, but after the embryo took shape they formed two groups on both sides of the embryo (Fig. 3).

Eggs caught at station 237 on 22 September 1968 at a water temperature of 17 to 18°, developed as follows.

22 September: 1200 hours. Blastodisc stage; the diameter of the blastodisc was 0.4 to 0.5 mm, and its height, about 0.3 mm (Fig. 3, a); 1400 hours: the blastoderm enveloped half of the yolk, and the fat drops

were situated along its periphery; 1900 hours: stage II (embryonic band); a group of fat drops was situated on either side of the embryo.

23 September: 0800 hours. Stage of formation of the tail bud; the embryo enveloped half of the surface of the yolk; melanophores appeared in the anterior portion of the body (Fig. 3, b).

24 September: 0800 hours. The tail of the embryo separated from the yolk (Stage III); there were scattered melanophores on the head, the body and the yolk (Fig. 3, c).

25 September: 0800 hours. The trail of the embryo touched the head (stage IV); the heart beat (Fig. 3, d); 2000 hours: the end of the tail extended beyond the head (Fig. 3, e); the embryo was long, and the height of its body was 0.1 mm; the head was low, and its height did not exceed 0.15 mm;

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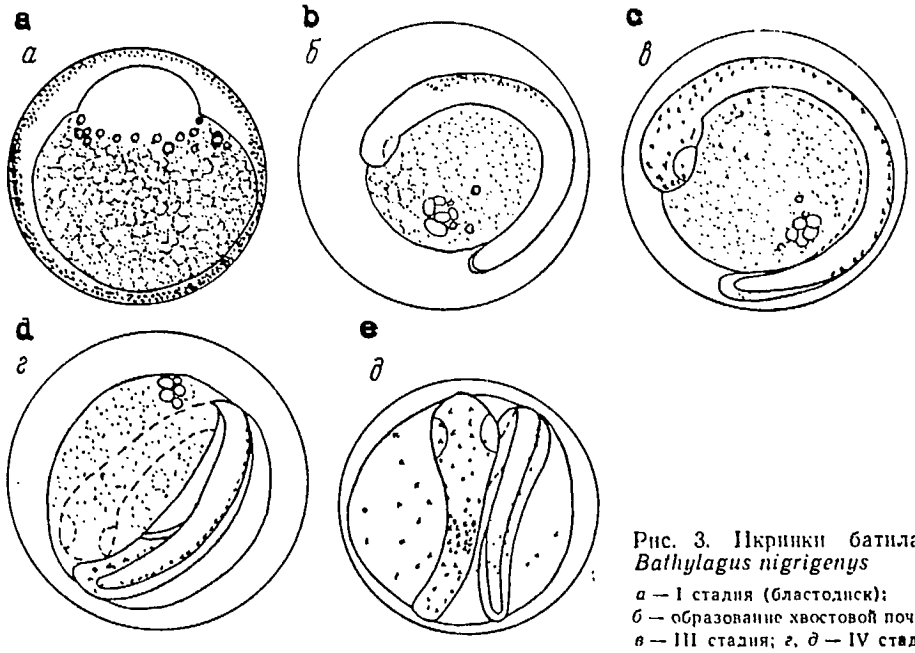

Рис. 3. Икринки батилага *Bathylagus nigrigenys*
а — I стадия (бластодиск); *б* — образование хвостовой почки; *в* — III стадия; *г*, *д* — IV стадия

Figure 3. Eggs of Bathylagus nigrigenys. a - stage I (blastodisc); b - formation of the tail bud; c - stage III; d and e - stage IV.

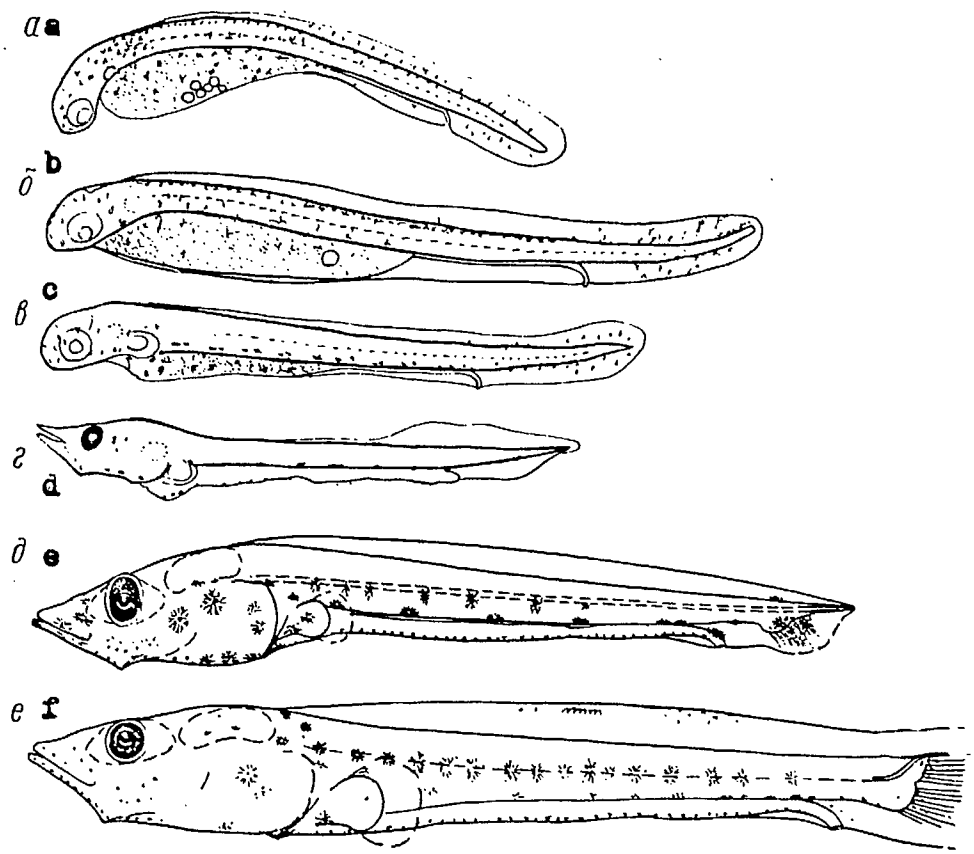

Рис. 4. Личинки батилага *Bathylagus nigrigenys*

а — только что выклюнувшаяся предличинка, длина 3 *мм*; *б* — предличинка, 4 *мм*; *в* — предличинка, 3,4 *мм*; *г* — личинка 4 *мм* (полусхематично, с поврежденной личинки); *д* — личинка, 5,7 *мм*; *е* — личинка, 7,8 *мм*

Figure 4. Larvae of Bathylagus nigrigenys. a - prolarva that has just hatched; length 3 mm; b - prolarva, 4 mm; c - prolarva, 3.4 mm; d - larva, 4 mm (semi-schematically, from a damaged larva); e - larva, 5.7 mm; f - larva, 7.8 mm.

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the eyes were slightly oval, and the length of the oval was 0.15 mm; the /14
intestine was long, and the anus opened near the end of the body; there were about 35 to 40 myotomes in the body of the embryo; pigmentation was represented by a band of scattered melanophores along the back extending from the auditory capsules to the beginning of the rear third of the embryo; the head, the rear third of the body and the yolk were unpigmented.

26 September: 0800 hours. Larvae hatched.

If we assume that the eggs caught in the sea were about 12 hours old at the beginning of the experiment, then the entire embryonic development at a water temperature of 17 to 18° takes about 4 to 4.5 days.

Prolarvae that have just hatched are very small - from 2.7 to 3.8 mm in length (Fig. 4, a). The head is slightly inclined, and its anterior end is free of the yolk; the snout is short, shorter than the eyes. The body gradually narrows towards its end; the yolk sac is relatively large; it is thickened in front, and towards the rear gradually narrows; two groups of small fat drops are located below in its middle portion. The anus is located far in the rear end of the body (aA = 78.5 to 80% l). The body is surrounded a low fin fold. There are 33 to 35 + 7 to 9 myotomes. Pigmentation is represented by branching melanophores scattered over the whole body and extending onto the upper margin of the yolk sac, and, in the rear half of the larva, even onto the fin fold.

In two days a prolarva reached a length of 4 mm. The number of fat drops was reduced to one. The nature of the pigmentation did not change (Fig. 4, b).

Two and a half days after hatching, the yolk sac of the prolarva contracted greatly (Fig. 4, c), and pectoral fins appeared; the length of the prolarva however, did not increase, but, on the contrary, shortened; after fixation its length was only 3.4 mm. The eyes of the prolarvae were still bright, but the pigmentation had been transformed in such a way that the melanophores crept onto the lower margin of the body and onto the trunk and grouped in eight spots. In addition, we could see a row of punctate melanophores on the edges of the tail and on the fin fold surrounding it. Myotomes (numbered) 35 + 7 to 8.

We traced further development from larvae collected in the sea. Larvae 3.7 mm long had a long, low body that was almost wormlike. The snout was very short, shorter than the diameter of the eyes. The eyes were black, and slightly oval, and their height was greater than their length. The head was short, and its length was slightly less than 1/5 the length of the body. The intestine was very long and slightly wavy; the anus opened near the end of the body (aA 80% 1). The pectoral fins were short. The urostyle was straight. The pigmentation of the larva was highly typical. There were punctate melanophores in the anterior portion of the abdomen, in the region of the pectoral girdle and along the sides; along the lower edge of the trunk there were seven sparsely set spots, the intervals between the last three spots being somewhat greater than between the anterior spots. In addition, a small pigment belt was situated on the tail beyond its center. The urostyle was not pigmented. The myotomes as far as the anus numbered 35, while [their number] in the tail was unclear.

In larvae 5.7 to 6.7 mm long (Fig. 4, e) the snout was longer than the diameter of the eyes. The head was short: in the small larvae it was slightly greater than 1/5, and in large specimens, 1/4, of the length of the body. The preanal distance [the distance from the end of the snout to the insertion of the anal fin] was, as before, great and constituted 80 to 85% of the standard length. The pigmentation was also represented by 8 to 11 spots along the lower edge of the trunk and by one spot near the middle of the tail. Myotomes [numbered] 35 to 37 + 7 to 8.

In larvae 7.8 to 8.1 mm long (Fig. 4, f) the snout was much longer than the diameter of the eyes; the head was considerably flattened, and its length in a larva 8.1 mm [long] constituted about a third of the length of

the body. The mouth was small, and its corner was located in front of the eye. The relative dimensions of the preanal distance increased up to 87.7% of the length of the body. The pectoral fins were small and situated low. In a larva 7.8 mm long the hypurals had been established under the urostyle, while in a larger specimen 10 rays of the tail fin had begun to show. In /15 the pectoral fins we could see the rudiments of the rays, and in the place of the future dorsal and anal fins we noted a thickening of the mesenchyme. The myotomes [numbered] 37 + 6 to 7. The pigmentation was made more complex by the appearance of 8 to 11 large branching melanophores on the sides along the middle line of the body.

A larva 13.2 mm long had a low body. The snout was fairly sharp and long. The eyes were small, and their diameter was much less than the length of the snout. The corner of the mouth was located in front of the eye. The head was long, and its length slightly exceeded a third of the length of the body. The transparent gill cover [opercle] did not cover the gill chamber completely and left the last two arches free. All of the gill arches had gill filaments; there were 6 + 1 + 10 rakers on the first gill arch. The intestine was distended in places. The pectoral fins were fan-shaped in the form of translucent plates; they were situated low, and the tip of their base reached the 7th myotome. The tail was almost homocercal. The urostyle was considerably bent, and its end protruded out. There were 19 rays in the tail fin, and the farthest of them were developed only slightly. A low fin fold ran along the upper edge of the body, and the rudiment [literally "establishment"] of the dorsal fin [consisting] of 9 pterygyophores was visible in it over the middle of the body. The larva was heavily pigmented. There were rows of dots on the lower half of the

head and on the isthmus, individual pegment cells on the pectoral girdle, a double row of very fine, almost punctate, melanophores on the lower edge of the intestine, 17 indistinct spots on the sides along the middle line, and 9 spots above the intestine. In addition, there were several small pigment cells on the end of the caudal peduncle.

In larvae 16 mm long the tail was completely homocercal. In a smaller larva we could see 14 pterygyophores in the anal fin along with the rudiments of rays; the rudiment of the dorsal fin had the appearance of a compact band on the peduncles; it included about 9 pterygyophores that were especially developed in the anterior portion.

In larvae 18 mm long the rays in the anal and dorsal fins were differentiated; in the anal fin we counted 14 pterygyophores with 11 weakly developed rays, while in the dorsal and pectoral fins they were damaged, but in the dorsal fin we noted the remains of 9 pterygyophores with the rudiments of rays. There were 6 + 1 + 13 rakers on the first gill arch. The larvae were heavily pigmented. There were melanophores on the head and on the abdomen, and along the sides of the body we traced four rows (not everywhere distinct) of large branching pigment cells that were elongated in a dorsal/ventral direction.

The identification of the eggs and larvae of B. nigrigenys left no room for doubt. The typical structural features of the egg membrane described above, the distinctive nature of the arrangement and migration of the fat drops, and the nature of the pigmentation of the embryos and larvae all correspond to the membrane structure of ovarian eggs and strongly resemble the features recently described for the closely related Californian species B. wesethi (Ahlstrom, 1965 and 1971).

The distribution of eggs and larvae. Bathyal eggs at different stages of development were widely distributed throughout the entire region of our research. Their quantities in the catches were small, usually not exceeding 10 eggs; most often there were only 2 to 4 such eggs, and only at station 220 were 36 eggs caught per square meter of sea surface.

We caught the eggs over considerable depths ranging from 2,560 to 680 meters, in the 0-25- to 200-100-meter water layers, but for the most part in the 25-100-meter layer at surface water temperatures varying from 16 to 26°.

We found the larvae from August to October over depths of 680 to 5,000 meters mainly below the thermocline and in most cases at depths ranging from 50 to 200 meters.

Lueroglossus stilbius urotranus Bussing /16

Material. Ninety-two eggs and 282 larvae ranging in length from 3.5 to 15.7 mm (stations 218, 220 to 224, 238, 291, 293, 295, 296, 298, 299, 302, 304, 307, 308 and 310).

The literature describes the eggs and larvae of the Californian and North Pacific Leuroglossus: L. stilbius stilbius Gilbert and L. stilbius schmidti Rass (Ahlstrom, 1965 and 1971). The assignment of our eggs and larvae to the Peruvian subspecies leaves no room for doubt.

Description. The eggs of the Peruvian Leuroglossus are pelagic and range in diameter from 1.15 to 1.25 mm (Ahlstrom indicates 1.03 to 1.21 mm). The membrane is punctate/spotty (it is covered with scattered vesicles on its inner surface). The yolk is lobate and contains 4 to 7 fat drops, which after the formation of the embryo become arranged in two groups symmetrically on both sides of the embryo. The embryo, with the exception of the end of

the tail and faintly evident melanophores near the anus, is not pigmented. The melanophores on the yolk are concentrated around the fat drops (Fig. 5, b and c). The eggs of L. stilbius urotranus evidently differ somewhat from those of L. stilbius stilbius in their slightly greater diameter (1.15 to 1.25 mm instead of 1.02 to 1.21 mm) and, possibly, in the less brilliant pigmentation of the embryo.

Several live eggs that we caught in the sea in the second stage of development were incubated to term in the laboratory. Their development at a water temperature of 18 to 19° took place as follows.

a) 8 November, 1100 hours: stage II: the embryo had a [literally] kupfer vesicle at the end of the its body, and fat drops were arranged symmetrically on both sides of the embryo (3 and 4 drops);

b) 1740 hours: the tail bud became outlined;

c) 2330 hours: the end of the tail separated from the yolk, but the embryo was still not pigmented;

d) 9 November, 1000 hours: the embryo enveloped more than 2/3 of the surface of the yolk, and the end of the tail was pigmented;

e) 10 November, 1000 hours: the tail extended far beyond the head, and melanophores were visible at the end of the tail and among the fat drops (Fig. 5, c).

A prolarva that had just hatched (Fig. 5, d) was 3.8 mm long. The yolk was elongated and occupied about half of the length of the trunk. Two fat drops were situated at the rear end of the yolk. The pigment cells were located at the rear end of the yolk among the fat drops, at the anterior end of the excretory intestine and at the end of the tail. Towards the end of resorption of the yolk the prolarva was 3.4 mm long (Fig. 5, e), retaining mainly the same kind of pigmentation.

We found larvae about 4 mm long without a yolk sac and with a mouth already open at the same time as the prolarvae described above. Their eyes were black and their melanophores passed from the yolk sac to the trunk and were distributed on the 13th and 14th myotomes.

In larvae 4.8 to 5.5 mm long (Fig. 5, f) the mouth was open, and its corner was situated in front of the eye. The snout was somewhat pointed. The eyes were oval, and their vertical large diameter was equal to the length of the snout. The pectoral fins were short; their tips reached the beginning of the third myotome. The urostyle was straight; aA 74-79% 1; c 20.7-22.9% 1. The myotomes numbered 33 to 34 + 6 to 9. The pigmentation was of the same appearance as in the preceding larvae, and the anterior group of melanophores (located in the prolarvae on the yolk near the fat drops) was situated on the 16 to 17th myotomes.

A larva 7.5 mm long (Fig. 5, g) had a deeper body than in the preceding stage. The eyes were oval and dark, with a small translucent protuberance below. The length of the snout slightly exceeded the large diameter of the eye. The upper profile of the snout above the eye was slightly concave. We noted small gill arches with gill filaments. The pectoral fins as before appeared as short, translucent plates, slightly rounded, whose tips reached the 4th myotome. The urostyle was slightly raised, and the hypurals were slightly outlined underneath it. As before, the larvae were only weakly /17
pigemented. The anterior group of melanophores had disappeared, but the group at the end of the intestine became more distinct.

The eggs of L. stilbius urotranus were caught fairly rarely, and were noted at the beginning of September and in November in small quantities only in the northern part of our study area in equatorial waters in a region

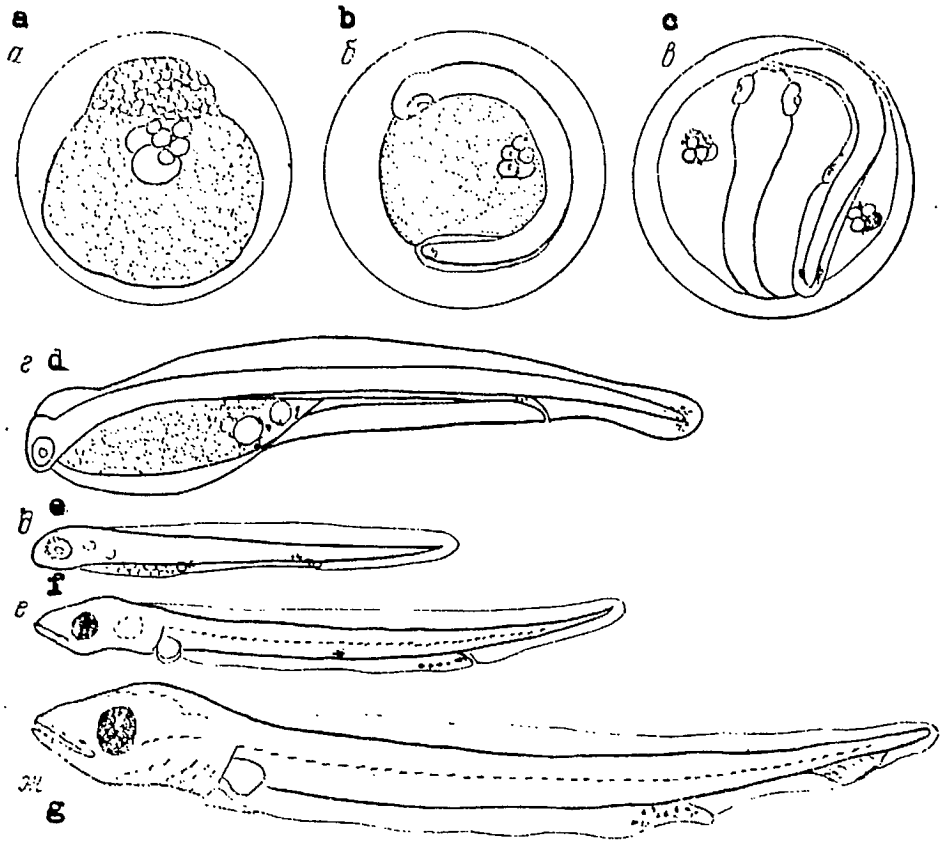

Рис. 5. Икринки и личинки левроглосса *Leuroglossus stilbius urotranus*

а — икринки на I стадии; *б* — икринки на III стадии; *в* — икринка на IV стадии; *г* — только что выклюнувшаяся предличинка длиной 3,8 *мм*; *д* — предличинка длиной 3,4 *мм*; *е* — личинка длиной 4,8 *мм*; *ж* — личинка длиной 7,5 *мм*

Figure 5. The eggs and larvae of Leuroglossus stilibius urotranus.
a - eggs in stage I; b - eggs in stage III; c - eggs in stage IV;
d - prolarva 3.8 mm long just hatched; e - prolarva 3.4 mm long;
f - larva 4.8 mm long; g - larva 7.5 mm long.

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extending from the equator to 6°04' S and between 82°58' and 89°0' W. The egg catches were small, the largest catch at station 223 amounting to 52 eggs per square meter of sea surface.

The larvae were distributed much more widely than the eggs and were found more often and in larger numbers. We noted them in the catches at the end of August and the end of September, and at the end of October/beginning

of November. We found accumulations of larvae at station 223 (142 specimens per square meter), station 302 (64 specimens) and at station 291 (40 specimens). Only isolated specimens were caught at the remaining stations.

We took the eggs and larvae from different layers in the 0-25- to the 200-500-meter range, but most were caught in the 100-50- and 200-100-meter layers at water temperatures ranging from 18 to 21.2° (25 [and] 15°) at the surface, 13.3 to 15.1° at a depth of 100 meters, and 12 to 13.3° at a depth of 200 meters. All of these catches were made over considerable depths ranging from (100-220) 1,820 to 6,180 meters and for the most part from 3,200 to 4,100 meters.

Family Gonostomatidae /18

Vinciguerria lucetia Garman

Material. A large number of eggs and larvae found at almost all stations.

V. lucetia occurs widely in the southeast Pacific Ocean (Parin and others, present collection of papers). The eggs and larvae of this species have been described by Ahlstrom and Counts (1958) and by Gorbunova (1968).

Description. The eggs of V. lucetia are small and do not contain a fat drop. The yolk is coarsely lobate. The diameter of the eggs that we collected ranged from 0.65 to 0.70 mm, and the yolk sizes, from 0.5 to 0.55 mm. The perivitelline space was narrow. The embryo was very distinctively pigmented. There was a double row of small pigment spots on the upper edge of the trunk, a small girdle on the middle of the tail and a few melanophores around the urostyle.

We conducted several series of incubations to term of eggs caught in the sea. Their embryonic development at a water temperature of 18° lasted for about two days.

The length of live prolarvae that had just hatched, reached 3 mm. After fixation this length decreased to 1.8 to 2.15 mm. The prolarvae were transparent and their mouths had not formed. The yolk sac was long (1.3 to 1.55 mm) and thickened in front. The anus opened near the end of the body. The pigmentation was highly typical. It was represented by paired melanophores arranged evenly along the upper and lower edges of the trunk, and, in addition, there was a pair of elongated pigment cells on the middle of the tail and a fan of striae around the urostyle. Resorption of the yolk in the prolarva terminated in three days, and on the fifth day the larva died. During these days the paired melanophores on the upper edge crept down and joined the lower [melanophores]. In the course of further development the melanophores on the trunk disappeared and were retained only on the tail.

