# SYSTEMATICS OF THE SOUTH AMERICAN FRESHWATER FISH GENUS *ADONTOSTERNARCHUS* (GYMNOTIFORMES, APTERONOTIDAE)

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**ABSTRACT.** The apteronotid fish genus *Adontosternarchus* Ellis, 1912, is revised, and characters are presented as evidence for the monophyly of the genus and of the interrelationships of its member species. Four species are recognized of which two are described as new: *A. sachsi* (Peters, 1877), *A. balaenops* (Cope, 1878), *A. devenanzii* new species, and *A. clarkae* new species. The known distribution of each species is plotted and a key to species is provided. Recent collections in channels of the lower Orinoco River show *A. sachsi* and *A. devenanzii* to be extremely abundant.

**RESUMEN.** Este trabajo es una revisión sistemática del género apteronótido *Adontosternarchus* Ellis, 1912, e incluye la presentación de caracteres que evidencian su condición monofilétiea, asi como también una hipótesis explícita de interrelaciones entre sus especies integrantes. Se reconocen cuatro especies en el género, de las cuales dos son nuevas para la ciencia: *A. sachsi* (Peters, 1877), *A. balaenops* (Cope, 1878), *A. devenanzii* sp. n. y *A. clarkae* sp. n. La distribución geográfica conocida para cada especie se muestra en mapas. Asi mismo, se señala que colecciones recientes hechas en los canales del Bajo Orinoco revelaron la extraordinaria abundancia de las especies *A. sachsi* y *A. devenanzii.*

## INTRODUCTION

The genus *Adontosternarchus* was established by Ellis (1912: 424) to distinguish apteronotids characterized by "Teeth wanting; lower jaw with a distinct V-shaped median groove for the reception of the pointed decurved upper jaw." The type species, by monotypy, and subsequent designation, is *Sternarchus sachsi,* a species described by Peters (1877) based on specimens collected by Dr. Carl Sachs from the Venezuelan llanos, near San Fernando de Apure. Ellis referred to *A. sachsi* all material of *Adontosternarchus* available to him from the Amazon basin. In 1942 Eigenmann and Allen added *Adontosternarchus balaenops* (Cope), a species based on a single poorly preserved specimen from Perú.

Recently we made large collections of *Adontosternarchus* from the Orinoco Delta and middle Orinoco that disclosed the presenee there of two species. Further study demonstrated a basis for recognizing four species in the genus. Only part of the material treated by Ellis represents *A. sachsi.* The fish he illustrated (1913: pl. 22, fig. 3; see our Fig. 9) as *A. sachsi,* and others in the same series, are *A. balaenops,* although he referred the name *balaenops* to *Sternarchella.* We redescribe *A. sachsi* and *A. balaenops,* and describe two additional species as new. One of these is the common middle Orinocan form modern workers have called *A. sachsi* (Mago-Leccia, 1967, fig. 10; 1970). The other was discovered among specimens provided to us by Ms. Kate Clark from the Río Negro, Venezuela, near the Brazilian border, and now is known to be widespread in the Amazon system.

## METHODS AND MATERIALS

Specimens, carefully straightened and pinned down, were measured with Helios dial calipers. Head measurements were made under low power magnification. Gymnotiform fishes often suffer damage (predation) to the tail region. Most wounded fish are recognized by their truncated, or abruptly narrowed and/or abruptly depigmented tails, but some individuals often remarkably regenerate the lost tail and fins. Despite careful external examination, apparently nearly complete regeneration occurred in some individuals in our measured samples. These fish are recognized as outliers on the low ends of the scales for measurements involving the tail but otherwise they have near average measurements. This problematic element of morphometric variation makes difficult both the preparation and the use of identification keys. Persons working with gymnotiform fishes should be aware of cryptically damaged but partly regenerated fish. The di-

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agnostic measurements are: Total length (abbreviated TL), length from snout to end of base of anal fin (abbreviated LEA), length of anal fin base, distance from tip of snout to origin of dorsal thong (a fleshy, ray-less filament attached to back over about last third of anal fin and the tail base; minor dissection is often necessary to locate thong's origin), length of tail (starting from posterior end of anal fin base), length of caudal peduncle, distance from snout to origin of anal fin, snout to vent distance, greatest body depth, head length (taken to upper end of soft opercular membrane), eye diameter, distance from snout tip to rictus, and size of branchial opening.

Counts of anal, caudal, and pectoral fin rays were taken with strong transmitted light and include all elements. Vertebral counts (all from radiographs) begin with the first free vertebra behind the compound Weberian complex. This is the first one bearing a full neural spine. The last one counted has its hemal spine immediately behind the base of the last anal fin ray.

Abbreviations used for various institutions are: Academy of Natural Sciences, Philadelphia (ANSP), American Museum of Natural History (AMNH), California Academy of Sciences (CAS), Carnegie Museum (CM, material now at FMNH), Duke University (DU), Field Museum of Natural History (FMNH), Ministerio de Agricultura y Cría, Estación de Puerto Ayacucho, Venezuela (MAC-PAY), Museo de Biología de la Universidad Central de Venezuela (MBUCV), Museum of Comparative Zoology, Harvard University (MCZ), Museu de Zoologia da Universidade de São Paulo, Brazil (MZUSP), National Museum of Natural History, Smithsonian Institution (USNM), Natural History Museum of Los Angeles County (LACM), University of Michigan Museum of Zoology (UMMZ), and Berlin Museum (ZMB).

## *Adontosternarchus* Ellis

*Adontosternarchus* Ellis, 1912:424 (in Ellis, 1912, type species: *Sternarchus sachsi* Peters, 1877, designated subsequently in Ellis, 1913:155 by monotypy).

The valid name *Adontosternarchus* was first published by Ellis (1912) in Eigenmann's monograph on the freshwater fishes of British Guiana. The name and diagnostic characters appeared just once in a key to genera said to inhabit Guianan waters. No *Adontosternarchus* species has been recorded from British Guiana. In his 1913 revision of gymnotiform fishes Ellis provided what he clearly intended to be the original description of this genus and discussion of the only recognized species, *A. sachsi*.

**DIAGNOSIS.** Apteronotid fishes with a unique beak-like, terminal mouth in which the margin of lower jaw is strongly curved to form a V-shaped notch across the mandibular symphysis flanked by elevated flanges and, in turn, the snout is curved downward into notch of mandibles, and the margin of the upper jaw is concave to received the lower. Other diagnostic features are the absenee of teeth at least in individuals over about 30 mm TL, and the slightly to markedly bulbous chin.

**DESCRIPTION.** Body compressed and moderately elongate; dorsal profile of body nearly straight to gently convex; ventral profile of body strongly convex to nearly angular at anal fin origin, nearly straight behind; anal fin origin about under branchial opening; lateral line complete.

Head small, slightly compressed to rounded; its dorsal profile variable, ventral profile nearly straight; mouth small; rictus in advance of center or margin of small eye; chin rounded to bulbous and projecting. The margin of lower jaw is strongly curved to form a V-shaped notch across the mandibular symphysis flanked by elevated flanges and, in turn, the snout is curved downward into notch of mandibles and the margin of the upper jaw is concave to receive the lower.

Eye small; anterior nostril located about midway between tip of snout and anterior margin of eye, opening at end of a short tube; posterior nostril without a tube and located above and slightly in front of anterodorsal margin of eye; branchial membranes joined to isthmus; branchial opening restricted to a short oblique slit in front of base of pectoral fin; anus and short urogenital papilla (both sexes) adjacent, located in large adult fish between raised rims of united branchial membranes, their positions shift relatively forward with growth (Fig. 12).

Anal fin elongate with 135–185 rays (Table 2); caudal and pectoral fins small with 10–22 rays and 12–18 rays respectively (Table 1); body and base of caudal fin scaled; head, fin membranes, and dorsal thong lacking scales; 4–8 rows of enlarged cycloid scales along the flanks, including the pored lateral line scale row; small scales above large scales to dorsal midline, below to anal fin base and onto breast; scales of lower flanks with free ventral or ventroposterior margins, other scales with free posterior margins.

Salient osteological features of *Adontosternarchus* are: premaxillary bone small and connected to maxillary by a long ligament; maxillary bone elongate (Figs. 2A,3); infraorbital series represented only by bony, superficial tubes; supratemporal and pterotic canals of the laterosensory system of the head represented by free bony tubes (Fig. 3); posttemporal fossae absent; cranial fontanelles present, the interfrontal shorter and broader than the interparietal; lateral ethmoids and vomer present; mesopterygoid bone short, edentulous and with a well-developed, ascending process which articulates with orbitosphenoid; preopercular bone broad (Fig. 3); pectoral girdle without mesocoracoid (Fig. 6); cleithrum broad; scapular foramen absent; coracoid with a long ventral process which fails to reach the cleithral symphysis; posttemporal fused to supracleithrum; 4 pectoral radials; 5 branchiostegal rays, the last two greatly broadened, the three anterior more slender (Fig. 4); urohyal small; gill-rakers reduced to small bony nodules covered by cartilage; 3 infrapharyngobranchials, the posteriormost one cartilaginous; 5 epibranchials, the fifth one cartilaginous; upper pharyngeal tooth plate present, strongly connected by a ligament to epibranchial 3 (Fig. 5); 53–64 vertebrae to base of last anal fin ray (Table 4); Weberian apparatus without claustrum.

**ETYMOLOGY.** Greek *a* = without + *odons* = tooth + *sternon* = breast + *archos* = anus. Gender masculine.

**MONOPHYLY AND RELATIONSHIPS.** It is not our purpose in this paper to accomplish a phylogenetic analysis

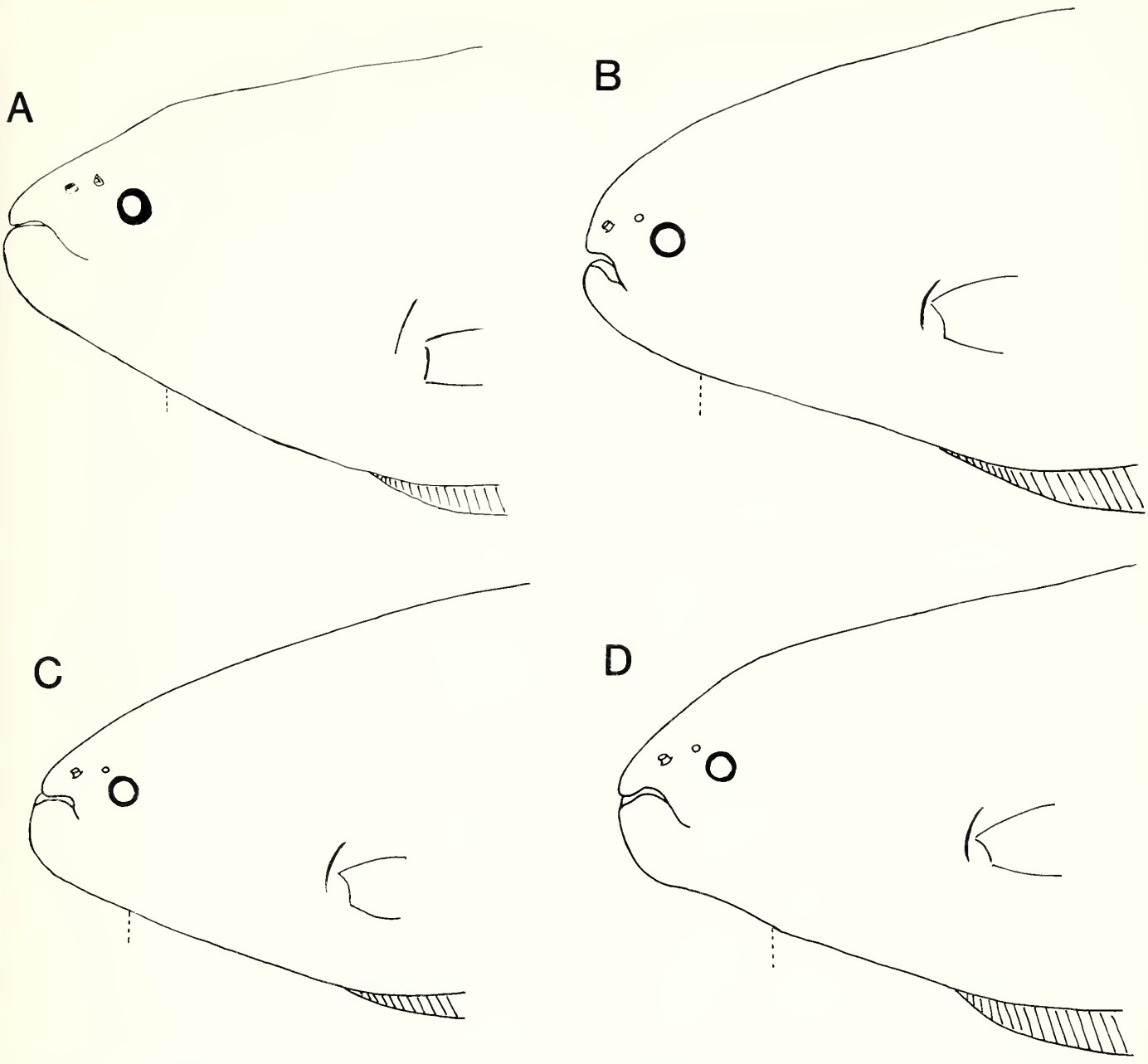



**Figure 1.** Head profiles of *Adontosternarchus* species. A, *A. balaenops;* B, *A. devenanzii;* C, *A. clarkae;* D, *A. sachsi.* Dotted line indicates position of anus.

of the Apteronotidae. One of us (FML) is engaged in a study of that broader subject. However, it is important for future phylogenetic work to point out the evidence for the monophyly of the genus *Adontosternarchus.* The hypothesis of exclusive common ancestry of the four species of *Adontosternarchus* is supported by the two features used by Ellis to erect the genus, i.e., (1) the form of the beak-like snout, bulbous chin and curved mouth (Fig. 1), and (2) the much reduced dentition (Figs. 2, 3). The odd form of the chin is due to the presence of an accessory electric organ formed from sensory nerve fibers (Bennett, 1971). Additionally, we mention the small size of the upper jaw elements, and the elongate premaxillary-maxillary ligament (Figs. 2, 3). Based upon comparisons with other apteronotids and gymnotiforms these characteristics appear to be uniquely shared by the species of *Adontosternarchus.* Of these features only the nearly complete absence of teeth (present only in juveniles) is approached by some other apteronotids (e.g., *Sternarchogiton* and an undescribed form from the lower Orinoco have lost upper jaw teeth but retain dentary teeth) but these taxa do not present facial or gnathal similarities to *Adontosternarchus* which can be interpreted as synapomorphies.

