

Larvae and Juveniles of Grey Triggerfish, *Balistes capricus*, from Southern Brazil

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Abstract The larval and juvenile stages of the grey triggerfish, *Balistes capricus*, are described and illustrated. In southern Brazilian waters larvae and juveniles were collected only during the summer season, especially in January cruises. They occurred not only at nearshore stations, but also at offshore stations near the margin of the continental shelf.

The Balistoidea can be divided into two families, Balistidae with three dorsal spines and Monacanthidae with one or two dorsal spines (Matsuura, 1979; Tyler, 1980). The Balistidae are represented by three genera including six species in the western Atlantic (Moore, 1967). They are essentially tropical fish and are commonly associated with coral reefs (Böhlke and Chaplin, 1968). Lema et al. (1975) studied the occurrence of balistid fishes on the southern Brazilian coast and mentioned the presence of two species, *Balistes capricus* and *B. carolinensis*, but their description and key were inadequate. There is no doubt concerning the identification of *Balistes capricus* Gmelin, 1788, however the name *B. carolinensis* Gmelin, 1788 is still used for the species (Tortonese, 1973). In this paper we use *B. capricus* according to Moore (1967), Tyler (1977) and others.

Recently considerable increases of balistoid abundance in coastal waters have been reported. Along the Ivory Coast and Ghana, for example, catches of *Balistes capricus* have increased recently, accompanied with a decrease of *Sardinella aurita* catch (ORSTOM, 1976; Caveriviere, 1979). Kohata (1979) reported the replacement of some quality fishes with the Japanese filefish *Navadon modestus* in Sagami Bay between 1970 and 1978. A comparison of the results of trawl sampling made in 1970 and 1980 in southern Brazilian waters showed an increase of distribution and abundance of *B. capricus*.

Because of a low commercial value, an increase of balistoid fish is not welcomed by fisherman and, in many cases, they are discarded as trash fish. The reason of emergences of balistoid populations is not yet clarified. Some

researchers attributed it to the resistance of balistoid fish to polluted environments, but we have no scientific information to substantiate this conclusion. Study of the early life history of *B. capricus* may contribute to understanding the mechanisms of expansion in abundance in this group. As the first step, we studied the morphological characters of balistoid larvae found in the plankton samples collected from the southern Brazilian waters and identified the larvae of *B. capricus*. A subsequent report will include detailed descriptions of developmental changes in this species.

The early life history of *Stephanolepis hispidus*, another common balistoid fish is well known (Hildebrand and Cable, 1930; Berry and Vogele, 1961; Fahy, 1975). On the contrary, only a few studies have been made on the early developmental stages of *B. capricus*. For example, Garnaud (1960) observed the spawning of *B. capricus* in captivity and showed a figure of yolk sac-larva. Sanzo (1939) described the larvae of *B. capricus* taken in plankton samples and showed a figure of a 4.0 mm postlarva. Recently, Martin and Drewry (1978) reviewed the life history of *B. capricus* in their extensive study on the development of fishes from the mid-Atlantic Bight.

Material and methods

Seven sampling cruises were carried out during the period from November 1975 to January 1978 by the R/V Prof. W. Besnard, covering the area from Cabo Frio (23°S) to Cabo de Santa Marta Grande (29°S). A 61 cm Bongo net was used and the sampling method and station plan were shown in Matsuura (1979). Plankton