The distribution of eggs and larvae. The eggs and larvae of V. lucetia were the most numerous and widely distributed throughout the entire region of our studies. The largest egg catches ran as high as 356 and 834 specimens per square meter of sea surface (stations 218 and 274). Ordinary catches, however, did not exceed a few dozen [literally "a few tens"] eggs.

The eggs were caught over depths ranging from 500 to 6,000 meters (for the most part in excess of 3,000 meters) at water temperatures in the surface layer of 15 to 25.8° (on the average 18°), and in the 100-200-meter layer at a temperature of about 11°. We found the eggs in the 25-0-meter layer and deeper, to the 500-200-meter layer. The largest number (553) was taken in the 100-50-m layer, less (385) in the 50-25-m layer, still less (176

and 121) in the 25-0- and 200-100-m layers and very few, only 18 specimens, in the 500-200-meter layer.

Larvae of V. lucetia ranging in length from 4 to 16 mm were widely distributed throughout the entire region of our studies. They were especially numerous in the open sea, mainly in the tropical waters between the equator and 10° S. The catches of larvae in the coastal regions did not exceed 10 specimens per square meter, increasing with greater distance from the shore to 50 and 82 specimens.

The larvae were caught in different layers of the water, from the surface to 500 m, but mainly within the limits of the upper 100 meters and for the most part over depths of 3,000 to 4,000 m and more. Isolated larvae were, however, found also over shallower depths as far down as 190 to 220 meters.

Gonostoma longipinnis Mukhacheva /19

This species of the genus Gonostoma, which is endemic to Peruvian waters, has recently been described by Mukhacheva (1972). Our collections include 5 larvae ranging in length from 5.0 to 12.6 mm, caught on 5 and 8 October (stations 258 and 263) over depths of 4,150 to 4,780 meters by means of through catches from depths of 500 and 779 m to the surface. Typical features include:

a) the number of myotomes (40 to 41: 17 + 23 to 24);

b) the absence of a clearly evident swim bladder (which in Cyclothone is, as a rule, sharply apparent);

c) the beginning of the anal fin moved somewhat forward (in relation to the beginning of the dorsal [fin]);

d) a combination of a short dorsal (D 12) fin and an anal (A about 28) fin that is twice as long;

e) the absence of pigmentation on the end of the tail.

A detailed description of these larvae will be given by V.A. Mukhacheva in a special study on the larvae of gonostome fishes that she is preparing.

Cyclothone spp.

Material. We caught only 3 larvae ranging in length from 4.1 to 5.7 mm (stations 217, 307, 309: 26 August and 7 and 8 November), wheras mature individuals of several species of this genus were caught at almost every station (Parin and others, 1973).

Typical of the Cyclothone larvae is a low, elongated body, 29 to 33 myotomes, an opposite beginning [to] D and A, the position of the anus being somewhat behind the middle of the body, and a sharply evident swim bladder; D [is] 12 to 15, and A [is] 16 to 21 (Grey, 1964).

Ichthyococcus sp.

Material. A larva 11.2 mm long (Fig. 6); station 221, 31 August, depth of site 2,560 meters; vertical catch with Juday plankton net [at depths of] 25 to 0 meters and a surface water temperature of 20.6°.

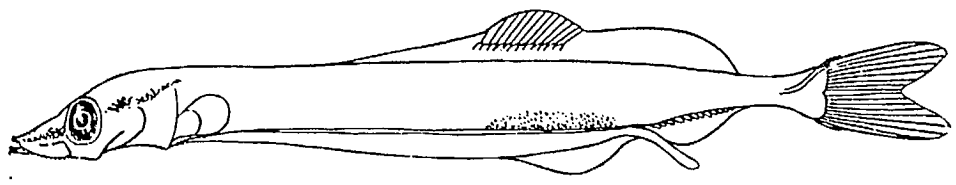

Рис. 6. Личинка *Ichthyococcus* sp. длиной 11,2 мм

Figure 6. Larva of Ichthyococcus sp. 11.2 mm long.

Description. The body of the larva is elongated and low; the tail is short, and the end of the excretory intestine hangs out; the head is low and long (H 9.1, aA 89.3, c 23.2, h 5.3% 1). The snout is long, extended and slightly flattened (ao 36.9% c); the lower jaw protrudes forward, and its rear end reaches the middle of the eye; the upper jaw bears small teeth. The eye is oval, and its longitudinal diameter constitutes 19.2% [of] c. The base of the dorsal fin is in front of the vertical [line] of the anus (see Fig. 6), and the base of the anal [fin] begins 6 myotomes behind the end of the base of the dorsal [fin]. There are about 51 myotomes. At the base of D [there are] 14 (15?) pterygyophores, and at the base of A, 13. The larva is slightly, but very typically, pigmented. A pigment band runs along almost the entire snout and continues back under the base of the cerebrum and the beginning of the spinal cord. There is also a short band at the end of the lower jaw. There is a longitudinally extended accumulation of pigment on the side over the upper profile of the body cavity and under the region where the dorsal fin is established.

The larva is extremely similar to that described for the species /20
I. ovatus by Jespersen and Tåning (1926), differing, however, in the absence of an elongated lower portion of the pectoral fin and in its large number of myotomes (in I. ovatus the number of vertebrae is 38 to 42; see Grey, 1974). The same differences occur in the larva 12.5 mm long from the waters of the western Indian Ocean assigned doubtfully by Aboussouan (1966) to I. ovatus. Only one species of the genus Ichthyococcus - I. irregularis, which has 38 to 39 vertebrae (Rechnitzer and Böhlke, 1958) - has been indicated for the region in which our larva was found. From its number of myotomes, our larva may be assigned to I. elongatus Imai, which is known

from the waters off Japan and to the northeast of the Hawaiian Islands and for which 47 vertebrae have been indicated, or to a closely related species of Ichthyococcus not yet described.

Certain doubts have arisen from the identification of the larvae (prior to the beginning of metamorphism) assigned at one time to the genus Ichthyococcus (Sanzo, 1913 and 1930; Jespersen and Tåning, 1926). A number of characteristic features (the short tail, the hanging rear intestine and the large number of myotomes) distinguish them from other larvae of the Gonostomatidae and give reason to believe that they should be assigned most probably to the Astronesthidae.

Maurolicus muelleri (Gmelin)

Material. Two eggs (station 304) and 5 larvae ranging in length from 7.2 to 8.0 mm (stations 220 and 311). Caught on 28 August (station 220) and from 7 to 10 November (stations 304 and 311) in waters near the equator between the Galapagos Islands and Guayaquil, in the 200-100-meter layer at water temperatures of 13.3 to 15.3° (25.2° at the surface).

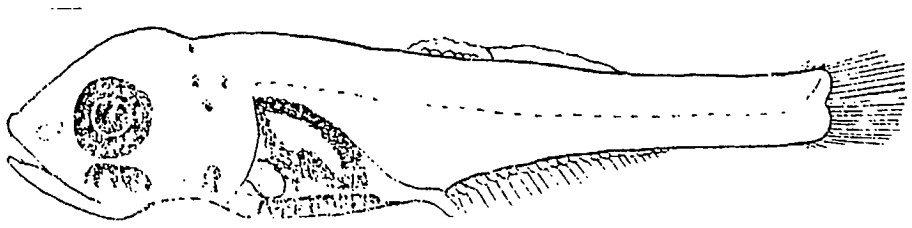

Рис. 7. Личинка *Maurolicus muelleri* длиной 8,0 *мм*

Figure 7. Larva of Maurolicus muelleri 8.0 mm long.

The distinctive eggs of this cosmopolitan species can be identified at first glance owing to the characteristic structure of the membrane, whose surface is covered with hexagonal/conical tubercles like [literally] mediaeval clubs (Sanzo, 1935; Rass, 1972a). Typical of the larvae are the joining of the suborbital and ventral photophores in elongated groups on solid pigment bands (Fig. 7), a long anal fin (A 21 to 22), a short dorsal [fin] (incompletely formed in our larvae), and short, thick head. The number of myotomes in our larvae was 29 to 30 (13 + 16 to 17).

Family Sternopthychidae

Sternoptyx diaphana Hermann

Material. Forty-three larvae ranging in length from 5.1 to 11.7 mm (stations 217, 220, 225 and 227, 228, 232, 296, 301, 304 and 308).

We noted the larvae chiefly in the equatorial waters from 3°31' N to 6°00' S (as many as 12 specimens per square meter of sea surface, and only at /21
two stations further south, [literally] under 8°38' and 12°32' (stations 228 and 232). We caught the larvae over considerable depths ranging from 3,200 to 6,180 meters and at the following water temperatures: 18.7° to 26.9° at the surface; 11.4 to 14.6° at a depth of 100 meters and from 7.3 to 13.3° at a depth of 200 meters. We caught three larvae in the layer near the surface, and the remainder in the 100-50-m, 200-100-m and 500-200-m layers of water and by through fishing from 1,000 to 0 meters.

Argyropelecus sp.

Material. Eight larvae ranging in length from 4.3 to 11.1 mm, caught north of 12°32' S (stations 217, 232 and 311), and at 23°20' S (station 259,

1 larva) over depths of 3,280 to 4,680 meters in the 100-0, 780-0 and 244-130-m layers.

Larvae of Argyopelecus have been described earlier (Holt and Byrne, 1913). Species identification was difficult, since in the region of our studies we noted adult specimens of two species of the genus Argyropelecus - A. pacificus Schultz and A. lychnus Garman (Parin and others, 1973).

Family Chauliodontidae

Chauliodus barbatus Garman

Material. Twenty-one eggs, 1 prolarva 7 mm long and 1 larve 37 mm long (stations 225, 230, 231 and 233-236). We caught the eggs at the end of August and beginning of September, chiefly in the 50-100-meter layer over depths ranging from 1,910 to 4,800 m. We caught the larva on 10 October 1968 in the 261-132-m layer over a depth of 4,131 m at a water temperature of 18 to 18.04°.

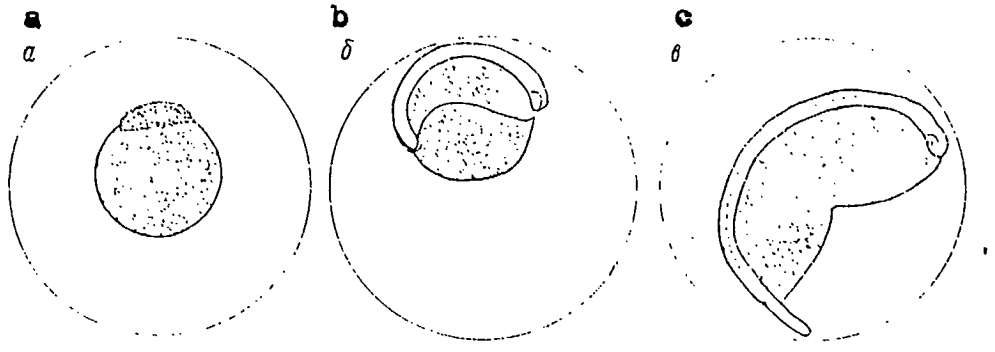

Рис. 8. Икринки *Chauliodus barbatus*
а — I стадия; *б* — II стадия; *в* — III стадия

Figure 8. Eggs of Chauliodus barbatus. a - stage I; b - stage II; c - stage III.

Of the three species of the genus Chauliodus (C. barbatus, C. vasnetzovi, and C. sloani) encountered in the southeastern waters of the Pacific Ocean, the one most frequently caught was C. barbatus Garman (Parin and others, 1973). The eggs were caught in the region of occurrence of adult specimens of this species. Their structure resembled in type that of larvae of the Mediterranean species C. sloani described previously (Bertolini et al., 1931-1956): typical features included large size, a large perivitelline space, the vesicular/cellular structure of the yolk and the absence of a fat drop. The eggs were incubated to term in the laboratory, and from them there hatched larvae whose structure confirmed the correctness of our identification.

Description. The eggs of C. barbatus (Fig. 8) have a diameter (2 and 7) of 3.1 to 3.6 mm; the diameter of the yolk is 1.5 to 1.9 mm, and the perivitelline space is large, constituting 25 to 28% of the diameter of the egg. The yolk is vesicular/cellular and contains no fat drop. The membrane /22
is simple and ordinary, as in the Mediterranean C. sloani. We must note the essential differences in the eggs of C. sloani from the waters of Japan, for which a small perivitelline space and a double membrane have been indicated (Mito, 1961-1963 and 1966). Incubation of the eggs to term was carried out at a water temperature of 18 to 19° and took about 5.5 days from stage II of development at the moment the eggs were caught (Fig. 8, a). The embryo was not pigmented, except for several dash-like melanophores extending radially from the end of the urostyle on the embryonic fold of the tail fin. The hatched prolarva was about 7 mm long. Its yolk sac was long, roughly cigar-shaped and somewhat thickened in front and extended from the head almost to the boundary of the rear third of the body. There

was still no mouth, nor were there any pectoral fins. There were melanophores only on the embryonic tail fin fold around the end of the urostyle.

The larva had a body that was elongated and snakelike and somewhat compressed on the sides and whose height represented only 4% of its length. The anus opened in the rear fourth of the body. There were about 50 myotomes.

Family Astronesthidae

Borostomias panamensis Regan and Trewavas

Material. Four larvae ranging in length from 5 to 17 mm (stations 223, 234 and 236).

Description. The larva 5 mm long (Fig. 9, a) had a long, low [body] (H = 10% l) with a very short tail (aA 88% l) and a hanging free rear end of the intestine. The head was long and low; the snout was long and flattened at the top, and the lower jaw protruded. The larva was pigmented only slightly; on its side it had a pair of melanophores at the end of the forward third of the body and five [melanophores] sparsely arranged in the region of the rear half of the trunk.

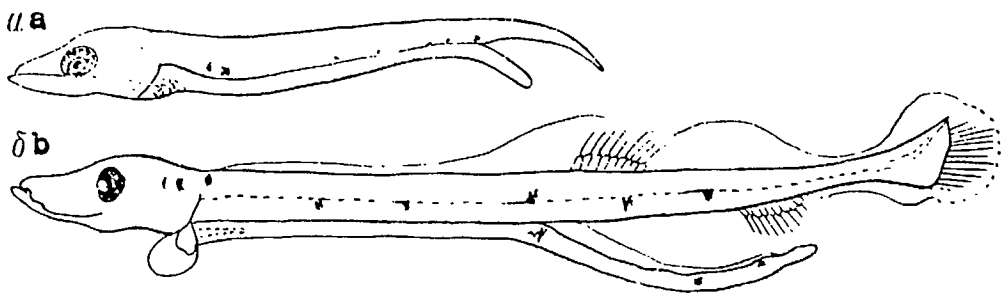

Рис. 9. Личинки *Borostomias panamensis*
а — 5 мм, *б* — 10,5 мм

Figure 9. Larvae of Borostomias panamensis. a - 5 mm; b - 10.5 mm.

A larva 10.5 mm long (Fig. 9, b) was considerably more formed. The body had become still further elongated, and the freely hanging rear end of the intestine had become greatly elongated. The snout, too, had lengthened; teeth had become outlined along the edges of the upper jaw. Rays had formed in nonpaired fins: D 14 to 15; A 11 to 12. The number of myotomes was determined as (49 to 50 = 35 + 14 to 15). The eye was oval. The base of the dorsal fin was considerably in front of the base of the anal [fin]; there were wide embryonic folds in front of it and behind it. The pectoral fins were small. Pigment spots were situated on the head above the auditory capsule and at the beginning of the dorsum above the pectoral girdle. Five spots were widely arranged along the sides between the head and the anus, and three, on the free end of the intestine.

Comparative remarks. The development of the Astronesthidae has /23 virtually not been studied. The only descriptions that have been prepared are of two larvae 14 and 23 mm long assigned tentatively to Astronesthes niger and caught off the Canary and Azores Islands (Roule and Angel, 1930), and one larva 20 mm long caught at [literally "under"] 32°40' S off southeastern Australia and described by Whitley under the name of A. (Warreenula) lupina (Whitley, 1941).

Our larvae are extraordinarily similar to the larva described by Whitley and probably belong to the same or a closely related species. The meristic features of our larvae and (in parentheses) the larvae described by Whitley - D 10 (14), A 11 to 12 (13), C 12 (18), and the number of myotomes (46) 49 to 50 = 35 + 14 to 15 (about 50) - correspond to what we know for Borostomias panamensis and B. antarcticus (Regan and Trewavas, 1930). We caught adult specimens of B. panamensis on our trip (Parin and others, 1973) at a number of stations (236, 277, 307 and 315), and sometimes in the same place as the larvae.

Family Stomiatidae

Stomias colubrinus Garman

Material. Eighty eggs, 3 prolarvae 3.5 to 3.6 mm long (which we got from eggs incubated to term), 33 larvae 30 mm long; [these items] were taken at stations 218 to 227, 229, 302, 308 to 310 and 313 over depths ranging from 2,250 to 4,080 meters, in the layer from 500 meters to the surface and at water temperatures of 18.5 to 25.8° at the surface, 13.9 to 15.3° at a depth of 100 m and 12.4 to 13.3° at a depth of 200 m. We collected the eggs and larvae in August, September and November mainly in waters near the equator (see Fig. 1), where we caught large (up to 29 cm) sexually mature specimens identified as S. colubrinus and S. atriventer (Parin and others, 1973).

Description. The eggs were spherical, with a double membrane. The diameter of the outer membrane was 1.3 to 1.4 mm, and that of the inner membrane, 1.05 to 1.1 mm. The membrane was thin and "moiré" (at high magnification we could see on it thin, delicate bands that reflected the light and that were oriented in different directions, in consequence of which the surface of the membrane produced a rainbow/moiré effect). The size of the slit between the outer and inner membranes represented 9.2 to 10.5% of the diameter of the egg; by the end of embryonic development this value had decreased to 6%. The perivitelline space constituted 15.7 to 15.9% of the diameter of the egg. The yolk was globular/cellular; the diameter of the yolk at stage I was 0.8 to 0.9 mm, and the diameter of the spherical granules composing it was about 0.025 mm. At the beginning of its development the yolk contained one large fat drop (from 0.20 to 0.25 mm in

diameter) and two or three small fat drops (0.01 to 0.02 mm); the latter disappeared after stage II (Fig. 10, a-c). The blastodisc was fairly high (up to 0.3 mm) and 0.5 mm wide (Fig. 10, a).

Melanophores appeared on the body of the embryo at the beginning of stage III at the same time that the tail bud formed. At first they [the melanophores] were situated only behind the head and in the forward half of the body (Fig. 10, b), and then they spread to the head and to the remaining part of the embryo's body. We should note that the small, almost punctate, melanophores on the body were situated on each segment and formed two parallel rows. Thus their number in each row corresponded approximately to the number of myotomes. The melanophores on the yolk appeared at the same time as the melanophores on the body of the embryo, at first singly and only near the forward part of the body, and then, increasing in number and size, they scattered over the entire surface of the yolk. At the end of stage III we noted the anus, which opened near the end of the body. We counted about 53 myotomes in the embryo's body from the auditory capsule to the anus.

We incubated three eggs to term in the laboratory. At a temperature /24 of 20 to 21° their development prior to the hatching of the prolarvae lasted for about four days, from 8 to 11 November. Prolarvae that had just hatched were 3.5 to 3.6 mm long; after fixation their length decreased to 3.3 to 3.4 mm. The prolarvae had long, low bodies in whose rear quarter the anus opened (aA 82.5 to 88.0% 1). The yolk sac was elongated and terminated near the middle of the trunk; its length (in a prolarva 3.3 mm long) was 1.35 mm, and its height, 0.35 mm; on the rear end there was an ellipsoidal fat drop measuring 0.3 x 0.17 mm (Fig. 10, d). Pigmentation was represented by scattered

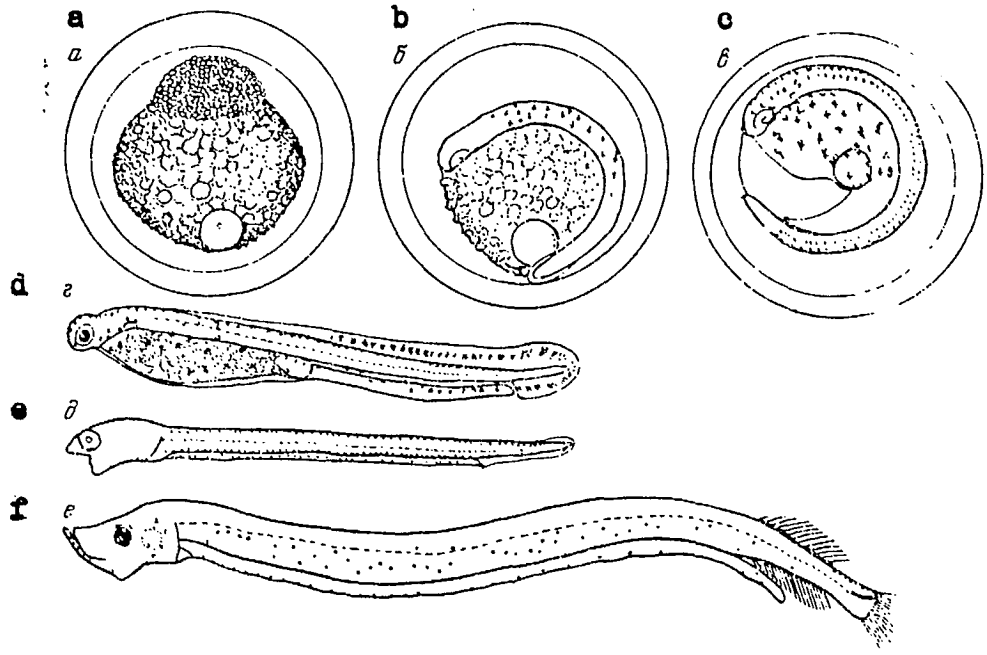

Рис. 10. Икринки и личинки *Stomias colubrinus*

а—в — икринки I, II, III стадий; *г* — предличинка длиной 3.3 *мм*; *д* — бесперая личинка длиной 5 *мм*; *е* — лучеперая личинка длиной 16 *мм*

Figure 10. Eggs and larvae of Stomias colubrinus. a-c - eggs in stages I, II and III; d - prolarva 3.3 mm long; e - apodal larva 5 mm long; f - spiny-rayed larva 16 mm long.

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melanophores on the head and forward part of the trunk, by a single dorsal row along the upper edge of the body on each side; by stellate pigment cells on the yolk sac and the fat drop; by smaller [pigment cells] (in live specimens, brown) in the rear half of the dorsal fin fold, by dash-like cells around the end of the tail and by a group of cells on the anal fin fold (Fig. 10, d). There were 71 to 78 myotomes (55 to 62 + 16).

A larva 5.2 mm long (Fig. 10, e) had an elongated, almost tapelike, body with a fairly large head (aA 82, H 6, c 19% 1). The eyes were small and oval, and their height was greater than their length. The intestine was very long and straight. The pectoral fins were short, and their tips reached

the fourth myotome. The urostyle was straight, and mesenchymal radiation was visible under it. The body was surrounded by a narrow fin fold whose height was less than half the height of the body. There were 72 to 73 (52 to 53 + 20) myotomes. Pigmentation was represented on each side by a dorsal row of punctate melanophores, a more compact lower lateral row and by an unpaired ventral row along the middle line of the abdomen. In addition, there were several scattered small pigment cells on the lower fin fold, two short rows merging in front on the isthmus, a pigment band on /25
the pectoral girdle, three melanophores in each auditory capsule and small groups on the upper and lower jaws (not shown in the illustration).

In a larva 6.8 mm long accumulations of mesenchyme appeared at the place of the anal fin and the hypurals.