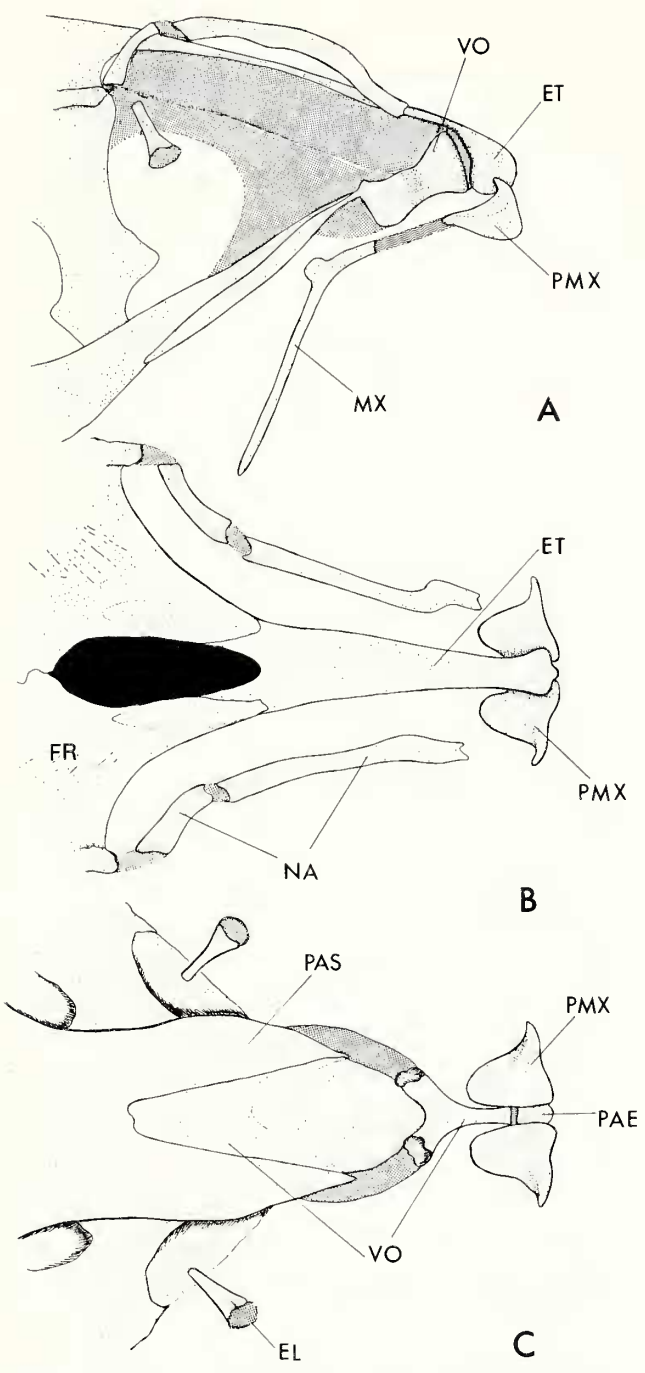



**Figure 2.** Snout region of *Adontosternarchus devenanzii* sp. n. 120.0 mm TL, MBUCV-V-4772. A, lateral view; B, dorsal view; C, ventral view. EL lateral ethmoid, ET ethmoid (=mesethmoid), FR frontal, MX maxillary, NA nasal, PAE anterior piece of ethmoid, PAS parasphenoid, PMX premaxillary, VO vomer.

Certain aspects of morphometric and coloration diversity among the species of *Adontosternarchus* suggest the following hypothesis of interrelationships. *A. sachsi* is taken to be the sister taxon of the three species *A. balaenops, A. devenanzii,* and *A. clarkae* which share a distinctive, boldly mottled color pattern on the back and sides (Figs. 7, 8, 14, 16). The pigmented blotches of this pattern are irregular in outline and generally cover areas larger than a single scale. *A. sachsi* has a nearly uniform coloration of the sides (Fig. 19) although the scale margins are often darker than their centers. This uniform pattern appears certainly to be the primitive condition in *Adontosternarchus* based on outgroup comparison to other apteronotids (*Apteronotus, Porotergus, Sternarchella, Sternarchogiton, Sternarchorhamphus,* and *Sternarchorhynchus*). The relatively deep body form and short tails of *A. balaenops* and *A. devenanzii* (Figs. 10, 11 and species diagnoses) are considered shared derived similarities based on outgroup comparisons; thus these are hypothesized to be sister species. *A. clarkae* and *A. sachsi* are shallower in relation to length and their tails are relatively long, more like the other apteronotids examined. *A. balaenops* and *A. devenanzii* each have their own phyletically advanced color pattern element. *A. balaenops* possesses black anal and pectoral fin membranes. *A. devenanzii* has a narrow pale or yellow stripe along the midline from the chin or snout to the base of the dorsal thong. Other *Adontosternarchus,* most other apteronotids (some species of *Apteronotus* and *Sternarchorhamphus* have black fin membranes; *Apteronotus albifrons* and *Sternarchorhynchus curvirostris* have broad, light, mid-dorsal stripes), sternopygids and rhamphichthyids lack these species-specific novelties. At this time we have not identified uniquely derived character states for either *A. clarkae* or *A. sachsi.*

In the context of our hypothesis on species interrelationships and their geographic ranges, *A. balaenops* (central Amazon) and *A. devenanzii* (middle and lower Orinoco) are sister species which arose in allopatry. Because *Adontosternarchus* is not present in the Guianas it seems likely that the Casiquaire served as the dispersal route for the common ancestor of *balaenops* and *devenanzii* between the Orinoco and Amazon although the basin of its origin is uncertain. Collection records suggest that these species are restricted now to lowland large rivers and lagoons, and perhaps the steeper gradients of the upper Orinoco mitigate against secondary contact.

*A. clarkae* is widespread in the upper parts of major Amazon tributaries. This species is sympatric with *A. sachsi* in the Río Negro and with *A. balaenops* in the Peruvian Amazon. *A. sachsi* is known to occur with *A. devenanzii,* both in great numbers, and *A. sachsi* is expected to be found with *A. balaenops.* The broader distributions of the phylogenetically older species of *A. clarkae* and *A. sachsi* do not suggest simple hypotheses on their speciation pattern and biogeographic history.

## KEY TO SPECIES OF *ADONTOSTERNARCHUS*

1a. Tail short (character not applicable to damaged or regenerated individuals), head length contained less than two times in caudal peduncle length; body depth below origin of dorsal thong greater than or equal to least distance between eye and pectoral fin base; anal and pectoral fin membranes dark, or, a pale stripe on dorsal midline ..... 2

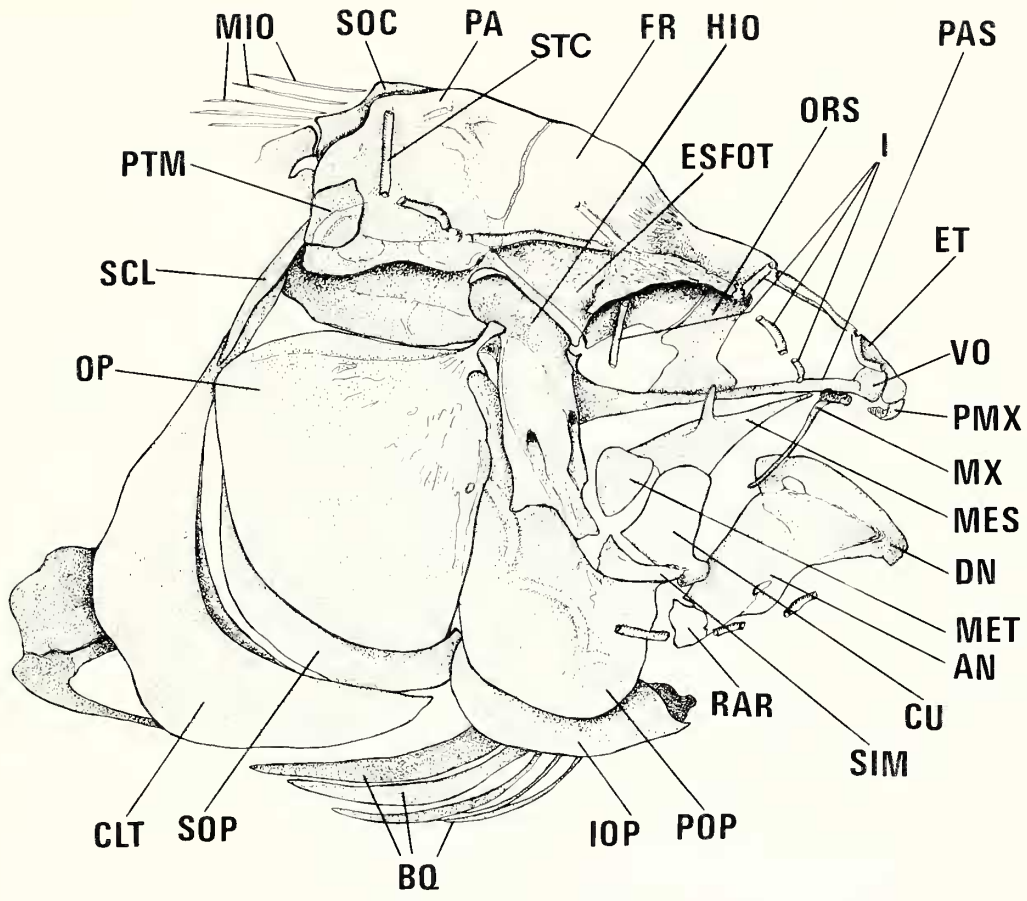



**Figure 3.** Head skeleton and pectoral girdle of *Adontosternarchus devenanzii* sp. n. 120.0 mm TL, MBUCV-V-4772. Lateral view of right side. AN angular, BQ branchiostegal rays, CLT cleithrum, CU quadrate, DN dentary, ET ethmoid (=mesethmoid), ESFOT sphenotic, FR frontal, HIO hyomandibular, I infraorbitals, IOP interopercular, MES mesopterygoid, MET metapterygoid, MIO intermuscular bones, MX maxillary, OP opercular, ORS orbitosphenoid, PA parietal, PAS parasphenoid, POP preopercular, PMX premaxillary, PTM posttemporal, RAR retroarticular, SCL supracleithrum, SIM symplectic, SOC supraoccipital, SOP subopercular, STC supratemporal sensory canal, VO vomer.

1b. Tail long, head length usually contained more than two times in caudal peduncle length; body depth below origin of dorsal thong less than or equal to least distance between eye and pectoral fin base; anal and pectoral fin membranes hyaline and no pale stripe on dorsal midline ..... 3

2a. Interradial membranes of anal and pectoral fins darkly pigmented with black or brown melanophores; no pale stripe on dorsal midline; chin bulbous, often projecting beyond snout; head profile nearly straight (Fig. 1A) .. ..... *A. balaenops* (Cope), Amazon Basin

2b. Interradial membranes of anal and pectoral fins hyaline; a pale (yellow in life) stripe present on dorsal midline, from snout (chin in most specimens) to near origin of dorsal thong; chin rounded and little projected; head profile rounded (Fig. 1B) ..... ..... *A. devenanzii* new species, Orinoco Basin

3a. Back and sides mottled with brown spots; anal rays (135?) 143–163 (Table 2); total pectoral rays 12–15 (Table 1); snout length usually greater than interorbital distance (snout 1.04–1.28 times interorbital width); body deeper, maximum depth contained 3.6 to 5.1 times in distance from snout to origin of dorsal thong (Fig. 9) ..... ..... *A. clarkae* new species, Amazon Basin

3b. Back and sides nearly uniform brown (scale margins have denser concentration of melanophores); anal rays 153–185 (Table 2); total pectoral rays 14–17 (Table 1); snout length usually less than interorbital distance (snout 0.80–1.04 times interorbital width); body shallower, maximum body depth contained 4.5–5.8 times in distance from snout to origin of dorsal thong (Fig. 9) .... ..... *A. sachsi* (Peters), Orinoco and Amazon Basins

## *Adontosternarchus balaenops* (Cope, 1878)

Figures 1A, 7–13

*Sternarchus balaenops* Cope, 1878:682 (original description, single specimens). Eigenmann and Eigenmann, 1891:62 (listed).

