Pseudanos winterbottomi: A New Anostomine Species (Teleostei: Characiformes: Anostomidae) from Venezuela and Brazil, and Comments on Its Phylogenetic Relationships

BRIAN L. SIDLAUSKAS AND GERALDO MENDES DOS SANTOS

Pseudanos winterbottomi n. sp. from the Orinoco drainage of Venezuela and the Tapajós drainage of Brazil resembles Pseudanos gracilis (Kner) in meristic and morphometric characters but differs from it in possession of a single midlateral stripe instead of a series of lateral spots, four branchiostegal rays instead of three, two pores on the sensory canal of the nasal instead of one, four pores on the sensory canal of the first infraorbital arranged in a square instead of three pores arranged in a line or shallow V, a dorsal process on the mesopterygoid that wraps around the posterior of the palatine (vs absence of such a process), the absence of a thin, posteriorly directed process on the ectopterygoid running ventral to the palatine (vs presence of such a process), a thick, blocklike palatine instead of a thinner, platelike palatine, and an almost completely closed metapterygoid/quadrate fenestra (vs an open fenestra). An updated key to the anostomine characiforms of the genera Anostomus, Gnathodolus, Pseudanos, Sartor, and Synaptolaemus is presented.

Pseudanos winterbottomi n. sp. de la cuenca del Orinoco en Venezuela y la cuenca del Tapajós en Brazil se parece a Pseudanos gracilis (Kner) en caracteres merísticos y morfométricos, pero se diferencia de esta especie por la posesión de una sola banda medio lateral en vez de una serie de motas laterales, cuatro radios branquios-tegales en vez de tres, dos poros en el canal sensorial del nasal en vez de uno, cuatro poros en el canal sensorial del primer infraorbital ordenados en un cuadrado en vez de tres poros ordenados en una línea o una V poco profunda, un proceso dorsal del mesopterigoideo que se envuelve alrededor del extremo posterior del palatino (en contraste con la ausencia de tal proceso), la ausencia de un proceso delgado, dirigido posteriormente sobre el pterigoideo corriendo ventral al palatino (en contraste con la presencia de tal proceso), un grueso palatino, como un bloque en vez de un palatino mas delgado, como una placa, y una fenestra metapterigoi-deo/cuadrado casi completamente cerrada (en contraste con una fenestra abierta). Se presenta una clave actualizada para los caraciformes de los generos Anostomus, Gnathodolus, Pseudanos, Sartor, y Synaptolaemus.

In the most recent revision of the anostomine characiforms, Winterbottom (1980) described an unusual color polymorphism in Pseudanos gracilis (Kner, 1859). Some individuals possess a series of two to four dark spots along the lateral-line scale row, whereas others exhibit a single dark stripe running from the opercle to the caudal peduncle along the lower half of the lateral-line scale row and the upper half of the row immediately ventral to it. No individuals possess both stripes and spots, and the color morphs are never collected together at a single locality. Winterbottom found no morphometric or meristic differences between the color morphs, and he chose to include both morphs in P. gracilis. Because of limited cleared-and-stained material, an osteological comparison of the color morphs was not possible at the time of Winterbottom’s revision. The original description, figure, and holotype of Schizodon gracilis Kner (1859:fig. 11, NMW 57119) are of the spotted morphotype.

During the course of phylogenetic study of the family Anostomidae, the first author cleared and stained individuals of P. gracilis exhibiting both color patterns. Osteological examination reveals that the striped form represents a new species that is described herein and is distinguishable in pigmentation and skeletal morphology from all other characiforms, despite its meristic and morphometric similarity to P. gracilis (Kner, 1859).

MATERIALS AND METHODS

Meristic counts follow Winterbottom (1980), with the following clarifications. Counts of transverse scales above and below the lateral line include the smaller scale at the base of the dorsal and anal fins as a half scale. This is con-
sistent with Hubbs and Lagler (1958) and Winterbottom (1980:fig. 1) but contradicts Winterbottom’s text, in which the upper and lower transverse scale counts appear to omit the half scale. Lateral-line counts include all pored scales, including those at the base of the caudal-fin rays. Therefore, the lateral-line count includes the two (rarely one) pored scales that extend beyond the posterior termination of the hypural plate. The predorsal scale count includes the U-shaped scale at the dorsal-fin origin. Dorsal- and anal-fin ray counts are given as unbranched (lower-case roman) + branched (arabic) rays and include the one (rarely two) small unbranched rays that lie under the fleshy covering at the fin’s anterior, observed in radiographs or alizarin preparations. In the cleared-and-stained specimens, there is also a tiny, free-floating bone visible immediately anterior to the anal-fin rays. This bone does not articulate with the pterygiophores and is not enumerated as an anal-fin ray. The last dorsal and anal rays are both considered split to the base and counted as one ray, a method of counting that reflects the one-to-one relationship of the branched rays to their pterygiophores. Vertebral counts include all centra, interpreting the Weberian apparatus as four and the complex ural centrum as one. All elements are included in the pelvic- and pectoral-ray counts, regardless of branching. Vertebræ, pterygiophores and dorsal- and anal-fin rays were counted from radiographs, and the externally visible fin-ray counts of all specimens were also verified under a dissecting microscope. All counts were made on the left side of the specimen.