In a larva 8.5 mm long 10 pterygyophores became outlined at the [point of] establishment of the anal fin, the mesenchymal rudiment [literally "establishment"] of the dorsal fin appeared, and three hypurals were visible at the base of the tail fin. In larvae ranging in length from 6.8 to 8.5 mm the rear end of the intestine hung out. The pigmentation was similar to that described for the larva 5.2 mm long, with the difference that the anterior half of the dorsal row was considerably thinned out.

Larvae 11 mm long had, like the preceding specimens, an elongated body, but its height increased. The eyes were small. In the dorsal fin we could see 14 pterygyophores and the rudiments of rays, and in the anal [fin] 17 pterygyophores and 10 weakly differentiated rays. Rays in the tail fin became outlined. The pigmentation was for the most part similar to that described for small larave, but the pigment rows on the body became less distinct and compact. In the lower lateral row (above the upper contour of

the intestine) we counted 30 irregularly arranged dots; the dorsal row was sparser, and only in the last quarter of the body was it somewhat denser than in front. In addition, there were several scattered punctate melanophores on the sides in the rear half of the trunk. As before, single pigment cells larger than those on the body were visible on the snout and on the upper half of the head behind the eye. In the tail fin we noted 6 hypurals with the rudiments of rays. There were 70 to 72 myotomes (51 + 20 to 21).

In larvae about 15.0 mm long most of the rays in the unpaired fins had been formed, but in the dorsal fin they were more weakly developed: A 17 to 19; [in] D 15 to 16 were outlined.

In larvae 16.3 to 16.5 mm long (Fig. 10, f) 20 to 21 rays had formed in the anal fin, and in the dorsal fin we noticed 15 to 16 pterygyophores and 12 to 13 rays. There were 69 to 70 (51 to 52 + 17 to 19) myotomes. Pigmentation in larvae 15.0 to 16.5 mm long was weaker than in smaller larvae (see Fig. 10, f). The dorsal row disappeared on the upper edge of the body, and only in one larva 16.5 mm long did we note its remnants on the upper margin of the caudal peduncle; the ventral row became very indistinct. There were scattered punctate pigment cells on the sides of the trunk and melanophores at the base of the rays of the anal fin. As before, we could see pigment cells on the head and on the lower jaw.

Our specimens ranging in length from 27 to 30 mm had been severely damaged. They already had photophores. As before, the pectoral fins were short, and very long ventral fins appeared; A 21 to 22.

Comparative remarks. The eggs of Stomias have not been described, but nevertheless the identification of our material left no room for doubt, since thanks to the incubation of eggs in the laboratory we got an uninterrupted

series of successive stages of development from the embryo to fingerlings 30 mm long that were recognizable from a whole series of features. On the basis of the number of rays in the anal fin (17 to 22) and the number of myotomes (68 to 78), and also allowing for the possibility of incomplete formation of rays in the fins and a greater number of myotomes in the larvae than vertebrae in adult specimens, we have assigned our eggs and larvae to the species S. colubrinus occurring in the region of our studies (Garman, 1899).

If we compare the successive stages of ontogeny in S. colubrinus, we may note the changes that occur: the lengthening of the body and its acquisition of a ribbon-like shape; the relative decrease in the length of the head in the process of its formation; the relative shortening of the tail; the delay in the formation of the dorsal fin as compared with the anal fin; and changes in the nature of the pigmentation. The larvae of S. colubrinus are very similar in their general appearance to the larvae of S. boa boa and S. boa ferox described previously, but differ somewhat in their pigmentation and their countable features (Bertolini et al., 1931-1956; Ege, 1918 and 1934). /26

Family Melanostomiatidae

Bathophilus filifer (Garman)

Material. Fourteen larvae ranging in length from 4 to 10 mm; caught at the end of August and beginning of September at stations 218, 220, 223 to 225, 229 and 232 in the region from 0°30' S to 12°3 ' S over depths of 3,140 to 4,650 meters, mainly in the 100-0-m layer near the surface and at water temperatures of 19.7 to 21.2° at the surface and 13.28 to 15.46° at a depth of 100 meters.

Description. A larva 4 mm long (Fig. 11) had a long, low body somewhat compressed on the sides and bordered by a fairly high embryonic fin fold. The anus opened in the rear quarter of the body (aA 77% l) on an isolated, thick papilla. The head was long and low. The snout was long, and its upper profile was slightly concave. The eyes were oval. The pectoral fins sat low and were fan-shaped. The pigmentation was represented by a dorsal and a lower-lateral/lower-caudal row of melanophores and a large number of scattered, almost punctate cells on the dorsal embryonic fold. There were 42 (35 + 7) distinct myotomes and 5 that were barely outlined.

A larva 7.5 mm long was very similar in its general appearance and pigmentation to that described above, differing in having a longer trunk (aA 86.5% l), a longer snout, and a urostyle bent slightly upwards.

In larvae 9 to 10 mm long the body was surrounded by the high fin fold characteristic of the genus Bathophilus; the head was inclined down, and the urostyle was bent sharply upwards; unpaired fins formed: 11 to 13 rays were outlined in the anal fin, 10 rays in the dorsal fin, and 10 in the tail fin. On the 18 to 19th myotomes there was a noticeable rudiment [literally "establishment"] of a ventral fin. There were 45 to 50 myotomes (35 to 36 + 10 to 14).

Рис 11. Личинка *Bathophilus filifer* длиной 4 *мм*

Figure 11. Larva of Bathophilus filifer 4 mm long.

The development of B. filifer has not been described previously. Nevertheless the assignment of our larvae to this species leaves no room for doubt, since they have the relatively small number of vertebrae (38 to 45) that distinguishes the genus Bathophilus, and also because they were caught at the same stations or near the places where adult specimens of B. filifer had been caught (Parin and others, 1973). The larvae of B. filifer are similar in their structure to the larvae, described earlier, of the western Atlantic Bathophilus sp. (Beebe and Crane 1939) and [to those of] the Mediterranean B. nigerrimus (Bertolini et al., 1931-1956).

Family Idiacanthidae /27

Idiacanthus sp. (antrostomus Gilbert?, panamensis Regan and Trewavas?)

Material. Eight larvae ranging in length from 20.5 to 39 mm from stations 217, 221, 223, 224, 232 and 308 from 3°31' N to 12°30' S over depths varying from 1,820 to 4,160 meters; in the 200-100-m and 100-50-m layers and in through fishing from 200 and 1,000 m to the surface.

Description. The larvae have features typical of Idiacanthus: a low, threadlike, elongated body with an anus set far back and overhanging on the free rear end of the intestine, and eyes advanced on long stalks (see Beebe, 1934; Aboussouan, 1966). In a larva 37 mm long the stalks of the eyes were 7.0 mm long. On the sides and along the middle line of the body there was a longitudinal row of 61 gray pigment spots.

Comparative remarks. Two species of the genus Idiacanthus - I. antrostomus and I. panamensis (Novikova, 1967) - may be found in the region where our larvae occurred. Available data on the meristic features of these species (especially on I. panamensis) are insufficient for the species identification of our larvae.

Family Synodontidae

Synodus sp.

Material. Eggs (and a larva 3.4 mm long that we got by incubation to term); caught at station 304 on 7 November over a depth of 252 meters in the 200-0-m layer at water temperatures of 23.85° at the surface and 14.06° at a depth of 200 m.

Description. The egg was spherical and 1.2 mm in diameter. The membrane had a hexagonal/reticulate structure (of the honeycomb type) and in a live egg shone with a golden luster. The perivitelline space was small. The yolk was homogeneous and contained no fat drop.

A prolarva that hatched from the egg seven days after it was caught had a large yolk sac. The yolk was almost completely resorbed in three days. A three-day larva 3.4 mm long had a low, elongated body surrounded by a fairly high embryonic fin fold (Fig. 12). The anus was located somewhat behind the middle of the body (aA 70.6% l). The intestine was long and straight. The blade-like pectoral fins were situated low. There were 59 to 60 (37 to 38 + 21 to 22) myotomes. The pigmentation ws entirely typical (see Fig. 12): in the form of spots in a longitudinal row along the lower part of the trunk on each side, between the head and the anus, and two smaller spots along the lower edge of the tail.

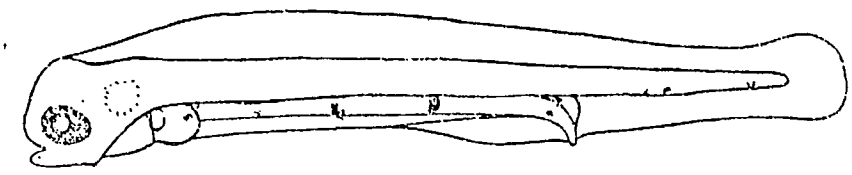

Рис. 12. Личинка *Synodus* sp. *(scituliceps?)* длиной 3,4 мм

Figure 12. Larva of Synodus sp. (scituliceps?) 3.4 mm long.

Comparative remarks. The identification of the egg and the larva left no room for doubt, thanks to features that are typical of eggs of Synodus: the structure of the membrane, the homogeneous yolk and the /28
absence of a fat drop (Zvyagina, 1965; Rass, 1972a). Off the coast of Ecuador we noted two species of Synodus: S. scituliceps and S. marchenae, and possible finds of two more species - S. sechusae and S. evermanni (Chirichigno, 1969). Our egg may possibly belong to S. scituliceps for which 62 vertebrae have been indicated.

Family Chlorophthalmidae

Chlorophthalmus mento Garman

Material. Two larvae 9.1 and 9.7 mm long caught on 27 August 1968 at station 217 (Gulf of Panama, [over] a depth of 3,280 meters and at water temperatures of 27° at the surface and 13.3° at a depth of 200 m; fishing in the 203-0-m [layer]).

Description. The larvae had elongated, well-proportioned bodies with short trunks and large heads (Fig. 13). The proportions of a larva 9.1 mm long were as follows: aA 44%, H 23.0%, H_1 (height immediately behind the anus) 15.4%, h 5.5%, c 29.0% 1. The mouth was small and reached as far as the vertical line of the forward edge of the eye and contained teeth. The intestine was short, and the ventral cavity was of a triangular shape. The pectoral fins were lobe-like and had a broad base. We observed rudiments [literally "establishments"] of the anal fin (at the beginning of the rear third of the body; we could distinguish 11 to 12 pterygyophores) and of the dorsal fin (the mesenchymal rudiment [literally "establishment"] above the anus has not been shown in the illustration). There were 50 (11 to 12 + 38

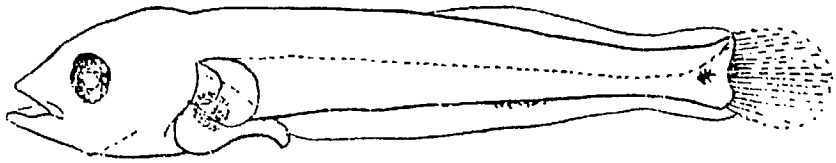

Рис. 13. Личинка *Chlorophthalmus mento* длиной 9,0 *мм*

Figure 13. Larva of Chlorophthalmus mento 9.0 mm long.

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to 39) myotomes. The pigmentation was represented by a gut [literally "peritoneal"] accumulation bordering the swim bladder in a semicircle from below and by a large pigment cell on the end of the tail (see Fig. 13).

Comparative remarks. Our larvae are extremely similar in their general appearance and pigmentation to the larvae of the closely related species C. agassizi (Tåning, 1918); their assignment to the genus Chlorophthalmus leaves no room for doubt. Only one species - C. mento Garman - has been indicated for the eastern coast of the tropical Pacific Ocean.

Family Scopelosauridae

Scopelosaurus sp.

Material. Twelve larvae ranging in length from 10.3 to 36.0 mm. Caught far from the coast between the equator and 23°20' S (stations 220, 222, 235, 236, 258, 307 and 309), over depths ranging from 2,360 to 4,650 meters in the 115-58-, 650-256-, 779-0- and 1,500-0-m layers.

Description. The larvae have a long, low body with a long head, a short trunk, an elongated body cavity and a long tail (Fig. 14).

In a larva 10.3 mm long (Fig. 14, a) the eyes were oval, aA 30.7% 1; only the embryonic tail fin from above and below the urostyle was pigmented.

In a larva 16.0 mm long (Fig. 14, b) the trunk lengthened somewhat, /29 the anal fin (A 17 to 18) formed in the rear third of the body and there were melanophores at the base of the tail fin.

In larvae 22 to 28 mm long the dorsal fin had formed, there was a small adipose fin above the rear end of the anal [fin] and the notch on the tail fin had formed. The base of the tail fin and the bases of the fin rays were pigmented. aA 37.3%, aD about 48%, H 6.4%, c 18.2 to 23.2% 1, ao 40 to 45% c, D 11, A 18 to 19, 60 myotomes.

Specimens ranging in length from 33 to 36 mm (Fig. 14, c) were [fully] formed fingerlings that had the features of mature specimens; D 10 to 11; A 16 to 18; P 10.

Comparative remarks. The typical appearance, the arrangement of the fins, and the countable features of the fingerlings, with the availability of a continuous series of stages of development from larvae 10.3 mm long, leave no doubt as to the correctness of our identification, especially since mature specimens have often been caught in the region of our studies (Bussing, 1965; Parin and others, 1973).

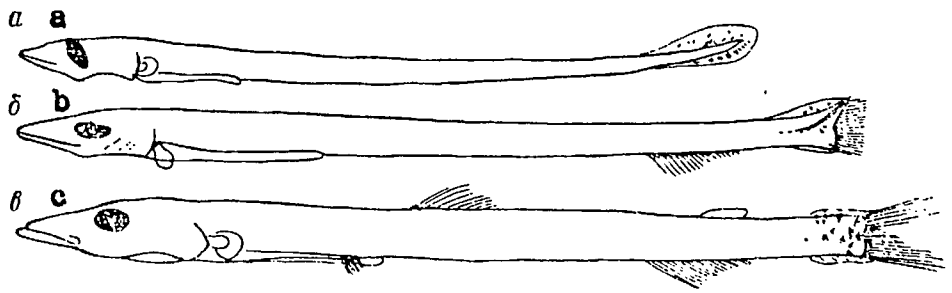

Рис. 14. Личинки *Scopelosaurus* sp.
а — 10,3 *мм*; *б* — 11,0 *мм*; *в* — 33 *мм*

Figure 14. Larvae of Scopelosaurus sp. a - 10.3 mm; b - 11.0 mm; c - 33 mm.

Family Myctophidae

Material. Eggs and larvae of more than 20 species, some of which we could not identify.

Eggs. We got ovarian eggs of Hygophum sp., Symbolophorus evermanni and Triphoturus mexicanus and floating, developing eggs of Hygophum sp. (?).

Description. We got mature (discharging) ovarian eggs from a female of Hygophum sp. (identification by V.E. Bekker, see Parin and others, 1973) caught at station 263 on 9 October 1968. The diameter of the eggs was 0.4 to 0.45 mm; one egg was 0.6 mm [in diameter] (the eggs had not completely swelled); the yolk was lobate and had a clearly evident fat drop. Developing eggs that very much resembled them and belonged evidently to some closely related species of Myctophidae were caught on 3 and 4 October 1968 at stations 251 and 257 by fishing in the 200-0- and 50-25-m [layers] over depths varying from 4,060 to 4,720 meters and at water temperatures of about 17.8° at the surface and 12.4° at a depth of 100 m. The eggs were spherical, with a smooth membrane, and from 0.7 to 0.8 mm in diameter; their perivitelline space was large and represented 26 to 27% of their diameter; the yolk was lobate and contained one fat drop about 0.15 mm in size.

We got maturing ovarian eggs from a female of S. evermanni caught at station 228 on 6 September 1968. The eggs were spherical, from 0.3 to 0.45 mm in diameter, with a smooth membrane; their yolks were lobate, with several merging fat drops.

We got mature (discharging) ovarian eggs from females of T. mexicanus /30 caught at stations 221, (31 August), 239 (23 September) and 313 (10 November) at surface water temperatures of 15.7 to 21.0°. The eggs were spherical, with a smooth membrane; they were 0.60 to 0.65 mm in diameter; the yolk was lobate with a fat drop 0.15 to 0.17 mm in diameter.

Comparative remarks. The structure of the eggs of Myctophidae has been described in different ways. Delsman (1938) and, after Delsman, Mito (1961-1963) assigned with some uncertainty to the Myctophidae eggs with numerous short trihedral protuberances over the entire membrane (diameter of eggs 0.8 mm) with a homogeneous yolk and several fat drops coalescing in the course of development. Sanzo (1939, after Bertolini et al., 1931-1956) described eggs of Electrona rissoi as having a smooth membrane 0.80 to 0.84 mm in diameter, a lobate yolk and a single fat drop [measuring] 0.28 mm forming from the merging initially of several smaller drops. Kulikova (1954) indicates that maturing (at the fourth stage of development) ovarian eggs of Lampanyctus (Stenobrachius) nannochir laticauda have a smooth membrane 0.58 to 0.79 mm in diameter and contain one fat drop measuring 0.19 to 0.34 mm.

Mito indicates that the larvae that hatched from the eggs had 55 to 64 myotomes. This number, however, is too large for the Myctophidae (see below), and we assume that the eggs described by Delsman and Mito with trihedral protuberances do not belong to the Myctophidae.

Larvae. We caught only a few hundred larvae; the quantity, sizes and number of myomeres of the larvae are shown in Table 1, and the distribution of the catches by stations is given in Table 2.

As may be seen from Table 1, the larvae ranged in length from 2.8 to 14 mm. The numbers of myomeres (equal, in larvae having rays in their fins, to the number of vertebrae), according to our own and published data, were as follows: from 28 to 30 in N. valdiviae to 40 and 43 in L. rectangularis; the number of myomeres was 30 to 32 in D. laternatus, 32 to 35 in D. atlanticus, T. mexicanus and Diaphus spp, 35 to 38 in P. crockeri, H. hygomi, C. townsendi, N. resplendens, and L. ritteri; 37 to 40 in H. reinhardti, two species of

Symbolophorus, M. nitidulum and G. tenuiculus and 35 to 40 in Lampanyctus spp. The tail was longest (in relation to the trunk) in larvae of Protomyctophum (25 to 28 myomeres as against 8 trunk [myomeres]; it was somewhat shorter in Diogenichthys (18 to 21 as against 12 to 16); next followed Hygophum (20 to 21 as against 15), Symbolophorus (22 to 24 as against 14 to 16), Lampichthys (23 to 24 as against 17 to 19), Ceratoscopelus and L. ritteri (19 to 20 as against 16 to 17); Triphoturus had the shortest tail (16 to 17 as against 18). These ratios to a certain extent correspond to the zoogeographical rule established previously by T.S. Rass (1941 and 1948) according to which the tail lengthens relatively in series of closely related forms of fish from tropical to arctic waters.

As shown in the last column of Table 1, the larvae of almost all the species have already been described (Pertseva-Ostroumova, 1964 and 1967; Tåning, 1918; Ahlstrom, 1965; Moser and Ahlstrom, 1970; hence there is no need to describe them in the present study. The larvae of Lampichthys rectangularis Fraser-Brunner have not been described previously. Three larvae of this species 7.6, 8.0 and 13.7 mm in length were caught at stations 229 and 234 over a depth of 4,650 meters in the 261-135-meter water layer and at the surface. Typical of this species is a large (for Myctophidae) number of myomeres (40 to 43) and a large number of rays in the unpaired fins (D 16 to 17; A 22).

The distribution of the larva catches by stations is shown in Table 2. The outside columns (stations 217-220 and 303-315) of this table cover the stations made in equatorial waters from 3°31' N to 2°45' S (see Fig. 1); the columns nearest to them apply to the stations in subtropical waters; next are those in notalian, moderately warm and strictly temperate waters. /31

Table 1.

Material on Lyctophidae Larvae

Таблица 1

Материалы по личинкам Myctophidae

1. Вид	2. Число личинок	3. Размер личинок, мм	Число позвонков по собственным (в скобках) и литературным данным 4.	Описание личинок * 5.
Protomyctophum crockeri	3	4,6—9,0	36—38 (8+25—28)	МА, 1970 П, 1967
Hygophum hygomi	11	6,3—8,6	36—37 (15+21)	Т, 1918
Hygophum sp.	13	4,6—8,0		
H. proximum	7	4,7—10,4		
H. reinhardti	4	3,4—14,0	38—39 (15—20)	МА, 1970
Diogenichthys laternatus 6.	Много	3,3—11,0	30—32 (12—13+18—19)	МА, 1970 Т, 1918
D. atlanticus 7.	Ок. 20	2,8—9,4	32—35 (12—16+19—21)	МА, 1970 П, 1957
Symbolophorus evermanni	12	3,5—9,3	37—40 (15—16+22—24)	П, 1964
S. boops	4	4,0—9,1	37—39 (14—16+23)	
Myctophum nitidulum	34	3,1—7,0	37—39	МА, 1970
Gonichthys tenuiculus	7	5,6—11,3	38—40	МА, 1970
Notolychnus valdiviae	4	12,5—15,3	28—30	П, 1964, Т, 1918
Triphoturus mexicanus	189	2,5—7,9	33—35 (18+16—17)	А, 1965
Ceratoscopelus townsendi	2	5,2—7,3	35—38 (16—17+19—20)	П, 1964
Notoscopelus resplendens	6	4,8—6,3	37—38	П, 1964 Т, 1918
Lampichthys rectangularis	3	7,6—8,0	40—43 (17—19+23—24)	
Lampanyctus ritteri	22	3,6—6,6	35—37 (16+19—20)	А, 1965
Lampanyctus spp.	93	3,5—10,1	35—40	П, 1964 Т, 1918
Diaphus sp.	1	6,0	31 (14+17)	П, 1964 Т, 1918

* МА — Moser, Ahlstrom, 1970; П — Перцева-Остроумова, 1964, 1967; Т — Taning, 1918; А — Ahlstrom, 1965.

Pertsa-ostroumova,

Key:

1. Species; 2. number of larvae; 3 - size of larvae in mm; 4 - number of vertebrae from our own (in parentheses) and published data; 5 - description of larvae; 6 - many; 7 - about.

We made stations 260 to 268 in this region of moderately cold, south notalian waters (36°17' to 32°30' S).

To judge from the distribution of the larva catches (Table 2), finds of M. nitidulum, N. valdiviae and N. resplendens have been confined chiefly to the warmest equatorial waters; L. laternatus and G. tenuiculus are found in equatorial and moderately warm waters; S. evermanni, T. mexicanus and L. ritteri, and to some extent L. rectangularis, mainly in moderately warm waters; P. crockeri Hygophum spp. and C. townsendi are found in strictly temperate and moderately cold notalian waters, and, finally, D. atlanticus and S. boops occur for the most part in moderately cold southern notalian waters. When we compare the meristic figures for the closely related species D. laternatus and D. atlanticus, S. evermanni and S. boops (Table 1), we can see that D. atlanticus, which is more cold-loving, has a larger number of vertebrae (mainly in the tail) than L. laternatus, which is more of a warm-water species, whereas in species of Symbolophorus such ratios virtually do not /33 appear. In M. nitidulum, N. valdiviae and N. resplendens (?), which are the most thermophilic species, there are 28 to 29 vertebrae, while D. atlanticus and S. boops, which are the most cold-loving species, have 37 to 40 vertebrae; L. rectangularis[1], which is caught at lower latitudes, but in abyssal cold water, has an even larger number of vertebrae (40 to 43). We (Rass, 1941 and 1948) have studied the geographic patterns of this genus in detail and analyzed them previously; there is no need to consider them here, especially since analysis of the structural differences of the Myctophidae related to temperature requires that allowance be made not only for the latitudes of their geographical ranges but also for their vertical distribution.

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[1]The largest number of vertebrae among the Myctophidae (41 to 45) has been indicated for the species of the predominantly subantarctic genus Gymnoscopelus (Andriyashev, 1962; Paxton, 1972).

Table 2.

The Distribution of Catches of Larvae of Myctophidae by Groups of Stations.

