

Description of larvae and juveniles of *Bairdiella ronchus* (Sciaenidae: Teleostei) in southeastern Brazil

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SUMMARY: Developmental stages from flexion larvae to early juvenile of *Bairdiella ronchus* were described and illustrated from specimens collected along the margins of tidal creeks in the southern zone of the Cananéia-Iguape System on the southeastern coast of Brazil. The *B. ronchus* larvae were identified working backwards from the juvenile using characteristics common to successively earlier ontogenetic stages. The number of myomeres was 25 (11+14). The flexion of notochord was completed by 5.5 mm SL. The fin formation began in the following sequence: caudal, second dorsal and anal, pelvic fins, first dorsal and pectoral. It was fully completed in this sequence: principal caudal, second dorsal, anal, first dorsal, pelvic and pectoral fins. Squamation began between 10.0 mm SL and 11.1 mm SL, and was entirely completed by 35.0 mm SL. The major head spines included the posterior preocular, supraocular and post-temporal. The larval morphology and pigmentation, mainly the swath pigmentation pattern, were very similar to those described for *B. chrysoura* in the South Atlantic Bight of the United States. Among sciaenid larvae co-occurring in the study area, *Stellifer rastrifer* shows larval characteristics more similar to those of *B. ronchus*, mainly in the preflexion and flexion stages, and in the contraction of the swath pigmentation. They can be differentiated by the fact that in *S. rastrifer* there is a post-anal lateral pigmentation or caudal pigment on the ventral midline radiating dorsally, which is absent in *B. ronchus*.

Keywords: larval description, *Bairdiella ronchus*, southeastern Brazil.

RESUMEN: DESCRIPCIÓN DE LARVAS Y JUVENILES DE *BAIRDIELLA RONCHUS* (SCIAENIDAE: TELEOSTEI) EN EL SUDESTE DE BRASIL. – El desarrollo larvario de *Bairdiella ronchus* desde estadios de flexión hasta juvenil temprano de fueron descritos e ilustrados a partir de especímenes recogidos a lo largo de los canales de marea de la parte sur del Sistema de Cananéia-Iguape en la costa sudeste de Brasil. Las larvas de *B. ronchus* fueron identificadas a partir de los juveniles usando características comunes a sucesivos estadios tempranos ontogenéticos. El número de miómeros es de 25 (11+14). La flexión de la notocorda se completa a los 5.5 mm SL. La formación de las aletas se inicia según la siguiente secuencia: caudal, segunda dorsal, anal, pélvicas, primera dorsal y pectoral, y alcanza la dotación final en este orden: caudal principal, segunda dorsal, anal, primera dorsal, pélvicas y pectoral. La escamación comienza entre 10.0 mm SL y 11.1 mm SL, y se completa a los 35.0 mm SL. Las principales espinas de la cabeza incluyen las preoculares anterior y posterior, supraocular y pos-temporal. La morfología y pigmentación larvaria, principalmente el patrón de pigmentación “swath”, fue muy similar al descrito para *B. chrysoura* del “South Atlantic Bight” de Estados Unidos. Entre las larvas sciaenidos encontradas también en el área de estudio, *Stellifer rastrifer* es la que muestra características más similares a *B. ronchus*, principalmente en los estadios de preflexión y flexión, y por la contracción de la pigmentación “swath”. Las larvas de *S. rastrifer* pueden ser identificadas por la presencia de una pigmentación pos-anal lateral o pigmentos caudales en la línea central ventral que radian dorsalmente, ausentes en *B. ronchus*.

Palabras clave: descripción larval, *Bairdiella ronchus*, sudeste de Brasil.

INTRODUCTION

The sciaenid genus *Bairdiella* includes at least 7 species inhabiting tropical and subtropical coastal

waters of the western Atlantic and eastern Pacific (Froese and Pauly, 2006). *Bairdiella ronchus* is the only species known on the southeast coast of Brazil (Menezes *et al.*, 2003). In the Caribbean, the north-

ern limit of its distribution, *B. ronchus* reaches a larger size than in Brazil and is of commercial importance. Probably because of the small size of adults, it is not exploited by local fisheries in Brazil (Chaves, 1995). However, this species is one of the most abundant demersal fishes, and may play an important role in the nearshore and estuarine communities as prey items for larger fish.

A large number of early developmental studies of sciaenids in the western Atlantic have been carried out, mainly on the coast of the United States (e.g., Hildebrand and Cable, 1934; Powles and Stender, 1978; Powles, 1980; Fahay, 1983; Ditty, 1989; Ditty *et al.*, 2006). Sinque (1980) described the larvae and juveniles of *Cynoscion leiarchus*, *Isopisthus parvipinnis*, *Macrodon ancylodon*, *Menticirrhus americanus*, *Micropogonias furnieri* and *Stellifer rastrifer* collected in the same area as that of the present study.