Following Winterbottom (1980), digital calipers were used to take 19 point-to-point measurements from the left side of each specimen. These measurements were converted to their natural logarithms and subjected to a principal components analysis (PCA) using the covariance matrix. The statistically unique eigenvectors from the PCA were subsequently analyzed with ANCOVA (allometric eigenvectors) or ANOVA (nonallometric eigenvectors) to determine whether these species differ in shape.

Cleared-and-stained specimens were prepared according to Taylor and Van Dyke (1985). Institutional abbreviations follow Leviton et al. (1985).

**Pseudanos winterbottomi** n. sp.

Figures 1, 2B, 3, 4, 5B; Tables 1A, 2A

**Pseudanos gracilis**: Winterbottom 1980:24 fig. 20A (in part, striped color morph, Orinoco). Taphorn 1992:57 fig. 21, fig. 22 (Aguaro).

Holotype.—MBUCV 32210 (ex FMNH 104020), (129.4 mm SL), Venezuela, Amazonas, Río Ventuari, pool behind beach on south side of river approximately 0.5 h (approximately 12 km) above mouth in Río Orinoco, Laguna Pavon (4°4’N, 66°56’W), B. Chernoff et al., 24 January 1991.

Paratypes.—All collections VENEZUELA. AMAZONAS: ANSP 161695, 31 of 38 (42.3–111.2 mm SL) and ANSP 161694, 1 (112.3 mm SL), Río Ventuari approximately 12 km from its confluence with Río Orinoco; backwater and rocky pool (4°4’N, 66°56’W), B. Chernoff et al., 25 March 1987. ANSP 161695, 2 (69.7–119.1 mm SL), caño separating island and beach just downstream from Quirataré (both ends of caño connect to Río Orinoco; 2°59’N, 66°4’W), W. G. Saul et al., 11 March 1987. ANSP 161696, 1 (52.7 mm SL), Caño Caripo (first R. Casiquiare caño approximately 5 min from confluence of Casiquiare and Orinoco—left side, approximately 3.0 km up from mouth; 3°06’N, 65°50’W), J. Fernandez and O. Castillo, 16 March 1987. CAS 20108, 2 (44.6–50.0 mm SL)
and SU 16276, 2 (107.1–41.1 mm SL), Colombia/Venezuela, Río Orinoco, Chono Salata rapids, C. Ternetz, 16 April 1925. CAS 20111, 1 (69.9 mm SL) and SU 16275, 1 (74.1 mm SL), Venezuela, Amazonas, Río Orinoco basin, Kirates, C. Ternetz, 30 March 1925. FMNH 85515, 3 (48.1–63.9 mm SL), Río Orinoco drainage, Titi Lagoon near Puerto Atabapo on road past airstrip, J. E. Thomerson et al., 11 January 1975. FMNH 103447, 7 (52.6–61.2 mm SL); rocks and rapids in Río Orinoco at Isla Cupaven, A. Machado et al., 29 January 1991. FMNH 103453, 1, (53.3 mm SL), Caño Tuparero approximately 2.5 h above San Fernando de Atabapo in Río Orinoco. B. Chernoff et al., 26 January 1991. FMNH 104020, 32 (46.6–116.8 mm SL; 2 specimens, 76.7–92.3 mm SL C&S); INPA 61858, 2 (86.7–124.4 mm SL), Río Guariquito, Aguas Muertas (8°15’20”N, 66°39’40”W), L. M. Page et al., 23 January 1986. INHS 69408, 3 (54.5–63.7 mm SL), Río San Bartolo (Río Guariquito—Río Orinoco Dr.) 9 km east of La Esperanza (8°15’20”N, 66°39’40”W), L. M. Page et al., 23 January 1986.

Nontype material.—INPA 6675, 2 (68.9–75.4 mm SL), Brazil, Rio Jamanxim, affluent of Rio Tapajós, Ilha Terra Preta (island of black soil), near beach, near currents. Approximately 4°30’S and 56°30’W. L. R. Py-Daniel and J. Zuanon, 19 October 1991.

