

The South American Electric Fish Genus *Platyurosternarchus* (Gymnotiformes: Apterontidae)

Carlos David de Santana¹ and Richard P. Vari²

The electric fish genus *Platyurosternarchus*, family Apterontidae, is reviewed based on both external morphology and osteology. Synapomorphies for *Platyurosternarchus* are identified, the genus is diagnosed, and a key to the species is provided. *Platyurosternarchus crypticus*, a new species, is described from the upper reaches of the Rio Branco in the northern portions of the Amazon basin. *Platyurosternarchus macrostoma* from the Amazonas, Orinoco, and Essequibo River basins is redescribed. The species differ in the form of the laterosensory canal segment in the soft tissues of the ventral portion of the head and within the preopercle, the posterior extent of the mid-dorsal electroreceptive filament, and the morphology of the first and fourth branchiostegal rays.

O gênero de peixes elétricos Neotropical *Platyurosternarchus*, família Apterontidae, é revisado com base na morfologia externa e osteologia. Sinapomorfias para *Platyurosternarchus* são identificadas, o gênero é diagnosticado, e uma chave para as espécies é fornecida. *Platyurosternarchus crypticus*, uma nova espécie, é descrita do alto rio Branco na bacia Amazônica. *Platyurosternarchus macrostoma* é redescrito das bacias dos rios Amazonas, Orinoco, e Essequibo. As duas espécies são diagnosticadas pelos seguintes caracteres: a forma do segmento do canal laterosensorial na porção ventral da cabeça e no pré-opérculo, a extensão posterior do órgão eletroreceptivo na região médio-dorsal do corpo, e a morfologia do primeiro e quarto raios branquiostégios.

ELECTRIC fishes of the genus *Platyurosternarchus* have a broad distribution across the Amazon, Orinoco, and Essequibo basins. Members of the genus are mid-sized as adults (up to 415 mm TL) and often live among submerged tree trunks and branches over a substrate of sand or clay covered with leaf litter (de Santana et al., 2006). In that microhabitat, individuals of *Platyurosternarchus* sift through soft mud for their invertebrate prey (Crampton and Albert, 2006). As is the case with all other genera of the Apterontidae, the species of *Platyurosternarchus* generate wave-type electric organ discharges.

The single species previously assigned to *Platyurosternarchus* was described as *Sternarchus macrostoma* by Günther (1870) from a specimen collected at Xeberos (=Jeberos) in the Peruvian Amazon. Subsequent authors sequentially shifted the species to *Rhamphosternarchus*, *Sternarchorhynchus*, and finally *Sternarchorhamphus* where it remained for nine decades until Mago-Leccia's (1994) summary study of the Gymnotiformes. In his analysis, Mago-Leccia proposed *Platyurosternarchus* for *Sternarchus macrostoma* to highlight the differences between that species and the other species then assigned to *Sternarchorhamphus*.

Although various publications dealt with *Platyurosternarchus* in passing, most often in faunal studies or phylogenetic analyses, *Sternarchus macrostoma* was never the subject of critical analysis in the 14 decades that elapsed since the original description of the species. During that time interval, the reported range for the species dramatically expanded from a single locality in northeastern Peru to encompass many of the major river systems in central and northern South America. Nonetheless, information on the species remained minimal, most likely due to its relative rarity in collections until recently. Ellis' (1913) monographic study of what is now termed the Gymnotiformes exemplifies this impediment. In lieu of specimens at hand, his

account of *Sternarchorhamphus macrostomus* consisted solely of the repetition of the relatively brief original description of *Sternarchus macrostoma*. Subsequent studies did not attempt any comprehensive analysis of that species across its reputed range.

We review *Platyurosternarchus* based on samples from across its distributional range utilizing characters of external morphology and osteology. Synapomorphies for the genus are detailed, and *P. crypticus* is described as new from the upper Rio Branco, a northeastern tributary of the Amazon. *Platyurosternarchus macrostoma* of the Amazon, Orinoco, and Essequibo River basins is redescribed.

MATERIALS AND METHODS

Institutional abbreviations are as listed at <http://www.asih.org/codons.pdf> with the addition of IAVHP, Instituto Alexander von Humboldt, Colección de Peces, Villa de Leyva, Colombia. Body sizes are reported as total length (TL) in mm. Morphological measurements were taken as point-to-point linear distances using digital calipers with a precision of 0.1 mm as follows: anal-fin base—the distance between the bases of the first and last rays of the anal fin; anus to anal-fin insertion—the distance from the posterior margin of the anus to the base of the first anal-fin ray; branchial opening—the height of the opening measured along the vertical; caudal length—the distance from the base of the posteriormost ray of the anal fin to the posteriormost point on the body; caudal-fin length—the distance from the hypural joint to the distalmost point along the posterior margin of the caudal fin; eye diameter—the horizontal width of the eye; greatest body depth—the greatest vertical extent of the body, usually situated slightly anterior to the beginning of the electroreceptive filament; head depth at eye—the head depth measured at the eye;

¹Predoctoral Fellow, Division of Fishes, Department of Vertebrate Zoology, MRC-159, National Museum of Natural History, P.O. Box 37012, Smithsonian Institution, Washington, D.C. 20013-7012. Present address: Department of Biology, University of Central Florida, 4000 Central Florida Boulevard, Orlando, Florida 32816-2368.

²Division of Fishes, Department of Vertebrate Zoology, MRC-159, National Museum of Natural History, P.O. Box 37012, Smithsonian Institution, Washington, D.C. 20013-7012; E-mail: varir@si.edu. Send reprint requests to this address.

Submitted: 2 May 2008. Accepted: 20 October 2008. Associate Editor: D. Buth.

© 2009 by the American Society of Ichthyologists and Herpetologists DOI: 10.1643/CI-08-082

head length—the distance from the tip of the snout to the posterodorsal angle of the branchial opening; head width—the head width measured at the opercular region; internarial distance—the distance between the posterior of the base of the tubular anterior naris and the anterior margin of the opening of the posterior naris; interocular width—the minimum width between the dorsal margins of the orbits; length to end of anal-fin (the LEA of Mago-Leccia et al., 1985)—the distance from the tip of the snout to the end of the base of the anal fin; mouth length—the distance from the tip of the snout to the rictus of the mouth; pectoral-fin length—the distance from the base of the dorsalmost ray of the pectoral fin to the distalmost point on the margin of the fin; posterior naris to snout—the distance from the anterior border of the naris to the tip of the snout; posterior naris to eye—the distance from the posterior border of the naris to the anterior margin of the eye; postocular distance—the distance from the posterior margin of the eye to the posterodorsal limit of the branchial opening; preanal-fin distance—the distance from the tip of the snout to the base of the first anal-fin ray; prepectoral-fin distance—the distance from the tip of the snout to the base of the dorsalmost pectoral-fin ray; snout to anus—the distance from the tip of the snout to the anterior margin of the anus; snout length—the distance from the tip of the snout to the anterior margin of the eye; tail depth—the depth of the tail measured immediately posterior to the base of the last anal-fin ray; and total length—distance from the tip of the snout to the end of the tip of the caudal fin.

Meristic data for the holotype of the new species appear in brackets. Osteological preparations were cleared and double stained (CS) for bone and cartilage following the method of Taylor and Van Dyke (1985). Radiographs of a broader range of specimens were used to confirm the generality of osteological observations from cleared-and-stained specimens. The neurocranium, suspensorium, and pectoral girdle were removed from the osteological preparations using standard methods for the dissection of small teleosts (Weitzman, 1974). Vertebral counts were taken from radiographs. Bone terminology follows Fink and Fink (1981), Patterson (1975), and Albert and Fink (1996). Branchiostegal rays are numbered from the anterior without indicating specific homology of elements with those in other apteronotids. The family level nomenclature follows Reis et al. (2003). Lists of examined material are arranged alphabetically by country, major political subdivisions, museum acronym and catalogue number, followed by number of specimens, range of TL in mm (in parentheses), exact locality information, and in the case of the new species, the collector(s).

Although the two species of *Platyurosternarchus* differ in a series of features, they share a pronounced overall similarity in general coloration and external head and body form. We describe the new species, *P. crypticus*, in detail, but, in light of the level of similarity between the two species, focus the redescription of *P. macrostoma* on details that differ between the congeners. Features not discussed in the description of *P. macrostoma* are comparable in that species to the conditions present in, and described for, *P. crypticus*.

RESULTS

For the purpose of the phylogenetic analysis, *Orthosternarchus*, *Sternarchorhamphus*, and *Sternarchorhynchus* are used as proximate outgroups to *Platyurosternarchus* following

Hilton et al. (2007) who noted that those four genera were relatively basal to “other apteronotid taxa.” That hypothesis is also congruent with the phylogenetic schemes proposed by Albert and Campos-da-Paz (1998), Albert (2001), and Triques (2005). Other genera of the Apterontidae serve as more distant outgroups in the analysis.

Divergent hypotheses as to phylogenetic relationships within the Apterontidae have been advanced in recent years. Above and beyond such incongruities, various of the features optimized as apomorphic or synapomorphic within those schemes for clades including *Platyurosternarchus* have proved problematic once examined across a broader range of specimens and species. Other reported synapomorphies involve questionable homology hypotheses. Various features optimized as apomorphic for *Platyurosternarchus* under those hypotheses, albeit with occurrences elsewhere in the Gymnotiformes. A determination of whether those would still apply at the level of *Platyurosternarchus* once problematic characters are recoded would require a phylogenetic study across the Gymnotiformes that would be much more encompassing than appropriate for this paper. In the following discussion, we focus on synapomorphic features unique to the species of *Platyurosternarchus*.