Таблица 2

Распределение ловов личинок Myctophidae по группам станций *

Вид Species	217,315	218—220	221—224,309,310	225—227	228	229—232	233—236,271	237—255	256—259,269—270	260,268	261—263,267	264—266	272—279	280—298	299—302	303—308	311—314
Protomyctophum crockeri	—	—	—	—	—	—	—	+	—	—	—	—	—	—	—	—	—
Hygophum hygomi	—	—	—	—	—	+	+	—	+	—	—	—	—	—	—	—	—
Hygophum sp.	—	—	—	—	—	+	—	+	+	—	+	+	—	—	—	—	—
H. proximum	—	—	—	—	—	+	+	—	—	—	—	+	—	—	—	—	—
H. reinhardti	—	—	—	—	—	+	—	—	+	—	—	—	—	+	—	—	—
Diogenichthys laternatus	+	+	+	+	+	+	+	+	+	—	—	—	+	+	+	+	+
D. atlanticus	—	—	—	—	—	—	—	+	+	+	+	—	—	—	—	—	—
Symbolophorus evermanni	—	—	+	+	—	+	+	—	—	—	—	—	—	—	+	—	+
S. boops	—	—	—	—	—	—	—	—	+	—	—	+	—	—	—	—	—
Myctophum nitidulum	+	+	+	—	—	+	—	—	—	—	—	—	—	—	—	+	+
Gonichthys tenuiculus	+	—	+	—	—	+	—	—	—	—	—	—	—	—	—	—	—
Notolychnus valdiviae	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tripholurus mexicanus	—	—	+	—	+	+	+	+	+	—	—	—	+	+	+	+	—
Ceratoscopelus townsendi	—	—	—	—	—	—	—	+	+	—	—	—	—	—	—	—	—
Notoscopelus resplendens (?)	—	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lampichthys rectangularis	—	—	—	—	—	+	+	—	—	—	—	—	—	—	—	—	—
Lampanyctus ritteri	—	—	+	—	—	+	+	—	+	—	—	—	+	+	—	+	—
Lampanyctus spp.	—	—	+	—	—	—	+	+	+	—	+	—	+	+	+	+	+
Diaphus sp.	—	—	—	—	—	—	—	+	—	—	—	—	—	—	—	—	—

* Графы таблицы (слева направо): 1—3 — тропические воды, 4—6 — субтропические, 7—9 — нотальные, 10—12 — южнонотальные, 13—14 — северонотальные, 15 — субтропические, 16—17 — тропические.

Table columns (from left to right): 1-3 - tropical waters; 4-6 - subtropical waters; 7-9 - notalian waters; 10-12 - south notalian waters; 13-14 - north notalian waters; 15 - subtropical waters; 16-17 - tropical waters.

/32

Family Myctophidae? Stalk-eyed Larvae

Material. Sixteen larvae ranging in length from 3.3 to 13.5 mm; caught at stations 217, 223, 231-233 and 304 in tropical/subtropical waters over depths varying from 240 to 4,660 meters; from catches in the 1,000-400-, 200-100-, 156-60-, 58-26- and 33-0-meter [layers].

Description. The larvae have a low, elongated body with a trunk that somewhat exceeds half the entire length, a long head and stalked eyes (Fig. 15). In a larva 3.3 mm [long] the eye stalks are about 0.2 mm long; in a larva 5 mm [long the eye stalks are] 0.5 mm long. The pigmentation is in rows: on the trunk there is a lower lateral row of sparsely set cells that continue back in the form of a lower caudal [row]; there is a short double row on the isthmus, scattered cells on the abdomen, and one melanophore on the upper edge of the tail above the rear melanophore of the lower caudal row. There are 41 to 42 (17 to 18 + 24) myotomes.

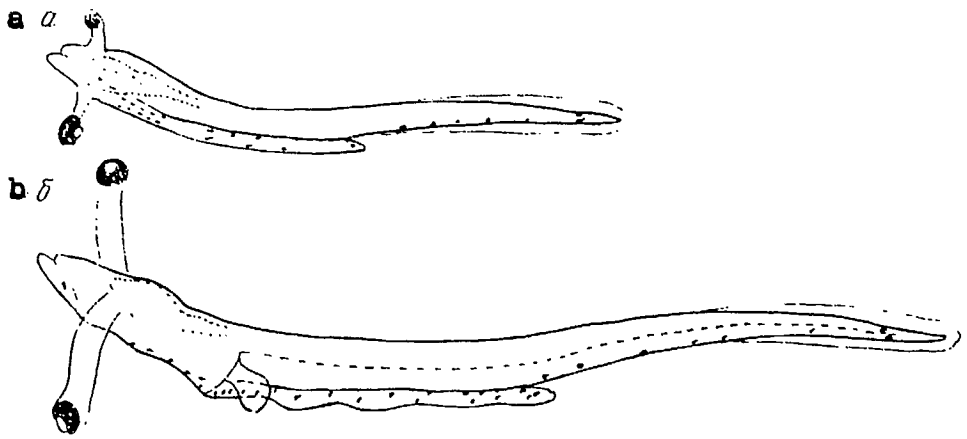

Рис. 15. Личинки Myctophidae (?) gen. sp.?
а — 3,3 мм; б — 5,0 мм

Figure 15. Larvae of Myctophidae (?) gen. sp.? a - 3.3 mm; b - 5.0 mm.

In a larva 8.5 mm [long] the eye stalks are longer than in the smaller larvae; their length is 2.0 mm and almost equal to the length of the head. The preanal distance has increased to 61.2% of the length of the body. The pigmentation stays the same. There are 48 myotomes.

Comparative remarks. We were unable to identify the larvae described, despite the presence of such a typical structural feature as the stalked eyes. Stalk-eyed larvae have been described for three groups of fish: Idiacanthidae, Bathylagidae and Myctophidae (Tåning, 1918 and 1931); Beebe, 1933; Ahlstrom, 1965; Moser and Ahlstrom, 1970). Our larvae, however, differ in various ways from the larvae of each of these groups. They differ from the larvae of the Idiacanthidae in their smaller number of segments (in the Idiacanthidae the number of vertebrae is 63 to 78 (see Gibbs, 1964; Novikova, 1967), a longer tail (in the larvae of the Idiacanthidae the length of the trunk represents more than 80 to 85% of the length of the body), and in the shorter length of the eye stalks. They are distinguished from larvae of the Bathylagidae by a shorter trunk, longer eye stalks and the general nature of their structure (compare Figs. 15 and 4), with a satisfactory correspondence in the numbers of myomeres (44 to 54 in Bathylagus). Moreover, the eyes in the larvae of those species of the Bathylagidae that we noted in the region of our studies, are virtually not stalked; eyes sitting on small stalks occur in cold water antarctic and Bering Sea species of the genus Bathylagus (Tåning, 1931; Cohen, 1964; our own observations). They were distinguished from larvae of the Myctophidae (some species of which our larvae resemble somewhat in their general appearance (for example, the species of Hygophum, see Moser and Ahlstrom, 1970) and in the relative length of the trunk

/34

and the pigmentation) by longer eye stalks and a somewhat greater number of myomeres: 41 to 48 instead of 35 to 39.

We have so far not been able to identify our larvae, but they most probably belong to the Myctophidae. They are very similar to larvae of Myctophum punctatum described by Mazzarelli (1909-1912; quoted from Bertolini et al., 1931-1956, p. 927) under the name "Stylophthalmoides lobiancoi". In larvae of this species 7 mm long the length of the eye stalks is about 0.4 mm; in larvae 9 mm long it is about 0.6 mm, and in larvae 11 mm [long] it is relatively smaller: 0.6 to 0.8 mm. A stalk-eyed larva of "Myctophum lunga" (?) 15 mm long has also been described by Tortonese (in: Bertolini et al., 1931-1956, p. 920).

Family Paralepididae

Stemonosudis macrura (Ege)

Material. A larva 12 mm long (station 234, 13 September 1968, depth of site 4,600 meters, in the 707-0-meter layer).

Description. The larva has a very long, low body, with a short trunk, a large head, low-set pectoral fins and rudiments [literally "establishments"] of the adipose, dorsal and long anal fins in the rear quarter of the body (Fig. 16). The lower jaw has a somewhat pointed appendage

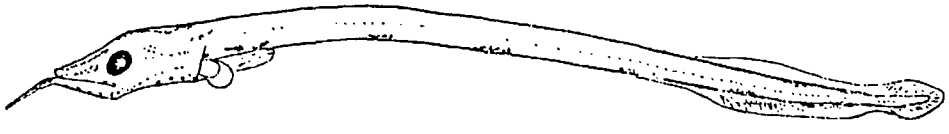

Рис. 16. Личинка *Stemonosudis macrura* длиной 12,0 мм

Figure 16. Larva of Stemonosudis macrura 12.0 mm long.

(a barbel 0.8 mm long) projecting forward. The mouth is large, and its rear corner reaches the vertical line of the middle of the eye. The rudiment [literally "establishment"] of the pterygyophores is visible in the anal fin. There are about 90 (8 + 82) myotomes. The proportions [of] aA (as far as the anus) are 28.3 H 3.6, with 17% 1. The pigmentation (see Fig. 16) is as follows: 5 short bands along the lower edge of the body; 2 along the upper edge of the tail; rows of melanophores on the snout, the lower jaw and the isthmus; and groups of cells on the gut [literally "peritoneum"] and on the head.

Comparative remarks. This larva has been assigned to S. macrura in /35 accordance with its number of myotomes, the presence of a chin barbel and longitudinal pigment bands along the ventral and dorsal edges of the tail. Larvae and fingerlings of this species ranging in length from 11.2 to 60 mm have been described by Ege (1957), and a specimen 76 mm long has been indicated by Parin and others (1973). The distinguishing feature of our larva is its somewhat greater juvenility as compared with the 11.2-mm larva described by Ege: a shorter trunk and a smaller number of spots on the gut [literally "peritoneum"].

Lestidiops pacificum (Parr)

Material. Seventeen larvae ranging in length from 5.5 to 18.0 mm, caught at stations 217, 220, 223, 299, 302 and 310 between 3°31' N and 6°03' S over depths varying from 2,360 to 3,570 meters and mainly in the layer of water extending from 50 to 100 meters.

In larvae 5.5 mm long the end of the snout was curved upwards, the lower jaw protruded, the eyes were almost quadrangular, and the trunk was very short (shorter than the head).

Description. The larvae had a very elongated, low body with a short head that was approximately rhomboid in profile (Fig. 17).

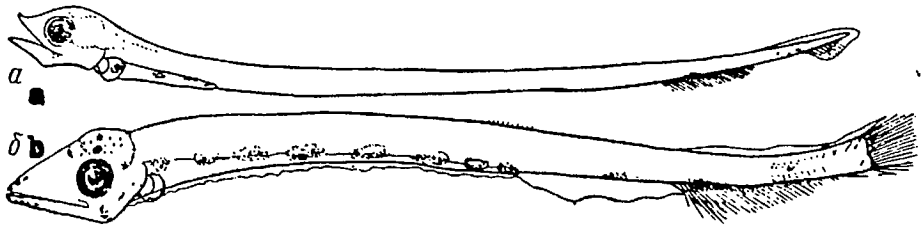

Рис. 17. Личинки *Lestidiops pacificum*
а — 13,6 *мм*; *б* — 17,0 *мм*

Figure 17. Larvae of Lestidiops pacificum. a - 13.6 mm; b - 17.0 mm.

The pigmentation was represented by one pigment spot on the gut [literally "peritoneum"]. In a larva 6.6 mm long there were two spots on the gut, and we counted about 87 myomeres in the body.

In larvae 10.3 to 11.0 mm long the base of the anal fin, in which we could see 10 pterygyophores, was forming, and an accumulation of mesenchyme had appeared under the urostyle. The number of myomeres was about 87. There were three pigment spots on the gut, single melanophores on the end of the snout, two spots on the lower edge of the tail (the anterior one on the 46th myotome, and the rear one on the 60th to 61st myotomes), and one melanophore at the end of the urostyle.

In a larva 13.6 mm long (Fig. 17, a) the trunk had lengthened somewhat. The snout, too, had become a little longer, the upper jaw was virtually not recurved upwards and the eye had acquired a round form. There were 26 pterygyophores at the base of the anal fin. There were 87 myotomes. Pigmentation was represented by 5 spots on the gut and by several cells on the caudal peduncle in front of the base of the tail fin.

A larva 17.0 mm long (Fig. 17, b) had a head rhomboid in outline, a greatly elongated trunk, [fully] formed anal and tail fins and a dorsal

fin that was in the process of forming (A 27 to 28, D 7 (very short), C 18), and richer pigmentation. There were 8 oblong spots on the gut, a short pigment band along the lower edge of the body in the region of the 9th to the 11th myotomes to the rear of the anus, melanophores at the base of the anal fin, and two rows of cells in the area of the chord over the rear half of the anal fin; there were melanophores on the upper surface of the head, on the snout and on the corner of the lower jaw.

The changes in the body proportions in the course of growth of /36 the larvae are shown in Table 3.

The identification of our larvae was facilitated by Ege's (1953) excellent descriptions and by a fairly complete series of larvae that enabled us to count up the meristic figures.

Table 3.

Changes in the proportions of larvae of L. pacificum in the course of growth (in percentages of body length).

Таблица 3

Изменения пропорций личинок *L. pacificum* по мере роста (в процентах длины тела)

1. Длина тела, мм	*ao*[2]	*H*	*h*	*c*
6,3	33,1	5,3	—	16,0
13,6	32,2	4,4	—	16,4
16,7	35,9	6,0	—	15,9
17,0	38,9	6,5	3,2	16,5

2. [2] До ануса.

Key:

1. body length in mm; 2. as far as the anus.

Family Scopelarchidae

Scopelarchoides nicholsi Parr

Material. Eleven larvae ranging in length from 6.6 to 26 mm. Caught at stations 222, 224 to 227, 231, 307 and 309 in tropical and subtropical waters from 2° to 12°30' S over depths varying from 2,300 to 4,000 meters.

Description. A larva 7.7 mm long (Fig. 18) had an elongated body with a large head and a strong tail constituting more than half of the length of the body (aa 42.5% l). The mouth was large, and its corner reached the vertical line of the rear edge of the eye. The eyes were elongated/oval with a long cone-shaped appendage and were seated obliquely. The body cavity was large, triangular in optical cross section and transparent, and a narrow intestinal tube ran through its lower portion. The pectoral fins sat high and were short. Hypurals had become established in the tail fin, and 15 rays had formed. There were 47 (16 + 31) myotomes, and, in a larva 6.6 mm long, 12 + 34. Pigmentation was represented by a spot on the gut (behind the base of the pectoral fin) and by a pair of cells at the base of the tail fin.

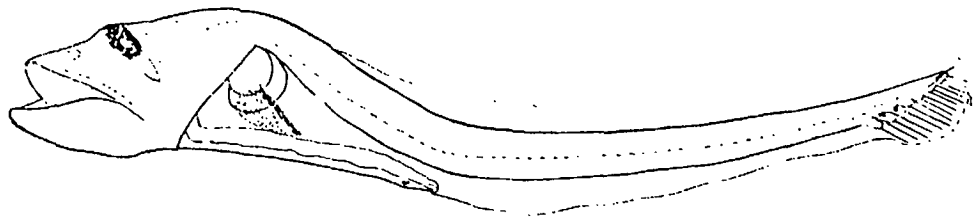

Рис. 18. Личинка *Scopelarchoides nicholsi* длиной 7,7 мм

Figure 18. Larva of Scopelarchoides nicholsi 7.7 mm long.

In larvae 13.2 mm [long] the length of the trunk (aa) increased to 48.1% l ; the anal fin had become established and 18 pterygyophores had formed in it.

In a larva 25 mm [long] the length of the trunk increased to 50% l; the anal fin had formed (A 22), and the dorsal fin was in the process of forming; aa 50, aD 24.6, c 23.1% l. The pigmentation was represented by two spots on the gut (one behind the base of the pectoral fin and the /37
second behind the base of the ventral fin) and by several melanophores on the end of the tail.

Comparative remarks. Our identification of the larvae was facilitated by the work of Rofen (1966), who had described the larvae of several species of the Scopelarchidae. When we compare our material with Rofen's information, we can note the unity of the structural type and the nature of the pigmentation of the larvae of different genera of the family (Scopelarchoides, Scopelarchus and Phanops).

Scopelarchus sp.?

Material. Four larvae ranging in length from 9.3 to 2.7 mm. Caught at stations 236, 258 and 270 between 2° and 23°30' S over depths varying from 2,700 to 4,800 meters.

Comparative remarks. These larvae differ from the larvae of S. nicholsi both in the region of their occurrence, and in the greater number of rays in their anal fins (A 28 as against 22). According to revisions of the family Scopelarchidae (Marshall, 1955; Rofen, 1966), a similar number (A 21 to 27) is typical of the genera Scopelarchus and Bentallbella, which differ in their number of vertebrae: 44 to 48 and 50 to 61 respectively. It is evident

that representatives of both genera can be found in the region of our studies. To judge from the number of myomeres (46 to 48), our larvae probably belong to one of the species of Scopelarchus.

Family Ophichthidae

Gen., sp. (Myrichthys tigrinus (Girard?)

Material. Seven eggs and 1 prolarva. Caught on 27 August and 5 to 8 November in tropical waters of the Gulf of Panama and further south at stations 217, 302 and 308 over depths of 1,800 to 3,700 meters.

Description. The eggs were spherical and 1.8 to 1.9 mm in diameter with a thin, smooth membrane and a large perivitelline space (Fig. 19, a). The yolk was vesicular/lobate, 0.7 to 0.8 mm in diameter, and contained one large (0.15 to 0.2 mm) fat drop and two or three small fat drops.

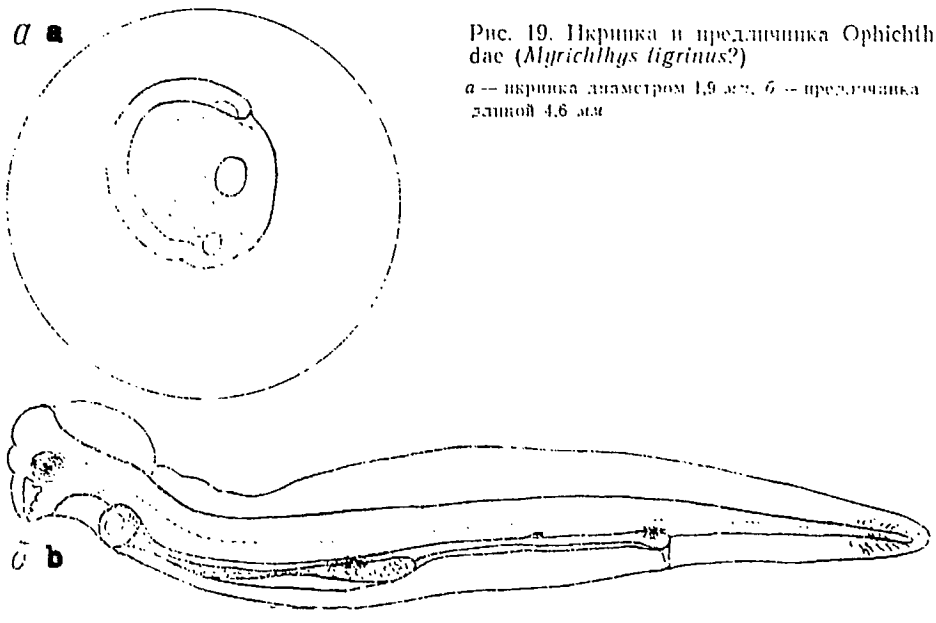

Рис. 19. Икринка и предличинка Ophichthidae (*Myrichthys tigrinus?*)
а — икринка диаметром 1,9 мм, *б* — предличинка длиной 4,6 мм

Figure 19. Egg and prolarva of Ophichthidae (Myrichthys tigrinus?). a - egg 1.9 mm in diameter; b - prolarva 4.6 mm long.

We got a prolarva 4.6 mm long (Fig. 19, b) by incubating one egg to /38 term. The prolarva had a long, low, eel-like body, and the anus opened on the boundary of the rear third of the body. An elongated yolk sac with a residual fat drop in the anterior end extended along the forward half of the trunk. The head had the distinctive shape typical of eel prolarvae with a mouth slit directed downwards and curved jaws. There were 87 (64 + 23?) myotomes. Typical features included large melanophores and their arrangement in the form of four spots in the lower part of the sides along the trunk.

Comparative remarks. The assignment of our eggs to the Ophichthidae is based on the pigmentation and number of myotomes in the prolarva fairly typical of this family, and on the small number of fat drops (see Bertolini et al., 1931-1956; Schmidt, 1913; Nair and Dharmamba, 1960; Ganapati and Raju, 1961 and 1963).

The size of the eggs and the prolarva, both relatively small for Ophichthidae, and the small number of myotomes[1], suggest that they do not belong to one of the species of Ophichtus or Coecula. They may belong to some purely tropical species found here, for example Myrichthys (M. tigrinus?).

In addition to the ones described above, we collected the eggs and larvae of other Angulliformes, which we could not, however, identify.

Family Scomberesocidae

Scomberesox saurus (Walb.)

Material. Developing eggs collected in the sea; eggs that we got using artificial fertilization; prolarvae hatched from developing eggs; larvae collected in the sea.

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[1]At the same time we evidently did not count up the number of tail myotomes completely.

We collected developing, floating eggs mainly in the layer near the surface, in waters extending from 8°06' S (at the shore, station 296) and 12°30' (in the open sea, station 230) to 30°30' S (Stations 261 to 263) at many stations (235, 236, 238, 239, 244 to 246, 249 to 251, 256 to 258, 271 and 274) from 10 September to 2 November 1968.

We were successful in artificially fertilizing mature eggs at station 244 on 26 September 1968 thanks to the fact that Prof. A.M. Gusev had caught a male and a female ready for spawning[1].

We caught larvae and fingerlings at many stations in the same waters as the eggs.

Description. A detailed description of the spawning, eggs and larvae of S. saurus from the southeastern Pacific Ocean has been given in a special study by A.M. Chigirinskii, to whom we also gave some of our own material. Hence we shall confine ourselves to a few brief notes. The eggs of S. saurus are spherical, with a thick membrane that is covered with a multitude of minute, thin villi. The diameter of the eggs is 2.1 to 2.5 mm (from measurements of 50 eggs), and the diameter of the yolk is 1.65 to 2.0 mm. The perivitelline space constitutes 10.4 to 11.7% of the diameter of the egg. Owing to the presence of villae, the membrane appears to the naked eye to be translucent/whitish and punctate/spotty. The villae are about 50 microns long and are scattered over the entire surface of the membrane; there are about 7 to 8 villae to a square with a side length of 50 microns. The bases of the villae have the appearance of light-refracting granules.

The prolarvae of S. saurus range in length from 5.8 to 6.2 mm; the /39
length of the yolk sac is 1.4 to 2.0 mm, and the height is 0.7 to 1.5 mm.

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[1]We should like to take this opportunity to express to Prof. Gusev our deep gratitude for his assistance in our studies.

The preanal distance constitutes 66.6 to 70.0%, and the length of the head, 19.2 to 22.6%, of the length of the body. The snout is short. Rays in the process of forming - 12 to 14 and 10 to 14 - are visible in the tail and anal fins respectively; in the dorsal fin there is only a compacted accumulation of mesenchyme. The number of myomeres is 66 to 67 (40 to 42 + 24 to 27). The prolarvae are diffusely pigmented with small melanophores; the dorsum is dark; the sides grow lighter towards the bottom, and the abdomen is light-colored. Yolk resorption may be completed in a larva when it is as small as about 6 mm.