Nontype material, not seen by the authors.—Based on the diagnosis and illustration contained herein, this material was identified as belonging to P. winterbottomi by F. Provenzano. All material VENEZUELA. AMAZONAS: MBUCV 7709, 1, Río Orinoco, Titi Lagoon, San Fernando de Atabapo, 5 December 1973. MBUCV 8495, 1, Río Orinoco, Titi Lagoon, San Fernando de Atabapo, A. Cortez et al., 21 November 1973. MBUCV 8506, 1, Río Orinoco, Titi Lagoon, San Fernando de Atabapo, A. Cortez et al., 21 November 1973. MBUCV 8535, 9, Río Orinoco, Titi Lagoon, San Fernando de Atabapo, A. Cortez et al., 18 November 1973. MBUCV 17077, 17, Río Ventuari, approximately 12 river km above the mouth in the Orinoco, 25 March 1987. MBUCV 18596, 1, Río Mavaca, approximately 5 km below base camp, 1 April 1988. MBUCV 22613, 1, Río Samariapo, Sarapito stream, Orinoco drainage, 2 km to the east of Samariapo, 9 April 1968. MBUCV 23166, 2, bank of a backwater east of the Río Casiquiare, above the mouth of the Río Pamoni, 20 March 1987. MBUCV 23176, 3, Río Orinoco, Quiritare, 11 March 1987. MBUCV 24951, 5, Río Orinoco, around Cupoven island in rapids and rocks, 29 January 1991. MBUCV 25875, 4, Pool on the Río Orinoco behind a beach about 0.5 river km above Temblador, 10 March 1987. MBUCV 25971, 4, Río Casiquiare, stagnant water 3 km up Caño Caripito, first backwater on the left back. About 5 km from the mouth of the Casiquiare en the Orinoco, 16 March 1987. APURE: MBUCV 23556, 10, Río Claro between Cunavietchito and Capanaparo, 28 February 1991. BOLIVAR: MBUCV 5140, 1, Río Orinoco, Caño Cocuiza, Tabirito bridge, near Caicara del Orinoco, 27 February 1968. MBUCV 12579, 1, Río Parguaza, Chalana Ford on the Río Pargua-za, 1 March 1981. MBUCV 15774, 1, Backwater tributary of the Río Caura, (possibly Caño Curi-mo), near the confluence of the Río Caura with the Orinoco, 22 November 1985. MBUCV 22603, 7, Río Maniapure, Cuchiovero-Chivapuri, high Río Maniapure, hydrographic complex
(14), 9 April 1968. MBUCV 22607, 8, Rio Cha-
viripa, Cuchivero-Chiapuri, hydrographic complex (14), 5 April 1968. MBUCV 25644, 1, Rio Maniapure, small backwater at the Caicara-
Puerto Ayacucho crossroads 16 km north of Ma-
niapure, 16 November 1985. DELTA AMACU-
RO: MBUCV 6714, 2, Rio Orinoco, La Ceiba
Lagoon and (drainage ditch?), Los Castillos de
Guayana, 24 May 1972. GUÁRICO: MBUCV
22623, 1, Río Aguaro, hydrographic complex
(26) Guariquito, Maniupire, to the west of Santa

Diagnosis.—Pseudanos winterbottomi is the only member of the subfamily Anostominae with a single longitudinal stripe (vs multiple longitudinal
stripes in Anostomus anostomus, Anostomus ternetzi,
and Anostomus brevior or variously spotted and/or
barred patterns in other anostomines). Pseu-
danos winterbottomi also lacks transverse bars
across the dorsum (vs transverse bars present in
Anostomus plicatus, Anostomus intermedius, Anos-
tomus spilochistrum, Pseudanos irinae, and Pseu-
danos trimaculatus). The new species is distinguished from Gnathodolus, Sartor and Synaptolaemus by possession of symphysal dentary teeth the same length as the teeth adjacent to them (vs at least twice as long), a lower jaw, exclusive of teeth, about as long as wide (vs a lower jaw lon-
ger than wide) and lips without dermal papillae (vs papillae present). Pseudanos winterbottomi re-
sembles P. gracilis in shape and in meristic char-
acters but is distinguished by (1) a dark hori-
zontal stripe along the lower half of the lateral-
line scale row and the upper half of the row adjoin-
ing (vs a lateral series of two to four cir-
cular spots, or no lateral markings in adults ap-
proximately 130 mm SL or greater), (2) the
presence of four branchiostegal rays in 79% of
specimens (vs three in all congeners), (3) two
externally visible pores on the sensory canal of
the nasal bone between its anterior and poste-
rior openings (vs one), (4) four externally vis-
ible pores associated with the sensory canal of
infraorbital one and arranged in an approxi-
mate square (vs three, arranged in a line or
broad V), (5) nearly complete closure of the
metapterygoid/quadrate fenestra (vs an open
fenestra), (6) the absence of a posterior process
of the ectopterygoid running ventral to the pal-
atin in lateral view (vs presence of such a pro-
cess), (7) the presence of a dorsal process of the
mesopterygoid that wraps around the pos-
terior of the palatine (vs absence of such a pro-
cess), and (8) a palatine with a high arch and
thick, blocklike morphology (vs a lower arch and
thinner, platelike morphology).