Synapomorphies for *Platyurosternarchus*.—The proposed unique synapomorphies for *Platyurosternarchus* are:

1. The absence of teeth on the premaxilla. Tooth-bearing premaxillae are by far the most common condition across the Gymnotiformes. Among proximate outgroups to *Platyurosternarchus*, teeth of variable form are present on the premaxilla of *Orthosternarchus* (Hilton et al., 2007:fig. 12), *Sternarchorhynchus*, and *Sternarchorhamphus* (Campos-da-Paz, 1995:fig. 4). In contrast, *Platyurosternarchus* lacks dentition on the premaxilla across the size range of examined specimens. It has been proposed (Albert and Campos-da-Paz, 1998) that absence of premaxillary dentition was synapomorphic for a clade consisting of *Platyurosternarchus* and *Sternarchorhynchus*. Our ongoing studies of *Sternarchorhynchus*, alternatively, confirmed that premaxillary dentition is consistently present across the genus as also coded without comment by Triques (2005). The absence of premaxillary teeth in some or all members of some other apteronotid genera (*Adontosternarchus*, *Sternarchogiton*) is homoplastic to that condition in *Platyurosternarchus* within the present understanding of relationships within the Apterontidae (Albert, 2001). The lack of premaxillary dentition in *Platyurosternarchus* is consequently a synapomorphy for the genus.
2. The implantation of the teeth on the outer surface of the dentary. The attachment point of the teeth on the dentary is consistently on the inner surface of the dentary in *Orthosternarchus* (Hilton et al., 2007:fig. 12), *Sternarchorhamphus* (Campos-da-Paz, 1995:fig. 5), *Sternarchorhynchus*, and most other apteronotids. *Platyurosternarchus*, alternatively, has the dentition implanted on the outer surface of the anterior one-third of the dentary, a hypothesized synapomorphy for the genus. Although the apteronotid *Megadontognathus* similarly has teeth implanted on the outer surface of the dentary, that dentition is limited to the posterior portion of the bone (Mago-Leccia, 1994:fig. 58), a much different and therefore non-homologous region of implantation from that of *Platyurosternarchus*.

3. The expansion of maxilla. Mago-Leccia (1994:38) remarked on the enlarged, overall rectangular maxilla in *Platyurosternarchus*. Albert and Campos-da-Paz (1998), Albert (2001), and Triques (2005) subsequently utilized this feature as a synapomorphy for the genus. That hypothesis is supported by our studies.
4. The extension of the posterodorsal corner of the maxilla. The posteriorly-attenuating process extending from the posteroventral margin of the expanded maxilla (Mago-Leccia, 1994:fig. 23d) is likely homologous with the posterior portion of the maxilla of other apteronotids. In contrast, the well-developed, posteriorly-attenuating process arising from the posterodorsal portion of maxilla is unique to *Platyurosternarchus* among examined gymnotiforms (Mago-Leccia, 1994:fig. 23, for maxilla morphology in diverse apteronotids). It is consequently considered a synapomorphy for the genus.
5. The transversely elongate intercalarium. The intercalarium in gymnotiforms is a relatively small ossification of variable form located within the interosseus ligament that extends anterodorsally from the anterior tip of the tripus to the scaphium (de la Hoz and Chardon, 1984:fig. 24, for illustration of arrangement in the sternopygid *Sternopygus macrurus*). A distinctly transversely-elongate form of the intercalarium from a dorsal view is characteristic of *Platyurosternarchus*. In *Sternarchorhynchus* the intercalarium ranges from being overall rectangular or narrower medially to distinctly triangular from a dorsal view, but never demonstrates the transversely distinctly-elongate form characteristic of *Platyurosternarchus*. Neither did we encounter the elongate *Platyurosternarchus* form of intercalarium in either *Orthosternarchus* and *Sternarchorhamphus* both of which have a rectangular intercalarium from dorsal view or elsewhere in the Apterontidae.
6. The reduction of the posterior fontanel. Two dorsomedial cranial fontanel are commonly present in the Apterontidae with the posterior fontanel an anteroposteriorly-elongate opening with irregular lateral margins. Anteriorly the posterior fontanel in this condition is delimited by the medial margins of the posterior portion of the frontals and then continues posteriorly between the contralateral parietals to terminate along the anteromedial border of the supraoccipital (*Orthosternarchus*; Hilton et al., 2007:fig. 10a). *Platyurosternarchus* has a dramatic reduction of the extent of the posterior fontanel. The posterior portions of the frontals contact their counterparts medially with comparable contact occurring along nearly all the length of the contralateral parietals. As a consequence of the extensive medial contacts of the frontals and parietals, the posterior fontanel is reduced to a circular opening delimited by the medial margins of the posteriormost portions of the parietals and the anteromedial section of the supraoccipital, a unique condition in the Apterontidae.
7. The deep tail proximate to the base of the caudal fin. Mago-Leccia (1994:37) followed by Albert (2001) and Triques (2005) noted that a deep tail was diagnostic for *Platyurosternarchus*, and the generic name is a direct reference to that feature. Juveniles of *P. crypticus* have the tail uniformly deep along its length (smaller specimens of *P. macrostoma* were unavailable for examination). Larger individuals of both *P. crypticus*

and *P. macrostoma* have a tail that is shallower proximate to the terminus of the anal fin and progressively deepens towards the base of the caudal fin. In light of the ontogenetic vertical expansion of the posterior portion of the tail, the derived nature of the character is more specifically stated as the possession of a deep tail that is highest proximate to the base of the caudal fin in specimens over 70 mm SL.

8. Overall pigmentation pattern. Mago-Leccia (1994:38) emphasized what he termed the “highly diagnostic” coloration pattern of contrasting dorsal and ventral pigmentation with overlying large scale marmoration in *Platyurosternarchus*. That condition was reiterated as a proposed apomorphy for the genus by Albert and Campos-da-Paz (1998) and Albert (2001), a conclusion we concur with in light of the unique nature of the coloration. The pigmentation pattern is illustrated in Figures 1 and 5 and described in detail under *P. crypticus*. The pigmentation pattern of *Platyurosternarchus* was equated as homologous with that present in the genus *Ubidia* by Triques (2005) who considered the coloration in both genera to be marmorated. These pigmentation patterns, however, differ in numerous details and we consider them to be non-homologous.

Problematic characters.—Several previously proposed synapomorphies for *Platyurosternarchus* require comment. A fusion of the extrascapular with the neurocranium was proposed as apomorphic for *Platyurosternarchus* (Albert and Campos-da-Paz, 1998; Albert, 2001). Such fusion is present in larger cleared-and-stained individuals of *P. macrostoma* but is lacking in the largest examined cleared-and-stained specimen of *P. crypticus*, a species described herein. Thus, the fusion is autapomorphic for *P. macrostoma* rather than synapomorphic for *Platyurosternarchus*.

The possession of two or three displaced haemal spines was advanced by Albert and Campos-da-Paz (1998) and Albert (2001) as apomorphic for *Platyurosternarchus*. Examination of a broader range of specimens of that genus revealed an intrageneric continuum in the number of such haemal spines that overlaps the two character states recognized by those authors (one versus two or three spines). That character cannot be applied at the level of *Platyurosternarchus*.

Albert and Campos-da-Paz (1998:430) and Albert (2001:73) reported the presence of numerous teeth along the ventral surface of the endopterygoid in *Platyurosternarchus* and utilized that feature as an apomorphy for the genus. None of six cleared-and-stained specimens of the two species of the genus (ca. 90–207 mm TL) examined in this study bore endopterygoid dentition.

***Platyurosternarchus* Mago-Leccia, 1994**

Platyurosternarchus Mago-Leccia, 1994:37 (type-species: *Sternarchus macrostoma* Günther, 1870; by original designation. Gender: masculine).

Diagnosis.—*Platyurosternarchus* is delimited by the synapomorphies discussed above, most of which are, however, features of internal anatomy. The species of *Platyurosternarchus* are readily distinguishable from all other genera of the Gymnotiformes by the possession of the combination of the following external features: the possession of a dorsal



Fig. 1. *Platyrosternarchus crypticus*, new species, holotype, CU 93433, 260 mm TL; Guyana, Rupununi, Moco-Moco Creek, approximately 3°18'52.95"N, 59°39'38.69"W. Dorsally-positioned electroreceptive filament not separated from body in life.

electroreceptive filament and caudal fin (latter absent or partially regenerated in some damaged specimens), an elongate snout (46.6–55.8% of HL), a relatively long mouth (30.0–37.9% of HL) that reaches nearly to the vertical through the anterior nostril and is situated approximately two orbital diameters forward of the anterior margin of the eye, and the location of both the anterior and posterior nares closer to the anterior margin of the eye than to the tip of snout. This posterior position of the nares is reflected both in the relatively short distance between the posterior naris and the anterior margin of the eye (0.7–6.4% of HL) and in the pronounced distance between the posterior naris and the tip of the snout (40.0–51.2% of HL).

***Platyrosternarchus crypticus*, new species**

Figures 1, 2, 3; Table 1

Sternarchorhamphus macrostoma, not of Günther.–Hopkins, 1974:520 [first report of nominal species from Guyana].

Platyrosternarchus macrostomus, not of Günther.–Ferreira et al., 2007:164, unnumbered photograph [Brazil, Rio Branco; habitat]

Holotype.—CU 93433, 1 (260), Guyana, Rupununi (Region 9), Moco-Moco Creek, upper Takutu River (Rio Branco basin), N slope of base of Kanuku Mountains, approximately 3°18'52.95"N, 59°39'38.69"W, approximately 16 km E of Lethem, 1 April 1971, C. D. Hopkins.