The embryology and larval development of *Bairdiella chrysoura* were described by Kuntz (1914), Powles (1980), Ditty (1989) and Ditty *et al.* (2006), but the early development of *B. ronchus* is described for the first time in the present paper. Some studies of the adult of *B. ronchus* have been made, especially related to its biology and autecology, including reproduction (Chaves, 1995; Torres Castro *et al.*, 1999), feeding (Vendel and Chaves, 1998) and growth (Louis, 1985). Betancourt and Gonz  les-Sans  n (1990) studied the feeding behaviour of *B. ronchus* juveniles from the coast of Cuba. Peralta (1993) studied the larval *B. ronchus* from the Ciénaga Grande de Santa Marta (Colombia), but only distribution data were published. The present study describes the morphological development of larval and juvenile *Bairdiella ronchus* in order to provide useful information for identification of this species during its early life stages.

MATERIAL AND METHODS

Bairdiella ronchus larvae and juveniles were collected in southeastern Brazil, in the Cananéia-Iguape estuarine-lagoon system (25°S - 48°W) from February 2001 to March 2004 (Fig. 1). A special sampling device, a type of small beach seine 3.0 m long, 1.5 m deep and with a 0.5 mm mesh size was used to catch the specimens (Itagaki, 2005). A simple square dip net (0.7 m × 0.7 m) with a 0.3 mm mesh size was also used for smaller larvae. The sampling sites were located very close to the shallow

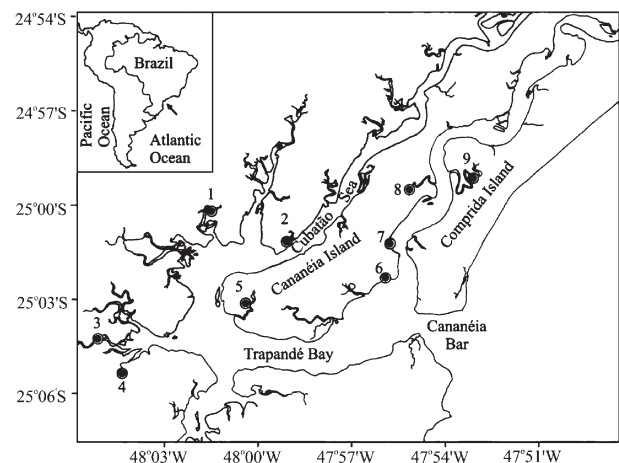


FIG. 1. – Map showing the study area in the Cananéia-Iguape System on the southeastern coast of Brazil. The black spots indicate the stations where the larvae were sampled.

margin of the tidal creeks. Apparently, fish larvae and juveniles use such places as nursery grounds, where the presence of mangrove roots can provide protection against predators. The hauls were done during low tide, when the border of the creek served as a barrier to prevent the specimens from escaping. As the tidal creek margin was too shallow, operations from the boat were not feasible; consequently two people entered the water and manually set the seine in a semicircle and quickly moved it toward the creek border with the catch. The local condition was not suitable for a normal quantitative sampling with plankton net, and only qualitative sampling was performed. Consequently, abundance results are not presented in this study. The samples were preserved in 4% buffered formalin.

The larvae were identified working backwards from the juveniles using characteristics common to earlier successive ontogenetic stages (Powles and Markle, 1984). Characteristics used included fin ray counts, number of precaudal and caudal myomeres, chin and snout pores, presence or absence of barbels, caudal fin shape, body shape, mouth length and position, second anal spine length pigmentation patterns and head spination (Chao, 1978; Menezes and Figueiredo, 1980; Chao, 2002). Larvae and juveniles were examined under a stereomicroscope and measured using an ocular micrometer (nearest 0.01 mm) attached to the objective lens. Specimens longer than 15.0 mm were measured with a digital caliper. Approximately 290 individuals were analysed in this study, and from this group 272 specimens were used for morphometry. Eleven body parts

were measured—body depth (BD), snout length (SnL), head length (HL), snout to anus (Sn-A), snout to anal fin origin (Sn-AO), caudal peduncle depth (CPD), eye diameter (ED), upper jaw length (UJL), anus to anal fin gap (GAP) and pre-dorsal fin length (PdL)—using the terminology and methodology of Ditty (1989), Powles (1980), Sinque (1980), Leis and Trnski (1989) and Moser (1996). The flexion larvae measurements, from the tip of the snout to the end of the notochord, were expressed as notochord length (NL), whereas the post-flexion larvae and juvenile measurements, from the tip of snout to the posterior edge of the developing hypurals, were expressed as standard length (SL). The mean and standard deviation of each measurement were estimated for each developmental stage.

Larvae were categorised as flexion or postflexion stage, according to the state of notochord flexion (Ahlstrom *et al.*, 1976). Larvae at the pre-flexion stage were not collected. The juvenile was defined generally as a pre-reproductive individual that is morphologically similar to the adult with complete fin ray elements and squamation (Moser, 1996). The presence of the rostral fold and shin and snout pores was classified as upper, marginal and mental, according to Chao (1978) and head spination was classified according to (Moser, 1996 and Neira *et al.*, 1998). Larvae and juveniles were illustrated with a camera lucida. Some specimens were stained with Rose Bengal to highlight the details of morphological structures.

The specimens used in this study were deposited at the Ichthyoplankton Laboratory of the Oceanographic Institute of the University of São Paulo.