Description.—Morphometric characters for ho-
lotype and paratypes in Table 1, meristic char-
acters in Table 2. Body fusiform, somewhat com-
pressed. Head shallow near snout but increasing in
depth considerably over parietal and opercu-
lar regions. Greatest depth of body at dorsal-
fin origin; greatest curvature of dorsal profile
between supraoccipital and dorsal-fin origin;
profile from base of last dorsal-fin ray to pro-
current rays straight and sloped slightly poste-
roventrally; ventral margin of body gently con-
 vex, with greatest upward slope along base of
anal fin. Adipose fin directly over midpoint of
anal-fin base. In all specimens, pelvic-fin origin
barely posterior to vertical through dorsal-fin
origin.

Mouth very small, strongly upturned and
opening on dorsal surface of head. Anterior
profile of lower jaw blunt, meeting ventral pro-
file of lower jaw at approximate right angle. Pre-
maxilla lies essentially parallel to long axis of
body. Lips buckled and ridged but lacking der-
mal papillae.

Each premaxilla and dentary with four flat-
tened teeth with two to four small cusps form-
ing continuous, straight, serrated edge. Cusp
number increases away from symphysis; teeth at
symphysis with two strong cusps and sometimes
weaker third cusp; teeth most distant from sym-
physis with four equal cusps. Cusps worn in larg-
er individuals. Teeth on premaxilla straight
along entire length, running parallel to long
axis of body and dorsoventrally flattened; den-
tary teeth in vertical orientation, anteroposteri-
orly flattened with interior surface concave, re-
sembling bowl of spoon. Teeth furthest from
symphyses of jaws slightly smaller than those
closer to symphyses. Single complete row of re-
placement teeth in each jaw; symphysal re-
placement teeth largest and most developed in
two cleared-and-stained specimens of 76.7 and
92.3 mm SL; replacement teeth not easily visible
in noncleared material.

Anterior nare tubular; posterior nare hori-
zontally elongate, lying in groove; both nares
ventral to horizontal through dorsal margin of
the orbit and just posterior to premaxilla’s pos-
terior border. Some olfactory ridges visible ex-
ternally.

Each infraorbital bone (Fig. 2) with portion
of sensory canal; canal branches near dorsal
border of fourth infraorbital, giving rise to sec-
ondary canal extending to opercle. Additional
canal running from dorsal tip of preopercle,
through tubular supraperopercle and continu-
ing dorsally across sixth infraorbital (dermosphe-
notic). Supraorbital flat, diamond-shaped and
positioned along dorsal and anterior mar-
Table 1. Morphometric Characters of (A) *Pseudanos winterbottomi* New Species (*N* = 143) and (B) *Pseudanos gracilis* (*N* = 44). Bent or damaged specimens were not measured. Standard lengths and their standard deviations and ranges are given in millimeters. Measurements 1–10 expressed as percentages of standard length, 11–18 as percentages of head length. Holotype of *Pseudanos gracilis* (NMW 57119) unavailable.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>(A) <em>P. winterbottomi</em></th>
<th>(B) <em>P. gracilis</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Holotype</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Standard Length</td>
<td>129.4 (72.5)</td>
<td>85.7 (26.9)</td>
</tr>
<tr>
<td>1. Lower jaw to anal-fin origin</td>
<td>79.3 (80.6)</td>
<td>80.9 (1.28)</td>
</tr>
<tr>
<td>2. Lower jaw to adipose-fin origin</td>
<td>84.9 (85.6)</td>
<td>85.8 (1.13)</td>
</tr>
<tr>
<td>3. Lower jaw to dorsal-fin origin</td>
<td>47.6 (49.8)</td>
<td>48.7 (1.41)</td>
</tr>
<tr>
<td>4. Lower jaw to pelvic-fin origin</td>
<td>48.3 (51.8)</td>
<td>51.2 (1.28)</td>
</tr>
<tr>
<td>5. Dorsal-fin origin to caudal-fin origin</td>
<td>55.4 (53.4)</td>
<td>54.3 (1.38)</td>
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<tr>
<td>6. Dorsal-fin origin to adipose-fin origin</td>
<td>39.9 (38.2)</td>
<td>39.5 (1.33)</td>
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<tr>
<td>7. Caudal-peduncle length</td>
<td>12.8 (11.9)</td>
<td>11.6 (1.27)</td>
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<tr>
<td>8. Body depth</td>
<td>22.7 (21.9)</td>
<td>22.3 (1.64)</td>
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<tr>
<td>9. Body width</td>
<td>12.5 (11.8)</td>
<td>12.6 (1.35)</td>
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<tr>
<td>10. Caudal-peduncle depth</td>
<td>9.4 (9.1)</td>
<td>9.1 (0.98)</td>
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<td>11. Head length</td>
<td>24.7 (27.6)</td>
<td>26.7 (1.77)</td>
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<td>12. Snout length</td>
<td>39.9 (37.9)</td>
<td>37.0 (2.30)</td>
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<tr>
<td>13. Preopercle length</td>
<td>72.0 (73.2)</td>
<td>72.6 (2.20)</td>
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<tr>
<td>14. Head depth</td>
<td>76.4 (67.0)</td>
<td>68.8 (6.16)</td>
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<tr>
<td>15. Preopercle depth</td>
<td>59.4 (57.9)</td>
<td>59.3 (3.37)</td>
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<tr>
<td>16. Snout diameter</td>
<td>37.7 (38.8)</td>
<td>40.1 (3.09)</td>
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<tr>
<td>17. Eye diameter</td>
<td>21.5 (27.3)</td>
<td>27.0 (2.59)</td>
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<tr>
<td>18. Bony interorbital</td>
<td>35.7 (33.6)</td>
<td>35.2 (2.62)</td>
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</table>
Table 2. Meristic Characters of (A) Pseudanos winterbottomi New Species (N = 149) and (B) Pseudanos gracilis (N = 46). Modes, standard deviations, and ranges are given for each species. Holotype of P. gracilis (NMW 57119) unavailable.