*Sternarchella balaenops.* Eigenmann and Ward, 1905:164

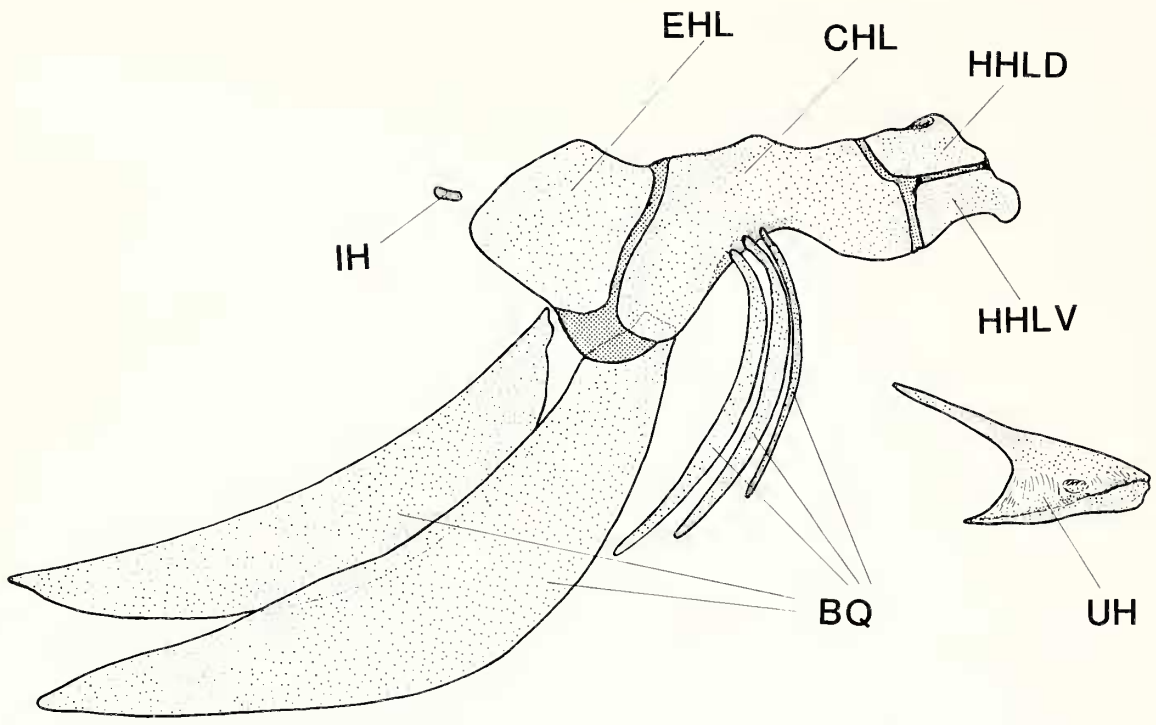



**Figure 4.** Lateral view of the right lower hyoid apparatus of *Adontosternarchus devenanzii* sp. n. BQ branchiostegal rays, CHL ceratohyal, EHL epihyal, HHLD dorsal hypohyal, HHLV ventral hypohyal, UH urohyal, IH interhyal.

(new combination, listed). Eigenmann, 1910:448 (listed). Ellis, 1913:152 (copy of original description, bibliography). Fowler, 1915: second page (characters). Fowler, 1943:121, fig. 68 (profile of type, bibliography). Fowler, 1945:184, fig. 68 (reprint of Fowler, 1943). Fowler, 1951:428 (bibliography).

*Adontosternarchus sachsi.* Ellis, 1913:156, pl. xxii, fig. 3 (in part, Bolivia, San Joaquin, Río Machupo). Eigenmann and Allen, 1942:326 (in part, Perú, Iquitos). Fowler, 1939:278 (characters of single specimen, Perú, near Contamana, Río Ucayali). Fowler, 1951:423, fig. 465 (copied from Ellis, 1913).

*Adontosternarchus balaenops.* Eigenmann and Allen, 1942: 327 (new combination, bibliography).

**MATERIAL EXAMINED.** Holotype of *Sternarchus balaenops:* ANSP 21462, ca. 165 mm; Perú, Loreto State, Pebas, Amazon River.

PERU: ANSP 83968, TL 138 (tail broken), Loreto State, Ucayali River near Contamana.

BRAZIL: MBUCV-V-11522, 2, LEA 173.8 mm (other length measurements not recorded due to damage); Amazonas State, Lago Janauacá. MBUCV-V-13219, 1, TL 168.9 mm, LEA 150.0 mm (both measurements below normal due to damage and regeneration), and MBUCV-V-13220, 2, TL 190–232 mm; Amazonas State, Rio Solimões, Ilha Marchanteria, Lago Camaleão, 25 km SE of Manaus, María Gercilia Mota. MCZ 9338, 1, TL 182 mm (measurement below normal due to damage and regeneration); Amazonas State, Rio Solimões, Manacapuru. MZUSP 6896, TL 146.8 mm, LEA 138.6 mm (both measurements below normal due to damage and regeneration); Amazonas State, Rio Madeira, 25 km below Nova Olinda. MZUSP 24954, 3, TL 168.1–188.9 mm, LEA 154.2–167.8 mm (measurements below normal due to damage and regeneration); Amazonas State, Rio Solimões, Lago Janauacá and vicinity. USNM 261385, 2,

**Table 1. Frequency distributions of pectoral fin ray and caudal fin ray counts in *Adontosternarchus*.**

| | Pectoral fin rays (one fin counted per fish) | | | | | | | Caudal fin rays | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| *balaenops* | | | | 2 | 5 | 2 | 1 | | | | 1 | | 2 | | | 3 | 1 | 1 | | |
| *devenanzii* | | | 13 | 11 | 6 | | | | | | | | 1 | 4 | 5 | 9 | 7 | 6 | 1 | 2 |
| *clarkae* | 5 | 7 | 6 | 3 | | | | 1 | | 2 | 1 | 6 | | 4 | | | | | | |
| *sachsi* | | | 11 | 19 | 12 | 1 | | | | | | 1 | 7 | 9 | 6 | 10 | 2 | 1 | | 1 |

TL 151–163 mm, and USNM 229407, 1, TL 148.8 mm, LEA 136.4 mm (measurements below normal due to damage and regeneration); Amazonas State, Lago do Janauari, Lago Terra Preta.

BOLIVIA: FMNH 54568 (formerly CM 3199), 5 (originally 6), TL 122.6–163.7 mm, LEA 113.5–139.5 mm (both measurements below normal due to damage and regeneration); Beni State, San Joaquin, Machupo. UMMZ 204883, 9, TL 106–124 mm; Beni State, Río Baures, 2 km above mouth.

**DIAGNOSIS.** Tail and caudal peduncle short, head length contained less than two times in peduncle; dorsal thong does not reach end of anal fin; body deep, maximum depth 222–385 thousandths of length to origin of dorsal thong (see Fig. 9); depth below origin of dorsal thong exceeds or equals least distance between eye and pectoral base; head angular, its dorsal profile sloping in nearly straight or slightly concave line to snout; chin projecting (Figs. 1A, 8), interorbital distance does not reach from eye to tip of chin; distance to anal fin origin 172–233 thousandths of length to origin of dorsal thong; 143–179 anal rays (Table 2); 15–18 pectoral rays (Table 1); 13–21 caudal rays (Table 1); back and sides irregularly marked with spots and blotches; no pale dorsal midline stripe; pectoral and anal fin interradial membranes dark brown or black.

**DESCRIPTION.** Measurements in thousandths of reference dimension. Body depth about 162–196 of LEA, 225–315 of length to origin of dorsal thong, 190–228 of anal fin base 1108–1521 of head length; depth at nape 152–214 of length to origin of dorsal thong, 767–1032 of head length; dorsal profile of body gently convex, more so behind the head; preanal fin distance 137–167 of LEA, 156–195 of anal fin base, 171–242 of length to origin of dorsal thong (Fig. 11); caudal peduncle 114–161 of LEA, 133–184 of anal fin base.

Head somewhat compressed, its length 171–223 of length to origin of dorsal thong; distance from snout tip to rictus 673–1056 of snout length; chin rounded; end of snout bluntly pointed; snout length 254–295 of head length, 818–1111 of interorbital distance; both jaws edentulous in adults.

Eye diameter 75–115 of head length, 272–406 of snout length, 269–377 of interorbital distance; interorbital distance 254–323 of head length; branchial opening 197–345 of depth at nape, 169–293 of head length; distance from tip of snout to vent 82–95 of LEA, vent shifts relatively anteriad with growth (Fig. 12).

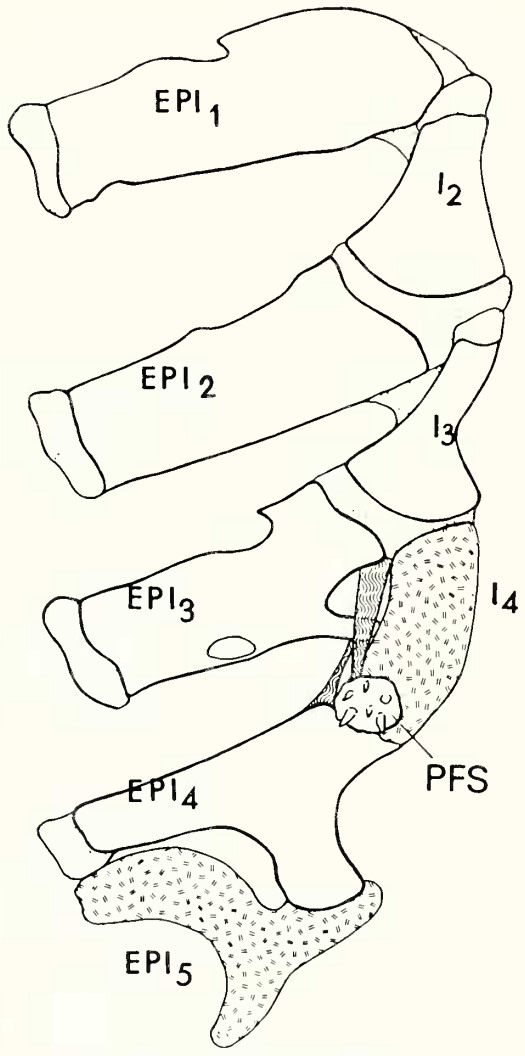



**Figure 5.** Upper pharyngeal tooth plate (PFS) and associated bones of *Adontosternarchus devenanzii* sp. n. EPI 1–5 epibranchials, I 2–4 infrapharyngobranchials. EPI 5 and I 4 are cartilaginous. I 1 is absent.

Anal fin base about 857–913 of LEA; length of pectoral fin 725–965 of head length.

53–60 vertebrae to base of last anal fin ray.

