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First report of *Aulopus* (Teleostei: Aulopidae) from Southwestern Atlantic, with a review of records and a key to Western Atlantic Aulopoidei species

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Abstract

In this second paper dedicated to report on deep-sea fishes from Brazilian waters, mainly from Bahia, the presence of one family and three species of Aulopoidei is reported for the first time from Brazilian waters: the aulopid *Aulopus filamentosus* (royal flagfin), the synodontids *Saurida normani* and *Synodus poeyi* (shortjaw lizardfish and offshore lizardfish, respectively). The presence of *Synodus saurus* and *Saurida suspicio* in Brazilian waters is discussed, and a key to the Western Atlantic Aulopoidei is provided.

Key words: Lizardfishes, flagfin, *Aulopus, Saurida, Synodus,* Aulopidae, Synodontidae, deep-sea fishes

Introduction

According to Davis (2010), the world-wide marine and usually deep-sea, benthic or pelagic Aulopiformes order, contains 16 families, split in 3 suborders of extant taxa: Alepisauroidei (Alepisauridae, Bathysauridae, Bathysauroididae, Bathysauropsidae, Chlorophthalmidae, Evermannellidae, Giganturidae, Ipnopidae, Notosudidae, Paralepididae, Scopelarchidae and Sudidae), Paraulopoidei (Paraulopidae), and Aulopoidei (Aulopidae, Pseudotrichonotidae, and Synodontidae). The latter suborder was represented in Brazilian waters only by the Synodontidae, with twelve species belonging to 4 genera: *Bathysaurus* (2), *Saurida* (4), *Synodus* (5), and *Trachinocephalus* (1) (Roux, 1973; Carvalho-Filho, 1999; Menezes & Figueiredo, 2003); *Bathysaurus*, formerly recognized within the Synodontidae, in now placed in its own family (Davis, 2010). Thus, until now, all the Aulopoidei from Brazilian waters belonged to the family Synodontidae, distributed in three genera and ten species: *Saurida brasiliensis, Saurida caribbaea, Saurida normani, Saurida suspicio, Synodus foetens, Synodus intermedius, Synodus poeyi, Synodus saurus, Synodus synodus*, and *Trachinocephalus myops.*

The family Synodontidae is distributed worldwide, and has about 74 species from four genera and two subfamilies: Synodontinae, with *Synodus* (44) and *Trachinocephalus* (3); and Harpadontinae, with *Harpadon* (5) and *Saurida* (21). For species account, see Russell (2002), Polanco & Acero (2005), Prokofiev (2008a), and Froese & Pauly (2010). Ten species are reported from the Western Atlantic and until now all of them were believed to be present in Brazilian waters (Roux 1973; Carvalho-Filho, 1999; Russell, 2002; Moura 2003). The monotypic genus *Trachinocephalus* is considered by Polanco & Acero (2005) as possible to be, in reality, a complex of at least three species; and Davis (2010) suggests that *T. myops* (Forster, 1801) "is a member of the genus *Synodus*, although further study is needed that would include a broader taxonomic sampling of the…species of *Synodus"*.

On the other hand, the much less speciose family Aulopidae has about 14 species that belong to the genus *Aulopus* (Davis, 2010). The previously recognized genera *Hime* and *Latropiscis,* (Thompson, 1998; Nelson,

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2006; Thompson & Stewart, 2006a and 2006b; Prokofiev, 2008b) have been synonymied with *Aulopus* by Davis (2010). Two species are reported from the Atlantic: *Aulopus cadenati* Poll, 1953 (Tropical Eastern Atlantic) and *A. filamentosus* (Bloch, 1792), widespread in the Mediterranean and the Northern Atlantic from the Canary, Cape Verde, and Madeira islands to Senegal in the Eastern Atlantic, to the Bermuda, the Gulf of Mexico, Caribbean, and Venezuela in the Western Atlantic (Sulak, 1989a; Cervigón, 1991; McEachran & Fecchelm, 1998; Smith-Vaniz *et al.*, 1999).

Deep-sea research in Brazilian waters during the last 100 years has been limited, but recent exploratory fishing work has resulted in a number of new records and new species for the Southwestern Atlantic and Brazil (e.g. Franco *et al.*, 2007; Melo, 2007, 2009; Melo *et al.*, 2009; Vaske *et al.*, 2008; Mincarone *et al*, 2008; Mincarone & Anderson, 2008; Braga *et al.*, 2008; Caires *et al*, 2008; Campos *et al.*, 2009; Rotundo & Vaske, 2009; Santos *et al.*, 2009). In this paper we report the first occurrence of the family Aulopidae, with the species *Aulopus filamentosus*, collected off Bahia. Also from Bahia we confirm the occurrence in Brazilian waters of the shortjaw lizardfish, *Saurida normani* Longley, 1935, previously reported by Carvalho-Filho (1999), with no voucher specimens. Meristic and morphometric data are presented for these species, as well as for the offshore lizardfish, *Synodus poeyi* Jordan, 1887, which is herein more completely reported from Brazil. The occurrence in Brazil of *Saurida suspicio* Breder, 1927, reported by Roux (1973), and *Synodus saurus* Linnaeus, 1758, reported by Roux (1973), Carvalho-Filho (1999) and Moura (2003), is discussed. A key to Western Atlantic Aulopoidei is presented.

Material and methods

The description of *Aulopus filamentosus* is based on seven specimens and on literature data; the descriptions of *Saurida normani* and of *Synodus poeyi* are based on two specimens of each species and on literature data. Measurements of fishes, when possible, were taken with a digital caliper to tenths of millimeters (mm); measurements over 150 mm and to 300 mm were taken with a manual caliper to the nearest tenth of mm; over 300 mm with a ruler to the nearest tenth of mm. Lengths of specimens are Standard Length (SL). Digital pictures were taken from the examined specimens. For details about collection methods see Carvalho-Filho *et al.*, 2009.

Institutional abbreviations follow Leviton *et al.* (1985), except AZUSC (Acervo Zoológico da Universidade Santa Cecília, Santos, São Paulo), UFBA (Universidade Federal da Bahia, Salvador, Bahia) and TAMAR (Projeto Tamar, São João da Mata, Bahia).