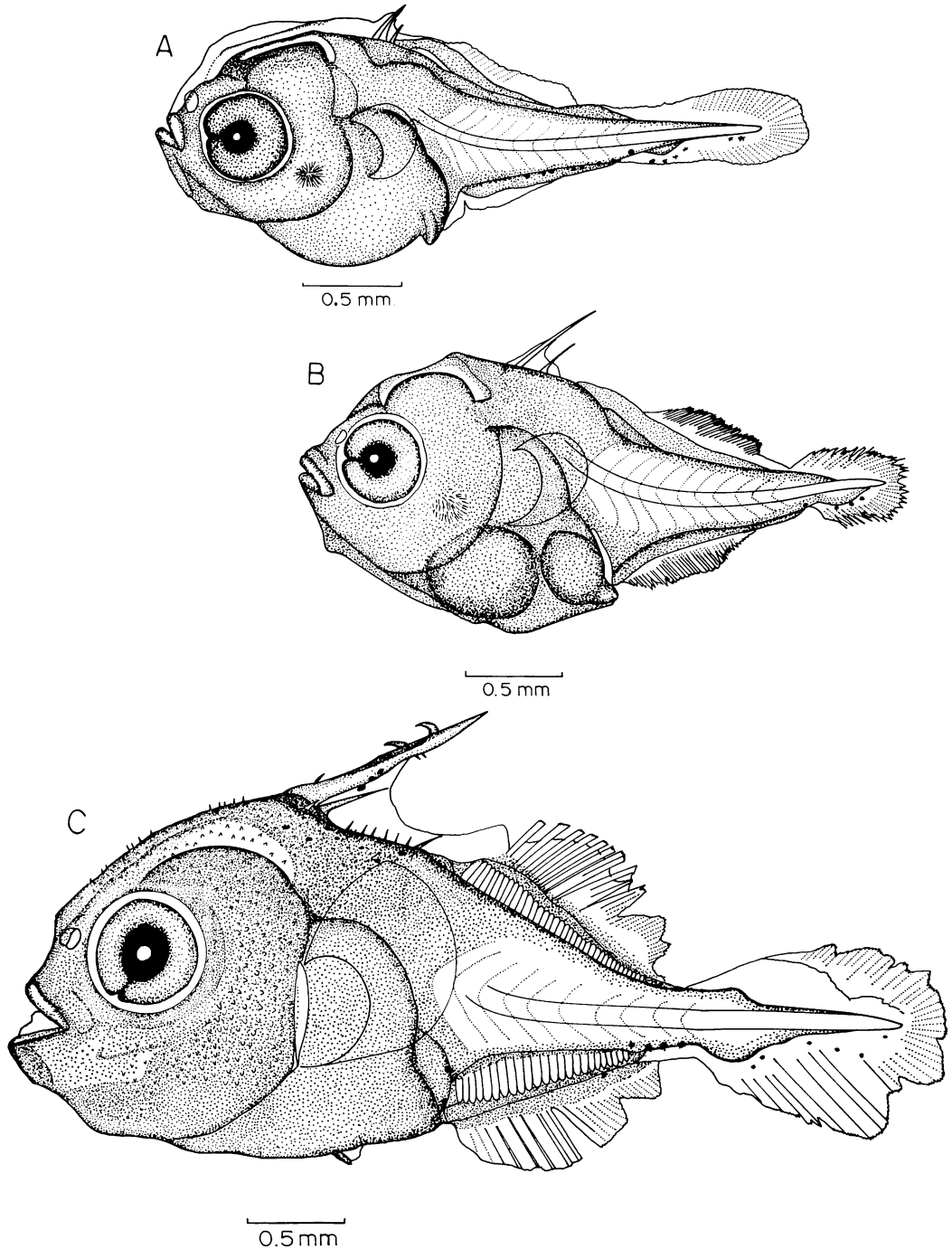
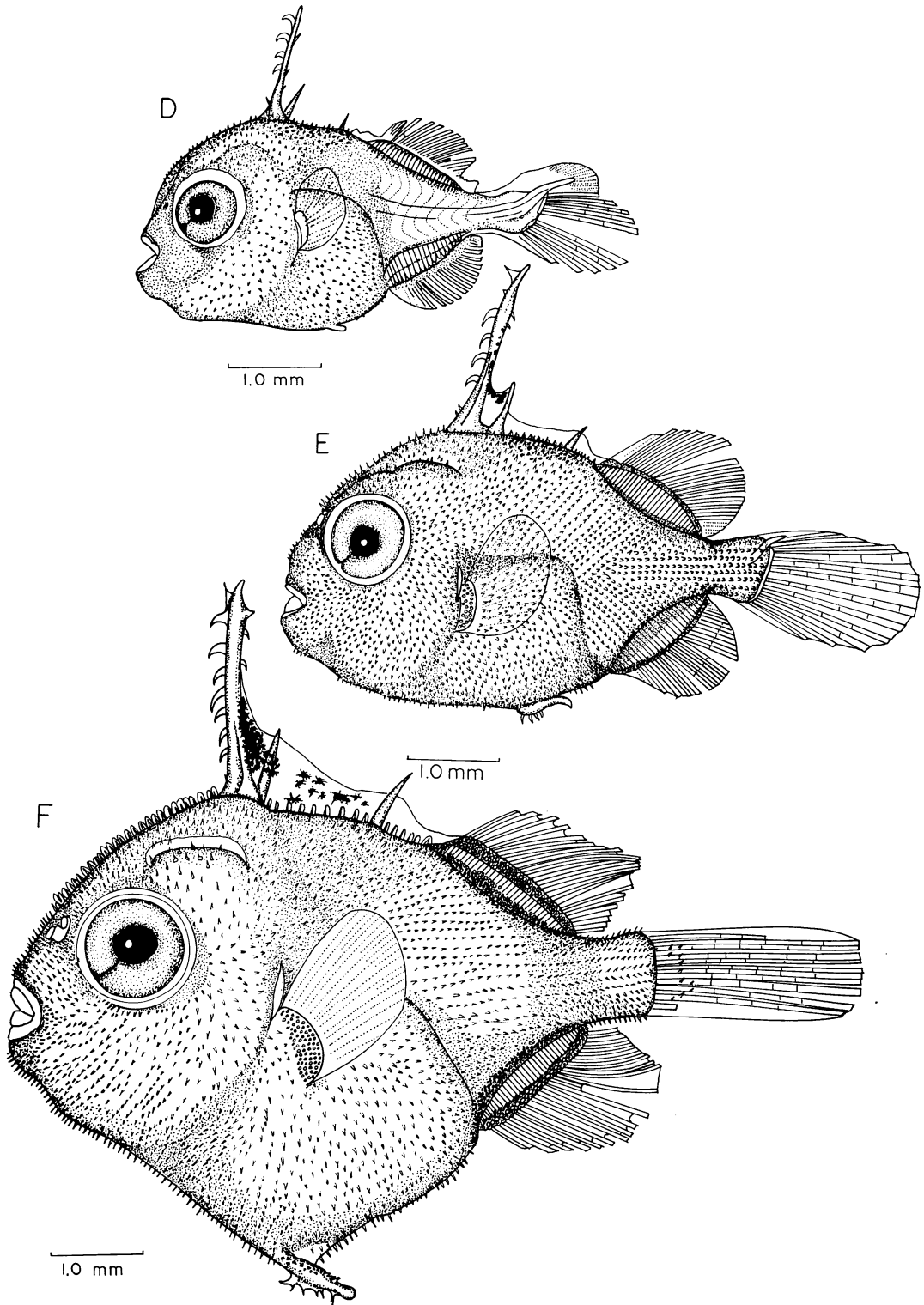