Paratypes.—All from Guyana, Rupununi (Region 9): CU 93432, 1 (308); CU 93434, 1 (235); CU 93435, 1 (111); CU 93436, 1 (117); CU 93437, 1 (145); MCZ 46889, 2 (CS; approximately 90–100); MCZ 50983, 4 (142–272); MCZ 98431, 1 (CS; 175); MBUCV 10918, 1 (264); USNM 209203, 2 (258–282); Moco-Moco Creek, upper Takutu River (Rio Branco basin), N slope of base of Kanuku Mountains, approximately 3°18'52.95"N, 59°39'38.69"W, approximately 16 km E of Lethem, collected at type locality, C. D. Hopkins. ANSP 179153, 1 (218), Yuora River, tributary to Ireng River, Takutu River-Rio Branco drainage, 6.7 km NE of village of Karasabai on road to Tiger Creek village, 4°03'14"N, 59°29'07"W, 31 October 2002, M. H. Sabaj et al. AUM 35545, 1 (142), Sauriwau River, 31.2 km NW of village of Sand Creek, 3.1143°N, 59.7754°W, Ireng River-Rio Branco system, 4 November 2002, J. W. Armbruster et al.

Non-type specimen.—Brazil, Roraima: INPA 7420, 1 (210), Igarapé do Ouro, approximately 78 km from Boa Vista, left

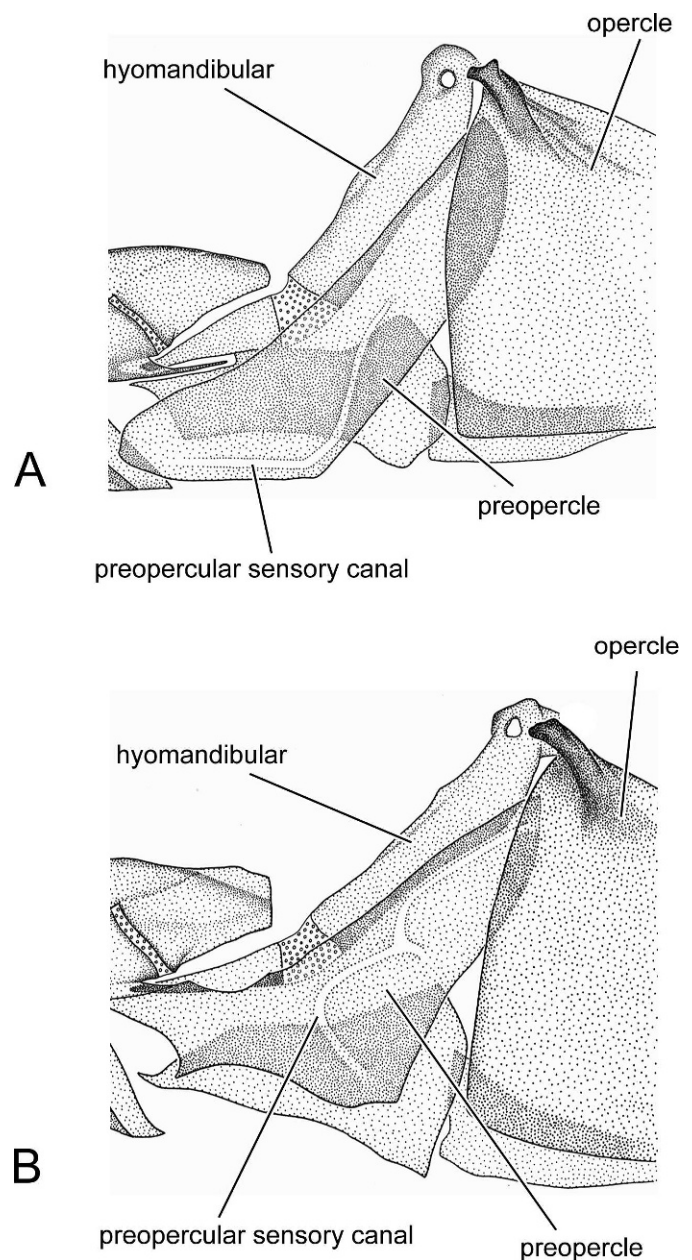


Fig. 2. Central portion of suspensorium of (A) *Platyrosternarchus crypticus*, MCZ 98431, and (B) *Platyrosternarchus macrostoma*, FMNH 100730, showing different forms of laterosensory canal within preopercle; left side, lateral view, anterior to left.

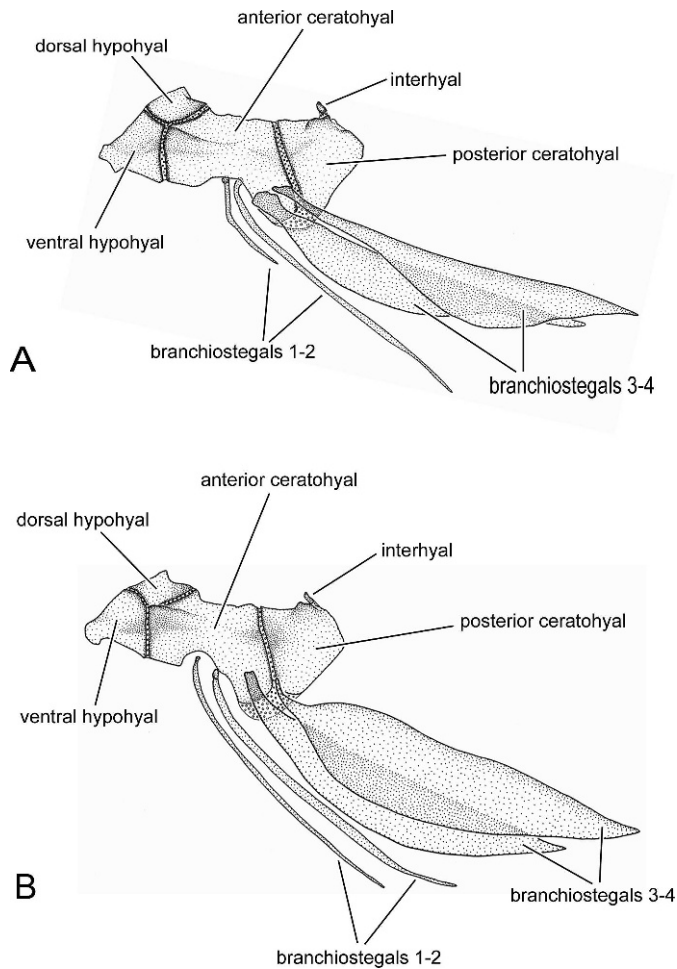


Fig. 3. Hyoid arch and branchiostegal rays of (A) *Platyurosternarchus crypticus*, MCZ 98431, and (B) *Platyurosternarchus macrostoma*, FMNH 100730; left side, lateral view, anterior to left.

channel on road to Confiança (latter presumably Colônia Agrícola da Confiança located at 2°29'11"N, 60°38'04"W; Barbosa and Ferreira, 2004).

Diagnosis.—*Platyurosternarchus crypticus* can be distinguished from its sole congener, *P. macrostoma*, by the position of the posterior limit of the mid-dorsal electroreceptive filament (extending to within the region delimited anteriorly by the vertical running two scales anterior to the vertical through the base of the last anal-fin ray and posteriorly by the vertical through the base of the last anal-fin ray versus extending approximately three scales beyond the vertical through the base of the last anal-fin ray, respectively), the form of the portion of the laterosensory canal segment along the ventral portion of the head and within the preopercle (running along the ventral portion of the head and the central and vertical portions of the preopercle with only a gradual change in orientation within the preopercle versus with distinct anterior convexity in the canal segment within the preopercle at the point where the canal in the bone contacts the canal embedded in the soft tissues of the ventral portion of the head, respectively; Fig. 2; see also Remarks below), the size and form of the first branchiostegal ray (first ray hypertrophied and approximately one-third the length of the second branchiostegal ray versus first and second branchiostegal rays elongate and approximately the same length, respectively; Fig. 3), the form of the anterior

portion of the fourth branchiostegal ray (approximately straight versus expanded anteriorly, respectively; Fig. 3), and the attachment point of the fourth branchiostegal ray (on the lateral surface of the posterior portion of the anterior ceratohyal versus on the lateral surface of the anteroventral margin of the posterior ceratohyal, respectively; Fig. 3).

Description.—Head and body shape and pigmentation in adults shown in Figure 1 and morphometrics presented in Table 1. Maximum body size 308 mm. Body distinctly laterally compressed. Greatest body depth at, or slightly posterior to, abdominal cavity. Dorsal profile of body ranging from nearly straight in smaller individuals to smoothly slightly convex in mid- to large-sized specimens. Lateral line extending posteriorly to caudal-fin base, but absent on fin. Anteriormost perforated scale located above pectoral-fin origin. Head laterally compressed, widest at opercular region. Dorsal profile of head slightly convex anteriorly, then straight to vertical through eye and then convex to rear of head. Eye small, laterally-positioned on head and completely covered by thin membrane. Mouth terminal with gape relatively elongate and rictus located slightly anterior to vertical through anterior naris. Anterior naris located at end of small tube and situated close to posterior naris. Posterior naris ovoid, without tubular extension and located close to anterior margin of eye. Branchial opening vertically-restricted and located slightly anterior to pectoral-fin insertion. Branchial membranes joined at isthmus. Anus and urogenital papilla adjacent, located at vertical approximately two orbital diameters behind posterior margin of eye. No noticeable ontogenetic shift of anus and urogenital papilla anteriorly, contrary to forward progression in position of those structures with increased body size in some apteronotids (pers. obs.). Lateral ethmoid absent. Neurocranial bones laminar. Infraorbital series represented solely by poorly ossified tubular first to sixth infraorbitals. Antorbital and first through third infraorbitals located along, but not attached to, lateral surface of enlarged maxilla. Premaxilla of moderate size, elongate, and edentulous. Edentulous maxilla expanded into large, overall rectangular plate-like ossification with narrow, posteriorly-attenuating projections extending from posterodorsal and posteroventral margins (Mago-Leccia, 1994:fig. 23d; Albert, 2001:fig. 16b).

