Pariosternarchus amazonensis:
a new genus and species of Neotropical electric fish
(Gymnotiformes: Apterontidae)
from the Amazon River

James S. Albert* and William G. R. Crampton**

Pariosternarchus amazonensis, new genus and species, is described from the Amazon river of Brazil and Peru. It is unique among apterontids in possessing a wide head that is flattened on its entire ventral surface, and in possessing highly expanded mandibular laterosensory canals. The phylogenetic position of Pariosternarchus is hypothesized by inclusion in a previously published data matrix of osteological and other morphological characters. Among apterontids Pariosternarchus is inferred to be the sister taxon to Sternarchella, with which it shares several derived features associated with a life history as benthic foragers in large whitewater Amazonian rivers: a short gape, a large maxilla with a robust anterior process, gill rakers attached to gill arches, and flexible gill rakers that are not ossified to their tips.

Introduction

The weakly electric Neotropical fish family Apterontidae is the most species rich family of gymnotiform fishes, with 53 valid species currently allotted to 14 genera. Many additional undescribed species are currently known in museum collections (e.g. Albert, 2003; Albert & Crampton, 2005; de Santana, 2003; de Santana & Maldonado-Ocampo, 2005; de Santana & Crampton, 2006). Apterontids are readily distinguished from other gymnotiforms by the presence of three unique morphological features: a commissural tube of the laterosensory system behind the posterior nares connecting the infraorbital and supraorbital canals, a fleshy midsaggital dorsal electro sensory organ, and a caudal fin with segmented rays and a hypural plate. Apterontids further differ from other gymnotiform fishes in a number of characters of cranial and post-cranial osteology and neuromorphology (Albert et al., 1998; Albert, 2001).

Apterontids are medium sized gymnotiform fishes (100-560 mm adult total length) that occur in practically all major river drainages of tropical South America, ranging from Rio La Plata of Argentina (35 °S) to the Rio Tuyra on the Pacific slope of Panama (8 °N) (Albert, 2003). The Ama...
zon basin is the area of highest apteronotid diversity, from where 61 % (34 of 53) of species representing all genera can be found, except the monotypic Tembeassu marauna from the Rio Para
na (Triques, 1998; Campos-da-Paz, 2005). The majority of apteronotid species inhabit the deep channels (up to 25 m) of large lowland tropical rivers, a habitat only recently surveyed system-
atically (Lundberg et al., 1987; Mago-Leccia, 1994; Lundberg et al., 1996; Crampton, 1998; Albert, 2001; Cox-Fernandes et al., 2004; Crampton & Albert, 2006). As a result, many apteronotid species were, until recently, rare or unknown in museum collections.

Many deep channel apteronotids are members of the navajini, an informal species-rich supragen-
eric taxon within the Apteronotinae that pos-
sesses a suit of derived traits associate with forag-
ing and locomotion in swiftly-flowing large river
environments (Albert, 2001). Members of the navajini share two derived character states: scales rhomboid in shape (vs. ovoid); and anal-fin pterygiophores longer than length of hemal spines
at same axial position (vs. shorter than hemal
spines). In all species of navajini the entire body
is strongly compressed laterally and the extent of
dosekeletal ossification is substantially reduced
by one of several mechanisms, including delayed
onset of mineralization (i.e., paedomorphosis)
and active bone remodeling (Albert, 2001). As
presently recognized (Albert, 2003) the navajini
includes six genera (Adontosternarchus, Com-
saraia, Magosternarchus, Porotergus, Sternarchella,
Sternarchogiton) as well as several species of un-
certain generic identity referred to in the literature as “Apteranotus” incertae cedis.

Here we describe a new genus and species of
apteronotid fish, Pariosternarchus amazonensis,
which inhabits the main channel of the Amazon
River of Brazil and Peru, including areas near the
mouths of some of the larger whitewater tributar-
ies of the Central Amazon basin. The new taxon
is characterized by a unique suite of morpho-
logical and osteological characters, especially
associated with a pronounced broadening and
flattening of the ventral surface of the head.