RESULTS

Morphology

From the flexion to juvenile stage, *B. ronchus* had large heads and moderate body depth. There were 25 myomeres, including the urostyle (11 pre-caudal and 14 caudal). Except for the ratio of the distance from anus to anal fin gap (GAP) vs body length (NL or SL) and the ratio of pre-dorsal fin length (PdL) vs body length, all other body proportions tended to increase from flexion to postflexion stage (Table 1). These increases were greater for head length (HL), snout-to-anus distance (Sn-A),

TABLE 1. – Body proportions (%) in relation to BL (n: number of specimens, SD: standard deviation) of *Bairdiella ronchus*. Measurement abbreviations explained in Material and Methods.

Stage	ED	SnL	UJL	HL	BD	PdL	Sn-A	Sn-AO	GAP	CPD	n
Flexion	Mean \pm SD Max. – Min.	8.1 \pm 0.7 9.2-6.5	15.8 \pm 1.0 17.9-13.6	33.5 \pm 2.5 37.5-25.5	34.4 \pm 1.3 36.4-30.9	41.6 \pm 7.5 60.1-30.9	47.8 \pm 2.4 52.0-43.2	60.6 \pm 2.2 64.3-56.6	12.8 \pm 2.3 17.0-8.3	8.7 \pm 0.9 10.3-6.7	n=30 nED=29
Postflexion	Mean \pm SD Max. – Min.	8.8 \pm 1.0 10.7-6.2	18.6 \pm 1.3 20.7-15.6	38.0 \pm 2.1 44.0-32.7	35.0 \pm 1.4 38.3-30.1	38.8 \pm 2.5 54.2-32.7	53.6 \pm 3.5 59.1-33.6	63.8 \pm 1.7 67.1-57.4	10.4 \pm 3.3 28.2-5.2	10.1 \pm 0.5 11.1-8.8	n=104 nED=103 nSn-AO=102 nCPD=103
Transformation	Mean \pm SD Max. – Min.	8.1 \pm 1.0 11.1-6.6	17.3 \pm 1.0 20.0-13.8	38.5 \pm 1.8 44.6-34.4	33.4 \pm 1.4 37.5-30.1	37.8 \pm 2.1 43.1-29.8	58.8 \pm 2.1 63.1-52.7	65.2 \pm 1.5 68.8-59.7	6.5 \pm 1.3 10.6-2.3	10.5 \pm 0.5 11.5-9.6	n=96 nUJL=95 nBD=94 nGap=95
Juvenile	Mean \pm SD Max. – Min.	8.7 \pm 0.7 10.0-7.1	16.1 \pm 1.2 18.6-13.8	38.6 \pm 2.0 43.7-35.4	32.6 \pm 1.4 35.0-29.6	35.9 \pm 1.9 41.3-33.5	60.3 \pm 1.8 63. – 6-56.3	67.7 \pm 2.3 72.2-63.7	7.4 \pm 1.5 10.4-4.4	10.8 \pm 0.3 11.3-10.3	n=42