Background color in alcohol tan to brown; sides and back mottled with brownish-black chromatophores; spots and large

**Table 2. Frequency distribution of anal fin rays in *Adontosternarchus*.**

| | Anal fin rays (grouped by twos) | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 135 | 137 | 139 | 141 | 143 | 145 | 147 | 149 | 151 | 153 | 155 | 157 | 159 | 161 | 163 | 165 | 167 | 169 | 171 | 173 | 175 | 177 | 179 | 181 | 183 | 185 |
| *balaenops* | | | | | 1 | | 1 | 2 | 3 | 2 | | | 1 | 2 | 1 | | 1 | 2 | | | | | 1 | | | |
| *devenanzii* | | | | | | | 2 | 2 | 2 | 8 | 5 | 6 | 4 | 5 | | 2 | | | | 1 | | | | | | |
| *clarkae* | 1 | | | | 1 | 3 | | 2 | 1 | 6 | 1 | 2 | 2 | | 2 | | | | | | | | | | | |
| *sachsi* | | | | | | | | | | 1 | 1 | 1 | | 2 | 4 | 3 | 4 | 4 | | 3 | 5 | 3 | 7 | | 1 | 1 |

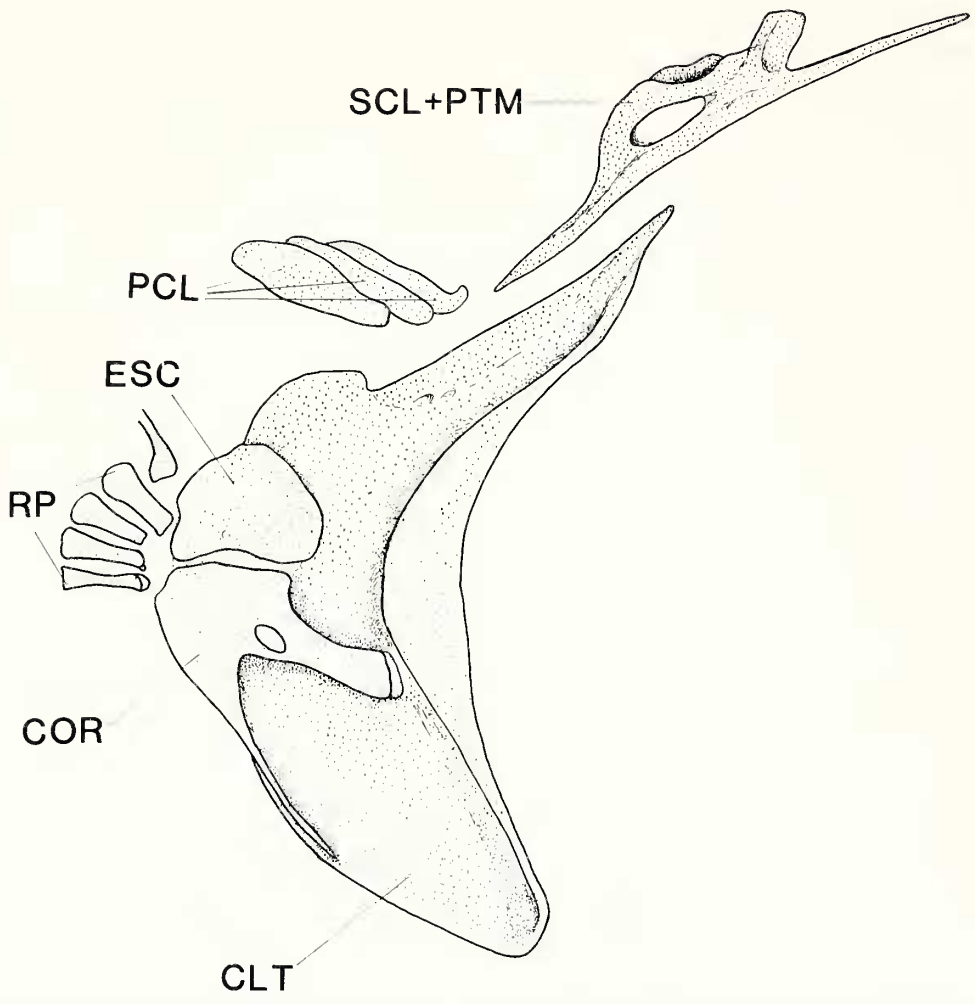



**Figure 6.** Medial view of the left pectoral girdle of *Adontotosternarchus devenanzii* sp. n. CLT cleithrum, COR coracoid, ESC scapula, PCL postcleithra, PTM posttemporal, RP pectoral radials, SCL supracleithrum.

dense blotches scattered irregularly on sides and dorsum; dorsal midline without a pale stripe; dorsal thong with hyaline ground color but otherwise colored as the back; lateral line sensory canal evident as a thin pale broken line on sides; lower sides with scattered superficial spots underlain with numerous dark, ventroposteriorly oblique lines formed by deep chromatophores and spaces between anal bases; anal fin membrane mostly black but few or no chromatophores over rays; caudal fin (all regenerated in material examined) mostly hyaline or with a light peppering of chromatophores at the base; anal and pectoral fin membranes mostly black except over the rays; top and upper sides of head pigmented as the body, tip of snout with a pale area; chin dusky or pale; lateral margin of upper lip pale; sides and under surface of

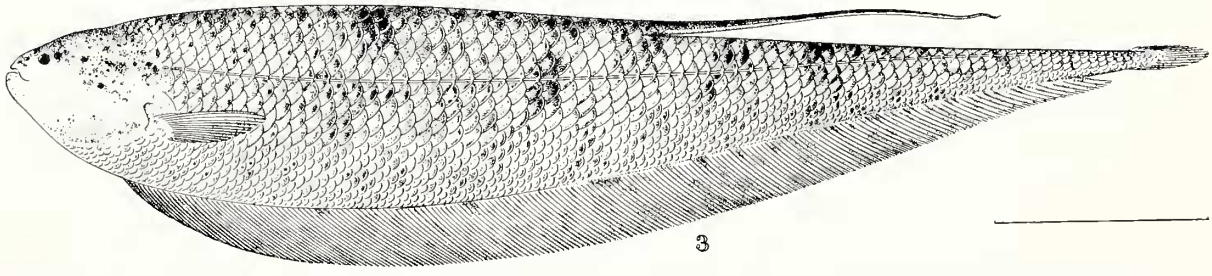



**Figure 7.** Lateral view of *Adontosternarchus balaenops* (CM 3199, 140 mm); reproduced from Ellis (1913, plate XXII, fig. 3) with permission of the Carnegie Museum.

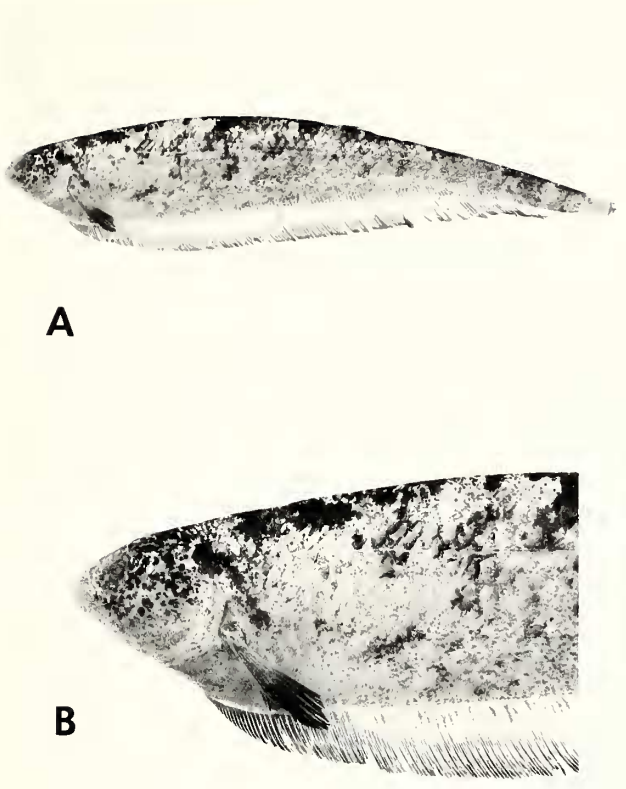



**Figure 8.** *Adontosternarchus balaenops* (Cope), 174.0 mm TL, Lago Janauacá, Rio Solimões, Amazonas, Brazil. A, entire fish; B, close up of head.

head paler, with variable amount of scattered chromatophores; tube of anterior naris immaculate.

**DISTRIBUTION.** *Adontosternarchus balaenops* is thus far known from the lowlands (< ca. 200 m elevation) of the Amazon River Basin of Brazil, Perú, and Bolivia (Fig. 13).

**REMARKS.** The original description of *A. balaenops* was based on a single specimen that had become severely distorted and damaged through desiccation. Ellis, following Eigenmann and Ward (1905), assigned the species to *Sternarchella,* a genus defined in part by the presence of small teeth in both jaws. The holotype, however, shows neither gnathal dentition, nor the nearly straight dorsal profile of *Sternarchella* (Ellis, 1913:151, fig. 14), but does exhibit features of the distinctive snout and jaws of *Adontosternarchus* (Fig. 1). Without explicit justification Eigenmann and Allen (1942) transferred *balaenops* to *Adontosternarchus.* One feature of

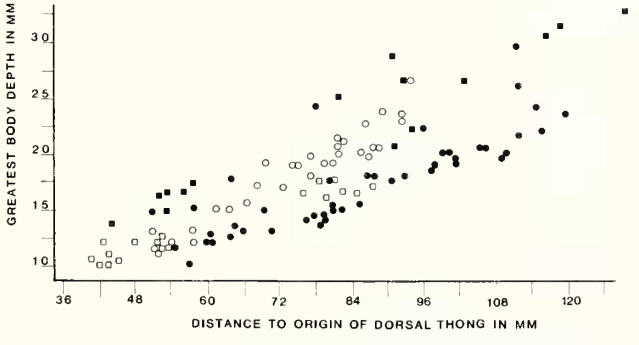



**Figure 9.** Greatest body depth versus distance to origin of dorsal thong in *Adontosternarchus;* closed squares, *balaenops;* open squares, *clarkae;* closed circles, *sachsi;* open circles, *devenanzii.*

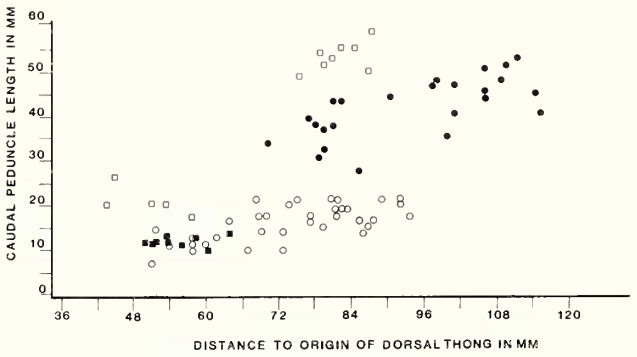



**Figure 10.** Caudal peduncle length versus distance to origin of dorsal thong in *Adontosternarchus;* closed squares, *balaenops;* open squares, *clarkae;* closed circles, *sachsi;* open circles, *devenanzii.*

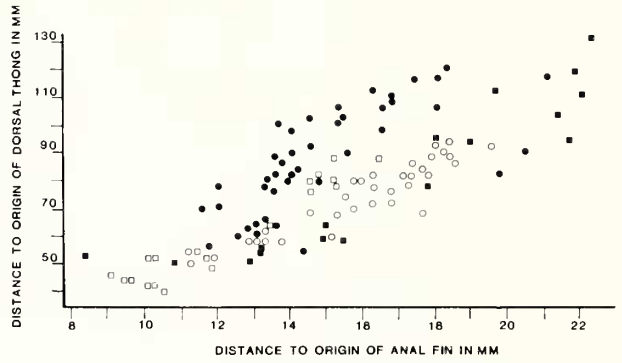



**Figure 11.** Length to origin of dorsal thong versus distance to origin of anal fin in *Adontosternarchus;* closed squares, *balaenops;* open squares, *clarkae;* closed circles, *sachsi;* open circles, *devenanzii.*

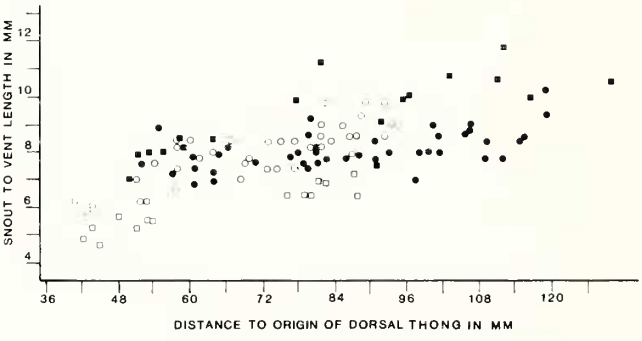



**Figure 12.** Snout to vent length versus distance to origin of dorsal thong in *Adontosternarchus;* closed squares, *balaenops;* open squares, *clarkae;* closed circles, *sachsi;* open circles, *devenanzii.*