Materials and methods

All body distance measurements are reported in
mm. Measurements reported include: (1) total
length, measured from snout (anterior margin of
upper jaw at mid-axis of body) to posterior tip of
longest caudal-fin rays; (2) standard length,
measured from snout to base of caudal fin;
(3) length to end of the anal fin, measured from
tip of snout to end of anal fin (where membrane
posterior to last ray contacts ventral surface of
body); (4) distance from nape to origin of mid-
sagittal dorsal organ; (5) length of anal-fin base,
from origin of anal fin to posterior end of anal
fin; (6) length to origin of anal-fin, measured as
distance from snout to base of first anal-fin ray;
(7) length to anus, measured as distance from
snout to anterior margin of anus; (8) head length,
measured from posterior margin of bony opercle
to tip of snout; (9) head length measured from
snout to branchial opening; (10) distance from
snout to nape; (11) head width, measured at mid
opercle; (12) head depth at nape, vertical distance
at nape to ventral body border with lateral line
held horizontal; (13) head depth at eye; (14)
mouth length, from middle of gape to rictus;
(15) mouth width, between ricti; (16) distance
from snout to posterior nares; (17) pre-orbital
head length, from anterior margin of eye to tip
of snout; (18) distance from posterior margin of
eye to branchial opening; (19) eye diameter,
measured from postorbital to pre-orbital margins
parallel with long axis; (20) postorbital head
length, from posterior margin of the bony opercle
to posterior margin of eye; (21) length from eye
to posterior nares, measured from pre-orbital
margin to posterior margin of posterior nares;
(22) internarial distance; (23) interorbital distance,
measured as linear distance between medial
margins of orbits; (24) length of the branchial
opening; (25) pectoral-fin length, from dorsal
border of fin base where it contacts cleithrum to
tip of longest ray; (26) width pectoral fin base;
(27) pre-pectoral distance; (28) greatest body
depth; (29) caudal peduncle depth; (30) length
longest anal-fin ray; (31) length of caudal pedun-
cle and caudal fin, measured as the distance from
the last anal-fin ray to the tip of longest caudal-fin
ray.

Measurements of total length and anal-fin
length were taken with a ruler to the nearest mil-
limeter. All other measurements were taken with
digital caliper to the nearest 0.1 mm. Morpho-
metric data in diagnosis are reported as mean
relative proportions, and ranges are reported in
brackets. Meristic protocols follow Albert & Fink
(1996). Skeletal counts obtained from cleared
and stained specimens and radiographs include:
number of precaudal vertebrae, which include those of the Weberian apparatus, and is a proxy for body cavity length (Albert, 2001); total number of anal-fin rays; number of pectoral-fin rays; scale rows above the lateral line at midbody; number of caudal fin rays. Measurements and counts were taken from the left side of specimens. Sex was determined by dissection. Sexually mature males have smooth, white testes. Sexually mature females have enlarged ovaries packed with yellow-white or yellow eggs. Specimens from the area of the type locality were captured using 50 × 6 m beach seines (10 mm mesh) as part of a long-term (1993-2001) multi-habitat sampling program undertaken by one of us (WGRC) near the town of Tefé, Amazonas, Brazil. Museum lot records indicate that all non-type specimens were captured with trawl nets to depths of 15 m. Abbreviations of museum collections from which materials were examined follow Leviton et al. (1985).

Osteological data were taken from cleared and stained specimens using the techniques of Taylor & Van Dyke (1985). We used standardized micro-dissection methods of small teleosts (Weitzman, 1962) and follow Fink & Fink (1981) and Albert (2001) for morphological nomenclature. See Albert (2001) for lists of apteronotid specimens examined for external morphology and osteology.

**Pariosternarchus, new genus**

**Diagnosis.** An apteronotid unique in possessing a wide head (head width 51-69 % HL [mean 58 %] vs. 30-40 % in other apteronotid genera) whose entire ventral surface is flat (vs. convex) from the mental to gular regions, and in possessing greatly expanded mandibular laterosensory canal ossicles, which extend more than half the distance from the lateral margin of the head to the ventral midline (vs. slender ossicles).