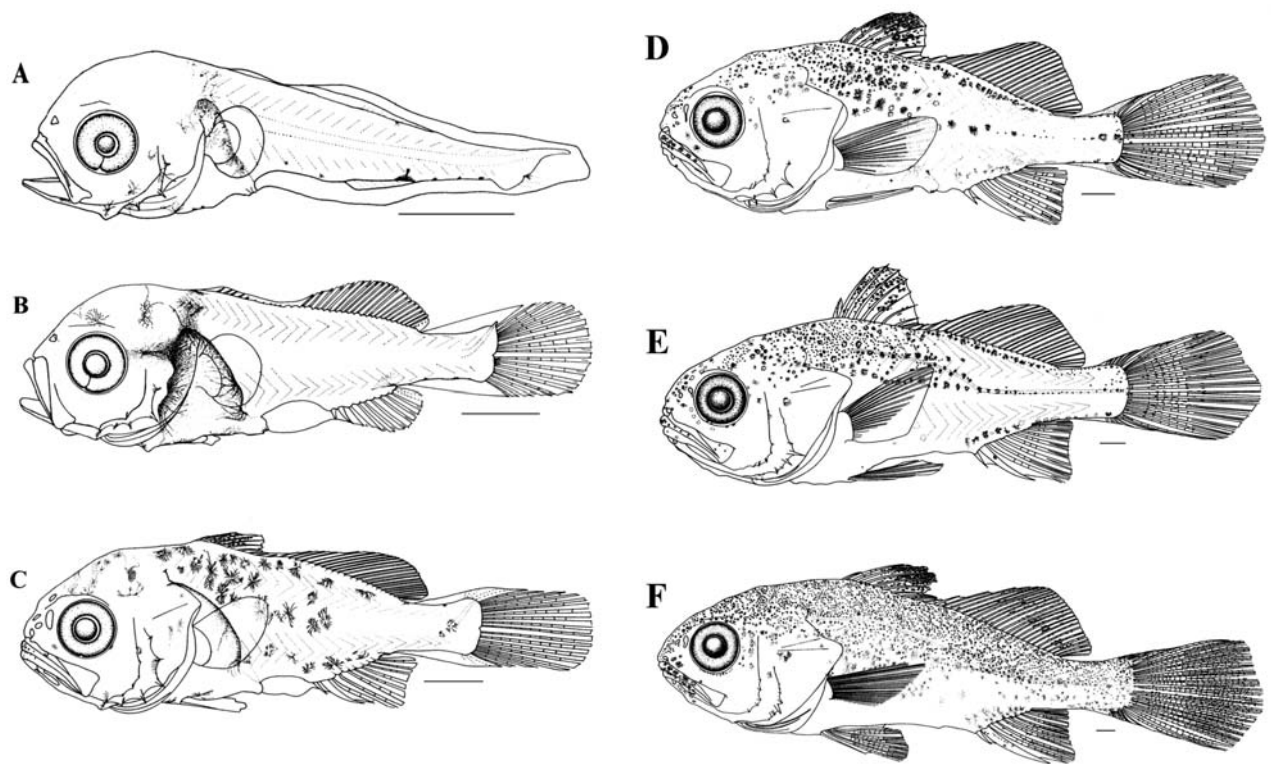


FIG. 2. – Early development of *Bairdiella ronchus*: A) 4.6 mm NL; B) 5.9 mm SL; C) 7.9 mm SL. Bar = 1 mm.; D) 13.9 mm SL; E) 18.5 mm SL; F) 23.9 mm SL. Bar = 1 mm

distance from snout to anal fin origin (Sn-AO), and caudal peduncle depth (CPD). In all these cases, the increases were also continuous until the juvenile stage. HL increased rapidly from 33.5% NL (sd = 2.5) in the flexion stage to 38.0% SL (sd = 2.1) in the postflexion stage, and then slowly through the transformation, reaching the maximum of 38.6% SL (sd = 2.0) in the juvenile stage. The Sn-A ratio increased from 47.8% NL (sd = 2.4) in the flexion stage to 53.6% SL (sd = 3.5) in the postflexion stage, and to the maximum of 60.3% SL (sd = 1.8) in the juvenile stage. The Sn-AO ratio increased constantly from 60.6% NL (sd = 2.2) in the flexion stage to 63.8% SL (sd = 1.7) in the postflexion stage, and then to 67.7% SL (sd = 2.3) in the juvenile stage. The CPD ratio increased from 8.7% NL (sd = 0.9) in the flexion stage to 10.1% SL (sd = 0.5) in the postflexion stage, and to 10.8% SL (sd = 0.3) in the juvenile stage.

The relationship of body depth (BD) to body length ranged between a minimum of 29.6% estimated in the juvenile stage and a maximum of 38.3% estimated in the postflexion larvae. The smaller specimens tended to be slightly deeper than

the larger ones, as the BD ratio increased from 34.4% NL (sd = 1.3) in the flexion stage to 35.0% SL (sd = 1.4) in the postflexion stage, but then decreased to 33.4% SL (sd = 1.4) in the transformation stage, and to 32.6% SL (sd = 1.4) in the juvenile stage. The SnL ratio increased from 8.1% NL (sd = 0.7) in the flexion stage to 8.8% NL (sd = 1.0) in flexion larvae and to 8.8% SL (sd = 1.0) in postflexion larvae. Thereafter, the ratio decreased to 8.1% SL (sd = 1.0) in the transformation stage, and then increased slightly to 8.7% SL (sd = 0.7) in the juvenile stage.

The ratio of the distance from anus to anal fin gap (GAP) decreased from the maximum of 12.8% NL (sd = 2.3) observed in the flexion stage to 10.4% SL (sd = 3.3) in the postflexion stage, then declined to 6.5% SL (sd = 1.3) in the transformation stage and thereafter tended to increase, reaching 7.4% SL (sd = 1.5) in the juvenile stage (Table 1). The visceral mass was almost triangular and reached the mid-body at about the transformation size. The ratio of pre-dorsal fin length (PdL) decreased continuously from flexion larvae (41.6% NL, sd = 7.5) to the juvenile stage (35.9% SL, sd = 1.9).

Head spination

The major head spines became visible early in the larval stages (Fig. 2). By 4.4 mm NL, three posterior preopercular spines, as well as a small supraocular ridge, were present. The number of posterior preopercular spines had increased to 5 by 8.0 mm SL (Table 2), and by 18.5 mm SL a series of 6-7 spines had extended as a serrate preopercular margin with strong spines at its angle, similar to those of adults (Fig. 2E-F). The supraocular ridge enlarged and became slightly serrated in larvae larger than 6.5 mm SL (Fig. 2), but tended to disappear by the juvenile stages. The anterior preopercular spines were first observed only in larvae larger than 5.0 mm NL and most frequently numbered 1-2 spines. During development, the number of anterior preopercular spines increased to 5 at 8.0 mm SL, occasionally attaining 6 spines during the transformation and juvenile stages (Table 2). At 5.0 mm NL a single small post-temporal spine was first observed, but the numbers of these spines increased to 2 in larvae larger than 10.0 mm SL, then to 4-5 in individuals larger than 13.5 mm SL.