<table>
<thead>
<tr>
<th></th>
<th>(A) P. winterbottomi</th>
<th>(B) P. gracilis</th>
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<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Mode</td>
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<tr>
<td>Unbranched dorsal-fin rays</td>
<td>iii</td>
<td>iii</td>
</tr>
<tr>
<td>Branched dorsal-fin rays</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Unbranched anal-fin rays</td>
<td>iii</td>
<td>iii</td>
</tr>
<tr>
<td>Branched anal-fin rays</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Pectoral-fin rays</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Pelvic-fin rays</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Branchiostegal rays</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Total vertebrae</td>
<td>42</td>
<td>42</td>
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<tr>
<td>Lateral-line scales</td>
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<td>44</td>
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<tr>
<td>Scales above lateral line</td>
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<td>Scales below lateral line</td>
<td>4.5</td>
<td>4.5</td>
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<td>Predorsal scales</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Circumpeduncular scales</td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

* Counts of 38, 39, 40, and 44 vertebrae in P. winterbottomi occurred once each. The individuals with 38, 39, and 40 have deformed vertebral columns.

** The specimen of P. gracilis with 38 lateral-line scales is clearly deformed. Among the other specimens, the minimum is 43 lateral-line scales.

gin of anterior orbit. Opercular membrane fused with isthmus, reducing size of gill opening relative to most nonanostomid characins.

Holotype and most paratypes (117, 79%) with four branchiostegal rays articulated to external surface of the hyoid apparatus. Thirty-one paratypes (21%) with fourth (median) branchiostegal not visible on left side; in these the fourth ray either located beneath third ray or missing. One of two cleared-and-stained specimens with three unbranched rays articulated to first proximal and distal pterygiophore behind. Dorsal fin typically branched; anal fin with three unbranched rays articulated to first proximal and distal pterygiophore. Tiny, free-floating bony element preceding anal fin sometimes visible under high magnification in radiographs or cleared-and-stained specimens but not enumerated. Anteriormost branched ray longest in anal and dorsal fins. One specimen with first normally branched dorsal-fin ray transformed into unbranched ray, yielding count of iv, 9 rather than iii, 10. Fleshy covering at base of several anteriormost dorsal- and anal-fin rays extending laterally and overlapping base of following ray. Anal-fin margin slightly concave; dorsal-fin margin slightly convex. Pectoral fin with 13 to 17 rays (13: N = 1, 14: N = 24, 15: N = 73, 16: N = 47, 17: N = 3, one cleared-and-stained specimen with 17, other with damaged fins). Distal margin of pectoral fin straight along margin of longest rays and slightly rounded along margin of shortest rays. Pelvic fin typically with 9 rays; three specimens with 8 rays. Shape of extended pelvic fin resembles a 45–45 right triangle. Caudal fin with 10 + 9 principal rays and deeply forked; middle rays less than one-third length of longest. Posterior margin of adipose fin somewhat blunt, closer to rectangle than to circular arc.

Coloration in alcohol.—Overall ground color drab brown, darker dorsally and fading gradually to lighter tan on ventral surface. Distinct, dark, midlateral stripe along lower half of lateral-line scale row and upper half of adjoining scale row. Stripe sometimes fading slightly towards anterior or posterior extremes. Pigmentation sometimes varies along stripe, particularly in juveniles. Stripe quite faint in few specimens, but never absent and never forming series of round spots. Stripe widening slightly over hypural plate, terminating just anterior to last lateralline scale.

Dark pigmentation present on central portion of opercle, subopercle, narrow lateral band along margin of posteriormost scales where overlapping caudal-fin rays, and skin around jaws. Lips pale overall, although anteroven tral margin of lower lip displays small, very dark spot or short dark bar near corner of mouth.

Each scale with dark oval or cross-shaped spot, somewhat wider than high, at center. Spots form eleven dotted longitudinal lines, each running along center of scale row. Dark spot on lateral-line scales lying immediately anterior to each pore and sometimes wrapping around it. Scale margins marked with faint crescent of loosely packed melanophores; crescents situated between dark spots of sequential scales.