Dentary elongate, with one tooth row of 11–22 [11] functional teeth positioned on outer surface of anterior portion of bone plus three to five medially-situated, externally-obvious, replacement teeth. Mesopterygoid edentulous. Ascending process of mesopterygoid extending towards orbitosphenoid in specimens of approximately 90–175 mm TL; process not apparent in largest radiographed specimens. Four branchiostegal rays; first and second rays narrow and elongate, third and fourth large and laminar overall, but with fourth ray narrow proximally (Fig. 3). All branchiostegals attach to anterior ceratohyal. First branchiostegal ray hypertrophied and approximately one-third length of second ray (Fig. 3). Fifth ceratobranchial with 10–11 narrow, distally posterolaterally-recurved teeth ($n = 2$). Upper pharyngeal tooth plate with 11–12 narrow, distally posteriorly-recurved teeth ($n = 1$).

Pectoral fin broad and distally somewhat pointed. Pectoral-fin rays ii + 11–13 [ii + 11] ($n = 15$). Anal-fin origin located at vertical through anterior margin of opercle in smaller individuals but distinctly anterior to that point in

Table 1. Morphometric Data for Species of *Platyrosterne*. Number of specimens indicated in parenthesis. Range for *P. crypticus* includes all specimens.

	holotype	<i>P. crypticus</i>		<i>P. macrostoma</i>	
		range	mean	range	mean
Total length	260	111–308 (<i>n</i> = 17)	—	170–323 (<i>n</i> = 33)	—
Length to end of anal fin	233	103–285 (<i>n</i> = 17)	—	150–282 (<i>n</i> = 32)	—
Head length	30.9	15.7–36.8 (<i>n</i> = 17)	—	21.8–40.4 (<i>n</i> = 33)	—
Caudal length	26.5	8.4–33.6 (<i>n</i> = 17)	—	17.3–41.6 (<i>n</i> = 32)	—
Percent of length to end of anal fin					
Anal-fin base	89.2	84.6–91.9 (<i>n</i> = 13)	88.1	78.2–91.5 (<i>n</i> = 32)	88.2
Anus to anal-fin insertion	1.9	0.9–2.3 (<i>n</i> = 11)	1.5	1.0–1.5 (<i>n</i> = 32)	1.4
Snout to anus	8.3	7.3–11.4 (<i>n</i> = 13)	9.4	5.9–10.9 (<i>n</i> = 32)	9.4
Preanal-fin distance	10.1	9.3–14.2 (<i>n</i> = 13)	11.7	9.1–12.8 (<i>n</i> = 32)	11.2
Prepectoral-fin distance	13.1	12.9–15.6 (<i>n</i> = 13)	14.1	11.1–16.4 (<i>n</i> = 32)	14.6
Greatest body depth	6.9	6.5–8.9 (<i>n</i> = 13)	7.4	7.4–9.6 (<i>n</i> = 32)	8.3
Caudal-fin length	11.3	8.2–13.7 (<i>n</i> = 9)	11.3	9.2–15.2 (<i>n</i> = 32)	12.6
Head length	13.2	12.9–15.3 (<i>n</i> = 13)	14.1	12.8–16.5 (<i>n</i> = 33)	14.5
Percent of head length					
Pectoral-fin length	47.8	38.3–47.8 (<i>n</i> = 17)	43.1	38.3–52.1 (<i>n</i> = 32)	47.0
Head depth at eye	32.7	28.6–39.3 (<i>n</i> = 17)	33.5	28.2–48.0 (<i>n</i> = 33)	32.2
Head width	23.4	20.3–31.2 (<i>n</i> = 17)	25.7	22.9–48.0 (<i>n</i> = 33)	27.7
Snout length	52.0	49.2–55.8 (<i>n</i> = 17)	52.2	46.6–53.6 (<i>n</i> = 33)	50.3
Posterior naris to snout	50.7	44.0–51.2 (<i>n</i> = 17)	47.8	40.0–47.3 (<i>n</i> = 33)	44.1
Posterior naris to eye	1.4	0.7–3.1 (<i>n</i> = 17)	1.3	1.1–6.4 (<i>n</i> = 33)	2.8
Mouth length	32.2	32.2–37.9 (<i>n</i> = 17)	35.6	30.0–36.5 (<i>n</i> = 33)	33.5
Internarial distance	3.9	3.3–5.7 (<i>n</i> = 17)	4.5	4.0–6.4 (<i>n</i> = 33)	5.4
Eye diameter	6.4	5.5–7.9 (<i>n</i> = 17)	6.4	4.9–7.5 (<i>n</i> = 33)	6.1
Interocular width	10.4	8.8–13.3 (<i>n</i> = 17)	10.5	8.4–11.6 (<i>n</i> = 33)	10.3
Postocular distance	45.1	43.9–49.8 (<i>n</i> = 17)	46.0	44.4–52.0 (<i>n</i> = 33)	47.8
Branchial opening	13.9	11.2–16.7 (<i>n</i> = 17)	13.3	10.1–15.9 (<i>n</i> = 33)	13.8
Percent of caudal length					
Tail depth	20.9	13.3–26.5 (<i>n</i> = 9)	19.6	17.4–27.1 (<i>n</i> = 32)	21.5

larger specimens. Unbranched anal-fin rays 35–39 [39] (*n* = 5), total anal-fin rays 210–224 [223] (*n* = 9). Scales absent along entire mid-dorsal region of body. Scales above lateral line to mid-dorsal line 6–9 [7] (*n* = 15). Mid-dorsal electroreceptive filament inserted into, and attached to, narrow mid-dorsal groove in life (specimen in Fig. 1 with partial postmortem separation of filament from body). Origin of filament located at approximately 50% of TL. Filament extending posteriorly to vertical through base of last anal-fin ray. Tail compressed, short, and ending in small caudal fin with rounded posterior margin. Tail in smallest examined specimens (approximately 110 mm TL) uniformly deep from posterior terminus of anal fin to base of caudal fin. Posterior portion of tail proportionally increasing in depth ontogenetically, with tail deepest proximate to base of caudal fin in moderate- and large-sized specimens. Caudal-fin rays 21–25 [23] (*n* = 9). Precaudal vertebrae 16 [16] (14 anterior, 2 transitional, *n* = 10).

Coloration in life.—Photograph of recently collected paratype of *Platyrosterne crypticus* (ANSP 179513) from the Yuora River, Guyana, shows much darker overall coloration than retained in that specimen in preservative. Most notably, entire lateral surface of recently collected specimen apparently uniformly dark, whereas same individual in preservative with dorsolateral region of body distinctly lighter than ventrolateral area. Photo also shows pinkish coloration along ventral portion of body proximate to anal-

fin base in areas that lack dark pigmentation in preserved specimen. Some pink coloration also apparent on portions of middle region of anal fin.

Coloration in alcohol.—Overall head coloration tan to dark brown, with coloration more intense in larger examined specimens. Smallest examined individuals with elongate band of distinctly darker pigmentation along dorsolateral surface of snout anterior to eye and with paler mid-dorsal pigmentation. Pale mid-dorsal band widens laterally on postocular portion of head. Lateral surface of snout ventral to band of dark pigmentation anterior to eye less intensely pigmented, particularly along posterior one-half of snout. Paler band on snout continuous posteriorly with pale patch situated ventral and posteroventral to orbit. Dark chromatophores scattered through pale patch. Head in larger specimens becoming progressively darker overall. Band of dark pigmentation present on snout anterior to eye in juveniles masked in adults by nearly uniform coloration over most of that region of head. Large individuals with pale region posteroventral of orbit less extensive and obvious than in juveniles, but retaining embedded dark chromatophores. Mid-dorsal region ranging from somewhat more lightly colored than adjoining areas to being approximately as dark as remainder of dorsal surface of head.

Body coloration ranging from tan to brown, with pigmentation darker on ventral half of body. Smaller individuals with dark ventral pigmentation best developed