Fin development

In the smallest larvae examined (4.4 mm NL), the pectoral fin buds were present and the pectoral fin rays were first observed by 6.2 mm SL. By 8.5 mm SL, all specimens possessed the full complement of 16-17 rays (Table 2). The caudal fin was in process of forming by 4.4 mm NL, when the anlagen of hypurals and 7 principal fin rays were

first observed; from 5.5 mm SL on, all specimens possessed the full complement of principal caudal rays (9+8) (Table 2); procurent caudal fin rays began to form by 5.0 mm NL, and by 10.1 mm SL all individuals showed the 9+7 pattern. The caudal fin was initially rounded and then became increasingly truncated during the transformation and juvenile stages (Fig. 2D-F). The anlagen of the second dorsal fin and anal fin were visible by 4.4 mm SL; development of the first rays of the second dorsal and anal fins began simultaneously by 4.6 mm NL; from 5.9 mm SL on, the full complement of anal fin rays (2 spines and 7-8 rays) was attained, and all elements of the second dorsal fin (21-24 rays) were observed in individuals from 5.7 mm SL on. The first dorsal fin began to form by 5.1 mm NL, when the first spines became visible, and all specimens from 7.0 mm SL onward showed the full complement (XI). The pelvic fins were observed as anlagen by 4.8 mm NL, but development of the pelvic fin rays only began by 6.4 mm SL, and the complete count of 1 spine and 5-6 rays was present in all specimens from 7.4 mm SL onward. The sequence of fin development was: caudal, second dorsal and anal, pelvic, first dorsal and pectoral. However, the fins were completely formed in a different order: principal caudal, second dorsal, anal, first dorsal, pelvic and pectoral. The second anal-fin spine, which was nearly the same size as the first anal-fin spine by 5.9 mm SL, increased substantially during the development, reaching nearly 80% of the size of the first anal fin ray by 12.5–12.5 mm SL (mean = 79.2%; sd = 5.5).

TABLE 2. – Number of fin spines, soft rays and head spines of *Bairdiella ronchus* larvae. Roman numeral indicates the number of fin spines. Dashed line indicates the limit between notochord flexion (above) and postflexion (below) stages.

BL(mm)	Anal Fin	First Dorsal Fin	Second Dorsal Fin	Caudal Fin	Pectoral Fin	Pelvic Fin	Anterior Preopercular	Posterior Preopercular	Post-temporal	Myomeres
4.4	+		+	(1 + 6)	+			3		11+14=25
4.6	5		8	(8 + 8)	+		+	3		11+14=25
4.8	8		17	(8 + 8)	+	+	+	3		11+14=25
5.1	I + 8	II	20	(8 + 8)1	+	+	+	3	1	11+14=25
5.5	I + 7	III	20	(9 + 8)1	+	+	3	4	1	11+14=25
6.2	II + 8	VI	22	(9 + 8)1	2	+	2	4	1	11+14=25
6.4	II + 7	XI	22	4(9 + 8)4	6	I + 3	4	4	1	11+14=25
6.5	II + 8	XI	23	4(9 + 8)3	13	I + 2	4	4	1	11+14=25
7.0	II + 8	XI	22	3(9 + 8)3	12	I + 4	3	4	1	11+14=25
7.9	II + 8	XI	23	6(9 + 8)5	13	I + 5	4	4	1	11+14=25
8.0	II + 8	XI	23	7(9 + 8)6	16	I + 5	5	5	1	11+14=25
8.8	II + 8	XI	23	7(9 + 8)5	16	I + 5	5	5	1	11+14=25
9.2	II + 8	XI	22	8(9 + 8)6	16	I + 5	4	4	1	11+14=25
9.6	II + 8	X	24	8(9 + 8)7	16	I + 5	4	5	1	11+14=25
10.1	II + 8	XI	22	9(9 + 8)7	16	I + 5	5	5	2	11+14=25

Pigmentation

Larvae of *B. ronchus* were moderately pigmented during the flexion stage, but their pigmentation increased markedly during the transition from post-flexion to juvenile (Fig. 2). A characteristic “swath” of wide, heavy pigmentation extended from the nape to the cleithral symphysis, covering most of the lateral part of the trunk, anterior to the anus (Figs. 2A, B). The swath was especially dark on the surface of the visceral mass. A branch of this pigmentation extended laterally as a strip behind the eye from the orbit margin (Fig. 2B). Occasionally, during the late flexion stage, this pigmentation became less distinct due to melanophore contractions or thickening of the body wall. During the postflexion stage (by 7.9 mm SL) the swath almost disappeared, and the melanophores spread throughout the body, mainly on the dorsal surface of the trunk and almost to the first half of the body (Fig. 2C).

Two melanophores, one at the angle of the lower jaw and the other on the posterior surface of the dentary, were observed from the early flexion (Fig. 2A), but later the pigmentation expanded to the premaxilla and throughout the lower jaw (Fig. 2C-F). Several melanophores on the anterior surface of the midbrain and at the junction of the mid- and hindbrain began to appear by the early post flexion stage (Fig. 2B), but increased thereafter covering the entire dorsal portion of the head by the transformation stage (Fig. 2D). During flexion and postflexion, two (occasionally three) melanophores formed, independently of the swath, along the ventral midline between the cleithral symphysis and the anus (Fig. 2).