Comparative remarks. Our data on the development of S. Saurus of the southeastern waters of the Pacific Ocean are very similar to those for the Mediterranean specimens (Sanzo, 1940; D'Ancona, in: Bertolini et al., 1931-1956). The slight discrepancy in the numbers of rays in the anal and tail fins as compared to that indicated for the species as a whole (Parin, 1958) and for the Mediterranean form, does not go beyond the limits of differences possible owing to incompleteness in the formation of the rays.

Family Atherinidae

Odonthesthes regia laticlavia (Val.)?

Material. Thirty-eight larvae ranging in length from 8.5 to 13.6 mm. Caught at stations 245, 265 and 298 (30 September, 9 October and 3 November), during our approaches to the shores of Chile and Peru (see Fig. 1), at the surface and at water temperatures varying from 13.3 to 16.1°.

Remarks. The eggs and larvae of O. regia have been thoroughly described both for the Chilean subspecies (O. regia laticlavia: Fischer, 1963) and for the Peruvian subspecies (O. regia regia: Chirinos de Vildoso and Chuman, 1964). Our larvae correspond to these descriptions.

Family Bregmacerotidae

Bregmaceros spp. (atlanticus Good a. Bean, bathymaster jordan a. Bollman)

Material. 1) One egg: station 231, 10 September 1968, depth of site 4,130 meters; water temperature at the surface 18.04°; fishing in the layer near the surface;

2) a prolarva 2.6 mm long that hatched from an egg from station 231;

3) two larvae 6.7 and 12.0 mm long: station 232, 11 September 1968; depth of site 3,900 to 4,160 meters; caught in the 156-75-meter layer at a water temperature of 15.5° and a depth of 100 m; a larva 9 mm long: station 304, 7 November 1968; depth of site 220 m; in the 115-38-m layer; the temperature at a depth of 40 meters was about 15.4° (estimated).

Description. A spherical egg with a smooth membrane 1.1 mm in diameter and a small perivitelline space. The yolk was homogeneous and contained a lustrous, slightly yellowish fat drop 0.2 mm in diameter. The egg was placed in a crystallizing basin for incubation to term. A prolarva hatched from it on 13 September. The prolarva (Fig. 20, a) was 2.6 mm long; its head and trunk were curved along the periphery of the adjacent portion of the capacious yolk sac, and the anus opened not on the edge of the fin fold but from the side, at its base (a typical feature of fishes of the Order Gadiformes; see Rass, 1949), immediately behind the yolk sac. The body of the prolarva, beginning at the middle of the trunk on the back and as far as the rear end of the yolk sac, was surrounded by a narrow fin fold. The preanal distance (as far as the anus) was one and a half time shorter than the length of the tail.

A fat drop was situated in the rear part of the yolk sac. The pigmentation on the body of the prolarva was represented by transverse/elongated spots/belts (accumulations of melanophores) in the region of the middle of the trunk, somewhat in front of the anus, in the anterior portion, at the middle and at /40 the end of the tail. Both of the trunk pigment belts were more strongly developed in their dorsal portion, and the two anterior caudal belts were better developed in their lower part; the third and fourth caudal belts were joined by bands of pigment in their upper and lower areas. The prolarva's eyes (along their periphery) and the rear surface of its fat drop were pigmented in addition to its body.

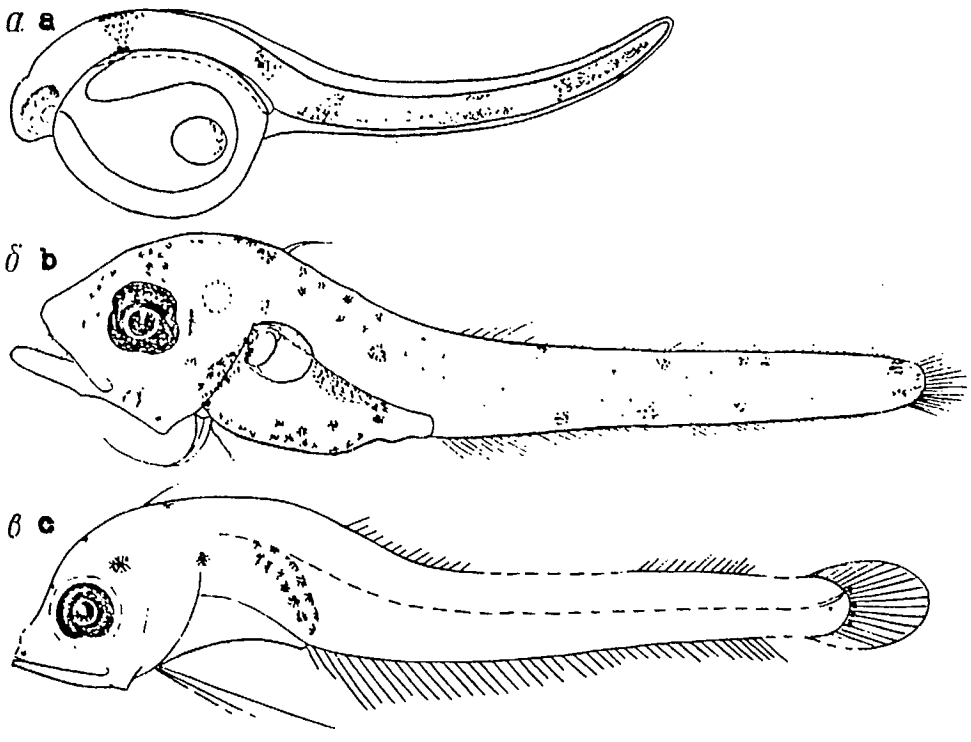

Рис. 20. Личинки *Bregmaceros* sp.
а, б — Bregmaceros atlanticus? длиной 2,6 мм; 6,7 мм; *в — B. bathymaster* длиной 9,0 мм (*P* не показан)

Figure 20. Larvae of Bregmaceros sp. a and b - Bergmaceros atlanticus? 2.6 mm long and 6.7 mm long; c - B. bathymaster 9.0 mm long (P is not shown).

A larva 6.7 mm long (Fig. 20, b) had a body shape and a location and structure of all fins that were typical of Bregmaceros (see D'Ancona and Cavinato, 1965). The pigmentation was fairly abundant. There were residual spots of pigment belts: one on the trunk over the rear end of the body cavity and four on the tail. Somewhat larger melanophores were scattered along the top of the snout, on the forehead, on the occiput, along the back, on the abdomen, behind the corner of the mouth and at the corner of the lower jaw; there were also cells scattered between the spots on the sides of the tail, as well as pigment accumulations in the anterior and upper parts of the lining of the gut [literally "peritoneum"]. The eye was completely pigmented. The proportions of the body were as follows: aA 43.3, H 23.9, H_1 (immediately behind the anus) 13.4, c 23.9% l; o 34.3, ao 31.2% c; D 50, A 54, C 28; the end rays of the dorsal and anal fins were scarcely outlined, and the solitary occipital ray was short.

In the larva 9 mm long the dorsal and anal fins had been damaged, and for this reason we were unable to count the rays. The number of vertebrae was 49 + urostyle. In contrast to the larva 6.7 mm long, this larva was only very slightly pigmented (Fig. 20, c), and the nature of its pigmentation differed from that of the larvae from station 232. There was an accumulation of pigment in the dorsal part of the body cavity ([literally] peritoneal accumulation), and large melanophores over the /41
eye, over the base of the pectoral fin and on the occiput. There were also pigment cells at the end of the snout, on the forehead and on the proximal part of the tail fin. The back, the abdomen and sides of the larva's tail were free of pigment.

In the larva 12 mm long the rays of all the fins had formed. The occipital ray was short: 1.6 mm long; D 50, C 33; there were about 50 vertebrae.

Comparative remarks. A developing egg of Bregmaceros is [here] described for the first time; hitherto only ovarian eggs had been known (D'Ancona and Cavinato, 1965).

It is now clear that the eggs of Bregmaceros are pelagic, with a small perivitelline space and a homogeneous yolk containing a fat drop, as in [literally] burbot/hake-type cods (Rass, 1953), grenadiers and the Moridae. A prolarva of Bregmaceros, having a type of structure of the excretory intestine ("cod anus") typical of the cods, is [here] described for the first time.

In the relative position of the bases of the dorsal and anal fins (the beginning of D is behind the vertical line of the beginning of A), in its countable features (D, A, and Vert) and in the short length of its occipital ray the Bregmaceros larvae that we caught resemble B. atlanticus and B. bathymaster. From the nature of their pigmentation the larvae from stations 231 and 232 may be assigned to B. atlanticus, and the larva 9.0 mm [long] from station 304, to B. bathymaster. Both of these species are known from the Gulf of Panama. To judge from our finds, they may be found even further south, in the waters off Peru as far as 12°32' S (station 231).

Family Merlucciidae

Merluccius gayi (Guichenot)

Material. 1) Six eggs caught at stations 223, 232, 257 and 308 on 1 September and 8 November 1968 over depths of 1,800 to 4,180 meters with vertical fishing [in the] 200-0-meter [layer] at water temperatures ranging from 17.35 to 20.26° at the surface and 14.44 to 16.99° at a depth of 100 meters;

2) two prolarvae that we got from the incubation to term in the laboratory of eggs from station 308.

Description. The eggs were in the first to fourth stages of development. Their diameter varied from 1.1 to 1.15 mm; the perivitelline space was small, and the yolk was lusterless and contained one colorless fat drop 0.25 mm in diameter. An embryo in the fourth stage had five pigment accumulations ("belts") on the trunk and on the tail: one on the head, two on the trunk and two on the tail. Prolarvae hatched on 10 November, after 2.5 days, from two eggs in the second stage at the beginning of gastrulation, which on 8 November were set to incubate to term at a water temperature of 19 to 20°.

The position of the anus in the prolarvae was typical of the fishes of the Order Gadiformes, opening as it did on the side at the base of the fin fold (and not on its edge). A fat drop was located in the rear end of the yolk sac.

Comparative remarks. The eggs and larvae did not differ in either their structure or their pigmentation from those described for M. gayi from the waters off Chile and Peru (Fischer, 1959: Santander and de Castillo, 1969). Neither the distribution nor the features of the eggs and larvae of M. gayi off the western coast of South America confirm the customarily accepted (Ginsburg, 1954; Angelescu, Gneri and Nani, 1958) division of this species into Peruvian and Chilean subspecies (M. gayi peruanus and M. gayi gayi). Differences in the sizes of their eggs are typical of subspecies (Rass, 1953).

Family Moridae /42

Physiculus sp.?

Material. A larva 7.0 mm long (station 310, 2 November 1968, depth of site 3,140 meters, fishing [in the] 130-63-meter [layer]; water temperature at a depth of 100 meters 14.5°; at a depth of 50 meters, 18.7°).

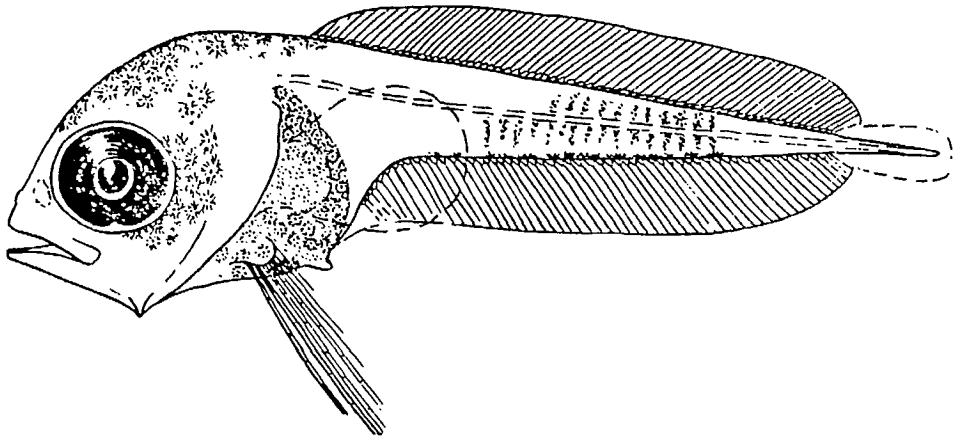

Рис. 21. Личинка Moridae (*Physiculus* sp.?) длиной 7,0 *мм*

Figure 21. Larva of Moridae (Physiculus sp.?) 7.0 mm long.

Description. The larva has an elongated body that is compressed on the sides, a large and high head, a short trunk, and a long, low tail (Fig. 21). The long dorsal and anal fins (D 65 and A 56) run from the occiput and the anus to the base of the tail fin; the narrowed base of the large, fan-shaped pectoral fin (P 24) sits high on the side, and the ventral fins are located under the pectoral fins, are elongated and contain 7 rays, of which the 3 middle ones are considerably longer than the ones on the far ends. The proportions of the body are as follows: aA 30.8, H 30.0, H_1 (behind the anus) 15.0, c 30.1% 1. The eyes are large and the snout is short. Pigment cells cover the sinciput and the preopercle behind the eyes, the [literally] peritoneum, the abdomen, and the bases of the ventral fins. A wide belt of pigment cells is located in the middle third of the tail.

Comparative remarks. From the ratios of the parts of its body and from the structure of its fins this larva undoubtedly belongs to one of the species of the Moridae. Species of the genera Physiculus and Melanonus have

been indicated for the regions near the place where it was caught. From the number of rays in its fins (especially in the pectoral fin) the larva probably belongs to one of the species of Physiculus (P. rastrelliger Gilbert?, P. nematopus Gilbert?). The absence of a chin barbel and its unseparated first dorsal fin, which distinguish it from Physiculus, may be larval features that change when larger dimensions are attained (Gaetani, 1928; D'Ancona, in: Bertolini et al., 1931-1956).

Family Brotulidae, gen., sp.

Material. A larva 5.5 mm long (station 222, 31 August 1968, depth of site 3,200 meters, fishing [in the] 232-0-meter [layer]).

Description. The larva has a body that is thick and high in front and is elongated and becomes thinner towards the rear (Fig. 22). The head is large (c 27.4% 1), and the eye is small. The fin fold extends from the occiput to the anus, and mesenchymal concentrations of tissue - the rudiments [literally "establishments"] of the long dorsal and anal fins - are outlined at its base. The pectoral fins are seated high. There are 64 (15 + 49) myotomes. The larva is pigmented with small, in places almost punctate, melanophores (see Fig. 22). /43

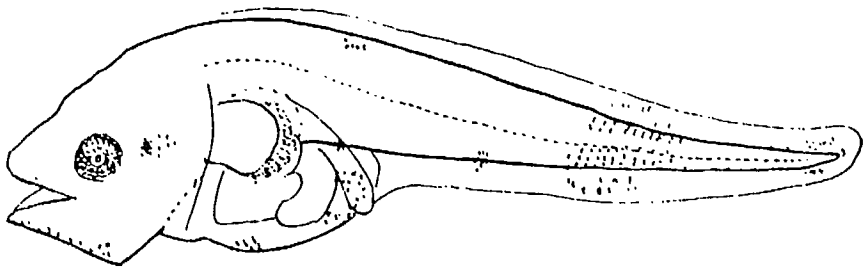

Рис 22. Личинка Brotulidae gen. sp. длиной 5,5 мм

Figure 22. Larva of Brodulidae gen. sp. 5.5 mm long.

There are accumulations of cells on the head (on the end of the snout, on the lower surface of the head, along the lower edge of the lower jaw and between the right and left jaws, and on the cheeks behind the eyes), on the trunk (on the abdomen, on the rear intestine, on the dorsum, and over the end of the intestine), and on the tail (a wide belt in the central portion of the tail, a small accumulation at the lower edge in the middle of the distance between the anus and the middle caudal belt and on the end of the tail.

Comparative remarks. The larvae of the Brotulidae have been only slightly studied (Sparta, in: Bertolini et al., 1931-1956), and identification of our larva as far down as species and even as far down as genus has been difficult. Its affiliation with the Brodulidae has been documented by the shape and ratios of its body parts, the small size of its eyes and the nature of its pigmentation.

Family Carapidae

Encheliophis jordani Heller a. Snodgrass?

Material. Three larvae 40 to 80 mm long caught between the Gulf of Guayaquil and the Galapagos Islands at stations 308 and 309 on 8 November 1968, over depths of 1,820 to 2,600 meters in the 115-58- and 200-0-meter layers.

Description. The larvae have a long, snake-like body with a short trunk and bear on their back a distinctive filiform appendage (vexillum); it is this that determines their affiliation with the Carapidae. The distance from the end of the snout to the vexillum constitutes 14 to 10%, and the preanal distance, 9.5 and 7.7% [respectively] of the length of the body (the first figures are for the specimen 40 mm long, and the second for the specimen 80 mm long). D 150 to 155; A 175 to 182.

Comparative remarks. To judge from their region of occurrence, the larvae probably belong to E. jordani, indicated for the Galapagos Islands. The larval stages of this species have not been described, and all that is known for it is one type specimen 114 mm long (Arnold, 1956). In their number of rays in the anal fin the larvae resemble the Hawaiian E. gracilis (A 172 to 180) (Strasburg, 1961). The discovery of larvae of the Carapidae in mid-water over fairly considerable depths has been indicated previously (Strasburg, 1961).

Family Melamphaidae

Scopelogadus mizolepis bispinosus (Gilbert)

Material. Four larvae ranging in length from 2.7 to 4.3 mm (stations 224, 226, 236 and 302; 1 September to 5 November 1968, between 5°00' and 20°00' S over depths of 3,840 to 4,680 meters; fishing [in the] 100-50-meter [layer] at a water temperature in this layer of 13.5 to 15.7°).

Description. A larva 2.7 mm long had an elongated, somewhat ridged /44 body (Fig. 23, a). The proportions of the body were as follows: aA 46.8, H 19.3, H_1 (behind the anus) 11.9, c 22.2% l. There were 24 (8 + 16) myotomes. The pigmentation was highly typical: there were accumulations of pigment in the upper part of the gut [literally "peritoneum"] and in the form of a wide belt in the middle of the anterior half of the tail; there were several melanophores on the lower edge of the tail behind the pigment belt.

In a larva 4.3 mm long (Fig. 23, b) the proportions of the body changed considerably: there was an increase in the height of the body, and in the length of the trunk, the head (aA 58.1, H 31.2, c 37.2% l) and especially the snout. The larva was fully formed: the urostyle was bent upwards, and

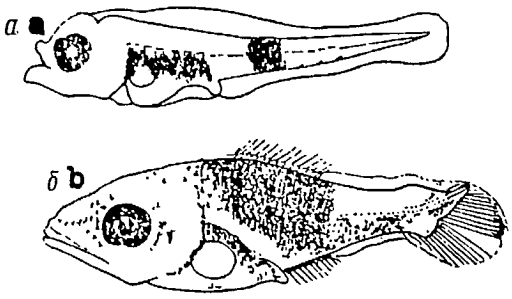

Рис. 23. Личинки *Scopelogadus mizolepis bispinosus*
а — длиной 2,7 мм; *б* — длиной 4,3 мм

Figure 23. Larvae of Scopelogadus mizolepis bispinosus. a - length 2.7 mm; b - 4.3 mm long.

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rays had developed in the fins (D 13, A 9, C 18); there were 28 (?) myotomes. The pigmentation became more intense: a pigment belt spread forward on the trunk: from the lower rear edge of the belt a pigment band ran back along the lower edge of the caudal peduncle; melanophores appeared on the head.

Comparative remarks. Larvae of S. mizolepis bispinosus 7.5 to 8.5 mm long were thoroughly described previously (Ebeling and Weed, 1963), which facilitated the identification of our larvae. Young and mature specimens of this species were caught at many stations on our voyage as far as 24° S (Parin and others, 1973).

Scopeloberyx opisthopterus (Parr)?

Material. A larva 7.6 mm long (station 223, 1 September 1968, depth of site 3,570 meters; fishing in the 100-50-meter [layer]; water temperature 13.9° at a depth of 100 meters).

Description. Body elongated with a short trunk (aA 45.4% l); head large (c 30.7% l) with a long snout (ao 34.8% c); caudal peduncle long and high (Fig. 24, a). All of the fins had formed: D 17, A 9. The rays of the ventral fin were elongated (length as much as 3.6 mm); their ends extended

back behind the anal fin. There were 26 (9 + 17) myotomes. Pigmentation was represented by accumulations of melanophores on the sinciput and in the upper part of the lining of the body cavity, by groups of cells above the anterior edge of the eye and on the temples, by a lower caudal row behind the anal fin, by several cells behind the dorsal fin and by a oblong, elongated spot at the base of the tail fin.

Scopeloberyx robustus (Günther)?

Material. Four larvae ranging in length from 4.2 to 6.3 mm (stations 231, 239 and 244, in September and October 1968 [over] depths varying from 4,130 to 7,000 meters; fishing in the 200-0 and 103-51-m layers; the temperature range at 100 meters extended from 12.0 to 16.3°).

Description. The body was elongated, with a short (especially in the smaller [specimen]) trunk, a long tail, and a large head with an abrupt profile in the larger larva (Fig. 24, b and c). The ventral fins were considerably elongated; in the dorsal fin of the larger larva the second and third rays /45 were elongated, and the rays in the remaining fins had not formed. The proportions in percentages of body length (the first figures are for a larva 4.2 mm long, and the second figures are for a larva 6.3 mm long) were as follows: aA 32.2 and 41.1, H 20.2 and 26.7, H_1 (behind the anus) 11.9 and 14.8, h 3.6 and 5.7, c 22.6 and 26.7. The pigmentation was typical: a gut [literally "peritoneal"] accumulation; three spots (accumulations): on the tail behind D, on the lower edge of the tail further back and under the urostyle; on the head, on the sinciput and behind the eye.

Comparative remarks. We assigned the larvae to the genus Scopeloberyx on the basis of the absence in them of pigmentation along the base of the dorsal fin (Ebeling, 1962, p. 17). The provisional identification of a larva

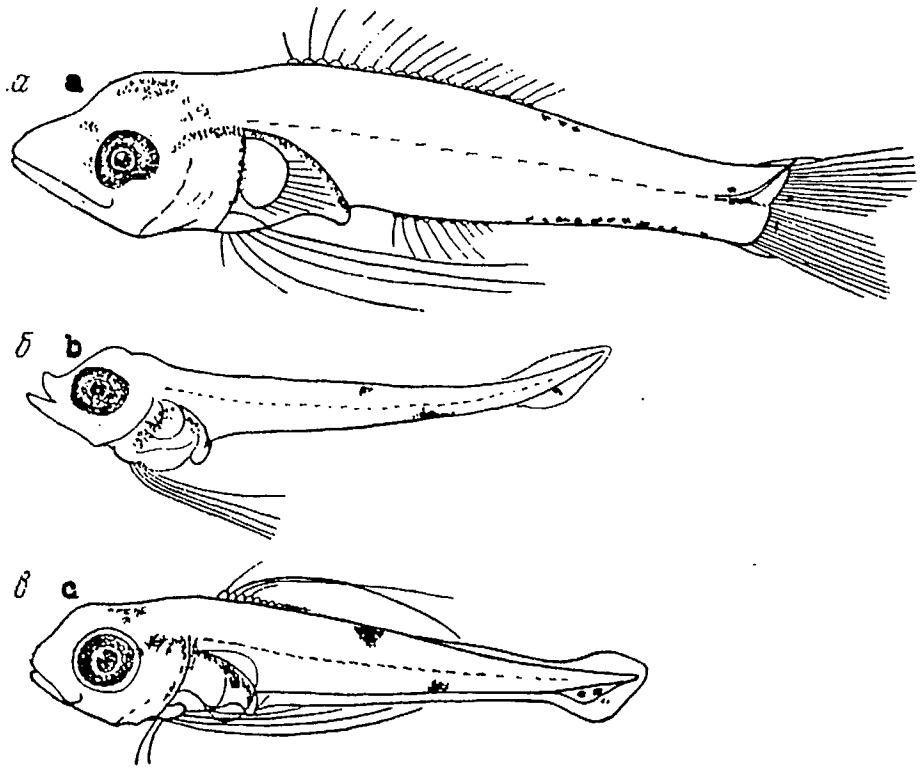

Рис. 24. Личинки *Scopeloberyx* spp.
а — S. opisthopterus (Parr) длиной 7,6 *мм*; *б, в — S. robustus* (Günther) длиной 4,2 и 6,3 *мм*

Figure 24. Larvae of Scopeloberyx spp. a - S. opisthopterus (Parr) 7.6 mm long; b and c - S. robustus (Günther) 4.2 and 6.3 mm long.