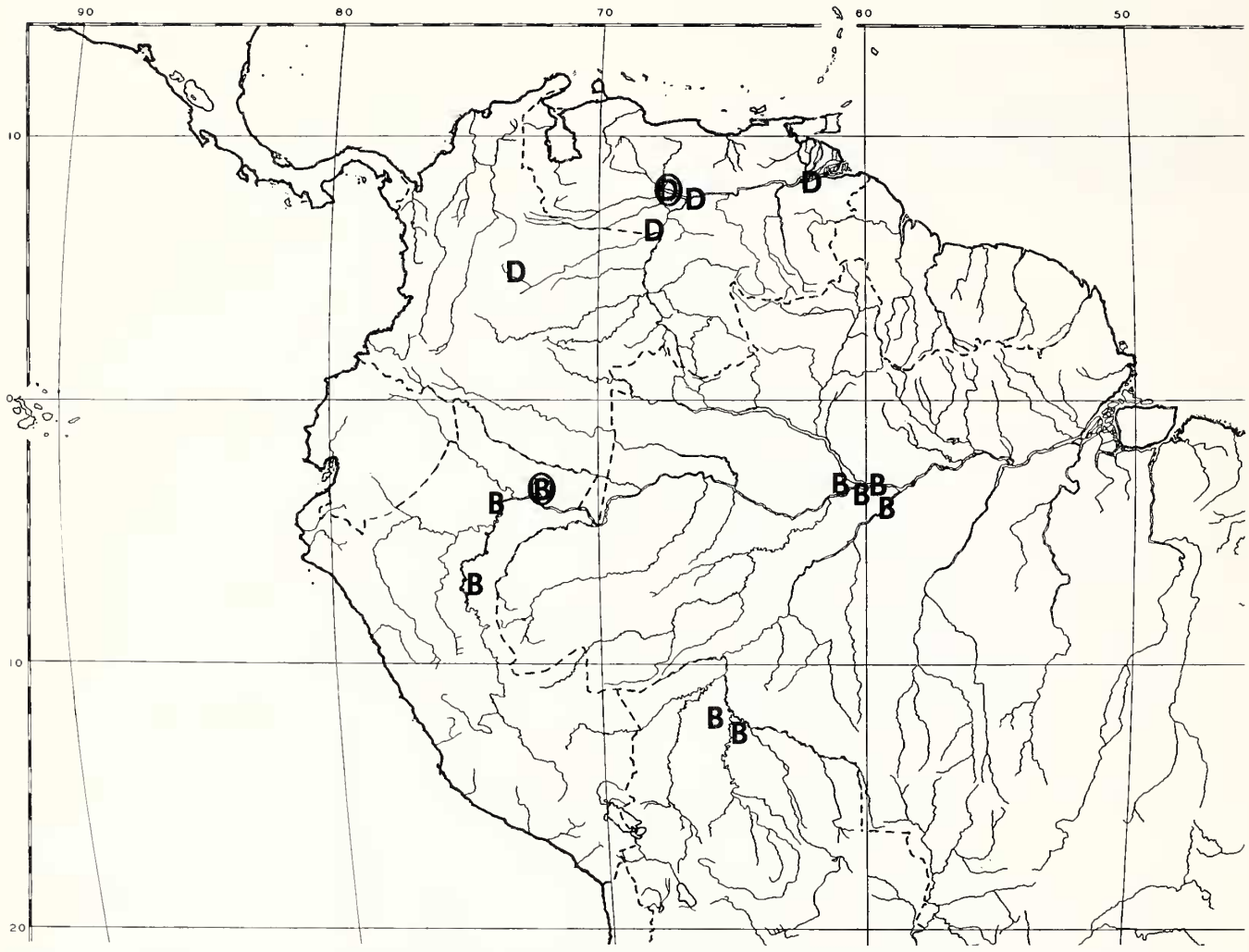



**Figure 13.** Geographic distribution of *Adontosternarchus balaenops* (B) and *A. devenanzii* (D); circled symbols = type localities; some symbols represent more than one collection locality or lot of specimens (see especially text section on distribution under *A. devenanzii* and Fig. 15).

the holotype that early concerned us as not being a character of *Adontosternarchus* is its concave, rather than bulbous chin. This, however, is clearly a result of desiccation at some point in the specimen's history; we find exactly the same concave chin shape with projecting lower lip in purposely dried specimens of *Adontosternarchus*. We fully agree with Eigenmann and Allen's generic placement of *balaenops*.

Cope's description of the type of *balaenops* offers little help in determining its relationship to the material examined by us. He wrote (1878:682),

> "Profile oblique, with a depression between the orbits; snout short and much narrowed; lower jaw large, projecting beyond the upper both anteriorly and laterally, enclosing the latter somewhat as in a whalebone whale. The fissure of the mouth is short, only reaching the vertical line from the anterior nostril. Eyes small, without free border, much nearer the snout than the gill-opening, one twelfth the length of the head, which latter enters the length without the caudal fin, 8.5 times. The depth at the base of the dorsal thong is equal to the length of the head. Anal radii 171. Scales very large, in only nine longitudinal rows at the base of the dorsal thong. Color olivaceous, with a pale dorsal band which reaches the dorsal thong, and a pale narrow band on each side near the dorsal band. Length 165 mm.; length to origin of anal 20 mm.; length to base of dorsal thong 96 mm.
>
> This species resembles remotely the *S. schotti* of Steindachner, but differs from it and from all the other species in the much enlarged mandible and large scales."

Most of these features suggest only *Adontosternarchus* in general, with some added specimen damage. Cope's count of 171 anal radials (the fin is missing) may be accurate but it falls within the anal fin ray count range of the two of the other three species recognized herein. (Our count of 156 radials and length measurement of 143 mm indicates that a part of the tail is now missing.) Cope's color notes could be

positively misleading since the pale dorsal bands are created by exposed connective tissue of myosepta; these are not part of the integumentary pigmentation and thus bear no similarity to the pale dorsal band of *A. devenanzii*. In fact, given the poor state of the type nothing can be said of its skin or fin pigmentation. Contrary to Copc's remark, the depth of the body at the base of the dorsal filament does not nearly equal the head length unless he intended to exclude snout and eye. This depth, however, exceeds the least distance between the eye and pectoral base, a character which we have found to be diagnostic of some species. Furthermore, the maximum body depth is contained a little less than 4½ times in the length to the origin of the dorsal thong (Fig. 9). These two expressions of a relatively deep body characterize two otherwise distinguishable species of *Adontosternarchus:* the Orinocan *A. devenanzii,* and the central Amazonian species to which we here apply the name *A. balaenops.* Our decision is based on the depth measurements and known geographic distribution of the two species. Other possible diagnostic features are not preserved in the type. Ours is a conservative course that avoids coining a likely superfluous binomen. We do recognize that, if the two species are someday found sympatric and no other diagnostics are discovered, *balaenops* might become a *nomen dubium.*

## *Adontosternarchus devenanzii* new species
"De Venanzi's knifefish"

Figures 1B, 2–7, 9–15

*Adontosternarchus sachsi.* Mago-Leccia, 1967:257, fig. 10 (Venezuela). Mago-Leccia, 1970:77 (listed). *Adontosternarchus* sp. López, Lundberg, and Marsh, 1984:333 (Venezuela, Río Orinoco Delta).

**HOLOTYPE.** MBUCV-V-7513, 1, TL 133.4 mm, LEA 113.0 mm (see Table 3); Venezuela, Caño Caujarito, tributary of Río Portuguesa, 3 km above La Unión, Guarico State, 23 Aug. 1974, J.N. Baskin, J.O. Silva, and L. Aguana.

**PARATYPES.** VENEUZUELA: MBUCV-V-4772, 20, TL 71.2–159.8 mm; Cãno Caracara tributary of Río Meta, Apure State, 10 March 1967, F. Mago-Leccia and J. Mosco (4 specimens cleared and stained). MBUCV-V-5139, 1, TL 106.8 mm; Caño Cocuiza, Tabirito bridge, near Caicara del Orinoco, Bolivar State, 27 Feb. 1969, F. Mago-Leccia and party. MBUCV-V-5984, 1, TL 116.5 mm; Esteros de Camaguan, Guarico State, 6 Aug. 1971, A. Machado. MBUCV-V-7516, 4, TL 111.0–135.9 mm; Boca Ruido lagoon, Río Portuguesa system, Guarico State, 8 Aug. 1971, F. Mago-Leccia. MBUCV-V-9301, 5, TL 85.9–123.7 mm; Modulos de Mantecal, Apure State, 1 June 1974, L. Aguana and A. Machado. MBUCV-V-12701, 4, TL 146.2–186.2 mm; Esteros de Camaguan, Guarico State, 25 April 1980, F. Provenzano, O. Castillo, and L. Aguana. The following material collected by J.N. Baskin, J.G. Lundberg, and F. Mago-Leccia. MBUCV-V-10385, 3, TL 154.6–162.5 mm; Río Orinoco, Los Castillos, southside of channel, Delta Amacuro Territory, 16 Feb. 1978. MBUCV-V-10486, 1, TL 137.7 mm; Río Orinoco, main channel North of Isla Tres Caños, at Caño Araguaíto, Delta Amacuro Territory, 19 Feb. 1978. MBUCV-V-10497, 6, TL 115.1–144.5 mm; Río Orinoco, upstream from Caño Tres Caños, Delta Amacuro Territory, 19 Feb. 1978. MBUCV-V-10528, 1, TL 152.9 mm; Río Orinoco, 2 km downstream from Barancas, Delta Amacuro Territory, 17 Feb. 1978. MBUCV-V-10535, 3, TL 126.8–174.7 mm; Río Orinoco, Los Castillos, Delta Amacuro Territory, 16 Feb. 1978. MBUCV-V-10580, 1, TL 125.6 mm; Río Orinoco, Tapatapa lagoon in Isla Tapatapa, Delta Amacuro Territory, 16 Feb. 1978. MBUCV-V-10588, 2, TL 103.4–159.0 mm; Río Orinoco, Brazo Imataca, Delta Amacuro Territory, 22 Feb. 1978. MBUCV-V-10595, 3, TL 110.8–132.0 mm; Río Orinoco, main channel N of Isla Tres Caños at Caño Araguaíto, Delta Amacuro Territory, 19 Feb. 1978. USNM

**Table 3. Measurements in mm and thousandths of length to end of anal fin base (LEA), and counts of meristic characters for holotypes of *Adontosternarchus devenanzii* and *A. clarkae*.**

| | *A. devenanzii* MBUCV-V-7513 | | *A. clarkae* MBUCV-V-12703 | |
|---|---|---|---|---|
| Measurements | mm | mils LEA | mm | mils LEA |
| Total length | 133.4 | 1181 | 172.0 | 1536 |
| LEA | 113.0 | — | 112.0 | — |
| Maximum body depth | 16.6 | 147 | 17.4 | 155 |
| Head depth at nape | 12.9 | 114 | 13.4 | 120 |
| Length to origin of anal fin | 17.6 | 156 | 15.1 | 135 |
| Caudal peduncle length | 13.2 | 117 | 52.9 | 472 |
| Tail length | 20.4 | 181 | 55.0 | 491 |
| Length to origin of dorsal thong | 68.2 | 608 | 80.9 | 722 |
| Head length | 16.0 | 142 | 12.7 | 113 |
| Snout length | 4.5 | 40 | 3.4 | 30 |
| Eye diameter | 1.7 | 15 | 1.4 | 13 |
| Interorbital distance | 4.8 | 42 | 3.9 | 35 |
| Postorbital length | 10.4 | 92 | 8.5 | 76 |
| Size of branchial aperture | 3.1 | 27 | 2.2 | 20 |
| Length to anus | 7.6 | 67 | 6.9 | 62 |
| Length of anal fin base | 99.0 | 876 | 101.2 | 904 |
| Pectoral fin length | 12.5 | 111 | 10.8 | 96 |
| Pectoral fin rays | ii, 13–14 | | ii, 10 | |
| Anal fin rays | 153 | | 154 | |
| Caudal fin rays | 20 | | 16 | |

**Table 4. Frequency distributions of number of vertebrae to base of last anal fin ray in *Adontosternarchus*.**

| | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 |
|---|---|---|---|---|---|---|---|---|
| *balaenops* | 2 | 1 | 4 | 2 | | | | |
| *devenanzii* | | | | 2 | 3 | 2 | 2 | 2 |
| *clarkae* | 2 | 2 | 4 | 1 | 1 | | | |
| *sachsi* | | | 1 | 1 | 2 | 4 | | 3 |