At flexion stages a series of melanophores were present along the ventral midline of the tail, two anterior to the anal fin base, one at the anal fin base terminus (occasionally expanding to occupy a large portion of the ventral tail area), and three posterior to the anal fin base (Fig. 2A). Melanophores were absent along the dorsal midline of the tail during the flexion stage, except for a rare melanophore located on the dorsal fin base (Fig. 2A), but a series of melanophores was present along the second dorsal fin base and caudal peduncle during the postflexion stage (Fig. 2C) and pigmentation along the lateral midline became evident during the postflexion stage (Figs 2C, D).

The caudal fin pigmentation began with one tiny melanophore present laterally on the hypural lobe by 4.4 mm NL (Fig. 2A), increasing in number of pigments and spreading along the hypural margins in

older specimens (Fig. 2D, F). Pigmentation on the first dorsal fin was first visible only during the post-flexion stage (Fig. 2C), when several melanophores spread over the fin surface, being especially patchy in the superior region. Pigmentation on the anal fin, as well as on the second dorsal fin began to form late during the transformation and juvenile stages; a single melanophore on the second spine of the anal fin was visible by 18.5 mm SL (Fig. 2E), and only by 23.9 mm SL (Fig. 2F) was a series of pigments observed on the second dorsal fin.

DISCUSSION

The larval and juvenile *B. ronchus* were identified by a set of characteristics: the presence of swath pigmentation; meristic counting including number of precaudal and caudal myomeres (11+14) and fins (first dorsal= XI-XII; second dorsal= 23 – 24; anal = II, 8; pectoral = 17); and morphological characteristic including compressed oblong body with triangular and compact visceral mass, rounded to rhomboid caudal fin, stout second anal spine, oblique and nearly sub-terminal mouth, and shin with pores in post-flexion stages but lacking barbells in early juveniles.

Flexion and early postflexion larvae here described are clearly separated from other Sciaenidae larvae occurring in the area by the presence of swath pigmentation. The swath pigmentation pattern is very similar to that described in *B. chrysoura* by Powles and Stender (1978) and Powles (1980). We think that the presence of swath pigmentation is a useful diagnostic characteristic for distinguishing *Bairdiella* larvae from other sciaenid species, and as *B. ronchus* is the only species of this genus inhabiting the area, the presence of this pigmentation allows these larvae to be identified as belonging to this species.

Postflexion and early juvenile *B. ronchus* can be distinguished from other sciaenids inhabiting southeastern Brazil by the number of precaudal and caudal myomeres and counts of fin elements (Table 3), except for *Cynoscion microlepidotus* and *Umbrina canosai*. Although there is no description of early stages of *C. microlepidotus* and *U. canosai*, a series of characteristics given by Matsuura and Nakatani (1979), Sinque (1980), and Ditty *et al.* (2006) indicate that *Cynoscion* postflexion larvae and juveniles have a more elongated body than *B. ronchus* (except *C. leiarchus* and *C. nothus*); in general they have

TABLE 3. – Summary of selected meristic characteristics and early life stage information for 27 Sciaenidae species of southeastern Brazilian coastal waters.