Melanophores present along fin rays but rarely on interradial membranes. Pigmentation on dorsal, anal and caudal fins outlining segmentation and branching of fin rays; anal and dorsal fins with pigmentation densest basally and on anteriormost fin rays and gradually disappearing distally. Adipose fin with diffuse bar halfway between fin origin and fin margin. Longest rays of both lobes of caudal fin most highly pigmented, particularly near based of lobes. Posterior margin of the caudal fin unpigmented.

Melanophores concentrated on lower jaw, infraorbitals three to six, opercle and subopercle, and very dense in gular region below urohyal. Pigmentation less intense but still apparent along branchiostegal rays. Dark pigmentation loosely organized into two narrow longitudinal V’s on ventral surface between pelvic and pectoral fins. Pattern on ventral surface apparently a reduced form of dark spots centered on each scale on rest of body.

Preserved specimens with considerable variation in overall color intensity. Some very pale overall; with lateral stripe hardly visible. Others with darker background color and intense stripes. Full range of intermediates examined with notable color variation among individuals collected at a given locality. Coloration not varying greatly ontogenetically. Examined individuals with lateral stripe diffuse or uneven in intensity most often in smallest fish.

Coloration in life.—A color photograph by S. H. Weitzman and W. L. Fink (USNM uncataloged) can be referred to *P. winterbottomi*. Background color dark gray; lateral line dark grey; dorsal and caudal fins faintly red; centers of scales iridescent yellow except those along lateral line. Upon preservation this specimen “exhibited the dark lateral stripe with elongated dark spots in the centres of the scales on a light tan background” (Winterbottom, 1980:26). Géry (1977: 185) contains a photo by H. Axelrod of two unidentified lisis that almost certainly represents *P. winterbottomi*. Although the pigmentation of the fish in Axelrod’s photo is lighter than that in Weitzman and Fink’s, both agree with the description given herein.

Distribution.—Occurring throughout the Río Orinoco drainage, including the ríos Casiquiare, Cinaruco, San Bartolo and Ventuari (Fig. 3).
Fig. 2. Lateral views, left infraorbital series of (A) *Pseudanos gracilis*, FMNH 103454, 81.6 mm SL, and right infraorbital series of (B) *Pseudanos winterbottomi* (paratype), FMNH 104020, 76.7 mm SL. Drawing in (B) reversed for ease of comparison with (A). The fusion of the left fourth and fifth infraorbital bones in the illustrated specimen of *P. gracilis* (A) is atypical and not diagnostic of the species. Dashed line in (A) indicates the typical division between the fourth and fifth infraorbital; dotted lines delineate areas of damage to the sixth infraorbital. The other available infraorbital series for this species also have atypical features (a supplementary canal, an extra pore, or an additional ossification) or are extensively damaged. Abbreviations: 1–6/H11005 infraorbitals one to six (6/H11005 dermosphenotic), ANT/H11005 antorbital, NAS/H11005 nasal, SUP/H11005 supraorbital.

Fig. 3. Venezuelan collection localities for *Pseudanos winterbottomi* and *Pseudanos gracilis*. For *P. winterbottomi*, holotype locality (Rio Ventuari) a black star, paratype localities black circles. Open circles represent material likely to belong to *P. winterbottomi* but not seen by the authors. Open circles are based upon an illustration and citation by Taphorn (1992, Rio Aguaro) or upon material at MBUCV identified by F. Provenzano and listed herein. Open squares indicate the Venezuelan collection localities of specimens of *P. gracilis* seen by the authors. Symbols sometimes represent multiple collection localities. Inset map by Marilyn Weitzman.

and in the Rio Tapajós drainage of Brazil (Fig. 4). Taphorn (1992) reports *P. gracilis* in the Aguaro drainage of Venezuela, but based on his illustration, we conclude that his material almost certainly belongs to *P. winterbottomi*. *Pseudanos winterbottomi* also occurs in the rios Aguaro, Chaviripa, Maniapure, Mavaca, Parguaza and Samariapo (F. Provenzano [MBUCV] pers. comm.).

Habitat.—Holotype collected in deep, clearwater pool behind rocky beach on Rio Ventuari near confluence with Rio Orinoco proper. Anostomus anostomus, Laemolyta taeniata, and Synaptolaemus cingulatus recorded syntopically. Other specimens collected from rapids, clearwaters, blackwaters, and possibly whitewaters and demonstrate an apparent preference for habitat with boulders, leaves, sticks, logs, or similar structure. Collected at least once from inside a submerged log (ANSP 166392).

Diet.—Stomach of one of two cleared-and-stained specimens containing a large quantity of sand; the other containing a mix of woody debris and a fibrous plant material. Knöeppel (1972) examined the stomach contents of several *P. gracilis* from the middle Rio Negro in Brazil. Based on the locality, Knöeppel’s specimens probably were *P. gracilis*. He found primarily plant remains, as well as fungi, algae, detritus, sand, chiton remains and terrestrial insects. Based on the general morphology of the mouth and digestive tract, the diet of *P. winterbottomi* is probably similar to that of *P. gracilis*.