Results and discussion

Family Aulopidae

Aulopus filamentosus (Bloch, 1792).
Royal Flagfin, Yellowfin Aulopus (English); Trairado (Brazilian Portuguese).
(FIG 1)

Material examined: UFBA 2817 (3 ex, one male – 332.3 mm SL - and 2 females – 325.2 and 334.2 mm SL) Brazil, Bahia, São João da Mata, Praia do Forte, collector G. Marcovaldi, depth 350 m, 10 May 2006 (largest female) and June 2006; TAMAR 004 (1 ex, female: 321.4 mm SL), Brazil, Bahia, São João da Mata, Praia do Forte, collectors G. Marcovaldi and A. Carvalho-Filho, depth 400 m, 15 August 2006; TAMAR 006 (1 ex, male: 324.8 mm SL), Brazil, Bahia, São João da Mata, Praia do Forte, collector G. Marcovaldi, depth 400 m, 15 October 2006; MZUSP 98894 (1 ex, female: 351.4 mm SL), Brazil, Bahia, São João da Mata, off Praia do Forte, collector G. Marcovaldi, depth 400 m, November 2007; AZUSC 3609 (1 ex, female: 318.1 mm SL), Brazil, Bahia, São João da Mata, Praia do Forte, collector G. Marcovaldi, depth 250 m, 12 April 2009.

On May 10, 2006, a large “lizardfish” was caught by the TAMAR team, a photograph was taken and the fish preserved. The fish was caught some 10 miles off Praia do Forte, (12º36´96”S; 37º53´78”W), Mata de São João, Bahia, Brazil, 400 m deep, with electric reel, and sardines as bait. It was a mature female which measured 351 mm SL. With continuous fishing at the same area and depth, other specimens were collected as depicted in Table 1. The identification of this fish as *Aulopus filamentosus* was confirmed by the late Dr Bruce A Thompson, Louisiana State University, (pers. comm., May 18, 2006) who wrote: “The literature would call this form *Aulopus nanae*, but …. I … cannot find differences between the western Atlantic form and the eastern Atlantic form where the males have an elongate filament on the anterior rays of the dorsal fin. The female lacks these very elongate filaments and often has a black blotch on the tip of the first few dorsal rays. There is a second *Aulopus* in the Atlantic confined to the African coast. This is *Aulopus cadenati* and neither sex has filaments in the anterior part of the dorsal ray. …. use the name *filamentosus* instead of *nanae*.”

We examined seven fishes (Table 1.A–B), ranging from 321 to 351 mm SL, two males and five females, one of these the largest.

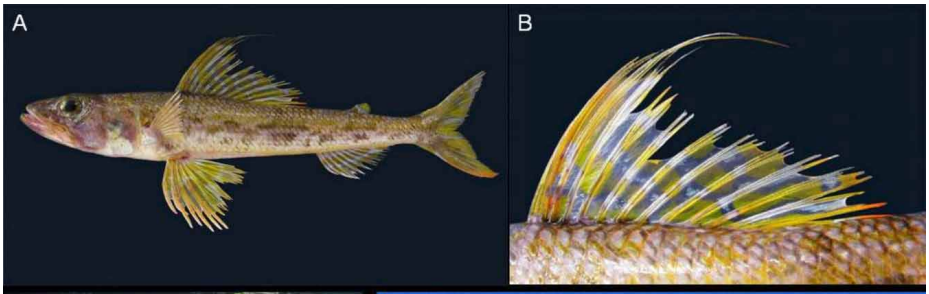

FIGURE 1. *Aulopus filamentosus*
A. Male recently collected, UFBA 2817, 332 mm SL. Equipe TAMAR.
B. Male´s dorsal fin close-up, showing prolonged anterior rays. Equipe TAMAR.
C-D. Female recently collected, TAMAR 004, 321 mm SL. Guy Marcovaldi/Equipe TAMAR.

Diagnostic characters: Based on examined specimens and literature (Mead, 1966; Sulak, 1989a; Cervigón, 1991; McEachran & Fechhelm, 1998; Thompson, 2002, 2008) (Table 1.A–B). Our data wide the range of several counts and body proportions.

Body moderately elongate and slender, oval in cross-section; head large, robust, about 30% of SL; snout relatively long and depressed; eyes large, elliptical, about the size of the snout length; upper jaw expanded posteriorly with two supramaxillaries, reaching to or beyond the eye centre; jaw teeth simple, short, depressible (but outer row), in broad bands, those in inner row usually longer; gill-rakers on first arch, 12–15, including rudiments. Dorsal fin high, located on anterior 1/3 of body, with 14–16 rays, the anterior 2–4 with an elongate filament on males; a small adipose fin above midpoint of anal fin; anal fin with 10–13 rays, shorter and lower than the dorsal fin; pelvic fin large, longer than pectoral and with 9 rays, the outer 4 rays thickened; pectoral fin rays 12–14; caudal fin forked. Scales on upper body spinoid to ctenoid, largest on gill cover; snout, top of head, and mandible, naked; belly and breast covered by cycloid scales; lateral line complete, with 47–53 scales; presence of small bony scutes (fulcral scales) preceding the procurrent caudal rays. Color greenish-brown to olive with darker saddles and lateral blotches; head darker, purplish to pink; upper body and head suffused with yellow; dorsal fin tip black; the males are more brightly colored, with red, orange, and yellow markings and bars on fins, but females might also present smaller reddish to orange marks

on fins; in life the scales are iridescent with transverse bands, and the belly silvery to whitish or light pink; adipose fin tip yellowish-green to orange. Grows to about 44 cm SL.

According to Ditty *et al.* (2006) the eggs of aulopids are unknown and the larvae and young are known only for *Hime* (*Aulopus*) *japonicus* from the Pacific Ocean. "…Descriptions of *Aulopus filamentosus* in Taning (1918) and Sanzo (1938) are erroneous and should be correctly ascribed to *Bathypterois* in the Ipnopidae…" (Ditty *et al.* 2006).

TABLE 1A. *Aulopus filamentosus*. Meristic data from selected papers.