Species	First Dorsal	Second Dorsal	Anal	Pectoral	Vertebrae	Egg	Larvve	Juvenile
<i>Bairdiella ronchus</i>	XI-XII	23-24(21-25)	II, 8(7-9)	17(16-18)	11+14 = 25	unknown	x	x
<i>Ctenosciaena gracilicirrhus</i>	XI	21-23(20-24)	II, 7- 8(9)	15-16	10+15 = 25	unknown	unknown	unknown
<i>Cynoscion acoupa</i>	XI	18-20(17-23)	II, 8(7-9)	17-18	12-13+13-12 = 25	unknown	x	unknown
<i>Cynoscion jamaicensis</i>	XI	23-25(23-27)	II, 9(8-10)	17	13+12 = 25	unknown	unknown	unknown
<i>Cynoscion leiarchus</i>	X-XI	21-23(20-24)	II, 11(10-12)	18 (17-19)	25	unknown	x	x
<i>Cynoscion microlepidotus</i>	XI	23-24(22-25)	II, 9(8-10)	20(18-21)	25	unknown	unknown	unknown
<i>Cynoscion striatus</i>	XI	18-21	II, 8-9	16-18	unknown	unknown	unknown	unknown
<i>Cynoscion virescens</i>	XI	27-31	II, 8(7-9)	17	14+11 = 25	unknown	unknown	unknown
<i>Equetus lanceolatus</i>	XIII-XIV	46-50(44-55)	II, 6(5-7)	15-16	10+15 = 25	unknown	unknown	unknown
<i>Isopisthus parvipinnis</i>	VIII-IX	18-20(21-22)	II, 18 - 20(16-17)	unknown	11+14 = 25	unknown	x	unknown
<i>Larimus breviceps</i>	X-XI	26-28(24-29)	II, 6-7	unknown	11+14 = 25	unknown	unknown	unknown
<i>Macrodon ancylodon</i>	XI	27-30	II, 8-9(10)	16	13+12 = 25	unknown	x	x
<i>Menticirrhus americanus</i>	XI	20-21(22-26)	I, 7(6-8)	≤20(18-24)	10+15 = 25	unknown	x	x
<i>Menticirrhus littoralis</i>	XI	22-25(21-26)	I, 7(6-8)	≤19(18-21)	10+15 = 25	unknown	unknown	x
<i>Micropogonias furnieri</i>	XI	26-28(26-30)	II, 7-8	17-19	10+15 = 25	unknown	x	x
<i>Nebris microps</i>	IX	31-33	II, 9-10	unknown	unknown	unknown	unknown	unknown
<i>Odontoscion dentex</i>	XII-XIII	22-27	II, 8-10	13-15	12+13 = 25	unknown	unknown	unknown
<i>Ophioscion punctatissimus</i>	XI	23-24	II, 6-7(8)	18	10+15 = 25	unknown	unknown	unknown
<i>Paralanchurus brasiliensis</i>	XI	28-31	II, 8(7-9)	unknown	11+18 = 28	unknown	unknown	unknown
<i>Pareques acuminatus</i>	X-XI	36-41	II, 7-8(6)	16-17	10+15 = 25	unknown	unknown	unknown
<i>Pogonias cromis</i>	XI	21-23(19-23)	II, 6(5-7)	18	10+14 = 24	x	x	x
<i>Stellifer sp.B</i>	XIII-XIV	20-21	II, 8-9	unknown	10+15 = 25	unknown	unknown	unknown
<i>Stellifer brasiliensis</i>	XI	21-22	II, 9	18-19	10+15 = 25	unknown	unknown	unknown
<i>Stellifer rastriifer</i>	XI-XIII	21-23	II, 9(8)	18-20	10+15 = 25	unknown	x	x
<i>Stellifer stellifer</i>	XII	18-20	II, 8	unknown	10+15 = 25	unknown	unknown	unknown
<i>Umbrina coroides</i>	XI	27-29(26-31)	II, 6	17(16-18)	11+14 = 25	unknown	x	x
<i>Umbrina canosai</i>	XI	21-25	II, 7-8	unknown	unknown	unknown	unknown	unknown

Menezes and Figueiredo, 1980; Ditty and Shaw, 1994; Ditty *et al.*, 2006

12-14 + 13-11 myomeres (except *C. nothus*), moderate to large posttemporal spines (small in *B. ronchus*), a large mouth with a prominent lower jaw, moderate to large teeth and a chin without pores. The presence of a rigid barbell on the chin and a moderate second spine of the anal fin separate the juvenile *Umbrina* from *B. ronchus*. In addition, *B. ronchus* specimens from transforming stage to early juveniles (>14 mm SL) already have the following adult morphological characteristics: compressed oblong body; sub-terminal and moderate oblique mouth, chin without barbells, pores in the snout, and a rostral fold; preopercle with two series of spines, one of small spines along the anterior margin, and one of small to moderate spines along the posterior margin with the largest spine at its angle (>20.0 mm SL); stout second anal spine with approximately the same length as the first soft ray, basal halves of the soft dorsal and anal fin scaled at 28.0 mm SL; caudal fin slightly rounded to rhomboid; and a lateral line extending to the middle of the caudal fin at 20.0 mm SL (Chao, 2002; Menezes and Figueiredo, 1980). These adult characteristics and the meristic data obtained from the analysed specimens provide enough information for correctly identifying the larger *B. ronchus* of the present study.

Though all morphological characteristics of the transformation stage and early juveniles are similar to those described for adults (Chao, 2002), the largest individual (24.0 mm SL), nonetheless, differs from them. For instance, the adults have a more pointed head, and the anal fin base is much less than half of the dorsal fin base. In body proportions, the ratios in relative body length tend to decrease and then increase gradually, except in a few cases. This trend suggests that the body shape of the juvenile (<24.0 mm SL) is different from that of the adult. Among some adult characteristics, only the rostral fold with the marginal pore inside (>6.0 mm SL) and the dorsal base longer than the anal base (>8.0 mm SL) can be seen in the larval stage.

In southeastern Brazil, larvae of *Stellifer rastriifer*, *Cynoscion leiarchus*, *Isopisthus parvipinnis*, *Macrodon ancylodon*, *Menticirrhus americanus*, and *Micropogonias furnieri* have been previously identified (Pearson, 1929; Sinque, 1980; Ditty, 1994) and are known to co-occur with larvae of *B. ronchus* in the Cananéia-Iguape estuarine-lagoon system region (Sinque, 1980). Larvae of *Pogonias cromis* (Itagaki, unpubl. data) can also be observed in the study area. Among these sciaenids, the larval *B. ronchus* is more similar to *S. rastriifer* during the

early larval stages (< 6.0 mm SL), mainly when the swath pigmentation is contracted. The same was observed in the northern Gulf of Mexico and on the Atlantic coast of the USA, where *B. chrysoura* larvae can be confused with *Stellifer lanceolatus* larvae (Chao, 2002). Smaller larvae of *B. ronchus* can also be distinguished from *S. rastrifer* by the presence of internal pigmentation in the otic region and the pigmentation embedded in the musculature of the nape (Table 4). Another difference is that in the larval *S. rastrifer* the post-anal lateral pigments and caudal pigments on the ventral and dorsal midline radiate internally and externally towards the lateral midline, reaching the lateral pigmentation. In *B. ronchus* such radiation was observed only externally, and post-anal lateral pigments were absent.