Fig. 1. Development of the larvae of *Balistes capriscus* collected from southern Brazil. A: 3.0 mm NL. B: 3.2 mm NL. C: 4.3 mm NL. D: 4.5 mm NL. E: 5.2 mm NL. F: 6.5 mm SL.



samples were fixed and preserved in 10% formalin solution.

A total of 436 balistoid larvae and juveniles were examined of which 100 (22.9%) represented *Balistes capriscus*, the second most abundant larvae of the Balistoidea of this region. One complete series of larvae and juveniles was collected from stations located at about 110 km south of Rio de Janeiro. Using this series, we identified the smaller specimens of *B. capriscus*.

Measurements of specimens were made with a portable micrometer, attached to a stereoscopic microscope. The terminology of measurement is defined as follows: Standard length (SL)=distance from tip of snout to end of hypural for larger specimens, after completion of flexion of notochord. Notochord length (NL)=distance from tip of snout to end of notochord for smaller larvae, before and during flexion of notochord. Head length (HL)=distance from tip of snout to posteriormost tip of gill opening for smaller specimens and to upper end of gill slit for larger ones. Body depth (BD)=distance between origins of second dorsal fin and anal fin. Preanal distance (PAD)=distance along midline of body from tip of snout to a vertical from anterior end of anal fin. Predorsal distance (PDD)=distance along midline of body from tip of snout to a vertical from anterior end of second dorsal fin.

Morphology of larvae and juveniles

Specimen of 3.0 mm NL (Fig. 1A): The smallest specimen identified for the species is 3.0 mm NL. The anterior part of the body is round and the posterior part is slender with a pointed tail. Two dorsal spines can be recognized at this size but the third dorsal spine has not appeared. Fin folds extend around the entire areas of the second dorsal, anal and caudal fins. A series of small melanophores is present at the postero-ventral side of the body and on the cheek region. When compared with the same size larva of *Stephanolepis hispidus*, those of *Balistes capriscus* can be distinguished easily by the presence of two dorsal spines, the lack of small spines on the forehead region and the presence of a patch of small spines on the cheek.