Counts	Mead (1966)*	Sulak (1989a)	Cervigón (1991)*	Cervigón (1991)*	McEachran & Fechhelm (1998)*	Thompson (2002) *	Present Study
Number of specimens	01	No data	01,A	01,B	Based on Mead	No data	07
Dorsal fin rays	15	16	14	15	15	14–16	14–15
Anal fin rays	12	11–12	12	12	12	10–13	11
Pectoral fin rays	12–13	12–13	13	13	12–13	13	13–14
Lateral line, scales	48	48–53	47	48	48	48–53	48–53
Total gill rakers	14	No data	13	14	14	No data	12–15

* As *Aulopus nanae.*

TABLE 1B. *Aulopus filamentosus.* Selected proportional measurements in % of SL

Proportions	Mead (1966)*	Cervigón (1991)**	Present Study***	Range
Head Length	30.0	28.5–29.0	29.3–30.8	28.5–30.8
Snout Length	8.3	7.3–7.6	8.4–9.1	7.3–9.1
Eye horizontal diameter	6.9	7.3–7.7	6.0–6.5	6.0–7.7
Eye vertical diameter	6.3	No data	4.6–5.4	4.6–6.3
Postorbital length	15.8	No data	12.8–14.7	12.8–15.8
Interorbital bony space	3.6	3.5	4.3–5.0	3.5–5.0
Body depth (dorsal fin or.)	16.6	16.5–16.7	17.4–18.3	16.5–18.3
Predorsal length	36.4	34.2–34.6	37.5–39.5	34.2–39.5
Preanal length	68.8	No data	71.2–79.0	68.8–79.0
Pectoral fin length	No data	14.5–16.5	15.1–16.0	14.5–16.5
Ventral fin length	27.6	21.4–23.9	20.5–25.6	20.5–27.6
Anal fin base	13.9	13.7	10.8–13.0	10.8–13.9
Dorsal fin base	21.7	22.1	19.1–20.3	19.1–22.1

*Holotype of *A. nanae* Mead, 1958, 223 mm SL. ** Two adult females, as *A. nanae*. *** Seven specimens as listed in text.

Range: Mediterranean and Atlantic: Eastern Atlantic from the Azores, Canary, Cape Verde, and Madeira islands, to Senegal; Western Atlantic from Bermuda, the Gulf of Mexico, Caribbean, and Venezuela to Eastern Brazil, Bahia (Mead, 1966; Sulak, 1989a; Cervigón, 1991; McEachran & Fechhelm, 1998; Santos *et al.*, 1997; Thompson, 2002, 2008). Our records extend the range of *Aulopus filamentosus* about 3,500 km to the Southern Atlantic.

Proposed Brazilian name: "Trairado", meaning "similar to the Traíra" a freshwater fish (Characiformes, Erythrinidae, *Hoplias* spp.) very common in Brazil that resembles *Aulopus filamentosus*.

Depth of occurrence: All the Brazilian specimens were caught on the bottom in about 250 to 400 m depth. The range of depth from the literature is between 50 and 1000 m (Thompson, 2008).

Behavior: Visual observations from the UID (underwater inhabited device) "Server-2", made in the 1980s at the seamounts of the Azores region, reported that this species was sighted on the Meteor Seamount at

a depth of 360–460 m lying motionless on the bottom at sites with rocky outcrops, more seldom on sandy seafloor; only at a photoflash did they break away to swim short distances (0.2–0.5 m), moving aside from the UID (Pakhorukov, 2008). This species probably ambushes passing prey at the sea bottom. A project to maintain live specimens in especial aquariums and study their behavior is being developed by TAMAR at its public exhibition area at Praia do Forte.

Reproduction: The five females examined had immature eggs.

Family Synodontidae

***Saurida normani* Longley, 1935**
Shortjaw Lizardfish (English), Lagartinho (Brazilian Portuguese).
(FIG. 2)

Material examined: UFBA 2821 (1 ex.: 283 mm SL), Brazil, Bahia, São João da Mata, off Praia do Forte, collector G. Marcovaldi, depth 300 m, 26 October 2006. TAMAR 0054 (1 ex.: 275 mm SL), Brazil, Bahia, São João da Mata, off Praia do Forte, collector G. Marcovaldi, depth 400 m, 27 May 2007.

On May 27, 2007, two slender, silvery, lizardfishes were collected off Bahia, São João da Mata, Praia do Forte at a depth of about 400 m. One of them, smaller and slender, was easily identified as the Caribbean lizardfish (or smallscale lizardfish), *Saurida caribbaea*, a common species of the genus in the area. The other one, stouter, larger and with the upper jaw longer than the lower, thus different of the smaller one, was preserved in the TAMAR collection and later identified by the first author as *Saurida normani*, the Shortjaw lizardfish. This is a fish rarely observed in Brazilian waters and, as far as known there are no other voucher specimens in any Brazilian scientific institution, despite having been recorded for the region by Carvalho-Filho (1999) and Costa *et al.* (2007).

We examined two male specimens, both collected at a depth of about 400 m.

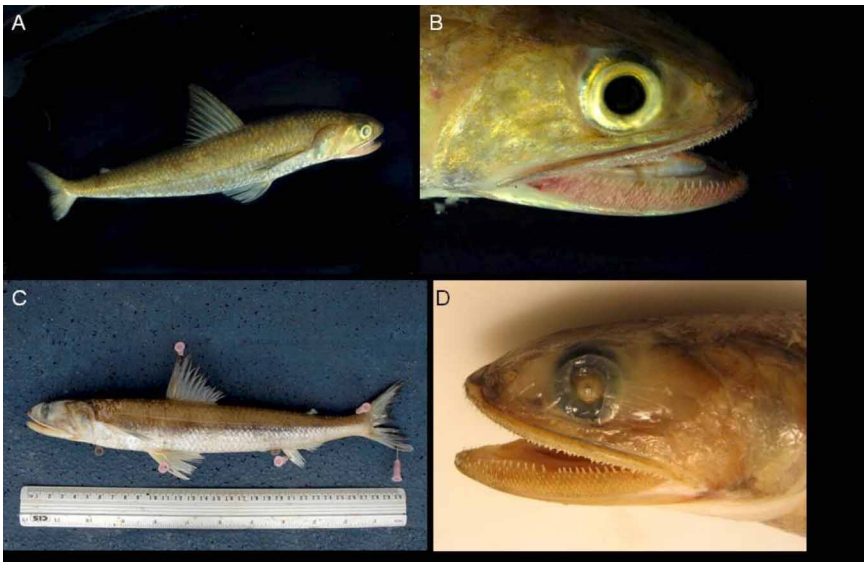

FIGURE 2. *Saurida normani*
A-B. TAMAR 0054, 275 mm SL, with close-up showing absence of adipose eyelid. Equipe TAMAR.
C-D. UFBA 2821, 283 mm SL, with close-up to show presence of the adipose eyelid. Equipe TAMAR-A. Carvalho Filho