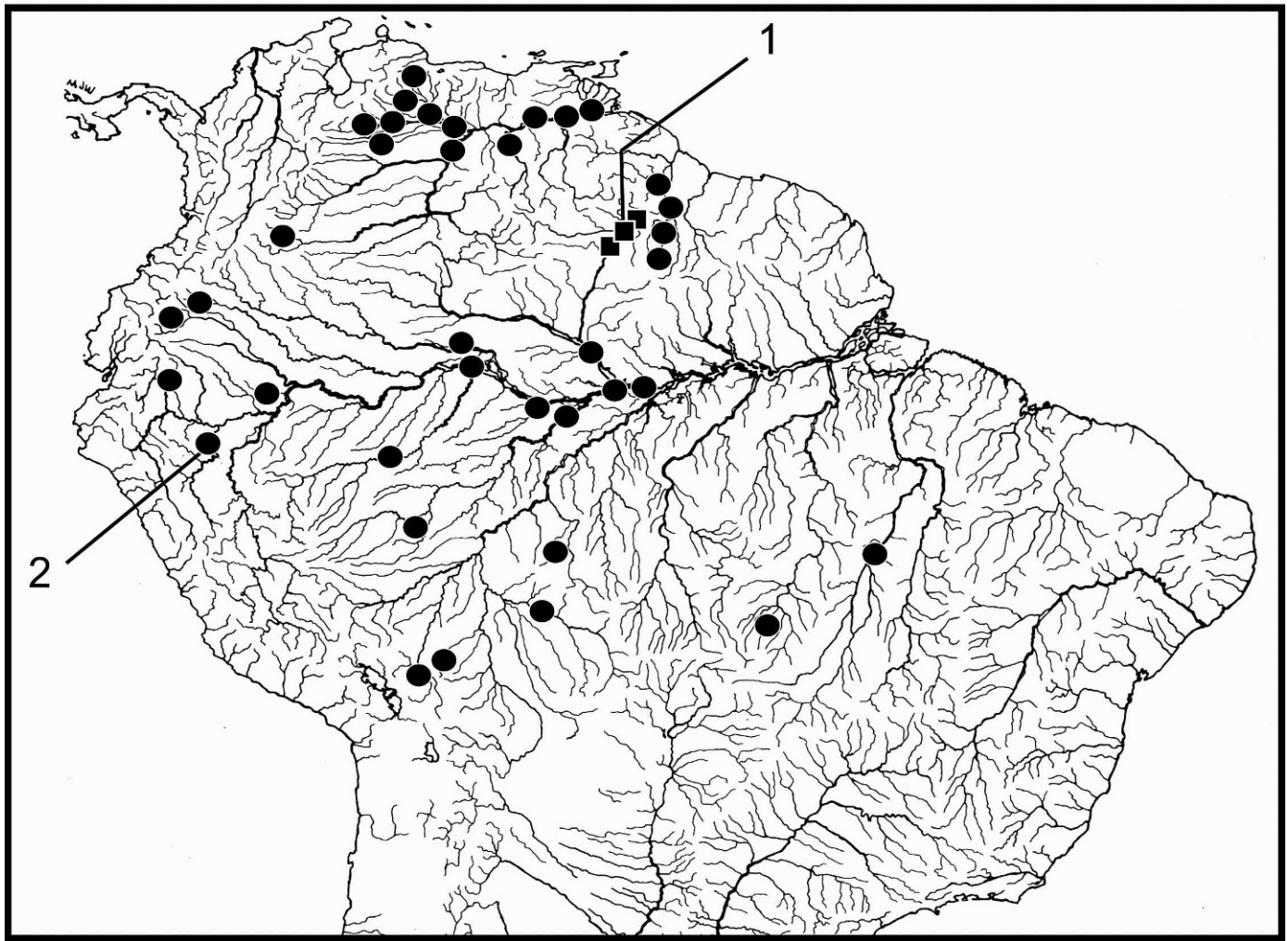


Fig. 4. Map of northern and central South America showing distribution of *Platyurosternarchus crypticus* (squares, 1 = type locality) and *Platyurosternarchus macrostoma* (dots, 2 = type locality of *Sternarchus macrostoma* at Xeberos [=Jeberos], Peru). Some symbols represent more than one lot and/or locality.

along margins of myomeres associated with anal-fin rays. Coloration on ventral half of body darker and more uniform in larger specimens, albeit with irregularity in intensity of pigmentation. Dark band on ventrolateral surface of body angling anteroventrally along abdominal region. Region of body proximate to base of anal fin with irregular pale areas in specimens of all sizes. Portion of body located dorsal of dark region on body overall more lightly pigmented and with overlying irregular, large-scale, mottled pattern of slightly darker pigmentation. Mid-dorsal region of body and dorsal surface of electroreceptive filament usually alternatively lightly and darkly pigmented in smaller and mid-sized specimens. Larger individuals either retain contrasting pigmentation along filament or with mid-dorsal region nearly uniformly dark.

Pectoral fin hyaline overall, but with some dark pigmentation basally on anterior and posterior surfaces in larger individuals. Caudal fin and proximate portions of tail dark, with anterior limit of dark pigmentation variable in extent and form. Anal fin hyaline along most of its length, but with progressively wider band of very dark pigmentation on posterior portion of fin. Dark pigmentation extends primarily over only basal portions of rays along anterior section of pigmentation patch, but covers all of ray surfaces posteriorly.

Habitat.—Moco-Moco Creek, the type-locality of *Platyurosternarchus crypticus*, is a small stream on the base of the north slope of the Kanuku Mountains. Water at that locality is usually clear but turns muddy for several hours after heavy rainfalls (Hopkins, 1974:519). One paratype (ANSP 179153) originated in a forest stream with relatively clear water weakly stained with tannins over a gravel and cobble bottom covered with leaf and twig litter. This specimen was in a submerged pile of such litter in a meter or less of flowing water. Ferreira et al. (2007:164) reported that *P. crypticus* (cited therein as *P. macrostomus*) lives in rapids and streams and classify it as a predator (presumably of invertebrates).

Distribution.—*Platyurosternarchus crypticus* is known from a limited region in the upper portions of the Rio Branco system of the Amazon basin in northeastern Roraima, Brazil, and in the easternmost portion of the Rupununi District, Guyana (Fig. 4).

Remarks.—The species of *Platyurosternarchus* differ in various internal features, but are most readily distinguishable externally in the morphology of the laterosensory canal system in the ventral portion of the head and the horizontal

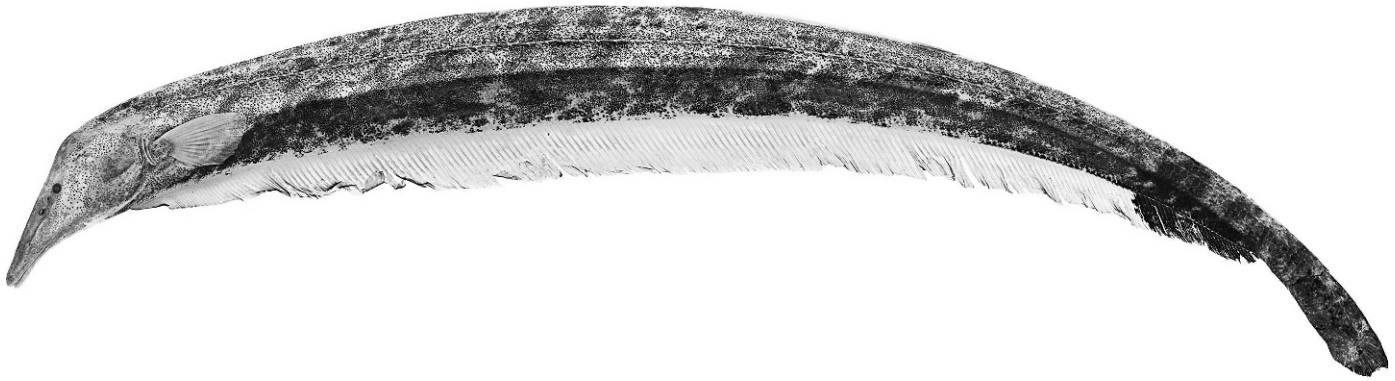


Fig. 5. *Platyurosternarchus macrostoma*, MCNG 52589, 235 mm TL, Venezuela, Apure, Caño Buracal, Arauca.

and vertical limbs of the preopercle. In each species the canal is obvious as a pale narrow tube. *Platyurosternarchus macrostoma* has the straight anterior portion of the system within the soft tissues anterior to the preopercle continuous posteriorly with an overall anteriorly convex canal segment running within the ventral portion of the vertical arm of the preopercle (Fig. 2A). *Platyurosternarchus crypticus* alternatively has the approximately horizontal laterosensory canal segment anterior to the preopercle followed by a preopercular canal that continues first horizontally, then anterodorsally at an obtuse angle (Fig. 2B). When examined in whole specimens, the pale combined canals in the soft tissue of the head and the ventral portion of the preopercle of *P. macrostoma* have a pronounced overall S-shape that differs significantly from the simple curve of that canal segment in *P. crypticus*.

Examined samples of *Platyurosternarchus crypticus* all originated in the upper portions of the Rio Branco system in the Takutu River system of western Guyana with the exception of one sample from Roraima, Brazil. In light of the distance of the collection site of that specimen (INPA 7420) from the holotype locality, we exclude it from the paratype series.

Etymology.—The species name, *crypticus*, from the Greek word, *kryptos*, meaning hidden or secret, refers to the previously undetected, albeit very distinct, differences between this species and its sole congener.

***Platyurosternarchus macrostoma* (Günther, 1870)**

Figures 2, 3, 5; Table 1

Sternarchus macrostoma Günther, 1870:4 [type locality: Xeberos (=Jeberos), Peru].

Rhamphosternarchus macrostoma.—Cope, 1878:682 [transfer to *Rhamphosternarchus*; Pebas, Peru].

Sternarchorhynchus macrostoma.—Eigenmann and Eigenmann, 1891:62 [transfer to *Sternarchorhynchus*; literature citation].

Sternarchorhamphus macrostomus.—Eigenmann and Ward, 1905:166 [transfer to *Sternarchorhamphus*; literature compilation].—Eigenmann, 1910:449 [citation].—Ellis, 1913:144 [repetition of original description by Günther, 1870].—Fowler, 1915:unpaginated [Peruvian Amazon; based on Cope (1878) material according to Fowler, 1945:180].—Eigenmann and Allen, 1942:319 [Peruvian Amazon].

Sternarchorhamphus macrostoma.—Fowler, 1945:180 [Peru].—Fowler, 1951:430 [literature summary; range reported as upper Amazon in Peru].—Ortega and Vari, 1986:12 [Peru].

Platyurosternarchus macrostomus.—Mago-Leccia, 1994:38, fig. 57 [as type species of monotypic *Platyurosternarchus*; Río Orinoco and Rio Amazonas systems and the Guianas; differential characters].—Taphorn et al., 1997:80 [Venezuela].—Albert and Campos-da-Paz, 1998:429 [as sister group to *Sternarchorhynchus*].—Campos-da-Paz, 2000:526 [as sister group to *Sternarchorhynchus*].—Albert, 2001:200 [as sister group to *Sternarchorhynchus*].—Albert, 2003:500 [Amazon River basin in Brazil, Peru, and Venezuela].—Lasso et al., 2004a:142 [Río Orinoco basin in Colombia and Venezuela].—Lasso et al., 2004b:181 [Venezuela; Río Orinoco basin].—Triques, 2007:124 [Brazil].—Crampton, 2007:295 [Guiana; Potaro-Essequibo River basin].