7.6 mm [long] as S. opisthopterus, and of the remaining larvae as S. robustus was based on the resemblance of the regions of their occurrence to the regions where mature specimens of these species had been caught (Parin and others, 1973) and on the typical differences in the ratios of the sizes of the trunk and the tail, which characterize larvae of the former species as being more of the warm-water kind, and those of the latter as somewhat more proper to cold-water areas (see Rass, 1941 and 1948).

Melamphaes fanae Ebeling?

Material. Two larvae 5.5 and 7.0 mm long (stations 220 and 226, 22 August and 3 September, [over] depths of 2,400 to 4,000 meters, from fishing in the 200-100-m [layer]; water temperatures in the fishing layer ranged from 12.4 to 15.3°, but for the most part were around 13.3 to 13.5°).

Description. The larva 5.5 mm long had an elongated body half of whose length was made up by the tail (aA 50% l), and a third, by the head (c 30% l). The profile of the head was somewhat pointed. The fins were almost [fully] /46 formed; the beginning of the base of the dorsal [fin] on the 4th myotome was in front, and the end [of the base of the dorsal fin] was above the end of

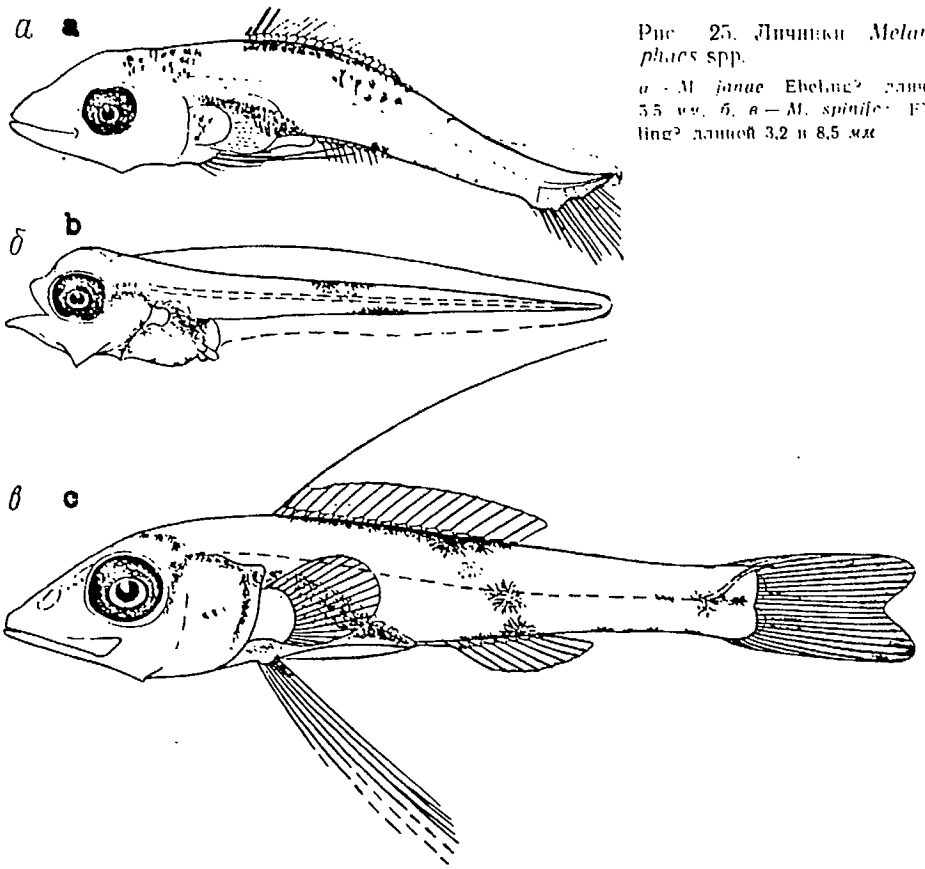

Рис. 25. Личинки *Melamphaes* spp.
а – *M. janae* Ebeling? длиной 5,5 мм; *б, в* – *M. spinifer* Ebeling? длиной 3,2 и 8,5 мм

Figure 25. Larvae of Melamphaes spp. a - M. Janae Ebeling? 5.5 mm long; b and c - M. spinifer Ebeling? 3.2 and 8.5 mm long.

the anal fin: D 18, A 7 (but [about] 10 pterygyophores), C 20, V 7. The myotomes numbered 26 (11 + 15). The pigmentation was represented by an accumulation of melanophores on the occiput and by a gut [literally "peritoneal"] [accumulation of melanophores], by a band along the base of the dorsal fin, by a group of melanophores descending from its [the larva's] rear half, by a small spot over the end of the base of the anal fin, by several cells along the lower edge of the caudal peduncle and by striae on the base of the caudal fin (Fig. 25, a).

In the larva 7.0 mm long the unpaired fin were fully formed: D 18, A 11, C 20. There were 27 (9 + 18) myotomes. The pigmentation was of the same kind as in the smaller larva, but the band along the upper edge of the body had somewhat lengthened.

Melamphaes spinifer Ebeling?

Material. Two larvae 3.2 and 8.5 mm long (station 237, 22 September 1968, [over] a depth of 5,000 meters, fishing in the 200-0-meter [layer]; temperature 11.0° at 200 meters and 16.06° at the surface).

Description. The larva 3.2 mm long had an elongated body with a very short trunk (aa, as far as the anus, 30.7% l) and a fairly large head (c 19.2% l) with a short, blunt snout; there were still no rudiments of unpaired fins in the embryonic fin fold going around the entire body, but there were already rudiments of rays in the ventral fins. The pigmentation was represented by accumulations of cells: a gut [literally "peritoneal"] /47
[cell accumulation], one behind the eyes, one on the lower surface of the abdomen and in the central part of the tail, where there were several [break in syntax] [two] bands of a tapered transverse pigment belt (Fig. 25, b), the upper one advanced forward and the lower one withdrawn to the rear.

The larva 8.5 mm long was fully formed. The body of the larva was more or less spindle-shaped, the head and the trunk had relatively increased in size, the snout was somewhat pointed, the urostyle was bent upwards, the fins were differentiated, and the ventral fins and the first rays of the dorsal [fin] were considerably elongated. The proportions (in percentages of the body length) were as follows: aA 54.3; aD 43.6, H 22.4; H_1 (behind the anus) 13.2, h 8.5, c 33.8, D 18, A 9, V 7. The pigmentation was represented by a gut [literally "peritoneal"] accumulation; by series of melanophores across the sinciput, along the periphery of the gill cover and at the base of V; by bright bands along the bases of D and A, whose rear cells had increased in size and were interconnected by large cells on the side of the tail, forming a middle caudal belt; by a lower caudal row; by a longitudinally elongated group of cells in the central part of the base of C, by one cell at its upper edge and by striae on the proximal parts of the middle rays (Fig. 25, c).

Comparative remarks. The pigment pattern typical of species of the genus Melamphaes (Ebeling, 1962, p. 18) indicates that the larvae belong to this genus. Their provisional assignment to M. janae and M. spinifer is based on a comparison of the places of their occurrence with the regions in which mature specimens have been caught (Parin and others, 1973) and on the typical differences in the structure of the larvae of two closely related species - one warm-water (M. janae) and one relatively cold-water (M. spinifer). The pattern of such differences in series of related forms has been shown previously (Rass, 1941 and 1948).

Family Trachipteridae

Desmodema polystictum (Ogilby)?

Material. Thirteen eggs (stations 220, 223 to 225, 232, 307, 310,

and 311), from 30 August to 2 September, on 11 September, and from 7 to 10 November 1968; equatorial waters; catches in different water layers ranging from 25-0 to 100-50 meters, and at water temperatures varying from 21.0 to 25.1° at the surface and from 14.0 to 15.3° at a depth of 100 meters; one prolarva that we got by incubating an egg to term; one larva 6.2 mm long (station 223, 1 September 1968, depth 3,570 meters, fishing in the 55-32-meter [layer]).

Description. The eggs were pelagic and 2.3 to 2.7 mm in diameter; the yolk was homogeneous, and its diameter was 2.0 to 2.4 mm. The perivitelline space was small, and in live [specimens] the yolk was almost adjacent to the membrane. There was no fat drop. There were large, branching melanophores on the yolk. The pigmentation of the body of an embryo at stages III to IV was represented by two rows of pigment cells on the head and trunk and the anterior part of the tail (Fig. 2, a and b).

The incubation of eggs from stage III (station 225, 2 September) at a temperature of 18 to 19° lasted for about 7 days. The length of a prolarva that had just been hatched was 5.1 mm (after fixation). The first dorsal fin was represented by a very long anterior ray with ampul-shaped swellings and three short rays behind it (Fig. 26, c). The eyes were dark. The snout was short. The mouth was small. In the anterior part the intestine formed a loop, and in the rear part was in the shape of a straight gut whose end was inclined towards the anus. The pectoral fins had a long, narrow base that was widened at its distal end, while the ventral fins had a long, narrow base and long rays. The unpaired fins had still not formed, and there was only the narrow band of the rudiment [literally "establishment"] of the dorsal fin along the upper edge of the trunk. We noted a small accumulation of mesenchyme under the urostyle. The body of the prolarva was surrounded

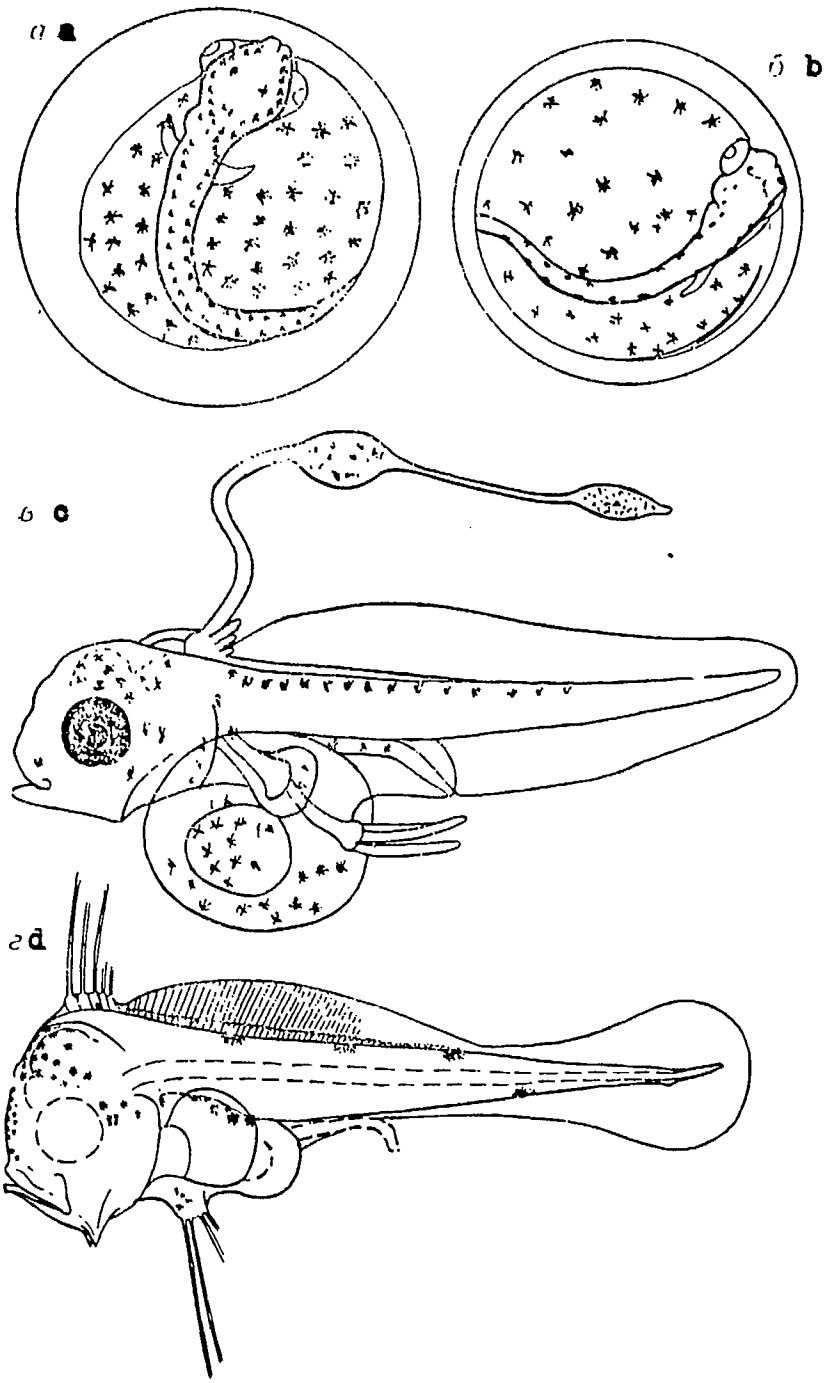

Рис. 26. Икринки и личинки *Desmodema polystictum*?
а, б — икринки III и IV стадий; *в* — предличинка длиной 5,1 *мм*; *г* — личинка длиной 6,2 *мм*

Figure 26. Eggs and larvae of Desmodema polystictum? a and b - eggs in stage III and IV; c - prolarva 5.1 mm long; d - larva 6.2 mm long.

by a fin fold whose height was somewhat less than the height of the body. The proportions were as follows: aa (as far as the anus) 55.0, H 9.8, c 21.6% l; o 41.0, ao 27.3% c. There were 20 + 52 + ? myotomes (the final tail [myotomes] were not counted).

A larva 6.2 mm long (Fig. 26, d), which was somewhat damaged during /49
catching (the ends of the rays D and v were broken off, and there were no eyes) had a body that was elongated like a ribbon and compressed on the sides. The head was short and high. The length of the trunk was somewhat greater than the length of the tail. The intestine was in the form of a loop in the anterior part and straight in the rear part. The fins were incompletely formed: I D 4, II D 47 + ? (the rays in the rear half were not differentiated), V 4. The pigmentation was represented by accumulations of melanophores on the head (on the forehead and the sinciput and above and behind the eyes), by a gut [literally "peritoneal"] [accumulation] and [one] on the base of the ventral fins, as well as by very widely separated large spotlike melanophores along the dorsal edge of the body (3 cells) and the lower edge of the tail (2 cells). There were about 70 myotomes.

Comparative remarks. Species of three genera of the Trachipteridae - Zu, Desmodema and Trachipterus (Fitch, 1964) have been indicated for the eastern waters of the Pacific Ocean. The eggs and the prolarva described above differ substantially from those of Zu in the nature of their pigmentation, and from the eggs and prolarvae of Trachipterus in the presence of an elongated first ray D having ampuls (Sanzo, 1918; Sparta in: Bertolini et al., 1931-1956). The number of trunk myotomes in the prolarva corresponds to that indicated for Desmodema polystictum, which is numerous in the eastern Pacific Ocean from California to the Galapagos Islands (Fitch, 1964). A larva 6.2 mm long caught

in the same place also differed from larvae of Zu and Trachipterus in its structure and pigmentation.

Family Mugilidae

Mugil sp.?

Material. Two prolarvae 2.85 and 3.0 mm long that we got by incubating eggs to term (station 304, 7 November 1968, depth 240 meters).

Description. The prolarvae had a short body surrounded by a high fin fold along with a large yolk sac (1.05 mm in the smaller larva) containing a large fat drop about 0.23 mm in size. The length of the trunk constituted 60.0 to 63.2% of the length of the body. The head was high, the snout short, and the eyes large, [representing] about 30% of the length of the head. The bodies of the prolarvae were highly pigmented: diffuse pigmentation covered the lower half of the sides of the trunk and the tail, and there were individual melanophores on the head, the yolk and the fat drop (Fig. 27). The end of the tail was not pigmented. There were 25 myotomes (13 + 12).

Рис 27 Предличинка кефали *Mugil* sp. длиной 3,0 мм

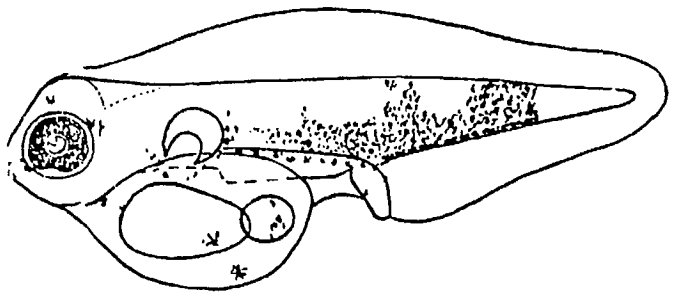

Figure 27. Prolarva of the mullet Mugil sp. 3.0 mm long.

Comparative remarks. The eggs were caught as we came out of the Gulf of Guayaquil. Several species of mullet of the genus Mugil and one species of the genus Chaenomugil have been indicated for these waters. Our larvae differed somewhat in their pigmentation from the larvae of M. cephalus (Sanzo, 1936; Dekhnik, 1972) and M. curema (Andersson, 1957) and belong probably to M. thoburni or Chaenomugil.

Family Apogonidae /50

Apogon sp.?

Material. A fingerling 9.5 mm long (station 217, 26 August 1968, [over] a depth of 3,280 meters; fishing at the surface at a temperature of 26.98°).

Description. The body of the fingerling was short and high; its head was large (31.6% l), and the caudal peduncle was long (Fig. 28). Two short dorsal fins divided by an interval; anal [fin] short; I D VII, II D 19; A III 7. Mouth wide and oblique. The pigmentation was diffuse, covering the entire body, and was thicker on the occiput, the back and the caudal peduncle; the fins were not pigmented.

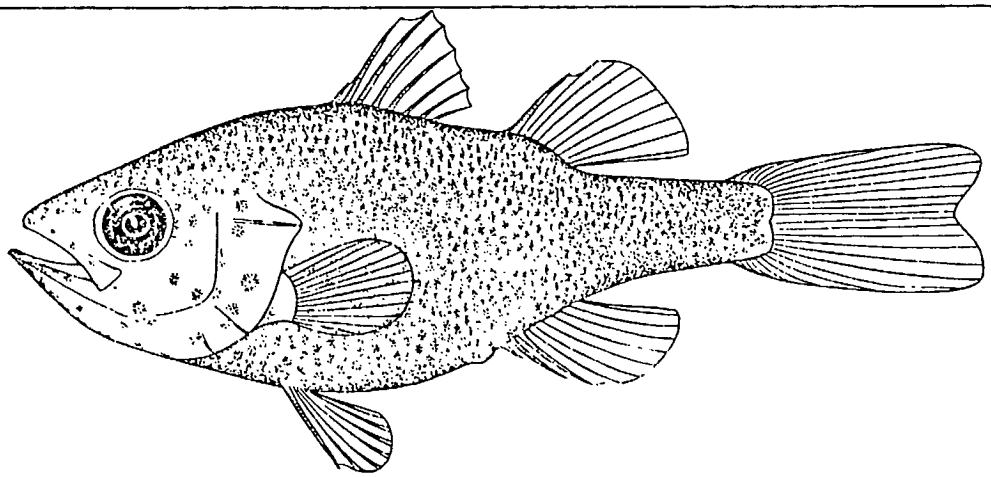

Рис. 28. Малек *Apogon* sp.? длиной 9,5 *мм*

Figure 28. A fingerling of Apogon sp.? 9.5 mm long.

Comparative remarks. In its general appearance and practically all its features this fingerling belongs to the genus Apogon, which is well represented in the region in which the fingerling was caught (Fowler, 1944); opposing evidence, however, is the presence of three nonbranching rays in the anal fin. The third ray may possibly begin to branch later. In any case, the fingerling belongs to the Apogonidae.

Family Carangidae

Naucrates ductor (L.)

Material. One egg (station 308, 8 November, [over] a depth of 2,400 meters), and 18 larvae 4.3 to 10.6 mm long (stations 222 and 310, 31 August and 9 November 1968, [over] depths of 3,140 and 3,200 meters; catches at the surface; water temperatures 20.8 and 22.01°).

Description. The diameter of the egg was 1.6 mm; the perivitelline space was small, and the yolk contained a fat drop [measuring] 0.25 mm.

We got a prolarva by incubating the egg to term. Twenty-four hours after hatching, the length of the prolarva was 4.4 mm; its low, elongated body was bordered by a fairly wide fin fold, and the formation of the head had not yet been completed (Fig. 29, a). The yolk sac was elongated, and the fat drop was located in its anterior portion. The anus was situated somewhat behind the middle of the body. The prolarva was highly pigmented; melanophores diffusely covered the head, the trunk and the dorsal edge of /51
the anterior half of the tail; only the lower edge of the tail and the entire rear half was unpigmented. There were 26 (12 + 14) myotomes.

A larva 4.5 mm long (Fig. 29, b) had a higher body; the snout had lengthened and the head acquired a triangular profile; typical long spines appeared on the preopercle. Mesenchymal rudiments [literally "establishment"]

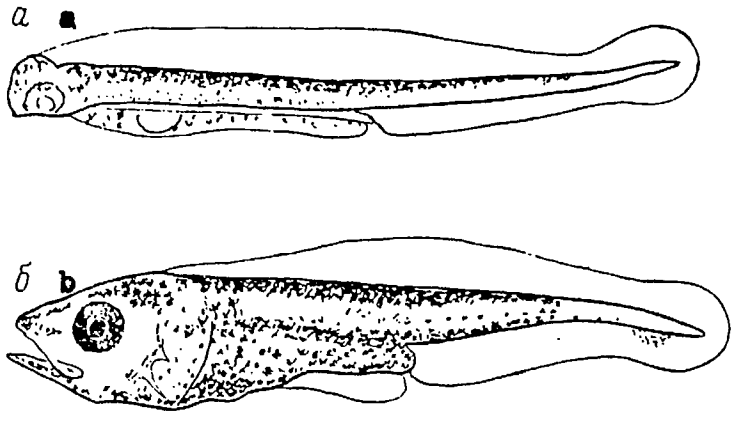

Рис. 29. Личинки *Naucrates ductor*
а — суточная предличинка длиной 4,4 *мм*; *б* — личинка длиной 4,5 *мм*

Figure 29. Larvae of Naucrates ductor. a - day-old prolarva 4.4 mm long; b - larva 4.5 mm long.

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of the fin rays occurred only along the lower edge of the urostyle. The proportions of the body were as follows: aa 57.7, H (behind the anus) 11.1, c 27.7% l. Pigmentation was heavy, especially along the dorsal and ventral surfaces of the head, the trunk and the tail; the end of the tail was not pigmented. There were 26 (12 + 14) myotomes.

In a larva 6 mm long the rays of all the fins had formed. The head was armed with strong spines. As in the smaller larvae, the pigmentation was very heavy.

Comparative remarks. Our assignment of the egg and larvae to the Carangidae is based on typical features of this family, including the location and relative size of the fat drop, the position of the anus behind the middle of the body, the large head, and the long spines of the preopercle. The large (for Carangidae) size of the egg, the very intense pigmentation and the strong spines on the head in the older larvae indicate that they belong

to Naucrates ductor (see Sanzo, 1931); Padoa in: Bertolini et al., 1931-1956).

Seriola sp. (?)

Material. Developing eggs in large number (station 248, 1 October 1958, [over] a depth of 950 meters; fishing at the surface; water temperature 17.13°), prolarvae 3.25 to 3.5 mm long that we got from incubating eggs.