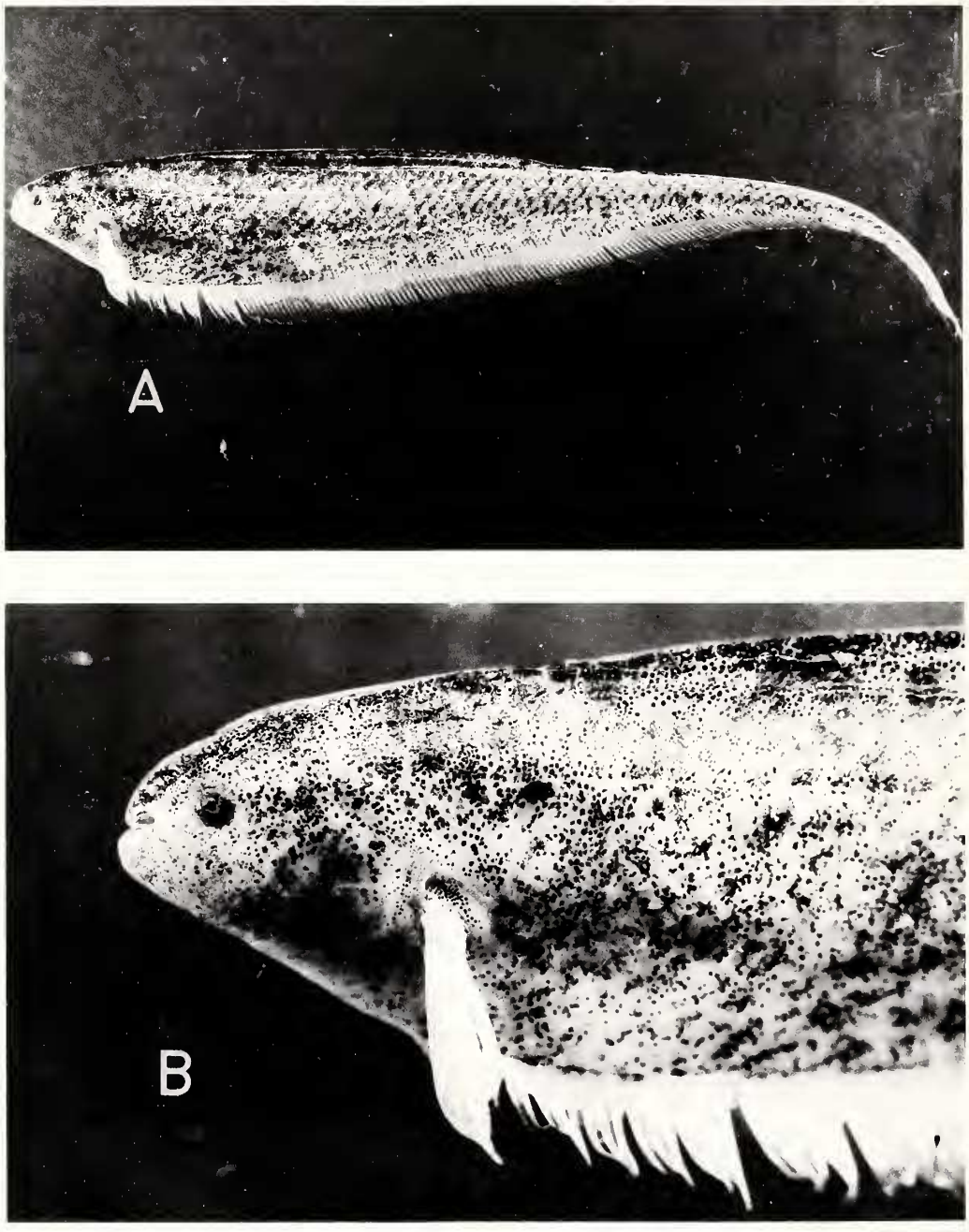
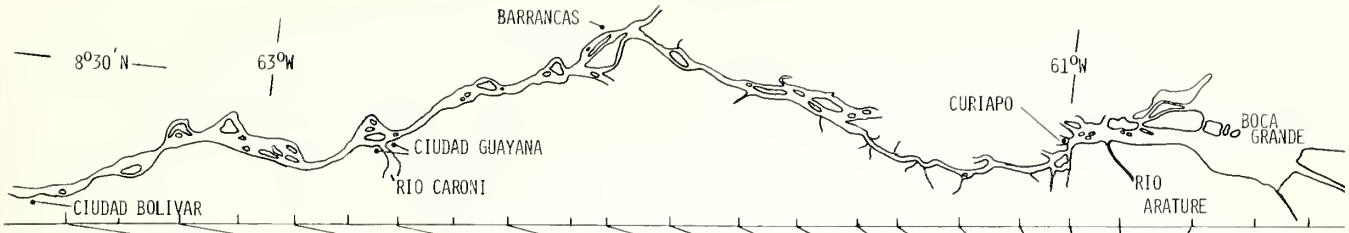



**Figure 14.** *Adontosternarchus devenanzii* sp. n., 154.6 mm TL, MBUCV-V-10385, paratype, Orinoco River, Los Castillos, Venezuela. A, entire fish; B, close up of head.

264839, 68, LEA 84–117 mm; Río Orinoco, main channel S of Isla Portuguesa, Delta Amacuro Territory, 20 Feb. 1978. LACM 43103-1, 75, LEA 90–147 mm; Río Orinoco, main channel N of Isla Fajardo, Delta Amacuro Territory, 14 Feb. 1978. FMNH 94909, 12, LEA 82–130 mm; Río Orinoco, main channel N of Isla Tres Caños, 19 Feb. 1978. CAS 54328, 24 LEA 82–124 mm; Río Orinoco, main channel near Caño Remolina, 25 Feb. 1978. LACM 43295-1, 27, LEA 67–84 mm; Río Orinoco, north shore at Isla Portuguesa in Caño Anabata, Delta Amacuro Territory, 16 Nov. 1979.

COLOMBIA: ANSP 128203, 8, TL 88–130 mm, LEA 76–111 mm; Meta State hacienda Mozambique, Laguna Mozambique, N shore, 20 March 1971, J.E. Böhlke. ANSP 131836, 1, TL 127 mm, LEA 114 mm, Meta State, Quebrada Venturosa between La Balsa and Puerto López, 4°05′N, 72°58′W, 21 March 1975, J.E. Böhlke. ANSP 138859, 1, TL 123 mm, LEA 109 mm; Meta State, Río Metica, N bank of river SW of Laguna Mozambique, 20 Feb. 1972, J.E. Böhlke.

**OTHER MATERIAL.** Additional material of *A. devenanzii* comprising 89 lots and 4594 individuals was collected




| | | | NAUTICAL MILES FROM SEA BUOY: 240 | 230 | 220 | 210 | 200 | 190 | 180 | 170 | 160 | 150 | 140 | 130 | 120 | 110 | 100 | 90 | 80 | 70 | 60 | 50 | 40 | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FEB 1978 (LOW WATER) | DEVENANZII (N=2438) | DEEP RIVER | | | | | | | 82 | | 52 | 28 | 35 | 1103 | 851 | 11 | 12 | 111 | 57 | 65 | 1 | | | 98.8 |
| | | SHALLOW RIVER | | | | | | | | | 23 | | | | | | | | | | | | | 0.9 |
| | | NEAR SHORE | | | | | | | | | | 3 | 2 | | | 1 | | 1 | | | | | | 0.3 |
| | SACHSI (N=652) | DEEP RIVER | | | | | | | 67 | | 73 | 111 | 19 | 120 | 162 | 1 | 1 | 30 | 36 | 6 | 10 | 16 | | 100.0 |
| | | SHALLOW RIVER | | | | | | | | | | | | | | | | | | | | | | |
| | | NEAR SHORE | | | | | | | | | | | | | | | | | | | | | | |
| NOV 1979 (HIGH WATER) | DEVENANZII (N=2184) | DEEP RIVER | | | | | | | | | | | | 1 | 4 | 1 | | | | | | | | 0.3 |
| | | SHALLOW RIVER | | | | | 2 | | 12 | | 6 | | 4 | 2031 | 99 | | | | 10 | | | | | 99.1 |
| | | NEAR SHORE | | | | | | | 3 | | | 3 | 2 | 1 | | | | 5 | | | | | | 0.6 |
| | SACHSI (N=1359) | DEEP RIVER | | | | | | | | | | | | 5 | 4 | 7 | | | | | | | 8 | 1.8 |
| | | SHALLOW RIVER | 1 | | | | 14 | | 117 | | 7 | | | 1014 | 100 | | | | 18 | | 5 | 37 | | 96.9 |
| | | NEAR SHORE | | | | | | | 21 | | | 1 | | | | | | | | | | | | 1.6 |

**Figure 15.** Longitudinal and habitat distribution of *Adontosternarchus sachsi* and *A. devenanzii* in the lower Orinoco River in 1978 and 1979. Values in the table are numbers of specimens taken in the indicated habitat (rows) at the indicated site (columns). (See text section on distribution under *A. devenanzii* for discussion.)

in 1978 and 1979 in the Orinoco River delta region, Venezuela, by J.N. Baskin, J.G. Lundberg, and F. Mago-Leccia from R/V EASTWARD, then of Duke University. This material is deposited in the following institutions: USNM, LACM, FMNH, UMMZ, ANSP, AMNH, and MCZ.

**DIAGNOSIS.** Tail and caudal peduncle short, head length contained in peduncle less than twice; dorsal thong usually does not reach end of anal fin (sometimes extends slightly beyond); body deep, maximum body depth 208–286 thousandths of length to origin of dorsal thong (Fig. 9); depth below origin of dorsal thong exceeds or equals least distance between eye and pectoral fin base; head chubby and rounded, its dorsal profile distinctly convex; chin not markedly projecting (Figs. 1B, 14), interorbital distance reaches from eye to tip of chin or beyond; distance to origin of anal fin 170–256 thousandths of length to origin of dorsal thong; 147–173 anal rays (Table 2); 14–16 pectoral rays (Table 1); 15–22 caudal rays (Table 1); a pale (yellow in life) stripe from chin tip and snout to near origin of dorsal thong (this stripe is occasionally obscured by dark spots or is very rarely obsolescent); pectoral and anal fins hyaline.

**DESCRIPTION.** Measurements in thousandths of reference dimension. Body depth 131–179 of LEA, 208–283 of length to origin of dorsal thong, 138–206 of anal fin base and 104–160 of head length; depth at nape 85–124 of LEA, 137–206 of length to origin of dorsal thong, 90–140 of anal fin base, 765–1020 of head length; dorsal profile of body gently convex, more so behind the head (Fig. 14); preanal fin distance 119–159 of LEA, 195–256 of distance to origin of dorsal thong (Fig. 11), 126–183 of anal fin base; caudal peduncle length 79–204 of LEA, 131–313 of distance to origin of dorsal thong (Fig. 10), 90–228 of anal fin base and 70–168 of total length; tail length 121–236 of LEA, 194–386 of distance to origin of dorsal thong, 133–267 of anal fin base, 108–191 of total length; length to origin of dorsal thong 583–716 of LEA.

Head rounded; head length 107–138 of LEA, 164–209 of distance to origin of dorsal thong, 113–158 of anal fin base and 578–1435 of caudal peduncle; dorsal profile of head convex, smoothly continuous with contour of back (Fig. 14), except in individuals ca. 100 mm TL in which there is often a shallow concavity at the nape; distance from snout tip to rictus 600–953 of snout length; chin rounded (Fig. 1B); end of snout bluntly pointed; snout length 260–298 of head length, 771–1040 of interorbital distance; both jaws edentulous in adults, but carrying conical teeth in juveniles up to ca. 26 mm TL.

Eye diameter 86–142 of head length, 317–500 of snout length, 265–500 of interorbital distance; interorbital distance 250–361 of head length; branchial opening 153–291 of depth at nape, 152–244 of head length; distance from tip of snout to vent 58–99 of LEA, vent shifts relatively anteriad with growth (Fig. 12).

Anal fin base 802–976 of LEA; length of pectoral fin 829–969 of head length.

56–64 vertebrae to base of last anal fin ray.

Background color in alcohol pale tan to yellowish-white; sides and back densely mottled with brownish-black chromatophores; spots and large dense blotches scattered irregularly on sides and dorsum; dorsal midline with a pale stripe from chin and snout to near origin of dorsal thong, irregularly obscured by dark spots or rarely obsolescent; dorsal thong

with a hyaline ground color but superficially spotted; lateral line sensory canal evident as a thin, pale broken line on sides; lower sides with scattered superficial spots underlain with numerous dark, ventroposteriorly oblique lines formed by deep chromatophores and spaces between anal fin bases; anal fin membrane hyaline except usually a few chromatophores present over rays; caudal fin usually with scattered chromatophores, particularly on its base; pectorals hyaline; top and upper sides of head pigmented as the body, the pale stripe of the dorsal midline extending onto tips of snout and chin where it is surrounded by a dark U-shaped band; sides and under surface of head paler, with scattered chromatophores; lateral margin of upper lip pigmented; tube of anterior naris always bears a few chromatophores.

Color in life: background color dark brownish, mottled; head yellow ocher and dark brown; dorsal midline with a yellow stripe; fins all hyaline, except the caudal which is pigmented with a darker area on its base; opercles darker than surrounding areas; snout with dark areas on each side of the midline stripe; chin with a dark U-shaped band.

**ETYMOLOGY.** The name *devenanzii* is for Dr. Francisco De Venanzi, former Rector of the Universidad Central de Venezuela, Caracas, who encouraged the first author to study fishes.

**DISTRIBUTION.** This new species is quite common throughout the Venezuelan and Colombian Low Llanos, the main course of the Río Orinoco and its large tributaries (Fig. 13).

Collections made by us in the Orinoco Delta region in 1978 and 1979 reveal that *Adontosternarchus* are more abundant than prior sampling suggested. In our survey work collections were made with trawls from R/V EASTWARD in deep river channels (10–80 m) and from smaller craft in shallower areas (ca. 10 m), as well as with conventional collecting gear in near shore habitats. The 1978 expedition was in February during the middle of the low water (dry) season; the 1979 expedition was in November near the end of the high water (wet) season. Large numbers of *A. devenanzii* and *A. sachsi* were collected in both years and their distributions along the transects were similar (Fig. 15).

Between 46% and 96% of the total sample of each species in each year were collected between channel markers 120 n,mi and 140 n,mi, the 20 n,mi stretch of river just below the head of the delta (channel markers and lights of the shipping lanes are labelled with distances from the sea buoy which is located about 30 n,mi off Boca Grande). *A. devenanzii* was not taken downstream from the 60 n,mi marker or above the 201 n,mi marker, but *A. sachsi* was found further downstream to the 42 n,mi marker (just 7 n,mi above the transition to brackish water) and further upstream at 241 n,mi. Despite the between-year similarity in longitudinal distribution, both species appear to shift habitat between low and high water seasons. In 1978 (low water) 88.7% of the *A. devenanzii* and 100% of *A. sachsi* were colleeted in bottom trawls in mid-river ehannels usually much greater than 10 m in depth. In 1979 only 11.5% of *devenanzii* and 28.6% of *sachsi* were collected in deep channels even though trawling effort in this habitat was greater in that year (151 vs. 186 deep channel trawls). The largest numbers of *Adontosternarchus* collected in 1979 (57.7% of *devenanzii* and 62.9% of *sachsi*) were taken with a small trawl pulled by a dugout canoe in lagoons and shallow places of the river between about 30 and 110 m from shore (López, Lundberg, and Marsh, 1984). In both years these fishes were rarely captured in near shore habitats. Overall then, it appears that *Adontosternarchus* are bottom-oriented fishes of large rivers and lagoons and that they make marked seasonal movements between the deep channels and the shallow channels and lagoons. The biological significance of this movement remains to be investigated.