B. chrysoura at 4.0 mm NL can be distinguished from *S. lanceolatus* by eye diameter (Powles, 1980; Ditty, 1989): the proportion observed in *B. chrysoura* is usually above 10% body length and that in *S. lanceolatus* under 10% body length. The same feature could be observed between *B. ronchus*, whose eye diameter proportion ranged from 10.7 to 14.3%, and *S. rastrifer* whose eye diameter proportion ranged from 7.4 to 9.3% (Itagaki, unpublished data).

The compact triangular visceral mass proved to be a useful character for distinguishing *B. ronchus* from other sciaenids, except for larval *S. rastrifer*. Ditty (1989) reported that *B. chrysoura* smaller than 5 mm SL could be distinguished from most other sciaenid species by their preanal length (<46% SL), except for *S. lanceolatus*. It was difficult to analyse this relationship because of the small number of *B. ronchus* smaller than 5.0 mm NL. Development of larvae smaller than 4.0 mm NL (preflexion) was not described in the present study.

In addition to its main diagnostics, *B. ronchus* larvae can be easily differentiated from the co-occurring sciaenid larvae, distinct from *S. rastrifer*, by a series of diagnostic characteristics presented in Powles and Stender, 1978, Sinque (1980) and Ditty *et al.* (2006) (Tables 3 and 4). Flexion and postflexion larvae of *Cynoscion leiarchus* can be distinguished from those of *B. ronchus* by a larger number of head spines, and by characteristic internal and external melanophores around the posterior surface of the visceral mass. *Isopisthus parvipinnis* postflexion larvae have a supra ocular spine, while those of *B. ronchus* have a slightly supraocular ridge; in addition, *Isopisthus parvipinnis* can be distinguished from other sciaenids by a very high anal ray count and low dorsal ray count. Larvae of *Macrodon ancylodon* can be distinguished from *B. ronchus* and other Scianidae from early stages by a prominent supraoccipital crest. Flexion stages of *Menticirrhus americanus* can be differentiated from those of *B. ronchus* and other sciaenids by characteristic rows of ventral and lateral midline pigmentation, multiple nape surface pigmentation, and lack of pigment anterior to cleithral symphysis. In the postflexion, *Menticirrhus americanus* larvae became heavily pigmented over the head and trunk. Larvae *Micropogonias furnieri* can be distinguished from *B. ronchus* and other sciaenid genera by their lack of pigmentation on the anterior margin of visceral mass. Finally, the preflexion and flexion *Pogonias cromis* larvae can be distinguished from *B. ronchus* by their enlarged melanophores along the dorsal and ventral midlines and stream-lined body shape, and postflexion larvae can be distinguished by their low anal element count.

TABLE 4. – Pigmentation in 9 Sciaenidae species during the flexion stage: (D) dentary; (ALJ) angle lower jaw; (LBE) strip laterally behind the eye; (IUH) internal under hindbrain; (AVM) anterior visceral mass; (OGB) over gas bladder; (SNAPE) nape surface; (NAPE) embedded in the musculature of nape; (PMV) posterior visceral mass; (I) isthmus; (CS) anterior to cleithral symphysis; (LM) lateral midline; (DML) dorsal midline; (VG) ventral on gut, (CVM) caudal ventral midline; (+) present; (-) absent; (±) some.° this study; *Ditty, J. 1989; **Sinque, C. 1980; ***Ditty, J. 1994.

Species	D	ALJ	Swath						PMV	I	CS	LM	DML	VG	CVM
			LBE	IUH	AVM	OGB	SNAPE	NAPE							
<i>Bairdiella ronchus</i> °	+	+	+	+	+	+	+	+	+	-	+	-	±	±	±
<i>Bairdiella chrysoura</i> *	+	+	+	+	+	+	+	+	-	-	+	-	±	±	±
<i>Stellifer rastrifer</i> **	-	+	-	+	+	+	+	-	+		+	±	±	±	±
<i>Isopisthus parvipinnis</i> **															
<i>Macrodon ancylodon</i> **			-		-	+	-	-	+			-		±	±
<i>Cynoscion leiarchus</i> **				+	-	+	+	+	+		+		±		-
<i>Menticirrhus americanus</i> **	+	+	-		+	+	+	+	+			+	±	±	+
<i>Pogonias cromis</i> ***	-	+	-		-	+	+	-	+		+	-	+	±	+
<i>Micropogonias furnieri</i> **	+	+	-		+	+	+	+	±		+	-	±	±	±

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