Diagnostic characters: Based on the examined specimens and literature data (Anderson *et al.*, 1966; Böhlke & Chaplin, 1968; Uyeno & Aizawa, 1983; Cervigón, 1991; Cervigón *et al.*, 1993; McEachran & Fechhelm, 1998; Carvalho-Filho, 1999; Russell, 2002; Ditty *et al.*, 2006). (Table 2.A–B).

Body cylindrical, moderately elongate and slender; head almost cylindrical; snout blunt, slightly shorter than eye diameter; interorbital space somewhat concave, the wider of Atlantic *Saurida* species; upper jaw

extends beyond lower jaw when the mouth is shut, a character unique among the Atlantic species of the genus; eye usually with a large adipose eyelid; dorsal fin origin anterior to mid-body, about equidistant between adipose fin and tip of snout, with 10–12 rays, the tips of the anterior, when depressed, usually extend beyond tips of all succeeding rays; anal fin with 9–11 rays, its base shorter than dorsal fin base; pelvic fin has 9 rays, the medial rays slightly longer than outer rays; pectoral fin with 13–14 rays and extends well beyond pelvic fin origin; scales moderate, the lateral line with 51–56 and not enlarged; pre-dorsal scales, 13–17; 4 rows of complete scales between lateral line and origin do dorsal fin; long and pointed axillary scales on pectoral and pelvic fins bases; gill-rakers very small, numerous and close-set. The color on head and body above lateral line is brownish to tan or grayish and some horizontal rows of scales might have a bluish center and a darker border; belly yellowish to silvery white with very small grayish dots; usually five or six, eventually up to nine, dark rounded blotches along lateral line, often inconspicuous; dorsal fin dusky, the tip often darker; caudal fin dusky, the borders eventually darker; pectoral fin with upper half dusky; anal and pelvic fins pale, the last one eventually with a dark, faded blotch on anterior edge; post-larvae up to 40 mm with 6 large ovoid peritoneal spots along gut, one or two on anal fin base and two in the ventral caudal peduncle. The largest Atlantic *Saurida* species with a maximum known size of about 450 mm; with about 400 mm SL, it weights 500 g.

Range: Western Atlantic, from North Carolina, USA to Bahia, Brazil, including the Gulf of Mexico and the Caribbean (McEachran & Fechhelm, 1998; Carvalho-Filho, 1999; Russell, 2002; Ditty *et al.*, 2006 and Costa *et al.*, 2007).

TABLE 2A. *Saurida normani.* Meristic data of selected papers.

Counts	Anderson *et al*. (1966)	Uyeno & Aizawa (1983)	Cervigón (1991)	McEachran & Fechhelm (1998)	Present Study
Number of specimens	39	20	10	No data	02
Dorsal fin rays	10–12	11–12	11–12	10–12	11
Anal fin rays	09–11	10–11	09–11	09–11	10–11
Pectoral fin rays	13–14	13	13–14	13–14	13–14
Lateral line, scales	51–56	51–54	53–56	51–56	51–54
Predorsal scales	13–17	No data	No data	No data	14–15

TABLE 2B. *Saurida normani.* Selected proportional measurements in % of SL. Number of specimens as in Table 2A.

	Anderson *et al*. (1966)	Cervigón (1991)	Present Study
Head Length	22.7–26.7	25.1–28.3	23.6–24.4
Snout Length	4.2–5.7	6.5–7.2	6.2–6.4
Eye horizontal diameter	4.7–6.3	5.0–6.8	5.0–5.5
Interorbital	4.9–5.7	No data	5.5–6.0
Body depth (pelvic fin or.)	11.7–15.1	13.3–16.6	16.3–16.4
Predorsal length	37.5–43.4	No data	40.4–40.6
Preanal length	72.3–77.0	No data	72.4–76.4
Pectoral fin longest ray	12.1–15.7	15.3–16.8	15.6–16.4
Ventral fin longest ray	12.6–16.2	16.7–17.0	16.3–17.0
Anal fin base	11.3–15.1	No data	10.1–12.0
Dorsal fin base	7.7–9.5	No data	9.5–10.6

Proposed Brazilian name: "Trairado-Branco" meaning white "Trairado", the common name proposed for *Aulopus filamentosus*, with which has strong resemblance due to its size and habitat.

Depth of occurrence: The examined specimens were collected in about 400 m deep. The range of depth from the literature is between 25 and 550 m (Cervigón *et al.*, 1993).

Behavior: Adults live over soft bottoms and postlarvae have been collected in surface reef waters (Cervigón, 1991). Nothing is known to date about its diet and reproduction.

***Synodus poeyi* Jordan, 1887.**
Offshore Lizardfish (English), Lagarto-do-Fundo (Brazilian Portuguese).
(FIG 3)

Material examined: *Synodus poeyi*: MZUSP 95441 (1 ex.: 72.7 mm SL), Brazil, 14º49´12”S and 39º00´14”W, Bahia, Ilhéus, Projeto AFAPESCA, ponto 02, collectors L.E. Morais, R.M. Romero & R. O'Reilly Vasques, depth 16 m, February 2004. MZUSP 95442 (1 ex.: 58.9 mm SL), Brazil, 14º49´01”S and 39º00´14”W, Bahia, Ilhéus, Projeto AFAPESCA, ponto 01, collectors L.E. Morais, R.M. Romero & R. O'Reilly Vasques, depth 16 m, January 2005.