Description. The eggs were spherical with a smooth membrane 0.95 to 1.0 mm in diameter; the diameter of the yolk was 0.8 to 0.95 mm; the yolk contained one fat drop about 0.2 mm [in size] with an opaque inclusion inside. Melanophores appeared in stage III along the edges of the body of the embryo and on the fat drop (Fig. 30, a and b). The duration of incubation of eggs caught at the blastula stage (the end of stage I) in the laboratory was two days at a temperature of 17 to 18°.

The prolarvae that hatched on 8 October were 3.25 to 3.50 mm long /52 and had a large (in the smaller prolarvae) yolk sac with a fat drop on the anterior end (Fig. 30, d and e). The prolarvae were fairly heavily pigmented: they had dorsal and ventral rows of melanophores; not pigmented were the end of the tail, the yolk sac and the eyes. In addition to their melanin pigment, the live prolarvae had lemon-yellow spots of xanthophores. In a prolarva 3.25 mm long the preanal distance was 1.85 mm, and the length of the yolk sac was 1.15 mm.

Twenty-four hours after hatching, the length of the prolarva increased to 4 mm, and the preanal distance, to 2.05 mm, and the length of the yolk sac decreased to 0.8 mm. After two days the length of the prolarva did not increase, but rather decreased to 3.75 mm. The resorption of the yolk sac /53 ended four days after the prolarva hatched, and on the next day the larvae died.

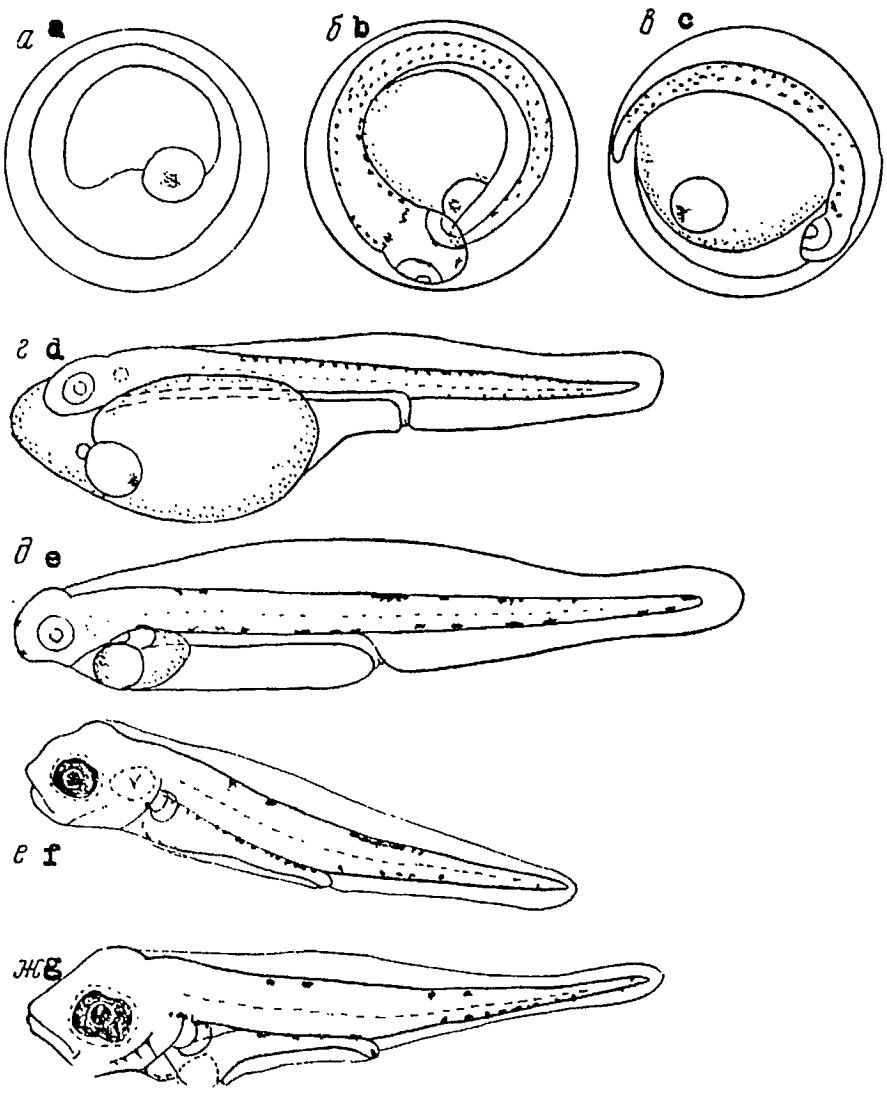

Рис. 30. Икринки и личинки Carangidae

Seriola sp. (?): *а, б, в* — икринки на I, III и IV стадиях; *г* — предличинка длиной 3,2 *мм*; *д* — предличинка длиной 3,5 *мм*. Личинки *Trachurus symmetricus murphyi*: *е* — длиной 2,65 *мм*; *ж* — длиной 3,1 *мм*

Figure 30. Eggs and larvae of Carangidae. Seriola sp. (?): a, b, and c - eggs at stages I, III and IV: d - prolarva 3.2 mm long; e - a prolarva 3.5 mm long. Larvae of Trachurus symmetricus murphyi: f - 2.65 mm long; g - 3.1 mm long.

Comparative remarks. The relatively large dimensions of the eggs and especially of the prolarvae, together with the typical features of the Carangidae, correspond to the descriptions of the eggs and prolarvae of Seriola (Padoa in: Bertolini et al., 1931-1956; Mito, 1961-1963). Two species of Seriola (S. mazatlana and S. dorsalis) have been indicated for the waters off northern Chile, in which we collected the eggs; these eggs belong to one of them. These prolarvae are too large for the Peruvian mackerel (Trachnurus symmetricus murphyi) that spawns in these waters.

Trachurus symmetricus murphyi (Nichols)

Material. Four larvae ranging in length from 2.65 to 3.10 mm (stations 251 and 256, 2 and 3 October 1968, [over] depths of 220 and 4,700 meters; fishing in the 100-0-meter [layer] at a water temperature of about 17.8° at the surface).

Description. Our larvae (Fig. 30, f and g) corresponded well to the recently published descriptions of the development of T. symmetricus murphyi (Santander and de Castillo, 1971). Typical features included the sizes of the larvae, the large head, the position of the anus behind the middle of the body (aa, 56.4% L in a larva 3.1 mm long), relatively small eyes, the small spines of the preopercle, and the dorsal, lower caudal and peritoneal rows of melanophores and the groups of melanophores on the breast and at the end of the urostyle.

Selar crumenophthalmus (Bloch)

Material. A larva 7.8 mm long (station 230, 9 September 1968, [over] a depth of 4,800 meters; fishing in the 300-150-meter [layer].

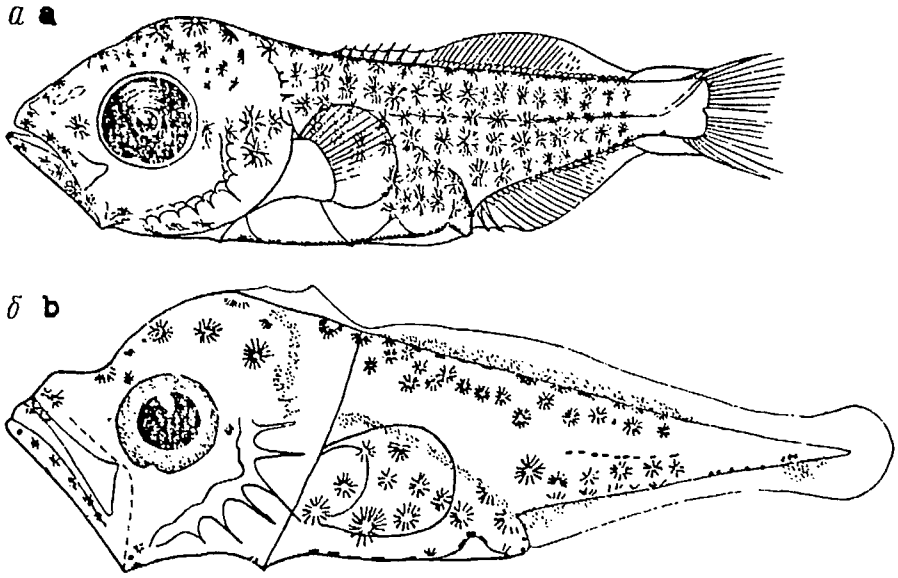

Рис. 31. Личинки Carangidae
а — Selar crumenophthalmus длиной 7,8 мм; *б — Decapterus afuerae* длиной 4,9 мм

Figure 31. Larvae of the Carangidae. a - Selar crumenophthalmus 7.8 mm long; b - Decapterus afuerae 4.9 mm long.

Description. The larva had a fairly high body somewhat compressed on the sides, with a large head (c 33.3% l), and a relatively short (aA 66.6% l) and high tail (Fig. 31, a). The head was high, the mouth oblique /54
and the eyes large, and the edge of the preopercle was armed with small spines. The fins had not been fully formed and the rear rays of the dorsal and anal fins and the marginal rays of the pectoral fin had not been differentiated. The numbers of rays in the fins with allowance for the pterygyphores was as follows: I D VI II 25; A II, I 25; P 17 +. The body and the head of the larva were diffusely pigmented with large branching melanophores. The cheeks, the sides of the abdomen, the rear end of the tail and the fins were free of pigment.

Comparative remarks. To judge from the large size of its eyes, its countable features and the region of the catch, this larva should be assigned to Selar crumenophthalmus, which has been indicated for the waters off Peru by recent authors (Chirichigno, 1969).

Decapterus afuerae Hildebrand (?)

Material. Four larvae ranging in length from 4.2 to 11.6 mm (station 229, 7 September 1968, [over] a depth of 4,650 meters; fishing in the 28-0-m [layer].

Description. A larva 4.9 mm long had features typical of Decapterus that included a high body and large head with a large oblique mouth; large eyes, an opercle armed with smooth spines and a small parietal ridge (Fig. 31, b).

Typical, too, was the pigmentation, which reflected an initial pattern of several longitudinal rows of melanophores (dorsal, lower caudal, middle lateral and ventral), supplemented by accumulations and groups of cells along the dorsum and in the middle part of the tail, on the gut [literally "peritoneum"], on the sinciput and on the snout and lower jaw.

Comparative remarks. In contrast to the Japanese species D. maruadsi (Shojima, 1962), the larva of D. afuerae was more heavily pigmented, corresponding in the nature of its pigmentation to a larva of D. maruadsi 9.5 mm long.

Family Sciaenidae

Stellifer sp. (?)

Material. Six larvae ranging in length from 1.8 to 4.3 mm (station 304, 7 November 1968, [over] a depth of 240 meters; fishing in the 58-26-meter

[layer]; water temperature 16.4° at a depth of 50 meters and 23.8° at the surface).

Description. The larvae had short, high bodies with large high heads and short trunks. The myotomes numbered 24 to 25 (7 + 17 to 18).

In a larva 1.8 mm long the preanal distance constituted about 39% l. Pigmentation was represented by a few melanophores on the occiput and along the lower edge of the tail, with an enlarged cell behind the anus, around the middle of the tail and on the abdomen, and also by a small band-like peritoneal accumulation.

In a larva 4.3 mm long (Fig. 32) the head was armed with spines and there were the rudiments [literally "establishments"] of rays in the unpaired fins. The head was armed with a small superorbital ridge, several spines in the temporal region over the upper end of the gill cover and by spines along the edge of the preopercle. The rays in the fins were not completely differentiated (counting the pterygyophores): D VI + I 23, A 10. The pigmentation was basically the same as that described for a smaller larva, but the peritoneal accumulation intensified, and melanophores appeared on the abdomen from the isthmus to the anus. The pectoral fin was fan-shaped, but with a wide base.

Comparative remarks. The presence of preopercular and post-temporal spines, the high head, the nature of pigmentation and the countable /55 features definitely indicate that the larvae belong to one of the species of Stellifer (Hildebrand, 1946; Hildebrand and Cable, 1934). The larvae of Stellifer sp. that we have described bear a striking resemblance to the larvae of the East Asian species Argyrosomus argentatus (Mito, 1966, p. 53, Fig. 48).

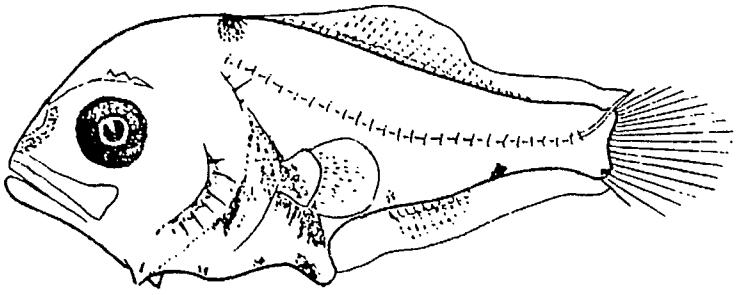

Рис. 32. Личинка *Stellifer* sp. длиной 4,3 *мм*

Figure 32. Larva of Stellifer sp. 4.3 mm long.

Family Girellidae

Doydixodon laevifrons (Tschudi)

Material. Fifteen larvae ranging in length from 5.5 to 11.8 mm (station 294, 31 October 1968, [over] a depth of 6,160 meters; fishing at the surface, water temperature 18.1°.

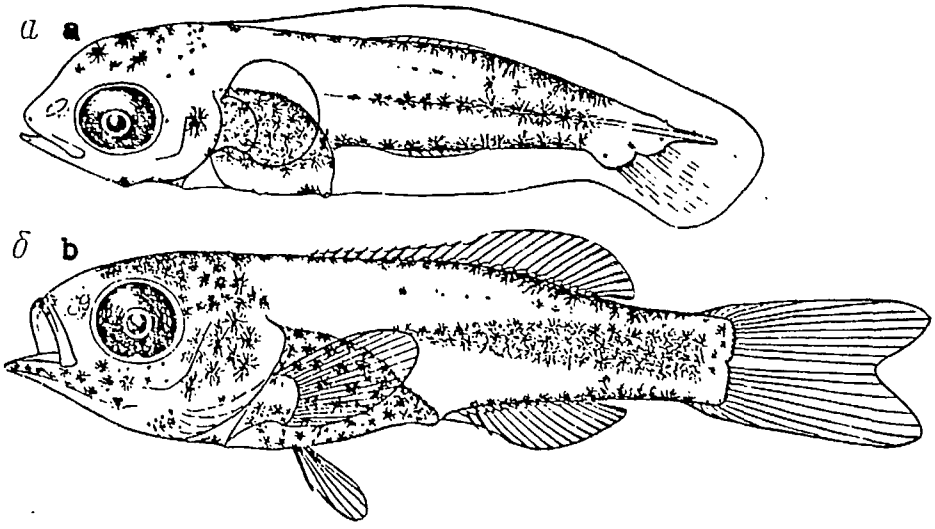

Рис. 33. Личинки *Doydixodon laevifrons*
а — длиной 6,3 *мм*; *б* — длиной 10,2 *мм*

Figure 33. Larvae of Doydixodon laevifrons. a - 6.3 mm long; b - 10.2 mm long.

Description. The larvae have a ridged, thickset body with a short trunk and a high caudal peduncle (Fig. 33). The head has rounded contours and bears no spines; the snout is short and the mouth is small. The pectoral fin is in the form of a wide blade. The number of myotomes is 26 to 27 (8 to 9 + 17 to 18). In larvae 5.5 to 6.3 mm long the trunk is short (aa 47.3 to 47.6% l), and the dorsal and anal fins are represented by rudiments [literally "establishments"] in the form of bands of compacted mesenchyme with slightly outlined pterygyophores. In a larva 6.3 mm long /56 16 rays are outlined in the tail fin. The pigmentation of this larva is very typical: large, branching melanophores form upper caudal, lower caudal and middle lateral rows, and the peritoneal and parietal accumulations are represented by single cells on the gill cover, at the end of the snout, on the lower corner of the head and on the abdomen in front of the anus (Fig. 33, a).

In larvae 10.2 to 11.8 mm long the dimensions of the trunk increased (aA 55.9 to 56.8% l); all of the fins were [fully] formed: D XI 16, A III 12 to 13, P 18, V 5. The pigmentation intensified, retaining its initial pattern. In a larva 10.2 mm long (Fig. 33, b) the upper caudal and lower caudal rows became more compact; the middle lateral [row] was transformed into a wedge-shaped band somewhat pointed in front and wide behind; the sinciput and the sides of the head, the cheeks and the lower jaw were pigmented, as well as the entire abdomen and the bases of the pectoral fins.

Comparative remarks. Our identification of the larvae left no room for doubt: the countable features, the small mouth, the nature of the pigmentation and the absence of spines along the edge of the preopercle were sufficiently typical. There was a very great resemblance to the larvae of Girella (G. punctata) and at the same time substantial differences from

which were caught at stations 260 and 261 and further south (Parin and others, 1973).

Nomeus albula (Meuschen)?

Material. Seventy-five eggs, including 30 [taken] at station 223 and isolated eggs at other stations; 2 prolarvae that we got by the incubation of eggs to term; 70 larvae ranging in length from 2.5 to 10.0 mm, including 40 at station 221 (stations 219, 221 to 231, 304, 308 and 310 from 28 August to 10 September and from 7 to 9 November 1968, [over] depths from 200 to 1,650 meters with fishing predominantly in the layer near the surface, and partly in the 100-50- and 500-200-meter layers and at water temperatures of 17.7 to 25.56° at the surface but mostly from 18 to 23°).

Description. The eggs were spherical, with a smooth membrane; they were from 1.2 to 1.3 mm in diameter; the diameter of the yolks ranged from 0.9 to 1.15 mm; the yolks were homogeneous and contained a yellow fat drop that varied [in size] from 0.25 to 0.3 mm.

Melanophores appeared from the second stage of development of the embryo onwards. In a third-stage embryo there were melanophores on the snout and behind the eyes; they bordered the edges of the body in rows and occurred on the fat drop. In the fourth stage the melanophores on the embryo's body grouped into several transverse belt accumulations: in the region of the pectoral girdle, above the anus, and in the middle of the tail; [melanophores] also occurred on the snout and behind the eyes, and there were individual cells near the end of the tail (Fig. 36, a).

The prolarvae that we got by incubating eggs to term in the laboratory were about 3.2 mm long immediately after hatching. The prolarval body was elongated and low; the yolk sac was of an ellipsoid shape, and a fat drop

was located on its rear end. The pigmentation retained the features of that of an embryo in stage IV with intensification and the addition of a dorsal accumulation between the anal and the middle caudal belt and a [fully] formed belt at the end of the tail (Fig. 36, b). The number of myotomes in a prolarva 3.2 mm long was 40 to 41 (13 + 27 to 28).

After twenty-four hours the length of the larvae increased to 3.6 to 3.7 mm, and the number of myotomes, to 42 (12 + 30). At the same time, we caught smaller prolarvae 2.7 to 2.8 mm long in the sea (possibly owing to the higher temperature of the water in the sea, and heaving, hatching occurred earlier than during incubation to term in the laboratory). The larvae taken in the sea that were 3.2 to 3.5 mm long had a higher body than the prolarvae; their mouths were small and oblique, and ventral fins [consisting] of 6 rays had formed. The nature of the pigmentation was similar to that described for the prolarvae, but the pigment belts were less distinct, and the dorsal accumulation behind the anus had almost disappeared; melanophores appeared on the lower jaw (Fig. 36, c).

In a larva 4.5 mm long the height of the body increased, and pterygyophores became outlined in the unpaired fins, but the urostyle was still not bent. The pigmentation retained its basic features: two transverse belts were outlined in the middle of the tail and on its end; there were melanophores in the dorsal part of the gut [literally "peritoneum"], on the excretory intestine, on the chin and the lower jaw; individual cells over the eye and a row of cells along the lower edge of the tail (Fig. 36, d).

A larva 7.5 mm long was fully formed; its body was better proportioned, its head had acquired a rounded shape, and all of its fins were differentiated (Fig. 36, e). There were accumulations of pigment on the peritoneum, on the

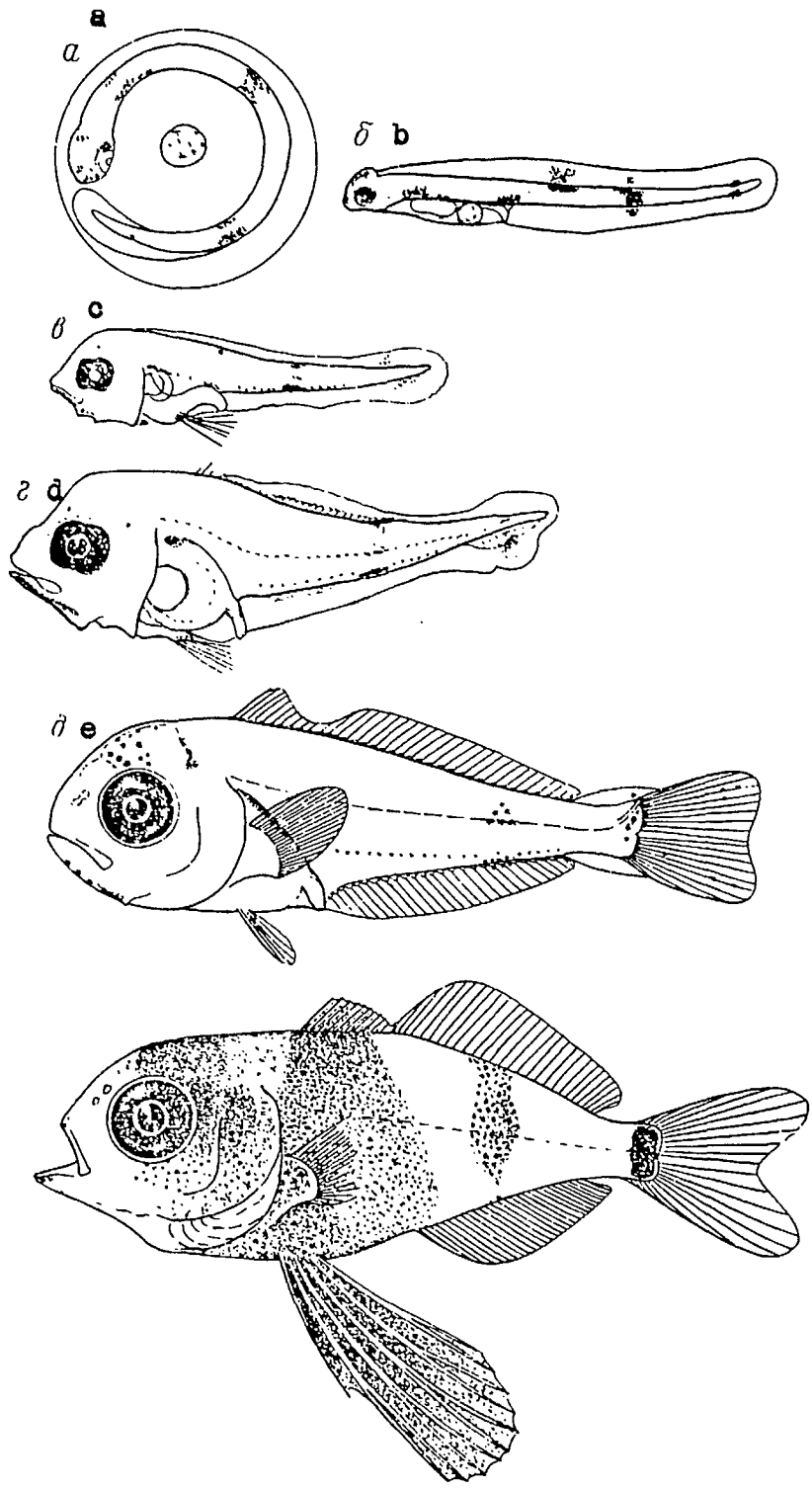

Рис. 36 Икринки и личинки *Nomeus albula*

а — икринка на IV стадии; *б* — предличинка длиной 3,2 мм; *в* — личинка длиной 3,4 мм; *г* — личинка длиной 4,5 мм; *д* — личинка длиной 7,5 мм; *е* — личинка длиной 10,0 мм

Figure 36. Eggs and larvae of Nomeus albula. a - egg in the fourth stage; b - prolarva 3.2 mm long; c - larva 3.4 mm long; d - larva 4.5 mm long; e - larva 7.5 mm long; f - larva 10.0 mm long.

sinciput and over the rear margin of the eye; spots in the middle part of the tail and at the base of the tail fin, and melanophores on the chin and under the lower jaw. /61

A larva 10.0 mm long (Fig. 36, f) had a body shape, kind of pigmentation and elongated ventral fins that resembled those of adult specimens of N. albula. D IX 27, A III 27. The body of the larva was heavily pigmented, with large dark spots that covered the sinciput and the sides of the head behind the eyes, the trunk, the middle of the tail, the base of the tail fin and the ventral fins. The proportions also changed in the direction of a still greater increase in the height of the body, the preanal distance, the length of the head and the size of the eye, and a shortening of the snout. The progress of the changes in the ratios of body parts is shown in Table 4.