Specimen of 3.2 mm NL (Fig. 1B): There is no remarkable change in the body structure.

Fin folds are more developed with slight traces of fin rays. The two dorsal spines are larger than before and the length of the first one is slightly longer than the eye diameter. Four small melanophores are present on the caudal region and one on the ventral side of the caudal peduncle. The pelvic process has not appeared.

Disappearance of the patch of small spines on the cheek region occurs at the size range from 3.8 to 4.0 mm NL. Also in this size range, the gill opening starts to close and afterwards there remains only a small gill slit in front of the base of the pectoral fins.

Specimen of 4.3 mm NL (Fig. 1C): At this size three dorsal spines are eminent. The first dorsal spine has two spiny barbs at the anterior margin, two tiny spines at the opposite side and one tiny spine at the anterior margin near the base. The pelvic process which soon develops into incasing scales, is present on the median line of the abdomen. Formation of soft rays on the second dorsal, caudal and anal fins starts at this size. The patch of small spines on the cheek region disappears and is substituted by tiny spines on the entire region of the head and cheek. Several small spines are present on the dorsal median line between the second and third dorsal spines.

A series of melanophores is present on the dorsal side of the body between the first and third dorsal spines and three black spots can be recognized on the fin membrane at the back of the first dorsal spine. Four melanophores are present on the ventral side of the caudal peduncle and some small melanophores on the ventral side of caudal fin folds.

Specimen of 4.5 mm NL (Fig. 1D): The body is covered by tiny spines with exceptions on the posterior part of the trunk and the mouth region. The soft dorsal, anal and caudal fins are fairly developed, but the number of fin rays is not completed. The number of barbs on the first dorsal spine has increased and traces of rays appear on the pectoral fin. The melanophores on the dorsal side of the body continue developing, but those on the ventral side of the caudal peduncle are now not clear.

Specimen of 5.2 mm NL (Fig. 1E): The body is totally covered by tiny spines and shows a more round form. The length of the first dorsal

spine is equal to the head length and the number of barbs and small spines continue to increase. Formation of soft rays on the caudal fin is completed but those of the second dorsal and anal fins have not attained the adult number. The incasing scales are more developed and have several small spines on the surface. Pigmentation on the fin membrane posterior to the first dorsal spine is more developed, but the melanophores on the dorsal side of the body become less pronounced due to the development of small spines on the body surface. There are two patches of melanophores on the ventral and dorsal sides of the caudal peduncle.

Specimen of 6.5 mm SL (Fig. 1F): The body is shaped as typical balistoid form and covered completely by tiny spines. The incasing scales are more developed and the line connected between the tip of the mandible and the origin of incasing scales is straight which gives them a somewhat diamond-shaped appearance. The first dorsal spine has large barbs on the anterior margin and small barbs on the posterior. The melanophores on the dorsal fin membrane are more developed and the formation of soft fin rays on the second dorsal, anal and caudal fins are completed. Several tiny spines are present on the base of the caudal fin rays. The small gill slit is open at the anterior margin of the pectoral fin base.

Specimen of 13.5 mm SL (Fig. 2): In shape and form the body is now identical with the adult with exception of the body color. Even after long-time preservation in formalin solution, the body shows a strong brown color, and on the second dorsal and anal fin bases, four dark brown bands can be recognized. The second dorsal, anal and caudal fin membranes are almost colorless, in which only spotted brownish pigments are scattered. The barbs on the first dorsal spine now consist of four rows, two rows on the anterior margin and the other two on the postero-lateral margin. The incasing scales are robust with many spines on the surface (Fig. 3).

Identification of larvae and juveniles

The specimens described above range from 3.0 mm NL to 13.5 mm SL and they show a consistent continuity on many characters such as pigmentation, body form, barbs on the first

Table 1. Frequency distributions of soft rays in the second dorsal, anal, and pectoral fins of the Balistidae from Brazilian coast (from Moore, 1967).