Geographic variation.—The two specimens (INPA 6675) from the Rio Jamanxim in the Rio Tapajós drainage of Brazil (Fig. 4) have the lateral stripe, fourth pair of branchiostegal rays and infraorbital pore pattern that diagnose *P. winterbottomi*, but their color pattern does not precisely match that of the material from the Rio Ori-
The lateral stripe of the Tapajós specimens is more intense than in any of the individuals from the Orinoco, extends slightly dorsal to the lateral-line pores (which it does not in specimens from the Orinoco), and has somewhat wavier margins. We tentatively interpret these color differences as regional variation within a single species. However, because we did not clear and stain either individual from the Tapajós, they may possess differences in internal morphology that would remove them to an undescribed species group. For this reason, we have excluded the Tapajós material from the type series of *P. winterbottomi*. Given that the Rio Tapajós and Río Orinoco specimens are probably conspecific, the known range for *P. winterbottomi* is highly disjunct, with localities separated by as much as 2000 km. This disjunction is likely an artifact of collection effort, and we expect the species to occur elsewhere within lowland South America.

Of the 31 *P. winterbottomi* paratypes that are missing the fourth branchiostegal ray, 23 come from six collections clustered on the north bank of the Rio Orinoco (Venezuela, Anzoategui: ANSP 166392; Apure: INHS 61514; Guarico: INHS 34041, INHS 34465, INHS 34820, INHS 61858). Sixty-two percent of the specimens examined from these three states lack the fourth ray. The remaining eight paratypes lacking a fourth branchiostegal ray are scattered throughout Amazonas and Bolivar states, representing only 7% of the specimens from these regions. The concentration of specimens without the fourth ray in the northern tributaries of the Orinoco suggests a geographic structure to the polymorphism.

**Etymology.**—The species-group name, *winterbottomi*, honors Richard Winterbottom for his significant contributions to anostomine systematics and natural history. A noun in the genitive case.

**DISCUSSION**

Comparison with *Pseudanos gracilis.*—PCA confirms Winterbottom’s conclusion (1980) that the shape of *P. winterbottomi* is identical to that of *P. gracilis* given this set of measurements (Table 1). Two unique eigenvectors are recovered ($\lambda_1 = 1.801, 97.4\%$ total variance, $\lambda_2 = 0.016, 0.9\%$ total variance). The third and subsequent eigenvectors are indistinguishable from error by Anderson’s test of eigenvalue equivalence (1963). PC1 correlates strongly with the standard length of the specimens (Pearson product-moment correlation $r = 0.99, P < 0.05$), but it is not an isometric scaling vector and represents allometric shape change as well as variation in specimen size (Anderson’s test of isometry: $\chi^2 = 1.65 \times 10^3, P < 0.05$, angle between PC1 and a theoretical vector of perfect isometry $= 7.63^\circ$). PC2 represents size-independent shape variation ($r = 0.11$, n.s.). Neither ANCOVA of PC1 using ln standard length as a covariate ($F = 0.44$, n.s.) nor ANOVA of PC2 ($F = 0.79$, n.s.) uncovers significant shape differences between *P. gracilis* and *P. winterbottomi*. The homogeneity of variance assumption is satisfied in both cases (Levene’s test) as is the assumption of parallelism in the ANCOVA. Therefore, we conclude that both species possess the same fusiform, somewhat compressed body plan and exhibit the same ontogenetic changes.

Although *P. winterbottomi* and *P. gracilis* are very similar in osteology, they differ in the aforementioned branchiostegal ray number, the
number and arrangement of the pores on the infraorbitals, the size and shape of the metapterygoid-quadrate fenestra, the morphology of the eopterygoid and mesopterygoid, and the shape of the palatine. *Pseudanos winterbottomi*, like most anostomines, has four pores on the sensory canal running along the first infraorbital, and the canal makes two bends of approximately 90 degrees each. In most *P. gracilis*, only three pores are present, and the canal bends only once at a very oblique angle (Fig. 2). One of the two cleared-and-stained *P. gracilis* examined has four pores on the right first infraorbital, but this condition is not typical for the species. Furthermore, *P. winterbottomi* has two intermediate pores on the canal of the nasal bone between its anterior and posterior openings, whereas *P. gracilis* has only one. Examination of other anostomines and outgroups including *Laemolyta* and *Schizodon* suggest that in both these cases the morphology of *P. gracilis* is apomorphic. The fusion of the fourth and fifth infraorbitals in the illustrated specimen of *P. gracilis* (Fig. 2A) is atypical, as these bones are separate on the right side of the illustrated specimen and both sides of a second specimen. The morphology of the infraorbital series of *P. gracilis* appears to be quite variable, as all examined specimens of that species had at least one atypical feature (fused bones, an extra pore, a supplementary canal or an additional ossification) somewhere along the infraorbital series.