FIGURE 3. *Synodus poeyi*
A-B. MZUSP 95441, 72 mm SL, with close of head to show the small fleshy knob on lower jaw tip. A. Carvalho Filho
C. Adult from Gulf of Mexico. Richard H. Moore

Synodus foetens: MZUSP 896 (1 ex.: 155.2 mm SL), Brazil, São Paulo, Santos, Largo do Canéu, collector Luederwaldt, June 1914; MZUSP 90800 (2 ex: 120.0–135.3 mm SL), Brazil, 20º47´59”S and 40º35’00”W, Espírito Santo, Anchieta, collectors C. Moreira & L. Souza, 11 April 2006; MNHN 1975-117 (1 ex.: 86,2 mm SL), Brazil, station 122, 23º26´S, 44º36´W, 36 m, rubble bottom, previously identified by Roux (1973) as *Synodus saurus*.

Synodus intermedius: MZUSP 43484 (1 ex.: 171.2 mm SL), Brazil, São Paulo, Laje de Santos island, collector R.L. Moura, depth 18 m, 25 August 1991. MZUSP 60547 (2 ex.: 62.7–155.8 mm SL), Brazil, Bahia, 17º57´50”S and 38º42’00”W Abrolhos Arquipelago, Santa Barbara island, collectors Moura, Francini-Filho, Flesch, Leite & Sazima, depth 7 m, 19 March 1999.

Synodus synodus: MZUSP 66784 (1 ex.: 89.9 mm SL), Brazil, 22º52´S and 41º56´W, Cabo Frio, Rio de Janeiro, collector Moura, Francini-Filho, Flesh *et al*. March 2000. MZUSP 75284 (1 ex.: 58.5 mm SL), Brazil, Bahia, Itaparica island, collector A. Carvalho-Filho, October 1984 1977.

Trachinocephalus myops: MZUSP 17796 (1 ex.: 101.5 mm SL), Brazil, 19º28´S and 39º35´W, N. Oc. Prof. W. Besnard, 15 m, 11 August 1969. MZUSP 75285 (1 ex.: 192.2 mm SL), Brazil, São Paulo, Guarujá, collector A. Carvalho-Filho, January 1979.

Examining the Synodontidae specimens deposited at the MZUSP collection, we found a *Synodus* species yet to be properly reported from Brazilian waters, *S. poeyi.* Despite already reported from Brazil by several authors (Uyeno & Aizawa, 1983; Eskinazi & Lima, 1968; Roux, 1973; Carvalho-Filho, 1999; and Costa *et al.*, 2007), only Moraes *et al*. (2009) records this species based on voucher specimens.

Diagnostic characters: Based on the examined specimens and literature data (Poey, 1883 - as *S. intermedius;* Jordan & Evermann, 1896; Anderson *et al*. 1966; Walls, 1975; Uyeno & Aizawa, 1983; Cervigón, 1991; McEachran & Fechhelm, 1998; Carvalho-Filho, 1999; Russell, 2002; Ditty *et al*., 2006). (Table 3.A–B).

Body cylindrical, moderately elongate and slender; head depressed, the top only slightly rugose; snout wide, sub-conical and moderately acute, shorter than eye in individuals to about 100 mm SL and equal to larger in adults; interorbital space moderately concave; lower jaw extends beyond upper jaw and its tip has a fleshy knob, more prominent in adults; dorsal fin origin anterior to mid-body, with 10–12 rays, the tips of the anterior, when depressed, extend to or usually beyond tips of some succeeding rays; anal fin with 9–12 rays, its base shorter than dorsal fin base; pelvic fin has 8 rays, the 6^{th},7^{th} or even 8^{th} inner rays the longest; pectoral fin with 10–12 rays and extends beyond pelvic fin origin; scales large, the lateral line with 43–48, not enlarged but slightly keeled on caudal peduncle; pre-dorsal scales, 13–16; 3 rows of complete scales between lateral line and origin do dorsal fin; enlarged axillary scales on pectoral and pelvic fins bases; large supraorbital scale, smooth. The color on head and body above lateral line is greenish or grayish brown, with several longitudinal yellowish lines; white to yellowish or flesh-colored (mainly on chest) below the lateral line; about eight obscure dark, diamond-shaped blotches, on sides along lateral line, not reaching the dorsum and more conspicuous in the young; fins pale to dusky; no black patch on shoulder girdle under opercle; adipose fin and fleshy knob on tip of lower jaw are darkened to almost black, more conspicuous in large specimens; iris reddish; post-larvae up to 30 mm with 6 large ovoid peritoneal spots along gut about equal to eye diameter, the last two more closely spaced than others. A small species of *Synodus*, its maximum known size is about 200 mm SL.

TABLE 3A. *Synodus poeyi.* Meristic data of selected papers.

Counts	Anderson *et al*. (1966)	Uyeno & Aizawa (1983)	Cervigón (1991)	McEachran & Fechhelm (1998)	Present Study
Number of specimens	17	12	04	No data	02
Dorsal fin rays	10–12	10–11	10–11	10–12	11
Anal fin rays	09–12	10–11	09–10	9–12	10–11
Pectoral fin rays	10–12	11–12	11–12	10–12	12
Lateral line, scales	43–48	43–44	46	43–48	43–44
Predorsal scales	13–16	No data	No data	No data	14

TABLE 3B. *Synodus poeyi.* Selected proportional measurements in % of SL. Number of specimens as in Table 2–A.