	Dorsal soft rays																	Anal soft rays							Pectoral soft rays						
	23	24	25	26	27	28	29	30	31	32	33	34	35	20	21	22	23	24	25	26	27	28	29	30	31	13	14	15	16	17	
<i>B. capriciscus</i>	—	—	—	2	39	47	6	—	—	—	—	—	—	—	—	—	1	40	46	7	—	—	—	—	—	3	165	7	—	—	
<i>B. vetula</i>	—	—	—	—	—	—	5	21	4	—	—	—	—	—	—	—	—	—	—	19	11	—	—	—	—	—	54	6	—	—	
<i>M. niger</i>	—	—	—	—	—	—	—	—	1	2	6	9	4	—	—	—	—	—	—	—	—	—	5	8	9	—	—	3	33	6	
<i>C. maculatus</i>	8	18	9	—	—	—	—	—	—	—	—	—	—	5	17	13	—	—	—	—	—	—	—	—	—	4	37	26	—	—	
<i>B. capriciscus*</i>	—	—	4	6	8	6	1	—	—	—	—	—	—	—	—	—	5	13	5	2	—	—	—	—	—	2	8	1	—	—	

* Data collected by the present authors on juvenile specimens from southern Brazil.

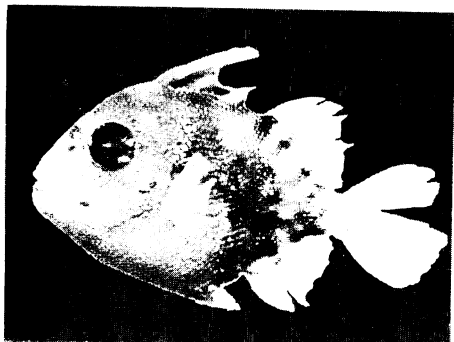


Fig. 2. Juvenile of *Balistes capriscus*, 13.5 mm SL.

dorsal spine, etc. Thus we consider them belonging to one species. The body form and the three strong dorsal spines of larvae and juveniles show that they belong to the family Balistidae. Reviewing the occurrences of the family Balistidae along the western Atlantic coast, Moore (1967) recorded six species: *Balistes capriscus*, *B. vetula*, *Melichthys niger*, *Xanthichthys ringens*, *Canthidermis sufflamen* and *C. maculatus* from which only four species occur along the southern Brazilian coast. In the same paper he showed the frequency distributions of soft rays of these species. Comparing with the data presented in the Moore's paper, the count of soft rays of the specimens from the

southern Brazilian coast almost coincided with those of *B. capriscus*. Thus we conclude that the larvae and juveniles described above are *B. capriscus*.

Larval development

Notochord length was used to examine the development of *B. capriscus* larvae smaller than 5.5 mm NL at which flexion of notochord is considered completed. Over this size, standard length was used. The relations between notochord length (or standard length) and the length of other body parts are not linear over the size range considered in this paper. For all body parts a remarkable change in body proportions was observed at the size range from 3.0 to 5.0 mm NL (Fig. 4). Head length, for example, showed a variation from 24 to 41% relative to standard length at 4.0 mm NL. Other remarkable changes in body characters at the size of about 4.0 mm NL are: the disappearance of a patch of small spines on the cheek region, the appearance of the third dorsal spine and the pelvic process and the formation of the small gill slit. At this size the pelvic process is not yet ossified and it appears as a single rod-like form.

At 6.0 mm SL, head length shows the largest proportion (47%) and after this, the proportion

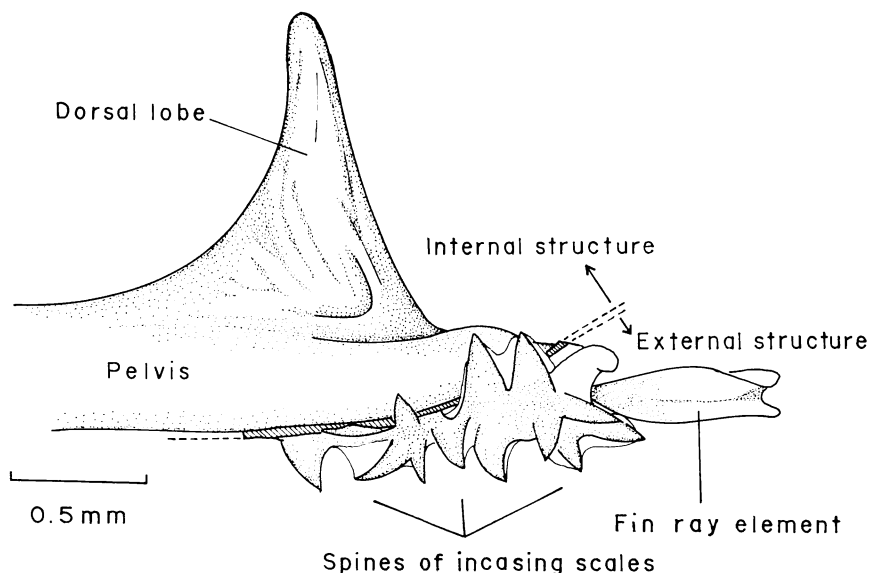


Fig. 3. Posterior end of pelvis and incising scales of the specimen shown in Fig. 2.