Table 4.

Body proportions in Larvae of N. albula of different length.

Таблица 4

Пропорции тела у личинок *N. albula* разной длины

1. Признак	2. Длина тела (*l*), мм									
	2,7*	3,2*	3,25	3,5	4,5	5,0	5,1	6,1	7,5	10,0
aA (в % *l*)	38,9	40,7	43,1	44,4	44,5	50,0	46,4	49,2	50,7	58,0
H	11,1	11,0	24,6	28,6	31,5	33,0	33,4	34,4	34,7	39,0
h	—	—	—	4,3	5,6	6,0	6,5	8,2	9,3	10,0
c	18,5	—	24,6	27,2	32,3	33,3	32,4	32,8	33,3	35,0
o (в % *c*)	50,0	—	37,5	36,8	34,5	30,3	37,1	35,0	36,0	37,2
ao то же	—	—	32,5	31,6	34,5	30,3	31,4	30,0	32,0	25,8

* Предличинки. Prolarvae

Key: 1. features; 2. length of body (l) in mm.

Comparative remarks. The development of Nomeus albula had not been described, and the identification of its eggs and larvae presented some difficulty. In their numbers of myotomes (37 to 43) and rays in their fins (D X to XI, I 25 to 26; A 24 to 28; P 14; C 15) our larvae may belong [literally] both to Nomeus and to Psenes (Haedrich, 1967). To judge from the available description of the development of P. cyanophrys (Legaspi, 1956), our larvae differ from the larvae of this species in the shape of their bodies, in their pigmentation and in their number of myotomes and cannot be assigned to [this species].

P. pellucidus is found in these waters in addition to P. cyanophrys. In P. pellucidus, however, D X to XI and I to II 27 to 33 (Haedrich, 1967), and our larvae differ from it in this feature. Finally, together with smaller larvae we caught an undoubted larva of N. albula 10.0 mm long.

Family Amarsipidae

Amarsipus carlsbergi Haedrich

Material. A larva 6.5 mm long (station 217, 27 August, 1968 [over] a depth of 3,280 meters; fishing in the 1,100-0-meter [layer].

Description. The larva has a well-proportioned body with a large head, a short trunk and a strong tail (Fig. 37). The head is high, with a short snout, a small oblique mouth and a large eye; aA 53.1, c 30.0% l. The ventral fins are elongated. D X 27, A 28, C 18, P 16+, V 15. There are 45 myotomes. The larva is slightly pigmented. Diffuse pigmentation covers the sinciput, the occiput, the gill covers, the anterior half of the abdomen, and the proximal part of the ventral fins. There are accumulations on the gut [literally "peritoneum"] and single cells at the beginning and /62
behind the middle of the base of the anal fin and on the base of the tail fin.

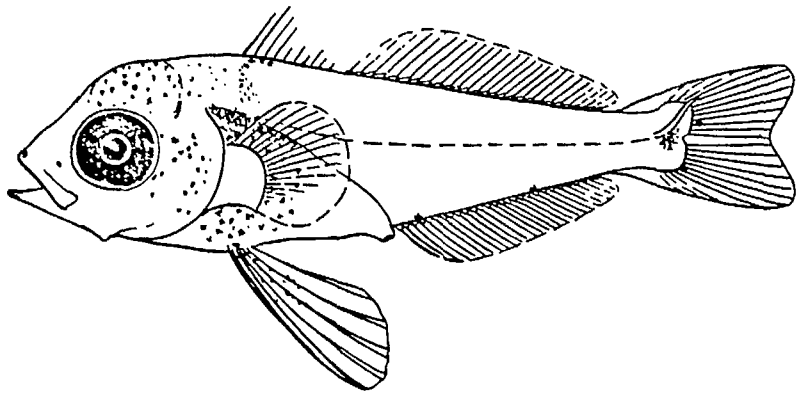

Рис. 37. Личинка *Amarsipus carlsbergi* длиной 6,5 *мм*

Figure 37. A larva of Amarsipus carlsbergi 6.5 mm long.

Comparative remarks. To judge from its countable features, this larva belongs to Amarsipus carlsbergi (Haedrich, 1969), although it somewhat recalls Nomeus.

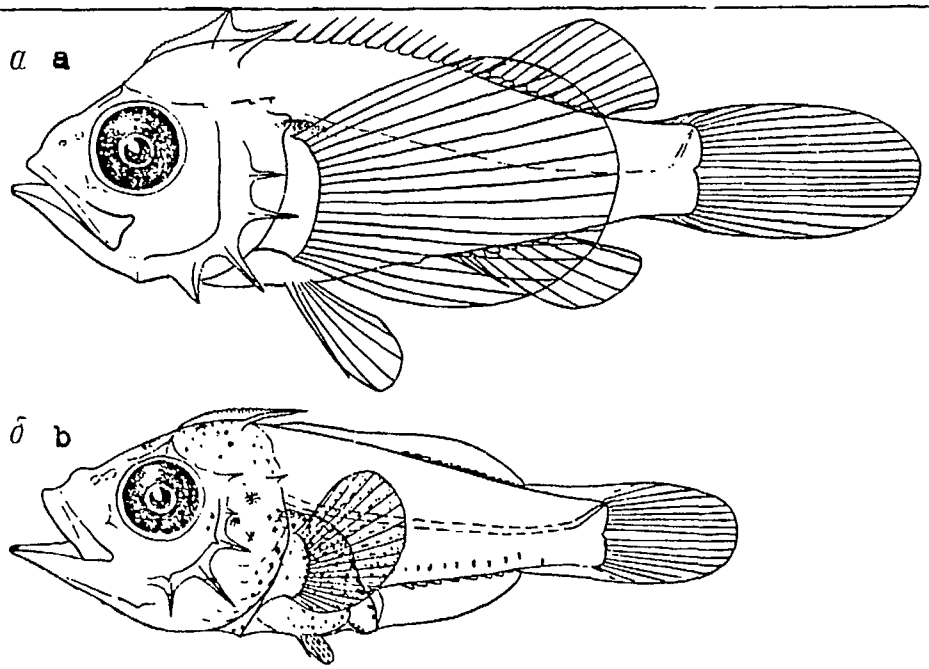

Рис. 38 Личинки *Scorpaena* spp.
а — длиной 8,0 *мм*; *б* — длиной 6,0 *мм*

Figure 38. Larvae of Scorpaena spp. a - 8.0 mm long; b - 6.0 mm long.

Family Scorpaenidae

Scorpaena spp.

Material. A larva 8.0 mm long (station 217, 27 August 1968, [over] a depth of 3,280 meters; fishing in the 1,000-0-meter [layer]); 15 larvae ranging in length from 6.1 to 8.4 mm (station 243, 24 September 1968, [over] depths of 1,230 to 1,700 meters; fishing at the surface, water temperature 14.7°.

Description. The larvae had a high, thick body with a large head, /63 a short trunk and a high caudal peduncle (Fig. 38, a and b). The head was armed with strong spines on the sinciput over the eye, on the preopercle, and over the upper end of the gill cover. The pectoral fins were large, with a broad base, and in the smaller larvae were diffusely pigmented (see Fig. 38, b). The countable features of the larva from station 217 were as follows: D XII 10, A II 6, P 18, v 7; of the larvae from station 243: D XII to XIII [,] I 6, A 8, P 16 to 18; myotomes [numbered] 23 to 24 (7 to 8 + 16).

Comparative remarks. From their general appearance (the spines on the head, their short, high body, and their large paired fins) and their countable features the larvae can be assigned to two different species of the genus Scorpaena, which is represented by several species both in equatorial waters (the region of station 217) and in the waters off Chile (the region of station 243).

Family Bothidae

Bothus constellatus (Jordan)

Material. A larva 16.1 mm long (station 217, 27 August 1968, [over] a depth of 3,280 meters; fishing in the 1,000-0-meter [layer]).

Description. The larva had a very high body compressed on the sides (H 54.0, h 10.6% l), still without signs of the development of asymmetry (Fig. 39, a). The head was short (c 14.9% l), the profile of the snout was concave, and the eye was small (ao 37.5 and o 29.2% c). The preanal distance was 19.9% l. The larva was not pigmented and completely transparent. The body cavity was situated obliquely in relation to the axis of the body; its height was greater than its length, and the intestine formed two elongated transverse loops, in front of which the leaf-like liver was located. The pectoral fins were short (they are not shown in the illustration), and the ventral fins had wide bases (the rays were separated); D 91, A 68, C 18. There were 38 vertebrae.

Comparative remarks. The high body of the larva, the typical structure of the intestine, the small eye and the separated rays of the ventral fin indicate that this larva belongs to the genus Bothus (see Bertolini et al., 1931-1956), while the countable features correspond to those that have been indicated for B. constellatus (Hildebrand, 1946; Norman, 1934).

Citarichthys gilberti Jenkins et Evermann

Material. Four larvae ranging in length from 2.65 to 7.80 mm (station 304, 7 November 1968, [over] a depth of 252 meters; fishing in the 115-38- and 58-26-meter [layers]; water temperature 23.4° at the surface and 14.1° at a depth of 100 meters).

Description. In a larva 2.65 mm long the body was compressed on the sides, the head was high, the snout short and mouth small. The intestine was long and formed a loop. Pigmentation was represented by a short row of melanophores on the isthmus, a row along the middle line of the abdomen

and by several cells along the sides [away] from it; by melanophores on the swim bladder and by a large melanophore on the excretory intestine. Along the upper edge of the body there was a small spot over the beginning of the excretory intestine and a melanophore above the beginning of the tail. There was a pigment belt beyond the middle of the tail and behind it a row of punctate cells along the lower edge of the tail.

In larvae ranging in length from 4.0 to 5.5 mm the body was more compressed on the sides, and its height had increased in comparison with the small larvae. The profile of the snout was convex, the snout short and the mouth small. Two elongated rays had formed on the top of the head. In a larva 5.5 mm long there were mesenchymal rudiments [literally "establishments"] of pterygyophores along the upper and lower edges of the body. The ends of the two elongated anterior rays extended back beyond the beginning of the tail. The pigmentation had somewhat intensified in comparison with that described for a larva 2.65 mm long (see Fig. 39, b): together with /64 a belt behind the middle of the tail there were individual cells along the upper edge of the tail outlining, as it were, the peaks of three more belts; there were cells along the lower edge [of] and under the urostyle; there was an intensification of the ventral row and the spots on the swim bladder and at the excretory intestine.

In a larva 7.8 mm long 82 rays were differentiated in the dorsal /65 fin and 65 in the anal fin. Pigmentation intensified, and the bases of three belts were visible on the lower edge of the tail.

The changes in the proportions of the larval bodies are shown in Table 5. The numbers of myotomes in larvae 2.65 and 5.5 mm long equalled 37 (11 + 26).

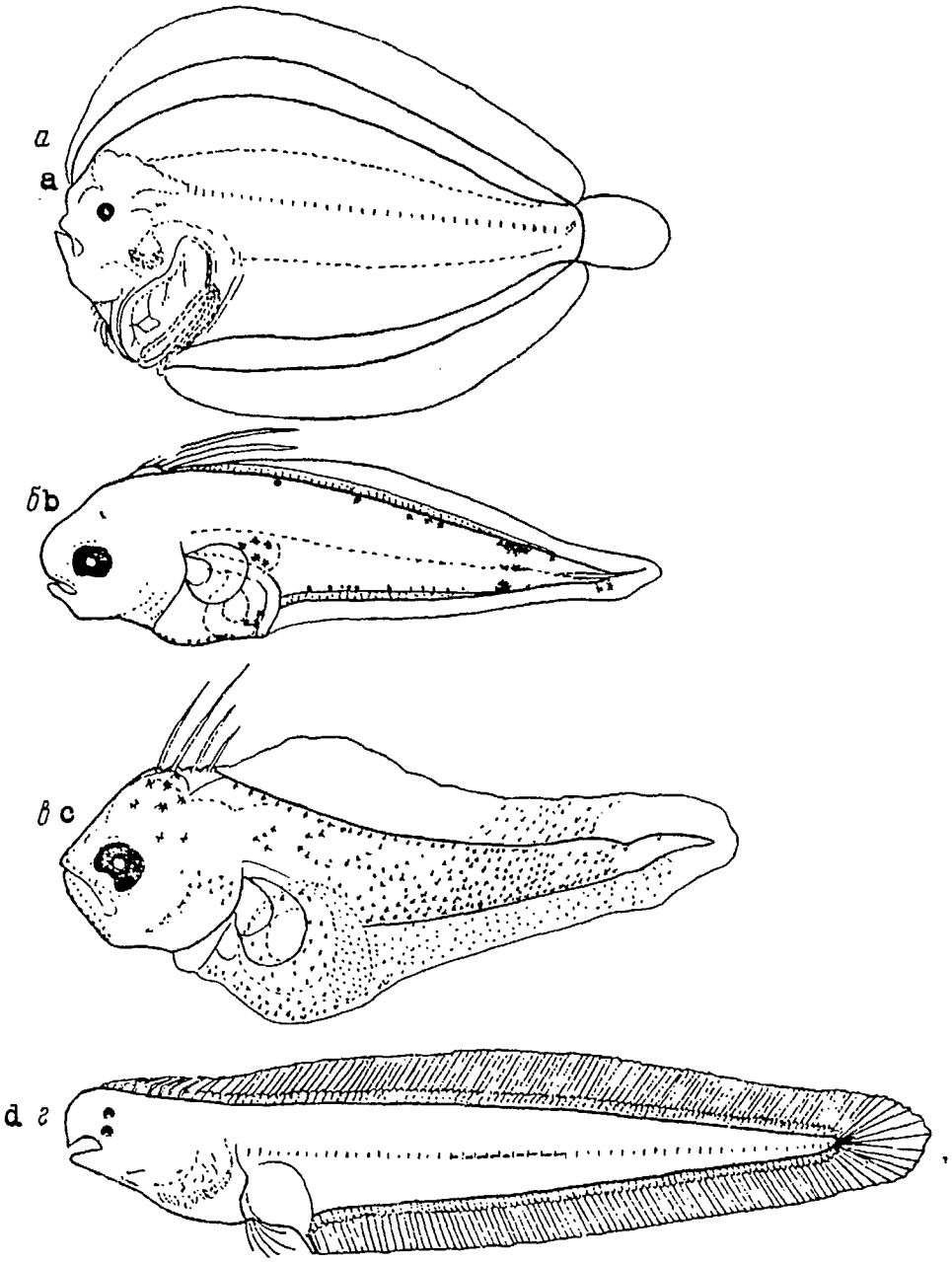

Рис. 39. Личинки и мальки Pleuronectiformes

а — Bothus constellatus длиной 16,1 *мм*; *б — Citharichthys gilberti* длиной 5,5 *мм*; *в — Etropus sp.* (?) длиной 5,9 *мм*; *г — Symphurus elongatus* (?) длиной 19 *мм*

Figure 39. Larvae and fingerlings of Pleuronectiforms. a - Bothus constellatus 16.1 mm long; b - Citharichthys gilberti 5.5 mm long; c - Etropus sp. (?) 5.9 mm long; d - Symphurus elongatus (?) 19 mm long.

Table 5.

Changes in the Body Proportions of Larvae of C. gilberti in the Course of their Growth

Таблица 5

Изменения пропорций тела у личинок *C. gilberti* по мере их роста

1. Длина тела, мм	2. В процентах длины			
	aA	*H*	H_1*	*c*
2,65	52,9	26,3	11,3	24,5
4,0	43,8	30,0	12,5	32,5
5,5	37,3	38,3	20,0	—
7,8	21,8	41,7	35,9	28,2

* за анусом behind the anus

Key: 1. Body length in mm; 2. in percentages of length.

Comparative remarks. The identification of our larvae as C. gilberti is based on the numbers of vertebrae and rays in the fins (Norman, 1934; Hildebrand, 1946), on the presence of the two anterior elongated rays of the dorsal fin (typical of larvae of the genus Citharichthys) and a specific pigment pattern, all of which have been excellently shown by Ahlstrom (1965).

Etropus sp?

Material. A larva 5.9 mm long (station 272, 23 October 1968, [over] a depth of 101 meters; fishing in the 50-27-m [layer]; water temperature 14.7° at a depth of 30 meters).

Description. The larva had a high body compressed on the sides, with a large head, a trunk projecting downwards and a fairly short tail (Fig. 39, c). The mouth was large and oblique. The intestine formed a loop. The beginning of the dorsal fin was represented by four elongated rays and later followed a high embryonic fin fold that went around the dorsum and the tail. The urostyle was large and virtually not bent, and underneath it were outlined the hypurals and the rays of the tail fin. aA 47.4%, c 27.6% l; ao 21.8, o 28.1% c.

The pigmentation was of the diffuse type. The trunk, the tail, the ventral fin fold and part of the dorsal fold over the middle of the tail were strewn with fine melanophores. There were also melanophores on the sinciput, on the gill cover, on the upper and lower jaws, and along the dorsum. The end of the tail and the anterior half of the dorsal fin fold were not pigmented. There were about 35 myotomes.

Comparative remarks. We assigned the larva tentatively to the genus Etropus. Its general appearance and the nature of its pigmentation very much recalled those of a larva of Achirus fasciatus (Hildebrand and Cable, 1938). We could not, however, assign it to Achirus because of the discrepancy in the number of myotomes (Achirinae has 28) and the presence of elongated anterior rays in the dorsal fin, which have not been indicated for Achirus. In its number of myotomes and in the presence of elongated rays in D this larva recalled Citharichthys, but in the larvae of this genus two, and not four, rays are typical, their bodies are more elongated, and their pigmentation is different. The genus Etropus, which is represented by several species off the coast of Peru, is closely related to Citharichthys. Its development has not been studied, and we may assume that some features of the resemblance of our larva to the larvae of Citharichthys indicate a certain proximity of these genera.

Family Cynoglossidae /66

Cynoglossus elongatus (Günther)

Material. A fingerling 19 mm long (station 304, 7 November 1968, [over] a depth of 252 meters; fishing in the 115-38-meter [layer]; water temperatures 14.1° at a depth of 100 meters and 23.4° at the surface.

Description. The body of the fingerling was long, low and compressed on the sides; both eyes were on the left side of the head, and the mouth was curved. The body was translucent. The head was large and the trunk was short. The preanal distance represented 30% of the length, and the height of the body, 8.94%. The pigmentation was sparse: there were pigment bands along the lateral line on the tail and a pair of striae on the end of the tail. D 105, A 85, C 12, V 5.

Comparative remarks. To judge from the number of rays and from the low, elongated body, this fingerling belongs to S. elongatus (Hildebrand, 1946).

Conclusions

We collected the eggs and larvae of over 120 species of fish in eastern Pacific waters from 3° N to 33° S and from 90 to 80° W to the coasts of Ecuador, Peru and northern Chile from the end of August to the middle of November 1968. Descriptions of the eggs and larvae of 75 species of 38 families and 13 orders have been given in this study. The expeditionary nature of our research, and its great extent in space, hindered our obtaining full series of fish development. Our systematic use, however, of the method of incubating to term developing eggs caught in the sea, the wide scope of plankton fishing, covering as it did water layers near the surface and abyssal layers down to several hundred meters, and, finally, our numerous simultaneous catches of fish from epipelagic and mesopelagic regions, helped us to identify a significant portion of the ichthyoplankton.

The ichthyoplankton that we identified included deepwater fishes from the mesopelagic and bathypelagic regions (Bathylagidae, Gonostomatidae, Sternoptychidae, Chauliodontidae, Astronesthidae, Stomiatidae, Melanostomiatidae,

Idiacanthidae, Chlorophthalmidae, Scopelosauridae, Myctophidae, Paralepididae, Scopelarchidae, Moridae, Brotulidae, Melamphaidae, Trachipteridae), fishes from the epipelagic region (Scomberesocidae, Carangidae, Scombridae (Sarda!), Nomeidae, Amarsipidae), and pelagic and demersal fishes of coastal and shelf waters (Clupeidae, Engraulidae, Atherinidae, Mugilidae, Synodontidae, Ophichthidae, Bregmacerotidae, Merlucciidae, Carapidae, Apogonidae, Sciaenidae, Girellidae, Scorpaenidae, Bothidae, Cynoglossidae). Represented by the largest number of species were the Myctophidae (19 species), the Gonostomatidae, the Melamphaidae and the Carangidae (5 species each). We noted large quantities of eggs and larvae (indicative of heavy spawning during the period of our studies) among deepwater fishes for V. lucetia (up to 380 eggs and 180 larvae per square meter of sea surface), L. stilbius urotranus (up to 52 eggs), B. nigrigenys (up to 36 eggs) and T. mexicanus, and among pelagic fish for E. ringens (up to 3,200 eggs per square meter), S. sagax (up to 1,120), Seriola sp. (up to 200), S. Saurus and S. Sarda chiliensis.

We caught the eggs and larvae of most of the deepwater species mainly in the 50-25-meter layer, somewhat fewer in the 100-50-meter layer and still fewer above and below these layers. We caught the eggs of the pelagic species (S. sagax, E. ringens, S. saurus and S. sarda chiliensis) mainly in the layer near the surface.

The great species wealth of tropical ichythyofauna is also reflected in the composition of the ichthyoplankton: we collected a larger number of species of larvae in tropical waters. On the other hand, the abundance of the eggs and larvae of the main notalian and subtropical species (E. ringens, S. sagax and others) was for each much higher than for the tropical species. /67

The descriptions of the eggs and larvae of a whole series of species have been given for the first time, since the state of knowledge of the

ichthyoplankton in the waters that we studied was very limited. At the same time, we cannot rule out the possibility of individual errors. Nevertheless the present study will be useful for developing these areas of research.

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ICHTHYOPLANKTON OF THE SOUTH-EASTERN PACIFIC OCEAN

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Summary

Eggs and larvae of 75 fish species taken in autumn 1968 along western coasts of South America are described. Mesopelagic fishes are in majority: Myctophidae (19 spp.), Gonostomatidae, Stomiatoidei s. s. (each by 5 spp.), Alepisauroidei (4 spp.), as also epipelagic Carangidae (5 spp.). Eggs and larvae of several deep-sea species are described, e. g. *Stomias colubrinus Chauliodus barbatus*, several species of Melamphaidae, *Desmodema polystieta*(?) etc, of open ocean pelagic species (*Naucrates ductor, Nomeus albula, Cubiceps coeruleus*), shore tropical *Bregmaceros*, as also several food-fish species (*Sardinops sagax, Engraulis ringens, Scomberesox saurus, Merluccius gayi, Seriola* sp., *Sarda chiliensis, Doydixodon laeviſrons*) etc. Eggs and larvae of many species were as yet not known.

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