	Anderson *et al*. (1966)	Cervigón (1991)	Present Study
Head Length	22.1–28.3	26.8–27.1	27.7–28.6
Snout Length	2.6–6.5	6.3–6.9	5.9–6.6
Eye horizontal diameter	5.0–12.4	6.6–8.1	7.0–7.4
Interorbital	3.4–5.1	No data	4.8–5.3
Body depth (pelvic fin or.)	8.8–18.5	13.6–15.4	11.0–13.2
Predorsal length	37.1–43.0	No data	43.3–43.8
Preanal length	71.4–77.4	No data	74.0–75.2
Pectoral fin longest ray	11.5–15.8	13.0–14.1	12.5–12.9
Ventral fin longest ray	14.2–20.4	18.3–21.1	20.1–22.2
Anal fin base	8.3–13.0	No data	11.0–11.7
Dorsal fin base	13.2–16.6	No data	13.8–14.9

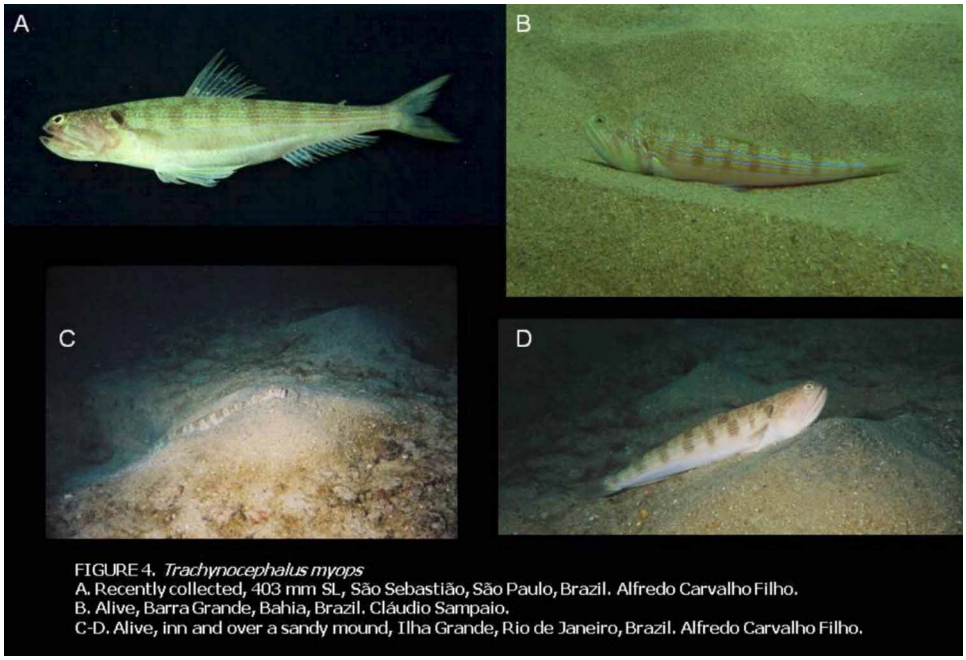

FIGURE 4. *Trachynocephalus myops*
A. Recently collected, 403 mm SL, São Sebastião, São Paulo, Brazil. Alfredo Carvalho Filho.
B. Alive, Barra Grande, Bahia, Brazil. Cláudio Sampaio.
C-D. Alive, inn and over a sandy mound, Ilha Grande, Rio de Janeiro, Brazil. Alfredo Carvalho Filho.

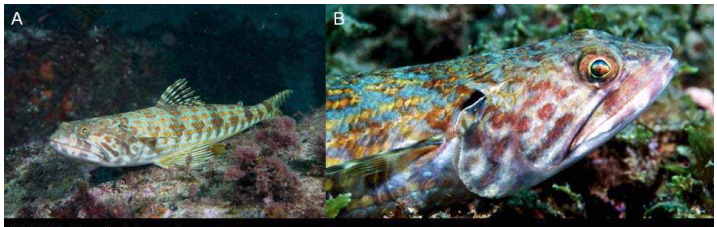

FIGURE 5. *Synodus intermedius*
A. Ilha Vitória, São Paulo, Brazil. J. P. Krajewski.
B. Close-up. Note black spot under upper opercle. Cabo Frio, Rio de Janeiro, Brazil. Osmar J. Luiz Jr.

FIGURE 6. *Synodus synodus*
A. Camamu, Bahia, Brazil. Áthila Bertoncini, athilapeixe.com
B. Close-up. Note black dot near tip of snout. Camamu, Bahia, Brazil. Áthila Bertoncini, athilapeixe.com

Range: Western Atlantic, from North Carolina, USA to Bahia, Brazil, including the Gulf of Mexico and the Caribbean (McEachran & Fechhelm, 1998; Carvalho-Filho, 1999; Russell, 2002; Costa *et al.*, 2007, Moraes *et al*., 2009)

Proposed Brazilian name: "Lagarto do fundo" meaning "lizardfish from offshore".

Depth of occurrence: Both examined specimens were collected at 16 m depth, the shallowest depth ever reported for the species. They were also collected relatively close to shore, an uncommon occurrence for this mainly offshore fish. The range of depth from literature is between 27 and 315 m (Russell, 2002; Froese & Pauly, 2008). Apparently replaces the common *Synodus foetens* in waters up to 50 m deep.

Behavior: The examined specimens were collected from sandy bottoms. Eskinazi & Lima (1968) reported the collection of four specimens between 45 and 69 m deep and from sandy, rubble and calcareous algae bottoms; Cervigón (1991) included muddy bottoms for adults and surface reef waters for postlarvae. Nothing is yet known about its diet and reproduction, but mature females were collected from Venezuela in February (Cervigón, 1991).

FIGURE 7. *Synodus foetens*. Both photographs from Bahia, Brazil. Cláudio Sampaio.

FIGURE 8. *Synodus saurus*. Both photographs from Azores Islands, Portugal. Osmar J. Luiz Jr.

The presence of *Synodus saurus* in Brazilian waters

Carvalho-Filho (1999) reported the presence of *Synodus saurus* in Brazilian waters based on Roux (1973) and the following sighting. Moura (2003, p. 83, Fig. 1.3.33) also reported the presence of this species in Brazilian waters, based on a photograph at Parcel Manuel Luís, a remote reef area north off São Luís do Maranhão (some 100 miles offshore), Northern Brazil. Carvalho-Filho identified the specimen as *Synodus saurus*. The absence of a dark blotch on upper margin of gill cover and the profusion of blue lines and dots on the sides of the body led to that identification; but no voucher specimen was collected and apart from Roux's record, none from Brazil could be found in any collection around the world.