Material examined.—Bolivia. Beni: INHS 37829, 1 (164), Río Chaparina, 11 km W of San Borja; USNM 305550, 2 (tail damaged—220), Ballivia Province, Río Curiraba, 10 km NE of El Porvenir Biological Station and 40 km E of San Borja, 14°55'S, 66°17'W.

Brazil. Acre: MBUCV 13431, 1 (232), Río Juruá, Município de Cruzeiro do Sul; MZUSP 49828, 1 (355), Rio Acre at Boa União; MZUSP 49835, 1 (360), Rio Acre near Lago Amapá. Amazonas: INPA 9631, 1 (179), Rio Negro, Lago Panema, in front of mouth of Rio Jaú; INPA 9967, 1 (180), Rio Japurá, Paraná de Nova Colômbia, 1 km N of Nova Colômbia, 2°52'32"S, 64°55'00"W; INPA 15828, 2 (not measured), Rio Japurá, Paraná Maiana, Reserva Mamirauá; INPA 14536, 2 (not measured), Rio Solimões, Costa da Machantaria; INPA 17584, 1 (not measured), Rio Solimões, Paraná do Rei, Ilha da Machantaria; INPA 26961, 1 (not measured), Rio Solimões, Ilha da Machantaria, 3°15'17"N, 59°55'03"W; INPA 20162, 2 (188–249), Rio Solimões, Paraná Xiborena; MCZ 9390, 1 (206), Rio Solimões, Lago Manacapuru, 3°06'S, 61°30'W; MZUSP 8949, 1 (148), Rio Solimões, Ilha Surubim, above Coari; MZUSP 56320, 2 (217–238), Rio Juruá, 10.2 km below Lago Pauapixuna, 2°41'07"S, 65°48'27"W; MZUSP 57686, 6, (180–216), Rio Purus, 13 km below Lago do Estopa, 3°57'S, 61°27'W. Mato Grosso: MZUSP 88501, 1 (200), Rio Jatobá, Rio Ronuro, bridge on road between Salto da Alegria and Nova Ubiratã, 12°49'19"S, 54°09'24"W. Rondônia: INPA 9835, 1 (230), INPA 9836, 2 (200–260), Rio Guaporé above Surpresa; INPA 9837, 3 (92–193), Rio Urupã, 10 km above Ji-Paraná. Tocantins: MZUSP 51365, 1 (not measured), Rio Água Fria, Fazenda Praia Alta 2, 27 km N of Araguaçu, on road from Araguaçu to Barreira do Piqui.

Colombia. Meta: ANSP 128199, 2 (286–325), ANSP 131656, 4 (235–273), ANSP 131468, 1 (263), MBUCV 12770, 2 (1 CS, 207–269), Río Meta, Quebrada Venturosa,

0.25 miles above road between La Balsa and Puerto Lopez, 4°25'S, 72°58'W.

Ecuador. Napo: FMNH 103365, 1 (415), Río Payamino, 23.3 km upstream from mouth in Río Napo, sandy beach on right bank, 0°26'54"S, 77°06'12"W; FMNH 100615, 1 (183), Río Jivino, lower 4 km to approximately 6 km upstream from mouth between two "ports" for Limoncocha, 0°24'36"S, 76°39'00"W.

Guyana. Essequibo: ANSP 177471, 1 (370), Essequibo River, black water creek 2 km downstream from Paddle Rock campsite, 4°45'40"N, 58°43'05"W. Rupununi (Region 9): AUM 35520, 1 (183), Rupununi River basin, Simoni River, four sites from 6.6 km SE to 3.2 km W of Karanambo, 3.7191°N, 59.2612°W; AUM 35881, 1 (192), Rupununi River, 4.6 km NW of Massara, 3.9260°N, 59.2804°W; AUM 35882, 1 (207), Rupununi River at Karanambo, 3.7500°N, 59.3083°W. Siparuni: ANSP 175946, 1 (263), small creek crossing Kurupukari to Sumara River road approximately 3 miles from Kurupukari field station.

Peru. Loreto: BMNH 1867.6.13.76, 1 (360; holotype of *Sternarchus macrostoma*; photographs and radiograph), BMNH 1869.5.21.16, 1 (approximately 180; photograph and radiographs), Xeberos (=Jeberos); ANSP 182507, 1 (159), ANSP 182522, 1 (342), Río Nanay, at village of Pampa Chica, 4.5 km W of Iquitos, 3°45'09"S, 73°17'00"W; MUSM 26451, 1 (137), upper Amazon, Andoas.

Venezuela. Anzoátegui: MBUCV 24037, 1 (240), mouth of Río Pao. Apure: ANSP 165224, 1 (257), Río Apure between mouth of Río Portuguesa and San Fernando de Apure airport, 7°54'00"N, 67°32'00"W; AUM 22759, 1 (163), MCNG 43008, 1 (155), Río Apure, Caño La Pastora, on road to UNELLEZ modulo, 7.4444°N, 69.4347°W; CU 93438, 1 (318), CU 93439, 1 (251), CU 93440, 1 (247), CU 93441, 1 (247), CU 93442, 1 (227), Río Matyure just S of village of Achaguas; MBUCV 13190, 1 (271), Río Apure at mouth of La Rompia; MCNG 9384, 1 (221), Río Apure, Caño Maporal, 7.4222°N, 69.5944°W; MCNG 13880, 1 (241), Río Apure, 10 km downstream from San Fernando de Apure, 7.8639°N, 67.3917°W; MCNG 14039, 1 (250), mouth of Río Portuguesa at Río Apure, 7.9500°N, 67.5278°W; MCNG 52335, 1 (221), Río Apure, Caño Maporal; MCNG 52589, 79 (150–323), Caño Buracal, Arauca. Barinas: FMNH 100730, 2 (dissected CS specimens), Caño Socopo, approximately 3.5 hours upstream from boat launch site of Hato Mercedes in Río Suripá; MBUCV 20865, 3 (195–352), Río Suripá, Caño Socopó; MBUCV 21077, 3 (189–223), mouth of Río Suripá, Caño La Indecicita; INHS 29917, 1 (252), Río Masparro, 5 km NW of Libertad, on road from Libertad to Barinas, 8°20.54'N, 69°39.48'W; INHS 28720, 1 (250), Río Santo Domingo in Torunos, 8°30.54'N, 70°05.05'W; MCNG 11995, 1 (175), Río Carapo above Los Mangos, 7.5972°N, 70.7972°W; MCNG 49070, 2 (198–214), MCNG 49081, 1 (231), MCNG 49165, 1 (177), MCNG 49190, 1 (260), MCNG 49199, 1 (202), MCNG 49231, 3 (208–218), MCNG 49388, 2 (246–323), MCNG 49544, 2 (227–228), MCNG 49590, 1 (218), MCNG 50820, 4 (196–210), MCNG 50845, 4 (168–209), MCNG 51749, 1 (178), MCNG 51755, 2 (179–199), MCNG 51771, 5 (187–205), MCNG 51789, 1 (196), MCNG 51801, 1 (187), Río Apure, Caño Bravo, 8.0000°N, 67.9833°W; MCNG 13508, 2 (160–193), Río Apure, at Bruzual bridge, 8.0583°N, 69.3278°W; MCNG 52582, 1 (224), Río Apure near Caño Fistolito. Bolívar: MBUCV 15295, 1 (232), Río Orinoco, mouth of Río Caura, 7°38'00"N, 64°52'00"W. Delta Amacuro: MBUCV 10503, 1

(230), Río Orinoco, near Los Castillos, 8°31'N, 62°26'W. Guárico: AMNH 58654, 1 (200), Río Apurito in Río Apure; MBUCV 12769, 1 (195), mouth of Río Apurito; MCNG 51456, 1 (218), Río Portuguesa, along boundary between Estados Barinas and Guárico, 7.5617°N, 67.3218°W; MBUCV 12099, 1 (223), Río Portuguesa, Caño Los Laureles. Monagas: USNM 233614, 1 (218), secondary caño about 500 m from its mouth into Caño Guarguapo, 8°30'24"N, 62°14'00"W. Portuguesa: INHS 35644, 3 (206–220), Río Portuguesa, Caño Maraca, on road from Guanare to Guanarito at 60 km marker, 8°49'34"N, 69°20'42"W; MCNG 27279, 1 (190), Caño Maraca on road from Guanare to Guanarito, at bridge, 8.8319°N, 69.3708°W.

Diagnosis.—*Platyurosternarchus macrostoma* can be distinguished from its sole congener, *P. crypticus*, by the position of the posterior limit of the mid-dorsal electroreceptive filament (extending posteriorly approximately three scales posterior to the vertical through the base of the last anal-fin ray versus extending to within the region delimited anteriorly by the vertical running two scales anterior to the vertical through the base of the last anal-fin ray and posteriorly by the vertical through the base of the last anal-fin ray, respectively), the form of the portion of the laterosensory canal segment along the ventral portion of the head and within the preopercle (with distinct anterior convexity in the canal segment within preopercle at point where the canal segment within the preopercle contacts the canal embedded in the soft tissues of the ventral portion of the head versus running along the ventral portion of the head and the central and vertical portions of the preopercle with only a gradual change in orientation, respectively; Fig. 2; see also Remarks under *P. crypticus*), the size and form of the first branchiostegal ray (first and second branchiostegal rays elongate and approximately the same length versus first ray hypertrophied and approximately one-third the length of the second branchiostegal ray, respectively; Fig. 3), the form of the anterior portion of the fourth branchiostegal ray (expanded anteriorly versus approximately straight, respectively; Fig. 3), and the attachment point of the fourth branchiostegal ray (on the lateral surface of the anteroventral margin of the posterior ceratohyal versus on the lateral surface of the posterior portion of the anterior ceratohyal, respectively; Fig. 3).

Description.—Head and body shape and pigmentation of adult shown in Figure 5 and morphometrics presented in Table 1. Maximum body size 415 mm. Overall morphology of head, body, and fins comparable to that in *P. crypticus* (see account of that species) other than for features described in following sections.