*Pariosternarchus* further differs from other apteronotid genera in possessing the following unique combination of characters: scales absent from dorsal surface of head and body (shared with other navajini except *Sternarchogiton nattereri* and *Adontosternarchus*; also shared with *Apteronestus cuchillejo* and *Orthosternarchus*; vs. scales present on middorsum in other Apteronotidae); scales large and rhomboid with 5-6 rows above lateral line at midbody (shared with other navajini; vs. scales small and ovoid in other Apteronotidae, with 6-12 rows); anterior infraorbital canal pore remote from first infraorbital bone (shared with *Magosternarchus, Sternarchella, Adontosternarchus*, *Parapteronotus, Sternarchorhamphus* and *Orthosternarchus*; vs. close to first infraorbital bone in other Apteronotidae); endopterygoid ascending process robustly ossified within the anterior pterygoid ligament (shared with *Magosternarchus, Sternarchella*; vs. slender or absent in other Apteronotidae); endopterygoid with an elongate anterior process (shared with most Apteronotidae; vs. short and deep, without an elongate anterior process in *Magosternarchus, Sternarchella, Parapteronotus* and *Adontosternarchus*); opercle dorsal margin slightly concave (shared with *Magosternarchus* and *Sternarchella*; vs. ossified in other Apteronotidae); anal-fin pterygiophores long, 1.0-1.5 times into depth of epaxial musculature (shared with most Apteronotidae; vs. 0.7-0.9 in *Apteronestus sensu stricto, Parapteronotus*, and *Megadontognathus*); tail short, mean caudal peduncle + fin length 14 % TL [range 8-17 %] (shared with *Sternarchella, Magosternarchus, Parapteronotus, Sternarchorhamphus* and *Platyurosternarchus*; vs. mean caudal peduncle + fin lengths 17-45 % TL in other Apteronotidae).

*Pariosternarchus* further differs from all apteronotids outside navajini (except *Sternarchorhamphus* and *Orthosternarchus*) in exhibiting very reduced pigmentation such that live specimens have a pale white-pink appearance (opaque yellow or hyaline in preserved specimens) within navajini, *Compsaraia, Magosternarchus* and some *Sternarchogiton* species share this reduced pigmentation. Among apteronotids *Pariosternarchus* is most similar to *Sternarchella* from which it readily separated by the broad head with flattened ventral surface (vs. narrow and rounded), expanded mandibular laterosensory canals (vs. narrow and slender), and in the shape maxilla (ventral margin evenly rounded vs. sharply angled).

**Etymology.** The genus name is from the Greek pario, cheek, in reference to the expanded ventrolateral surface of the head, and sternarchus, a commonly used name in apteronotid taxonomy. Gender masculine.
Pariosternarchus amazonensis, new species  
(Fig. 1)

**Holotype.** MCP 34916, 121 mm; Brazil: Amazonas: Paraná Maiana, Mamirauá Lake System, municipality of Alvarães, 3°06.74’S 64°47.53’W; W. G. R. Crampton, 1 Feb 1999,

**Paratype.** MCP 34917, 1, 106 mm, cleared and stained; collected with holotype.


**Diagnosis.** As for the genus.

**Description.** Body shape and pigment patterns illustrated in Fig. 1. Morphological and meristic data presented in Table 1. Known size up to 153 mm TL. Sexually mature males with 106-153 mm TL (n=2). Single mature female with 145 mm TL. No cranial or post-cranial sexual dimorphism observed among sexually mature specimens (n=2 males, 1 female) although we acknowledge the small sample size is not enough to exclude dimorphism. Scales cycloid, ovoid, present on entire post-cranial portion of body from nape to tip of caudal appendage. Scales small, 6-8 (mode 6) rows above lateral line at midbody. Oral teeth conical. Premaxilla small, elongate, premaxillary teeth retained to adult.