Studying digital pictures of Roux´s specimen, as well as the published work of Anderson *et al.* (1966), Böhlke & Chaplin (1968), and analyzing pictures of the true *S. saurus* (Wirtz, 1994; Debelius, 1997; Froese & Pauly, 2008; Humann & DeLoach, 2008), we conclude that there is not enough evidence to corroborate the presence of the species in Brazilian waters, as follows:

Roux reported the specimen from a single station, number 122, at 23º26´S, 44º36´W, 36 m deep, over rubble bottom. This station is very close to shore in Paraty region (Rio de Janeiro state) in Southeastern Brazil. If the identification was correct, this would be the first report of the species in a non-offshore island environment in the Western Atlantic. Over the last 15 years thousands of scientific dives and exploratory and commercial trawling have been undertaken in the area, but none have reported the presence of the species, although there have been abundant reports of *S. foetens*, *S. intermedius*, *S. synodus* and *Trachinocephalus myops*. We also examined high definition digital pictures taken by Claude Ferrara (FIG 13) of the preserved specimen (MNHN 1975-0117), send to us by Romain Causse, manager of the MNHN fish collection, and we identified it as *Synodus foetens*. The short pectoral fin (not reaching the pelvic origin); the triangular, acute, dorsal profile of the snout (greater than eye-length), and the number of scales between the dorsal fin origin and the lateral line (4.5), led us to this identification.

Moura and Carvalho-Filho's identification of the Parcel Manuel Luís specimens might not be correct and unfortunately the photograph is no longer available.. The fish visually measured about 15–20 cm and its color pattern presented several conspicuous diamond shaped blotches over the lateral line, plus some other dark blotches between those and about 4 saddle-like dark blotches on dorsum; several light blue and yellow lines on back and upper sides, and a row of bluish spots below the lateral line; there was no bright blue or marked pale line running on back, above and parallel to the lateral line. The literature data show that this color pattern, for *S. saurus*, is present only in young fish to about 100 mm SL; in larger individuals the dark marks become faded and indistinct (Anderson *et al.*, 1966); photographs of both forms are illustrated by Debelius (1997:

p86). The absence of the bright blue or conspicuous pale line on the back also is evidence against identification as *S. saurus*. The true identification of the specimen from Parcel Manuel Luís could either be of *S. synodus* or an extralimital *S. intermedius*.

As no voucher specimens were found at the National Ichthyologic Collections Information Service (Brazil, www.mnrj.ufrj.br/pronex/pronex.htm) we conclude that there is no evidence to presently support the presence of *S. saurus* in Brazilian waters.

The presence of *Saurida suspicio* and other species of the genus in Brazilian waters.

Material examined: *Saurida brasiliensis*: Specimens deposited in MZUSP collection: MZUSP 17922 (4 ex.: 79.6–95.1 mm SL), Brazil, 27º57'S and 48º16´W, N. Oc. Prof. W. Besnard, Station 1187, 16 August 1970. MZUSP 80384 (6 ex.: 29.0–75.4 mm SL), Brazil, 32º52'57"S and 50º33´31"W, N. Oc. Atlântico Sul, Revizee Sul, Station 389, 103 m., 20 December 1997.

Saurida caribbaea: Specimens deposited in MZUSP collection: MZUSP 80390 (5 ex.: 73.2–94.4 mm SL), Brazil, 26º06´35"S and 46º13´55"W, N. Oc. Atlantico Sul, Revizee Sul, Station 240, 255 m., 13 May 1997. MZUSP 17859 (4 ex.: 74.4–95.3 mm SL), Brazil, 23º15´S and 42º24´W, N. Oc. Prof. W. Besnard, Station 1146, 110 m, 08 August 1970. MNHN 1975-111 (4 ex.: 58.4–78.4 mm SL), Brazil, station 150, 30º40´S, 49º35´W, 135–141 m, sandy bottom, previously identified by Roux (1973) as *Saurida suspicio*.

Roux (1973) reported the collection of four specimens of *S. suspicio* from a single station from southern Brazil (station 150, 30º40´S, 49º35´W, 135–141 m, sandy bottom); *S. brasiliensis* was also collected from the same station. Another species, *S. caribbaea*, was reportedly collected from two northern stations (station 92, "plage de Anchieta", Espírito Santo state, 5–10 m; and station 104, off Rio de Janeiro, 103 m; the first station (92) is probably in error, not only because the depth and site (a beach), but also because *S. caribbaea* is not listed for any other station except for 104.

Figueiredo *et al.* (2002) and Bernardes *et al.* (2005), only to refer to the most recent publications dealing with exploratory research in Southeastern and Southern Brazil, reported the collection of about 4,800 *Saurida* specimens, roughly 4,300 of which are identified as *S. caribbaea*. *S. caribbaea* is by far the commonest species in Brazilian waters.

The main taxonomic differences between *S. caribbaea* and *S. suspicio* are: predorsal scales 13–18 (*suspicio*) against 18–21 (*caribbaea*); three rows of complete scales between lateral line and base of dorsal fin (*suspicio*) against four (*caribbaea*); pectoral fin tip reaching to or barely past the pelvic fin origin (*suspicio*) against much beyond the pelvic fin base (*caribbaea*). The geographic range of *suspicio* is restricted to the Northern Atlantic and "a rather limited range associated with the Bahamas, West Indies, and Caribbean Sea (Anderson *et al.*, 1966)", south to Venezuela and Trinidad & Tobago (Florida Museum of Natural History, www.flmnh.ufl.edu/scripts/dbs/fish_pub.asp).

We examined all 123 samples from the Southeastern and Southern Brazil labeled as *Saurida*, *Saurida* sp, *Saurida* aff. *caribbaea* and *Saurida caribbaea* deposited at MZUSP, a total of 856 specimens; of these we analyzed all of those not named as *caribbaea* and randomly analyzed another 234 named as *caribbaea*. All were identified positively as *caribbaea*, none as *suspicio*.