Dentary elongate, with one tooth row of 14–18 functional teeth attaching to the outer surface of anterior portion of bone plus four to eight more medially-positioned, externally-obvious, replacement teeth. Mesopterygoid edentulous, narrow, short, and without ascending process extending towards orbitosphenoid (in CS and radiographed specimens of approximately 146–207 mm TL). Four branchiostegal rays; first and second rays narrow and elongate, third and fourth large and laminar. First through third rays attaching to ventral and lateral surfaces of anterior ceratohyal and fourth ray to lateral surface of anteroventral margin of posterior ceratohyal. First and second branchiostegal rays elongate and approximately of same length (Fig. 3). Fifth

ceratobranchial with eight or nine narrow, distally postero-laterally-recurved teeth ($n = 3$). Upper pharyngeal tooth plate with 9–14 narrow, distally posteriorly-recurved teeth ($n = 3$).

Pectoral fin broad and somewhat distally pointed. Pectoral-fin rays ii + 12–14 ($n = 33$). Anal-fin origin located anterior to vertical through anterior margin of opercle. Unbranched anal-fin rays 32–43 ($n = 31$), total anal-fin rays 209–229 ($n = 32$) [202 anal-fin rays reported for holotype by Günther (1870)]. Scales absent along entire mid-dorsal region of body. Scales above lateral line to mid-dorsal line 5–9 ($n = 33$). Mid-dorsal electroreceptive filament extending posteriorly three scales beyond vertical through rear of base of anal fin. Tail relatively deep along its entire length in both mid- and large-sized specimens. Caudal-fin rays 22–30 ($n = 30$). Precaudal vertebrae 16 (14 anterior, 2 transitional, $n = 10$).

Coloration in life.—Photograph of recently collected *Platyurosternarchus macrostoma* from Río Nanay in Peruvian Amazon (ANSP 182522) shows overall relatively lightly colored individual with muted contrast between dorsolateral and ventrolateral portions of body. Photo shows very prominent dark pigmentation on tail, caudal fin, and posterior portion of anal fin characteristic of preserved material of species. Coloration of that specimen in alcohol similar, albeit with ventrolateral pigmentation more intense relative to that on dorsolateral region.

Coloration in alcohol.—Coloration pattern of *Platyurosternarchus macrostoma* comparable to that of *P. crypticus* but with greater variation between samples in intensity of head and body coloration in larger individuals. Such variation demonstrates neither geographic pattern nor correlates with differences in other features. Variation may reflect differential development of pigmentation in different water types or artifacts of postmortem preservation. One apparent albino originated near mouth of Río Orinoco.

Electric organ discharge.—*Platyurosternarchus macrostoma* produces biphasic electric organ discharges of frequencies varying from 750 to 1031 Hz (Crampton and Albert, 2006:688, figs. 23.10 and 23.11).

Habitat.—Sampling in the central Río Orinoco in the Río Apure, Venezuela, yielded 79 individuals of *Platyurosternarchus macrostoma* at a near shore locality. The site was full of submerged tree trunks and branches over a sand and/or clay substrate covered with leaf litter (de Santana et al., 2006). Two samples (ANSP 182507, ANSP 182522) from the Río Nanay in the Peruvian Amazon originated in turbid blackwaters over a substrate of mud, silt, and organic debris in a near shore depositional zone.

Distribution.—*Platyurosternarchus macrostoma* is known from across broad expanses within the Rio Amazonas and Río Orinoco basins and is also present in portions of the Essequibo River in Guyana (Fig. 4).

Autapomorphy.—As aforementioned, *Platyurosternarchus macrostoma* has the extrascapular fused with the neurocranium contrary to the separation of those bones in *P. crypticus* and outgroups. Fusion of these elements was previously

proposed as apomorphic for *Platyurosternarchus*, which at the time contained solely *P. macrostoma*. In light of the observed condition in *P. crypticus*, it is rather applicable as an autapomorphy for *P. macrostoma*.

Remarks.—Günther (1870:4) reported that *Sternarchus macrostoma* was based on a specimen of “Fourteen inches long” collected at Xeberos (=Jeberos) and was “From Mr. Bartlett’s Collection.” The specimen long recorded as the holotype in the records of the BMNH (BMNH 1869.5.21.16) is only one-half that length (J. Maclaine, BMNH, pers. comm.) and was furthermore originally entered in the register as *Cheirodon*, a genus of characiforms of small body sizes. This scale of misidentification casts doubt on the data associated with the lot. A second specimen in that collection (BMNH 1867.6.13.76) is at 370 mm approximately the 14 inch (360 mm) length reported for the type by Günther, and was “purchased from Higgins and collected by Bartlett” (J. Maclaine, BMNH, pers. comm.) at Xeberos. In light of the fit of the data associated with that individual with the information provided in the original description of the species, that specimen is judged to be the holotype of *Sternarchus macrostoma*. Photographs and radiographs of the specimen make it clear that it is conspecific with the other specimens identified as that species in this study.

KEY TO THE SPECIES OF *PLATYUROSTERNARCHUS*

(Based on specimens over 100 mm TL)

- 1a. Laterosensory canal system along ventral portion of head and ventral portion of preopercle appearing as narrow, pale band with smooth obtuse angle within preopercle (Fig. 2A); mid-dorsal electroreceptive filament extending posteriorly to within region delimited anteriorly by vertical 2 scales anterior to vertical through base of last anal-fin ray and posteriorly by vertical through base of last anal-fin ray
Platyurosternarchus crypticus, new species
(northeastern portions of Rio Branco system in Brazil and Guyana)
- 1b. Laterosensory canal system along ventral portion of head and ventral portion of preopercle appearing as narrow, pale band with distinct anterior convexity within preopercle (Fig. 2B); mid-dorsal electroreceptive filament extending posteriorly approximately 3 scales beyond vertical through base of last anal-fin ray
Platyurosternarchus macrostoma
(Rio Amazonas and Río Orinoco basins, Essequibo River)

MATERIAL EXAMINED

Adontosternarchus devenanzii: MBUCV 12779, 1 (CS).
Adontosternarchus nebulosus: INPA 25886, 3 (CS).
Adontosternarchus sachsi: FMNH 100742, 1 (CS).
Apterotonus albifrons: MCZ 52011, 1 (CS); MCZ 52013, 1 (CS); MHNG 240761, 1(CS); USNM 260256, 1 (CS).
Apterotonus apurensis: USNM 228869, 1 (CS).
Apterotonus cf. rostratus: MCZ 52023, 1 (CS); MCZ 52024, 1 (CS).
Apterotonus cuchillejo: MBUCV 6974, 1 (CS, paratype).

Apteronotus cuchillo: MBUCV 7554, 1 (CS); MCZ 52010, 1 (CS, paratype); USNM 121591, 1 (holotype); USNM 121857, 13 (paratypes); USNM 121590, 6 (CS, paratypes).
Apteronotus eschmeyeri: CAS 72115 (holotype); IAVHP 3304, 1; IAVHP 3304, 8 (paratypes).
Apteronotus rostratus: MBUCV 10926, 2 (CS).
Compsaraia compsus: USNM 373018, 1 (CS).
Magosternarchus ducis: USNM 373268, 1 (CS).
Megadontogathus kaitukaensis: INPA 3936, 1 (CS).
Orthosternarchus tamandua: USNM 373072, 2; USNM 373017, 1 (CS).
Parapteronotus hasemani: MUSM 21897, 1.
Porotergus gimbeli: USNM 372998, 33 (2 CS).
Porotergus gymnotus: CAS 62035, 2 (paratypes).
Sternarchella orthos: FMNH 100746, 1 (CS).
Sternarchogiton labiatus: MCP 37545, 1 (CS).
Sternarchogiton porcinum: MBUCV 19589, 1 (CS).
Sternarchorhamphus muelleri: USNM 228807, 6 (CS); USNM 373030, 5.
Sternarchorhynchus caboclo: INPA 10594, 58 (2 CS).
Sternarchorhynchus curumim: INPA 25256, 1 (CS).
Sternarchorhynchus curvirostris: MCZ 48676, 1.
Sternarchorhynchus gnomus: INPA 35636, 1 (CS).
Sternarchorhynchus mormyrus: USNM 306843, 1 (CS).
Sternarchorhynchus oxyrhynchus: ANSP 162670, 3; MBUCV 12079, 1 (CS); USNM 228787, 8 (1 CS).
Sternarchorhynchus severii: INPA 22898, 2 (CS); INPA 22898, 1 (CS).
Sternarchorhynchus sp.: FMNH 96983, 1 (CS).
Tembeassu marauna: MZUSP 48510 (holotype); MZUSP 23090, 2 (paratypes).
Ubidia magdalenensis: IAVHP 7829, 3; IAVHP 7831, 2; IAVHP 7833, 1; IAVHP 7834, 4; USNM 123795, 1 (paratype).

ACKNOWLEDGMENTS

Support for this project came from a Smithsonian Predoctoral Fellowship in the Division of Fishes, National Museum of Natural History (CDS), and the Herbert R. and Evelyn Axelrod Chair in Systematic Ichthyology, National Museum of Natural History, Smithsonian Institution (RPV). We thank J. Alves-Gomes, J. Armbruster, L. Chao, J. Friel, K. Hartel, C. Hopkins, Z. Lucena, J. Lundberg, D. Nelson, F. Provenzano, M. Sabaj Pérez, L. Rapp Py-Daniel, R. Reis, M. Retzer, R. Robins, M. Rogers, D. Taphorn, and D. Werneke for access to specimens and information. J. Maclaine provided invaluable assistance in clarifying the identity of the holotype of *Sternarchus macrostoma* and generously provided us with photographs and radiographs of specimens pertinent to the question of the identity of that species along with other information. M. Sabaj Pérez provided information on habitats where several samples of both species of *Platyurosternarchus* originated along with photographs that were the basis of the life coloration descriptions. Figures 1 and 5 were prepared by T. Britt Griswold, Figures 2 and 3 by D. Marques, and Figure 4 by S. Raredon who also provided assistance throughout the study. The paper benefited from the comments and suggestions of T. Munroe and C. Ferraris, Jr.