**Table 1.** Morphometric and meristic data for Pariosternarchus amazonensis (n=9). All data reported for adult specimens (males n=2, females n=1) and immature specimens (n=6) combined. Hence, n=9 unless otherwise stated.

<table>
<thead>
<tr>
<th>Character</th>
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<th>Range</th>
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<td>Total length (mm)</td>
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<td>Standard length (mm)</td>
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<td>Length to end of anal fin (mm)</td>
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<td>In % of standard length</td>
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<td>Nape-origin dorsal organ</td>
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<td>In % of total length</td>
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<td></td>
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<tr>
<td>Caudal peduncle + fin length</td>
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<td>8-17</td>
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<td>Snout to nape</td>
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<td>In % of head length</td>
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<td>Branchial opening</td>
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<td>Length to origin of anal fin</td>
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<td>Mouth width</td>
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<tr>
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<td>Longest anal-fin ray</td>
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<td>Caudal peduncle depth</td>
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**meristics**

<table>
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<tr>
<td>Pectoral fin rays</td>
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<tr>
<td>Caudal fin rays</td>
<td>16</td>
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<tr>
<td>Scale rows above lateral line</td>
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<td>6-8</td>
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<tr>
<td>Posterior lateral line scales</td>
<td>73</td>
<td>68-76</td>
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<tr>
<td>Preeardial vertebrae (n=2)</td>
<td>12-14</td>
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</tbody>
</table>
Maxilla thin, more than twice as deep as wide, with a small straight and thin anterior process, and crescent-shaped, descending blade of maxilla curved, its ventral margin rounded. Dentary with 2-3 rows of teeth; dentary robustly ossified and somewhat elongate, its length greater than its depth. Anterior limb of anguloarticular longer than posterior limb. Posterior limb of anguloarticular shorter than retroarticular. Snout moderate length, preorbital distance about one third head length (mean preorbital distance 30-40 % head length [mean 35 %, n = 9]).

Mesethmoid length moderate, its anterior tip small and flexed ventrally, with a median concave groove. Ventral ethmoid deepest at about mid-length, with blunt, rounded lateral processes, and medium septum approximately as long as deep. Dermal vomer ossified and overlapping anterior limb of parasphenoid. Lateral ethmoid ossified, small with broad base but not contacting other cranial bones. Frontals without antorbital process. Dorsal margin of frontals flat or convex. Two

Fig. 1. Pariosternarchus amazonensis, MCP 34916, holotype, 121 mm total length; Brazil, Amazonas: Paraná Maiana. Scale bars 10 mm.


**Color in life.** Body very pale white-pink in life. Pigment reduced with even distribution. No stripes, bars or irregular blotches. Head never banded, spotted or blotched, uniformly light gray but slightly paler in gular region. Numerous minute chromatophores speckled over branchiostegal membranes and ventral surface of head. Pectoral-fin and anal-fin rays and membranes hyaline or translucent. Color variation was not correlated with size or sex in the specimens examined.
**Coloration in alcohol.** Much as in life, but with gray pigmentation changed to faded brown and white ground color changed to pale yellow. In brief: body coloration pale yellow with light brown mottling. Pectoral and anal fins hyaline.

**Electric organ discharge.** Not known.

**Distribution.** Known from localities along the main Amazon River channel in Brazil and Peru. Collection localities are in the Rio Amazonas (Amazon River), near Iquitos, Peru, and along the Rio Solimões (Amazon River) in Brazil from near the confluence of the Rio Japurá to near the confluence of the Rio Madeira (Fig. 2).

**Ecology.** *Pariosternarchus amazonensis* has been collected from flooded beaches and deep river channels using seines and trawl nets in the Amazon River, and the mouths of some of its larger whitewater tributaries (inferred from museum labels). *Pariosternarchus* exhibits a mosaic of traits associated with a life history in large river habitats, including reduced squamation and pigmentation, a laterally compressed body with a short body cavity, a small eye, and a small subterminal mouth with robust tooth-bearing bones of the oral jaws.

**Etymology.** Species named for the Amazon River.

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**Literature cited**


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