Roux's specimens are deposited at the Muséum National d´Histoire Naturelle, Paris (MNHN 1975-111). We examined high definition digital photographs (FIG 12) of these specimens, and found 19 predorsal scales, four rows of complete scales between the lateral line and dorsal fin base, and that the tip of the pectoral fin reaches much beyond the pelvic fin origin, thus leading us to identify the specimens as *S. caribbaea*. Roux probably identified it as *S. suspicio* because of the difference in lateral line scales number (see Key below), as well as considering that *S. caribbaea* was a more northern species not supposed to occur in southern Brazil. Considering all the information above, including the restricted range, and that no voucher specimen was found at the Brazilian Ichthyologic Collections Information Service – Sistema Brasileiro de Informações sobre Coleções Ictiológicas (www.mnrj.ufrj.br/pronex/pronex.htm), we conclude that the presence of *S. suspicio* in Brazilian waters, as reported by Roux (1973), is unsubstantiated and that this author identified specimens of *S. caribbaea* as *suspicio*.

FIGURE 9. *Saurida brasiliensis,* MZUSP 17922, 86 mm SL. Alfredo Carvalho-Filho

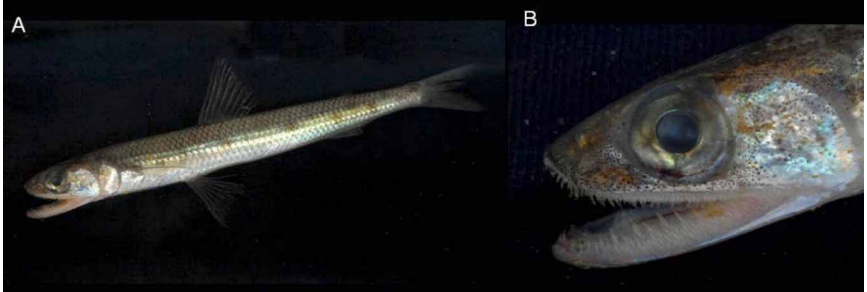

FIGURE 10. *Saurida caribbaea.*
A-B. Recently collected, 245 mm SL, Praia do Forte, São João da Mata, Bahia, Brazil. Equipe TAMAR.

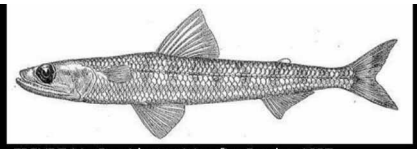

FIGURE 11. *Saurida suspicio,* after Breder, 1927.

FIGURE 12. *Saurida caribbaea.,* MNHN 1975-111, previouysly identified as *Saurida suspicio* by Roux (1973).
Claude Ferrara.

FIGURE 13. *Synodus foetens,* MNHN 1975-117, previouysly identified as *Synodus saurus* by Roux (1973).
Claude Ferrara.

Key to Western Atlantic families and species of Aulopoidei.

Adapted from Jordan & Evermann (1896), Breder (1927), Gosline *et al.* (1966), Smith & Heemstra, (1991), Cervigón (1991), McEachran & Fechhelm (1998), Thompson (2002), and Nelson (2006). The key does not include families, genera or species other than the Western Atlantic Aulopoidei.

1a. Pelvic fins thoracic; two well developed supramaxillaries, dilated posteriorly; a well developed fulcral scale (a horizontally aligned bony plate), just ahead of the most anterior upper and lower procurrent caudal ray ....Aulopidae: *Aulopus filamentosus* (Bloch, 1792) (FIG 1)

1b. Pelvic fins subthoracic or abdominal; none, one or two small supramaxillaries, not dilated posteriorly; no fulcral scale..... Synodontidae (2).

2a. Pelvic fin rays 8, the inner rays longer than outer ones; palatine with a single series of teeth. ..... .(3).

2b. Pelvic fin rays 9, the inner rays about equal to, or not much longer than, outer ones; palatine with two series of teeth .....*Saurida* (8).

3a. Snout shorter than eye diameter; anal fin rays 13–16; origin of anal fin nearer base of pelvic fin than base of caudal fin; anal fin base longer than dorsal fin base ..... *Trachinocephalus myops* (Forster, 1801) (FIG 4).

3b. Snout equal to or longer than eye diameter; anal fin rays 08-12; origin of anal fin nearer base of pelvic fin than base of caudal fin; anal fin base shorter than dorsal fin base..... *Synodus* (4).

4a. Scales in lateral line 43–50 (rarely 51 or 52)..... .(5).

4b. Scales in lateral line 55–64 (rarely 54 or 65)..... (6).

5a. Lower jaw ending in fleshy knob; dorsal fin anterior rays extending to or usually beyond tips of succeeding rays when depressed; no dark spot on shoulder girdle under gill cover..... *Synodus poeyi* Jordan, 1887 (FIG 3).

5b. Lower jaw not ending in fleshy knob; dorsal fin anterior rays not extending or just reaching to tips of succeeding rays when depressed; a dark spot on shoulder girdle under gill cover .....*Synodus intermedius* (Spix, 1829) (FIG 5).

6a. Three rows of complete scales between lateral line and dorsal fin base .....*Synodus saurus* (Linnaeus, 1758). (FIG 8)

6b. Four to six complete scales between lateral line and dorsal fin base ..... (7).

7a. Anal fin rays 8–10; anal fin base much shorter than dorsal fin base; tip of pectoral fin extending well beyond pelvic fin base; predorsal scales 15–18..... *Synodus synodus* (Linnaeus, 1758) (FIG 6)

7b. Anal fin rays 11–12; anal fin base equal or longer than dorsal fin base; tip of pectoral fin barely or not reaching pelvic fin base; predorsal scales 20–30.....*Synodus foetens* (Linnaeus, 1758) (FIG 7 & 13)

8a. Lower jaw shorter than upper jaw, not visible from above when mouth is closed..... .....*Saurida normani* Longley, 1935 (FIG 2)

8b. Lower jaw longer than upper jaw, distinctly visible from above when mouth is closed..... (9).

9a. Scales in lateral line 40–50.....*Saurida brasiliensis* Norman, 1935 (FIG 9)

9b. Scales in lateral line 51–60..... (10)

10a. Three rows of complete scales between lateral line and base of dorsal fin; predorsal scales 13–18; pectoral fin tip reaching to, or barely beyond, pelvic fin base… *Saurida suspicio* Breder 1927 (FIG 11)

10b. Four rows of complete scales between lateral line and base of dorsal fin; predorsal scales 18–21; pectoral fin tip reaching much beyond pelvic fin base..... *Saurida caribbaea* Breder 1927 (FIG 10 & 12)

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