## *Adontosternachus clarkae* new species
"Clark's knifefish"

Figures 1C, 9–12, 16–17

**HOLOTYPE.** MBUCV-V-12703, TL 172.0 mm, LEA 112.0 mm (see also Table 3); Venezuela, Raudal (Rapids) de Mavahate, Río Negro, near San Carlos de Río Negro, Amazonas Territory, 6 May 1981, Edgar Armas.

**PARATYPES.** VENEZUELA: MAC-PAY-0369, 3, TL 172–186 mm, LEA 110–119 mm; paratopotypes taken with the type specimen. MBUCV-V-11218, 2, TL 158.6–172.5 mm; rapids downstream from the mouth of the Casiquiare in the Río Negro, about 10 km N of San Carlos de Río Negro, Amazonas Territory, 2 May 1978, Kate Clark and Raimundo Videra. MBUCV-V-11293, 1, TL 162.4 mm; San Carlos de Río Negro, Amazonas Territory, Nov. 1980, Kate Clark. MBUCV-V-11936, 2, TL 168.1–168.5 mm; paratopotypes (one specimen stained).

COLOMBIA: FMNH 94263, 5, TL 73.1–94.8 mm, LEA 68.1–77.4 mm; Amazonas State, Amazon River above Leticia, Nov. 1973, J. Thomerson.

PERU: MZUSP uncatalogued, 2, TL 88.3–133.8 mm, LEA 72.5–109.0 mm; Ucayali State, Río Ucayali, Masisea, H. Ortega, Oet. 1975.

ECUADOR: FMNH 94264, 1, TL 105.3 mm, LEA 75.5 mm; Río Tiputini at confluence with Río Napo, 0°48.9′S, 75°32.5′W, Dec. 1981, D.J. Stewart.

BRAZIL: MCZ 46877, 141, TL 85.0–104.2 mm, LEA 65.3–80.5 mm; Terr. Roraima, Rio Negro near confluence with Rio Branco and lower 30 miles of Rio Branco, 1°24′S, 61°27′W, March–April 1967, Alpha Helix. USNM 266551, 3, TL 95–127 mm; same data as preceding lot. MCZ 46872, 41, TL 60.4–90.9 mm, Rio Negro at 1°24′S, 61°27′W, 2 miles below confluence with Rio Branco, 27–28 March 1967, Alpha Helix. LACM 43645-1, 3, TL 74.1–94.1 mm; same data as preceding lot.

**DIAGNOSIS.** Tail and caudal peduncle long, head length contained in peduncle twice or more; dorsal thong reaches beyond end of anal fin; body depth moderate relative to other species of the genus, maximum body depth 196–278 thousandths length to origin of dorsal thong (Fig. 9); depth below origin of dorsal thong less than or equal to least distance between eye and pectoral base; head angular, its dorsal profile straight or slightly convex; chin projecting (Figs. 1C, 16), interorbital distance reaches from eye to chin tip; distance to origin of anal fin 167–256 thousandths of length to origin

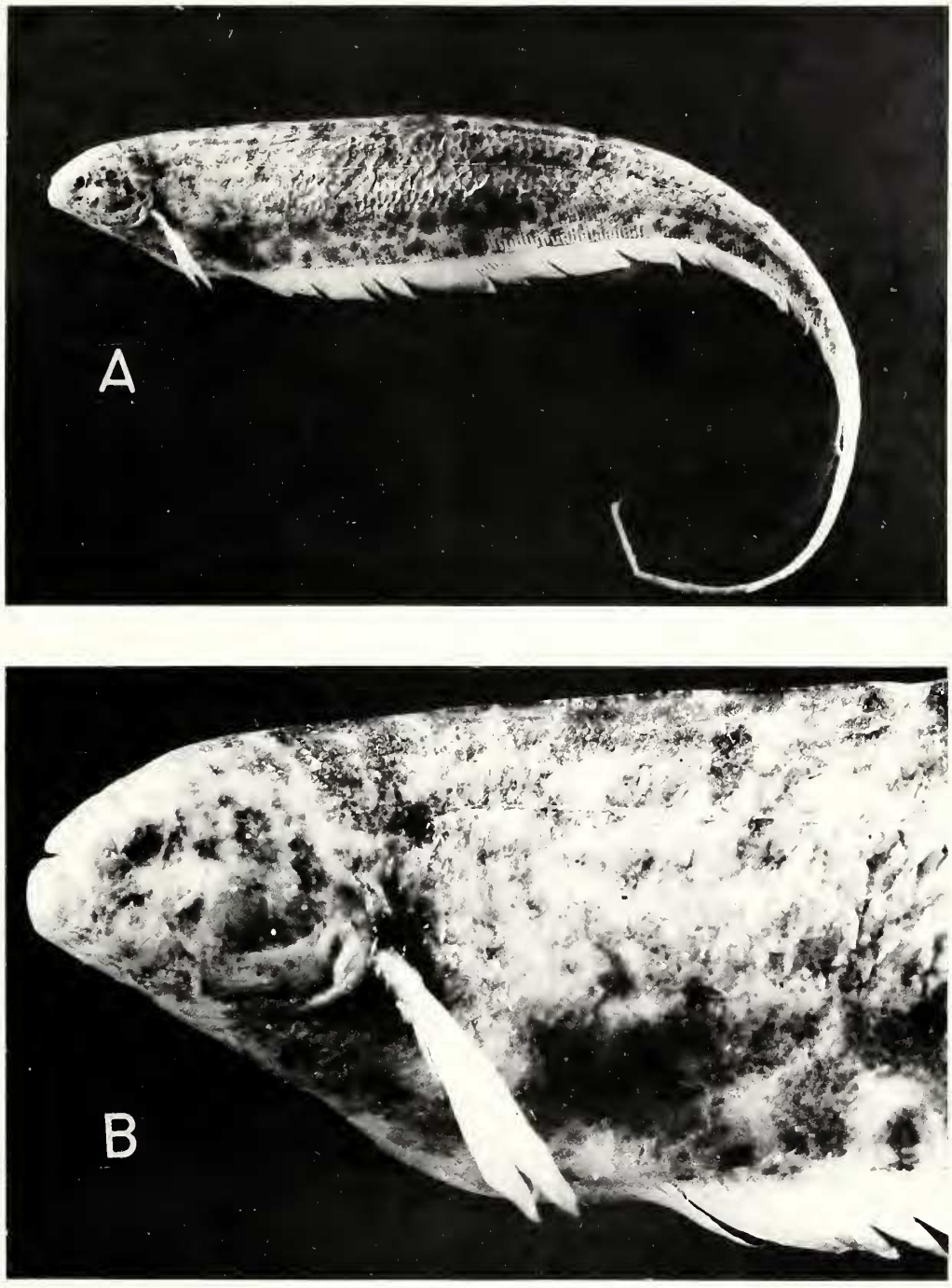



**Figure 16.** *Adontosternarchus clarkae* sp. n., 172.5 mm TL, MBUCV-V-11218, paratype, Río Negro, Amazonas Territory, Venezuela. A, entire fish; B, close up of head.

of dorsal thong; (135 partly regenerated?) 144–164 anal fin rays (Table 2); 12–15 pectoral fin rays (Table 1); 10–16 caudal fin rays (Table 1); back and sides mottled with light and dark brown, oddly shaped spots; no pale dorsal midline stripe; pectoral and anal fins hyaline.

**DESCRIPTION.** Measurements in thousandths of reference dimension. Body depth 138–170 of LEA, 195–278 of length to origin of dorsal thong, 154–199 of anal fin base, 1149–1458 of head length; depth at nape 92–127 of LEA, 126–183 of length to origin of dorsal thong, 105–149 of anal fin base, 730–1118 of head length; dorsal profile of body gently convex more so behind the head (Fig. 16); preanal distance 115–154 of LEA, 166–259 of distance to origin of dorsal thong (Fig. 11), 133–175 of anal fin base; caudal peduncle length 258–495 of LEA, 379–679 of distance to origin of dorsal thong (Fig. 10), 293–549 of anal fin base, 194–318

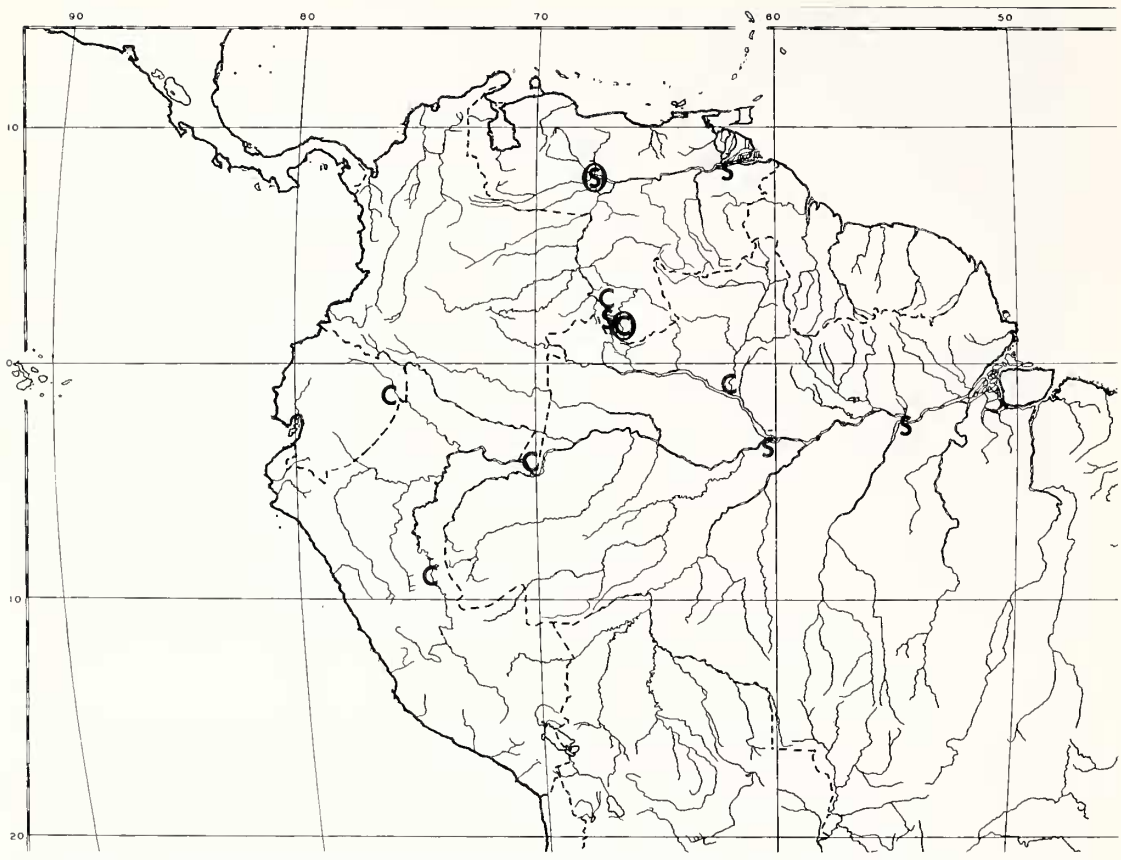



**Figure 17.** Geographic distribution of *Adontosternarchus clarkae* (C) and *A. sachsi* (S); circled letters = type localities; some symbols represent more than one collection locality or lot of specimens (see especially text section on distribution under *A. devenanzii* and Fig. 15 for additional information on *A. sachsi*).

of total length; tail length 310–565 of LEA, 454–765 of distance to origin of dorsal thong, 351–633 of anal fin base, 243–361 of total length; distance to origin of dorsal thong 595–756 of LEA.

Head rounded (head length 104–140 of LEA, 139–228 of length to origin of dorsal thong, 117–158 of anal fin base, 213–495 of caudal peduncle); dorsal profile of head slightly convex, smoothly continuous with contour of back (Fig. 1C); distance from snout tip to rictus 543–1000 of snout length; chin bulbous; end of snout bluntly pointed; snout length 253–303 of head length, 775–1000 interorbital distance; both jaws edentulous in adults.

Eye diameter 85–130 of head length, 294–500 of snout length, 267–458 of interorbital distance; interorbital distance 270–345 of head length; branchial opening 128–268 of depth at nape, 137–242 of head length; distance from tip of snout to vent 54–90 of LEA, vent shifts relatively anteriad with growth (Fig. 12).

Anal fin base 851–919 of LEA; length of pectoral fin 833–1021 of head length.

57–61 vertebrae to base of last anal fin ray.