LITERATURE CITED

Albert, J. S. 2001. Species diversity and phylogenetic systematics of American knifefishes (Gymnotiformes,

Teleostei). *Miscellaneous Publications of the Museum of Zoology, University of Michigan* 190:1–129.

- Albert, J. S. 2003. Gymnotiformes: Apterontidae—ghost knifefishes, p. 497–502. *In: Check List of the Freshwater Fishes of South and Central America*. R. E. Reis, S. O. Kullander, and C. J. Ferraris, Jr. (eds.). Edipucrs, Porto Alegre, Brazil.
- Albert, J. S., and R. Campos-da-Paz. 1998. Phylogenetic systematics of Gymnotiformes with diagnoses of 58 clades: a review of available data, p. 419–446. *In: Phylogeny and Classification of Neotropical Fishes*. L. R. Malabarba, R. E. Reis, R. P. Vari, Z. M. S. Lucena, and C. A. S. Lucena (eds.). Edipucrs, Porto Alegre, Brazil.
- Albert, J. S., and W. L. Fink. 1996. *Sternopygus xingu*, a new species of electric fish from Brazil (Teleostei: Gymnotoidei), with comments on the phylogenetic position of *Sternopygus*. *Copeia* 1996:85–102.
- Barbosa, R. I., and A. A. C. Ferreira. 2004. Biomassa acima do solo de um ecossistema de “campina” em Roraima, norte da Amazônia Brasileira. *Acta Amazonica* 34:577–586.
- Campos-da-Paz, R. 1995. Revision of the South American freshwater fish genus *Sternarchorhamphus* Eigenmann, 1905 (Ostariophysi: Gymnotiformes: Apterontidae), with notes on its relationships. *Proceedings of the Biological Society of Washington* 108:29–44.
- Campos-da-Paz, R. 2000. On *Sternarchorhynchus* Castelnau: a South American electric knifefish, with descriptions of two new species (Ostariophysi: Gymnotiformes: Apterontidae). *Copeia* 2000:521–535.
- Cope, E. D. 1878. Synopsis of the fishes of the Peruvian Amazon, obtained by Professor Orton during his expeditions of 1873 and 1877. *Proceedings of the American Philosophical Society* 17:673–701.
- Crampton, W. G. R. 2007. Diversity and adaptation in deep-channel neotropical electric fishes, p. 283–339. *In: Fish Life in Special Environments*. P. Sébert, D. W. Onyango, and B. G. Kapoor (eds.). Scientific Publishers, Inc., Enfield, New Hampshire.
- Crampton, W. G. R., and J. S. Albert. 2006. Evolution of electric signal diversity in gymnotiform fishes, p. 647–731. *In: Fish Communication*. F. Ladich, S. P. Collin, P. Moller, and B. G. Kapoor (eds.). Scientific Publishers Inc., Enfield, New Hampshire.
- Eigenmann, C. H. 1910. Catalogue of the fresh-water fishes of tropical and south temperate America. Reports of the Princeton University Expedition to Patagonia, 1896–1899. Volume 3—*Zoology*:375–511.
- Eigenmann, C. H., and W. R. Allen. 1942. Fishes of Western South America, I: The Intercordilleran and Amazonian Lowlands of Peru, II: The High Pampas, Bolivia, and Northern Chile, with a Revision of the Peruvian Gymnotidae, and of the Genus *Orestias*. University of Kentucky, Lexington, Kentucky.
- Eigenmann, C. H., and R. S. Eigenmann. 1891. A catalogue of the fresh-water fishes of South America. *Proceedings of the United States National Museum* 16:1–81.
- Eigenmann, C. H., and D. P. Ward. 1905. The Gymnotidae. *Proceedings of the Washington Academy of Sciences* 7:157–186.
- Ellis, M. M. 1913. The gymnotid eels of tropical America. *Memoirs of the Carnegie Museum* 6:109–195.
- Ferreira, E., J. Zuanon, B. Fosberg, M. Goulding, and R. Briglia-Ferreira. 2007. Rio Branco. Peixes, *Ecología e*

- Conservação de Roraima. Amazon Conservation Association, Instituto Nacional de Pesquisas da Amazônia, Sociedade Civil Mamirauá, Manaus, Brazil.
- Fink, S. V., and W. L. Fink.** 1981. Interrelationships of the ostariophysan fishes (Teleostei). *Zoological Journal of the Linnean Society* 72:297–353.
- Fowler, H. W.** 1915. Note on some gymnotid fishes. *Copeia* 15:2 pages unpaginated.
- Fowler, H. W.** 1945. Los peces del Peru. Catálogo sistemático de los peces que habitan en aguas peruanas. Museo de Historia Natural “Javier Prado”, Lima, Peru.
- Fowler, H. W.** 1951. Os peixes de água doce do Brasil (3.^a entrega). *Arquivos de Zoologia do Estado do São Paulo* 6:205–625.
- Günther, A. C. L. G.** 1870. Catalogue of the Physostomi, containing the Families Gymnotidae, Symbranchidae, Muraenidae, Pegasidae, and of the Lophobranchii, Plecognathi, Dipnoi, Ganoidei, Chondropterygii, Cyclostomata, Leptocardii in the British Museum. *A Catalogue of Fishes in the British Museum* 8:1–549.
- Hilton, E. J., C. Cox Fernandes, J. P. Sullivan, J. G. Lundberg, and R. Campos-da-Paz.** 2007. Redescription of *Orthosternarchus tamandua* (Boulenger, 1898) (Gymnotiformes, Apterontidae), with reviews of its ecology, electric organ discharges, external morphology, osteology, and phylogenetic affinities. *Proceedings of the Academy of Natural Sciences of Philadelphia* 156:1–25.
- Hopkins, C. D.** 1974. Electric communication in the reproductive behavior of *Sternopygus macrurus* (Gymnotoidei). *Zeitschrift für Tierpsychologie* 35:518–535.
- Hoz, E. de la, and M. Chardon.** 1984. Skeleton, muscles, ligaments and swim-bladder of a gymnotid fish, *Sternopygus macrurus* Bloch & Schneider (Ostariophysi Gymnotoidei). *Bulletin de la Société Royale des Sciences de Liège* 53:9–53.
- Lasso, C. A., D. Lew, D. C. Taphorn, C. DoNascimento, O. Lasso-Alcalá, F. Provenzano, and A. Machado-Allison.** 2004b. Biodiversidad ictológico continental de Venezuela. Parte 1. Lista de especies y distribución por cuencas. *Memoria de la Fundación La Salle de Ciencias Naturales* 159–160 (for 2003):105–195.
- Lasso, C. A., J. I. Mojica, J. S. Usma, J. A. Maldonado, C. DoNascimento, D. C. Taphorn, F. Provenzano, O. M. Lasso-Alcalá, G. Galvis, L. Vásquez, M. A. Lugo, R. Royero, C. Suárez, and A. Ortega-Lara.** 2004a. Peces de las cuencas del río Orinoco. Parte I: lista de especies y distribución por subcuencas. *Biota Colombiana* 5:95–158.
- Mago-Leccia, F.** 1994. Electric fishes of continental waters of America. *Biblioteca de la Academia de Ciencias Físicas, Matemáticas y Naturales, Caracas, Venezuela* 29:1–225.
- Mago-Leccia, F., J. G. Lundberg, and J. N. Baskin.** 1985. Systematics of the South American freshwater fish genus *Adontosternarchus* (Gymnotiformes, Apterontidae). *Contributions in Sciences, Natural History Museum of Los Angeles County* 358:1–19.
- Ortega, H., and R. P. Vari.** 1986. Annotated checklist of the freshwater fishes of Peru. *Smithsonian Contributions to Zoology* 437:1–25.
- Patterson, C.** 1975. The braincase of pholidophorid and leptolepid fishes, with a review of the actinopterygian braincase. *Philosophical Transactions of the Royal Society of London, Series B* 269:275–579.
- Reis, R. E., S. O. Kullander, and C. J. Ferraris, Jr. (eds.).** 2003. *Check List of the Freshwater Fishes of South and Central America*. Edipucrs, Porto Alegre, Brazil.
- de Santana, C. D., O. Castillo, and D. Taphorn.** 2006. *Apterontus magoi*, a new species of ghost knifefish from the Río Orinoco basin, Venezuela (Gymnotiformes: Apterontidae). *Ichthyological Exploration of Freshwaters* 17:275–280.
- Taphorn, D., R. Royero, A. Machado-Allison, and F. Mago-Leccia.** 1997. Lista Actualizada de los Peces de Agua Dulce de Venezuela, p. 55–100. *In: Vertebrados Actuales y Fósiles de Venezuela*. E. La Marca (ed.). Museo de Ciencia y Tecnología de Mérida, Mérida, Venezuela.
- Taylor, W. R., and G. C. Van Dyke.** 1985. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. *Cybiurn* 9:107–119.
- Triques, M. L.** 2005. Análise cladística dos caracteres de anatomia externa e esquelética de Apterontidae (Teleostei: Gymnotiformes). *Lundiana* 2:121–149.
- Triques, M. L.** 2007. Família Apterontidae, p. 123–125. *In: Catálogo das Espécies de Peixes de Água Doce do Brasil*. P. A. Backup, N. A. Menezes, and M. S. Ghazzi (eds.). Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil.
- Weitzman, S. H.** 1974. Osteology and evolutionary relationships of the Sternoptychidae, with a new classification of stomioid families. *Bulletin of the American Museum of Natural History* 153:327–478.