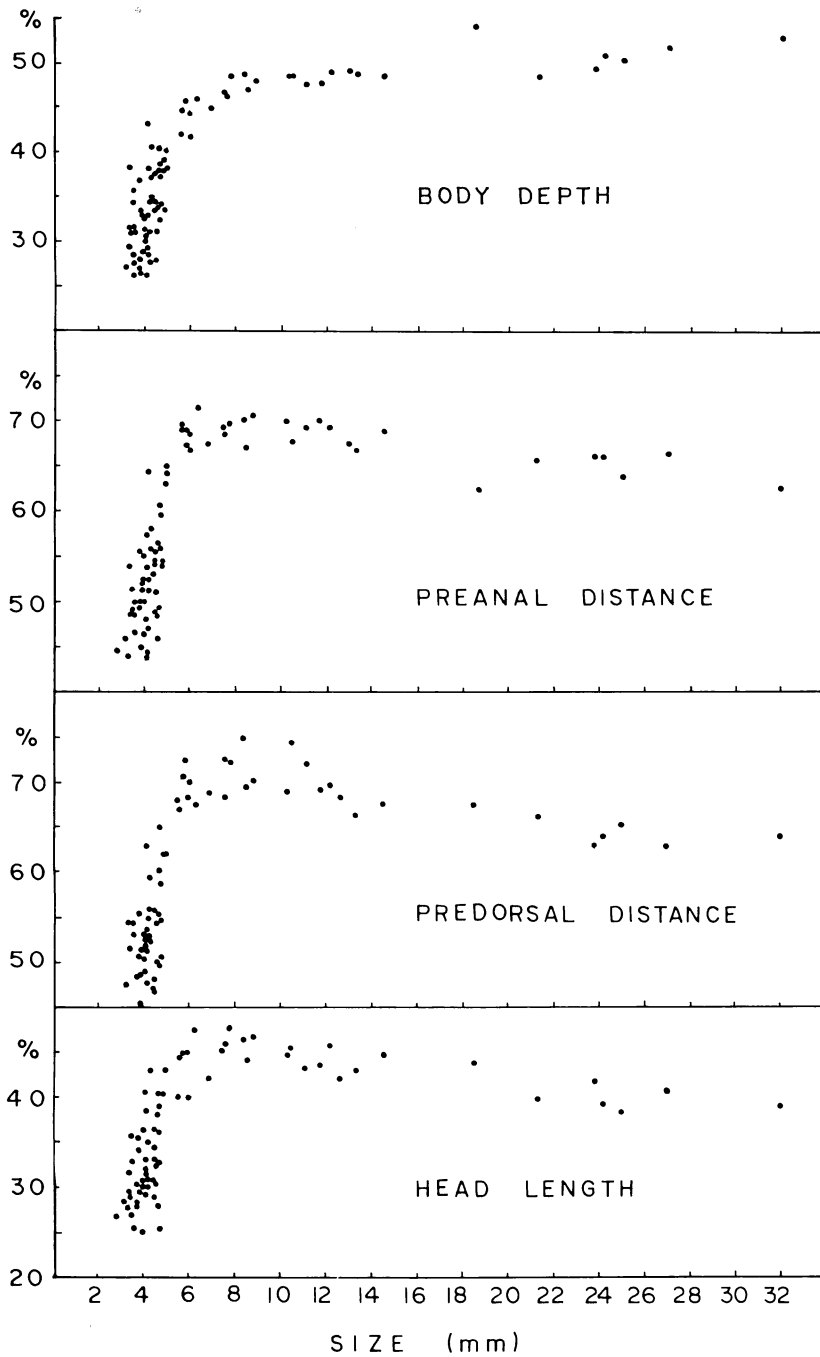


Fig. 4. Changes of body proportions relative to body size presented in notochord length for smaller specimens (less than 5.5 mm) or in standard length for larger specimens.

decreases gradually with the development of the larvae. The same kind of change of body proportions was observed for all other char-

acters.