Background color in alcohol pale tan to yellowish-white; sides and back densely mottled with irregularly scattered, brownish-black blotches; dorsal midline without a pale stripe; dorsal thong with a hyaline ground color but superficially with dark brown blotches; lateral line sensory canal evident as a thin pale broken line on sides; anal fin membrane hyaline except for a few chromatophores present over rays; caudal fin pigmented with small spots and chromatophores more concentrated over its base; pectoral fins hyaline; top and upper sides of head with blotches as the body; lower sides and undersurface of head with scattered blotches and dots; tip of snout, margin of upper lip, tip of chin, and tube of anterior naris always immaculate.

**ETYMOLOGY.** The name *clarkae* is for Ms. Kate Clark, collector of this new species from the Río Negro, Venezuela.

**DISTRIBUTION.** *Adontosternarchus clarkae* is distributed in the upper parts of the Amazon River Basin of Brazil, Venezuela, Colombia, Ecuador, and Perú (Fig. 17). There are no records of it from the lower Amazon. The Venezuelan specimens were collected in black waters near rapids.

## *Adontosternarchus sachsi* (Peters)
## "Sachs' knifefish"

Figures 1D, 9–12, 15, 17–19

*Sternarchus sachsi* Peters, 1877:473 (original description, type locality: San Fernando de Apure, Venezuela). Sachs, 1879:

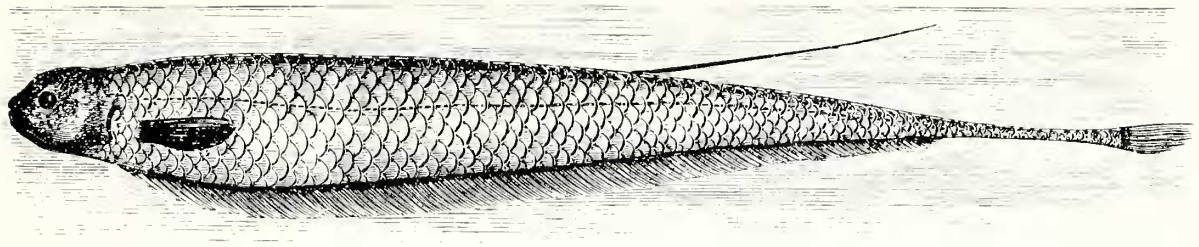


**Figure 18.** *Adontosternarchus sachsi* (Peters) (exact origin and disposition of specimen unknown) reproduced from Sachs (1879:279).

153, 367, fig. on p. 279 (Apure). Eigenmann and Eigenmann, 1891:62 (listed). Röhl, 1942:377, fig. 189 (copied from Sachs).

*Sternarchogiton sachsi.* Eigenmann and Ward, 1905:165 (new combination). Ihering, 1907:275 (listed). Eigenmann, 1910: 448 (listed).

*Adontosternarchus sachsi.* Ellis, 1913:156 (in part). Fowler, 1939:278 (Perú, Contamana). Schultz, 1949:74 (listed, characters). Fowler, 1943:124 (listed). Fowler, 1945:185 (reprint of Fowler, 1943). Fowler, 1951:423 (listed).

**MATERIAL EXAMINED.** VENEZUELA: Photograph of holotype of *Sternarchus sachsi;* ZMB No. 10044; Venezuela, Apure State, San Fernando de Apure. MBUCV-V-11292, 1, TL 165.6 mm; Venezuela, Río Negro, Amazonas Territory, near San Carlos de Río Negro. MBUCV-V-4643, 1, TL 120.8 mm; Río Orinoco, Quiritare, Amazonas Territory. MBUCV-V-10377, 3, TL 152.8–200.5 mm; Río Orinoco, Brazo Imataca, Delta Amacuro Territory. MBUCV-V-10417, 2, TL 190.8–203.0 mm; Río Orinoco, old shipping channel, S of Isla Portuguesa, Delta Amacuro Territory. MBUCV-V-10431, 3, TL 211.1–222.9 mm; Río Orinoco, near Isla Iguana, Delta Amacuro Territory. MBUCV-V-10441, 2, TL 193.4–202.6 mm, Río Orinoco, along S shore by Caño Guine, Delta Amacuro Territory. MBUCV-V-10445, 1, TL 186.4 mm; Venezuela, Río Orinoco, along S shore by Caño Guine, Delta Amacuro Territory. MBUCV-V-10470, 1, TL 169.9 mm; Río Orinoco, main channel E of Isla Portuguesa, Delta Amacuro Territory. MBUCV-V-10495, 3, TL 147.8–180.7 mm; Río Orinoco, Caño Tres Caños, Delta Amacuro Territory. MBUCV-V-10506, 1, TL 200.0 mm; Río Orinoco, near Los Castillos, Delta Amacuro Territory. MBUCV-V-10554, 13, TL 145.5–321.8 mm; Venezuela, Río Orinoco, Isla Veradero, Delta Amacuro Territory (4 specimens stained). LACM 43295-2, 29, LEA 57–85 mm; Rio Orinoco, north shore at Isla Portuguesa in Caño Anabata, Delta Amacuro Territory.

BRAZIL: MZUSP 24925, 2, TL 138.2–160.2 mm, LEA 129.4–141.6 mm Rio Solimões, Lago Janauacá and vicinity. FMNH 54569 and 15187, 15188, 15189, 15190, 15191 (formerly CM 3200), 55, TL 93.4–116.6 mm, LEA 83.2–108.3 mm; Pará State, Santarém.

**OTHER MATERIAL.** Additional material of *A. sachsi* comprising 89 lots and 2011 individuals was taken in 1978 and 1979 in the Orinoco River Delta region, Venezuela, by J.N. Baskin, J.G. Lundberg, and F. Mago-Leccia from R/V EASTWARD, then of Duke University. This material is deposited in the following institutions: USNM, LACM, FMNH, UMMZ, CAS, ANSP, AMNH, and MCZ.

**DIAGNOSIS.** Tail and caudal peduncle long, head contained in peduncle twice or more; dorsal thong reaches beyond end of anal fin; body shallow, maximum body depth 172–222 thousandths of distance to origin of dorsal thong (Fig. 9); depth below origin of dorsal thong less than or equal to least distance between eye and pectoral base; head angular, its dorsal profile variable but not strongly convex; chin projecting (Fig. 1D, 19), interorbital distance not reaching from eye to chin tip; distance to origin of anal fin 137–213 thousandths of distance to origin of dorsal thong; 154–185 anal rays (Table 2); 14–17 pectoral rays (Table 1); 14–22 caudal rays (Table 1); back and sides nearly uniform brown, except for dark margins of some scales; no pale midline stripe; pectoral and anal fins hyaline.

**DESCRIPTION.** Measurements in thousandths of reference dimension. Body depth 116–143 of LEA, 174–218 of distance to origin of dorsal thong, 126–174 of anal fin base, 953–1548 of head length; depth at nape 79–106 of LEA, 119–163 of distance to origin of dorsal thong, 85–129 of anal fin base, 733–1087 of head length; dorsal profile of body scarcely convex to straight (Fig. 19); preanal distance 86–146 of LEA, 137–214 of distance to origin of dorsal thong (Fig. 11), 93–169 of anal fin base; caudal peduncle length 219–366 of LEA, 327–524 of distance to origin of dorsal thong (Fig. 10), 236–404 of anal fin base, 170–257 of total length; tail length 287–426 of LEA, 411–628 of distance to origin of dorsal thong, 306–468 of anal fin base, 217–299 of total length; distance to origin of dorsal thong 621–710 of LEA.

Head slightly compressed (head length 92–135 of LEA, 135–205 of length to origin of dorsal thong, 99–164 of anal fin base, 296–460 of caudal peduncle); dorsal profile of head angular, with a shallow concavity at the nape at all sizes (Fig. 19); distance from snout to rictus 611–1083 of snout length; chin bulbous; snout sharply pointed; snout length 267–323 of head length, 935–1241 of interorbital distance; both jaws edentulous in adults.

Eye diameter 90–136 of head length, 293–484 of snout length, 314–500 of interorbital distance; interorbital distance 242–315 of head length; branchial opening 155–337 of depth at nape, 153–271 of head length; distance from tip of snout to vent 47–143 of LEA, vent shifting anteriad with increasing size (Fig. 12).

Anal fin base 778–951 of LEA; length of pectoral fin 885–1000 of head length.

59–64 vertebrae to base of last anal fin ray.

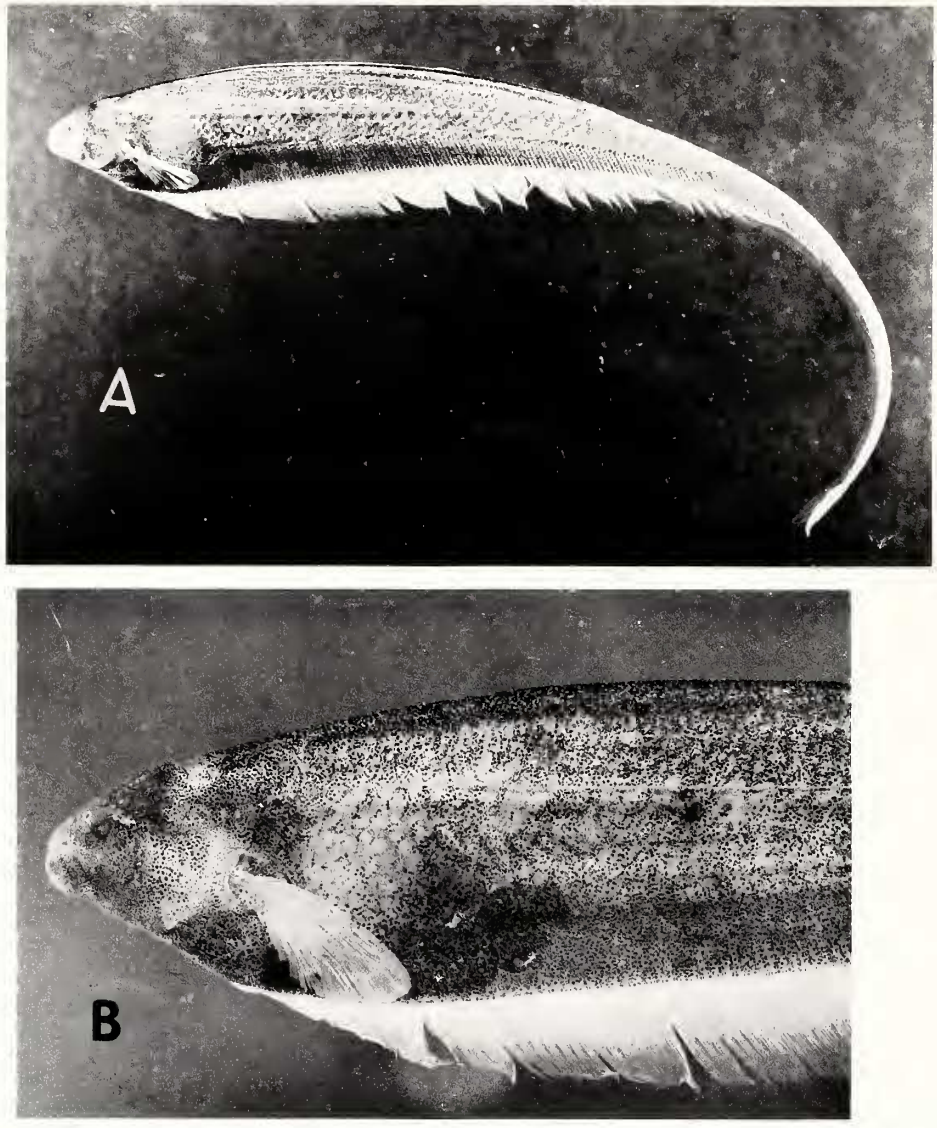



**Figure 19.** *Adontosternarchus sachsi* (Peters) 205.0 mm TL, MBUCV-V-10441, Orinoco River, Caño Guine, Venezuela. A, entire fish; B, close up of head.

Background color in alcohol pale tan to brown; sides and back densely and almost uniformly peppered with brownish-black chromatophores; chromatophores of mid-sides often arranged as oblique bands along scale margins; mid-doral pale stripe absent; dorsal thong with a hyaline ground color but superficially covered with chromatophores; lateral line sensory canal evident as a thin pale line on sides; superficial chromatophores of lower sides sometimes forming ventroposteriorly oblique lines and underlain with numerous corresponding dark lines formed by deep chromatophores and spaces between anal fin basals; anal fin membrane hyaline but usually a few chromatophores present over rays; caudal fin dusky at base and centrally, its distal end hyaline; pectoral fins hyaline; top and upper sides of head pigmented as the anterior part of the body; lower sides and undersurface of head paler, with scattered chromatophores; tip of snout, margin of upper lip, tip of chin and tube of anterior naris almost always immaculate.

**DISTRIBUTION.** *Adontosternarchus sachsi* is found in the middle and lower parts of the Orinoco and Amazon rivers (Fig. 17). Data on its detailed distribution in the Orinoco Delta region was presented above in connection with *A. devenanzii* (p. 14 and Fig. 15).

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