The soft ray formation starts at about 4.0 mm NL and all larvae have complete numbers of fin

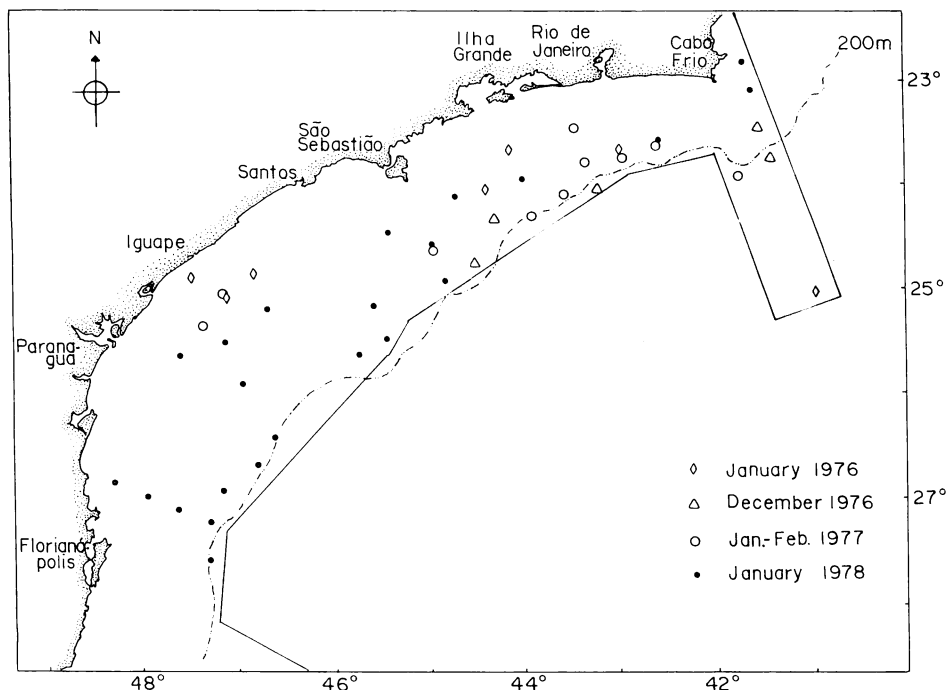


Fig. 5. Stations at which larvae and juveniles of *Balistes capriscus* were collected during 1975~1978 seasons with the R/V "Prof. W. Besnard". The area of frequent occupancy is outlined by solid line (see Matsuura, 1979).

rays at 6.0 mm SL. Also at this size the body form changes from round to diamond-shaped balistoid form. Therefore we can conclude that the end of larval stage occurs at about 6.0 mm SL and afterwards the juvenile stage will start.

Distribution

From seven cruises (December 1975, January, May, September-October and December 1976, January-February 1977 and January 1978) carried out in this region, the larvae and juveniles of *Balistes capriscus* occurred only during the summer season, especially in January cruises (Fig. 5). Most larvae were collected on offshore stations near the margin of the continental shelf, but some were collected on nearshore stations. When the occurrences of larvae on four cruises were compared we noticed that the distribution on the cruise of January 1978 was different from those of the other three cruises (Jan. '76, Dec. '76 and Jan.-Feb. '77). The distribution patterns of the latter three cruises were similar to one another in that two areas of concentration of the larvae and juveniles can be de-

tected: the first one located along the margin of the continental shelf from Cabo Frio to São Sebastião and another at nearshore stations off Iguape. Juveniles occurred more on offshore stations. On the cruise of January 1976, one juvenile of 21.3 mm SL was taken at station 1539, 240 km from the coast.

On the cruise of January 1978, four areas of concentration can be distinguished: Cabo Frio, Ilha Grande-São Sebastião, Iguape and Florianópolis.

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- 南ブラジルの大陸棚において採集された *Balistes capriscus* (モンガラカワハギ科) の仔魚
松浦康修・Mario Katsuragawa
- 大西洋産モンガラカワハギの一種 *Balistes capriscus* の仔稚魚を記載した。南ブラジル海域において仔稚魚は夏期、特に一月の調査航海においてのみ得られた。仔稚魚は沿岸地帯から大陸棚縁辺に及ぶ広い海域で採集された。