Like many anostomids, *P. gracilis* has distinct notches in the posterodorsal margin of the quadrate and the anteroventral margin of the metapterygoid (Fig. 5). These notches together form a window through the suspensorium: the metapterygoid-quadrate fenestra. In *P. winterbottomi*, this fenestra is present but greatly reduced. As the shape of the fenestra varies widely in anostomines, the polarity of this character is currently difficult to determine. It is nevertheless clear that these two species differ in the form of this aperture.

These species also differ in the palatine region (Fig. 5). *Pseudanos gracilis* has a small posteriorly directed process on the posterolateral portion of the eopterygoid, which cradles a portion of the palatine’s ventral margin. This eopterygoid process is absent in *P. winterbottomi*. The mesopterygoid in *P. winterbottomi* has a small dorsally directed process that curves around the posteriormost portion of the palatine that is absent in *P. gracilis*. The palatine in *P. winterbottomi* is laterally thickened, and its dorsal margin has a higher arch relative to *P. gracilis*, resulting in a thick, blocklike palatine in *P. winterbottomi* and a thinner, platelike palatine in *P. gracilis*.

*Pseudanos winterbottomi* and *P. gracilis* appear to have never been captured together, and in Venezuela, their ranges are adjacent but do not overlap. All of the Venezuelan *P. gracilis* that we have examined come from the Ríos Atabapo and Negro (Fig. 3), both of which are blackwater rivers, whereas *P. winterbottomi* occurs throughout the mostly clearwater and whitewater Río Orinoco system.

**Taxonomic relationships.**—Although *P. winterbottomi* clearly possesses the diagnostic characteristics of the Anostominae (*Winterbottom 1980*), including a suprateminal mouth, reduced metapterygoid/quadrate fenestra, and sloping dorsal portion of the metapterygoid, it does not fit neatly within any of the anostomine genera as currently conceived. *Pseudanos winterbottomi* definitely lacks the diagnostic characters of the genera *Sartor*, *Sympetaloemus*, and *Gnathodolus* (enlarged symphyseal teeth, elongate lower jaw, dermal lip papillae; Winterbottom 1980). However, its placement in *Anostomus* or *Pseudanos* is equivocal.

*Pseudanos winterbottomi* closely resembles *P. gracilis*, yet *Pseudanos* is currently diagnosed by possession of three branchiostegal rays, and *P. winterbottomi* usually has four rays. *Pseudanos winterbottomi*’s longitudinal stripe and fourth branchiostegal ray suggest a possible affinity with *Anostomus anostomus* or *Anostomus brevior*. The confusion is compounded by the apparent evolutionary lability of coloration in anostomids (many congeneric species display very different color patterns) and by the fact that *Anostomus ternetsi* appears to have lost the fourth branchiostegal ray independently of the loss of that element in *Pseudanos* (*Winterbottom, 1980*).

In an effort to determine the correct placement of *P. winterbottomi*, we compared its morphology to Winterbottom’s list (1980) of skeletal specializations in *Pseudanos* and in the lineage containing *Anostomus*, *Gnathodolus*, *Sympetaloemus*, and *Sartor*. Winterbottom’s paper sometimes lacks precise binary character state descriptions, and unfortunately, the skeletal morphology of the new species is often intermediate between the states that he implies for the two major lineages. As a result, the proper placement of this species remains somewhat equivocal.

Of the eight specializations that Winterbottom cited for the clade containing *Anostomus*, *Gnathodolus*, *Sartor*, and *Sympetaloemus*, only one is clearly shared by *P. winterbottomi* (presence of a notch in the lateral ethmoid immediately dor-
Fig. 5. Lateral views of anterior suspensoria of (A) *Pseudanos gracilis*, FMNH 103454, 81.6 mm SL, and (B) *Pseudanos winterbottomi* (paratype), FMNH 104020, 76.7 mm SL. Drawings were prepared from dissections of the right side of the head and reversed for ease of comparison with published illustrations. Abbreviations: ECT = ectopterygoid, MES = mesopterygoid, MET = metapterygoid, PAL = palatine, PRE? = tubular ossifications around sensory canal anterior to preopercular canal, possibly homologous with part of preopercle in other species, QUAD = quadrate, SYM = symplectic. Dotted line in (A) delineates area of damage to the metapterygoid.

Several to the ethmoid-palatine ligament), and five are definitely not shared (incomplete lateral shelf of quadrate, concave opercular margin, inclined epiphy-al-ceratohyal joint, ethmoid longer than wide, ridge of bone on the exoccipital). For the other two characters (expansion of the ventral portion of the maxilla into a triangular process and a more oblique inclination of the joint between the orbitosphenoid and pterosphenoid), the state in *P. winterbottomi* is intermediate to those in *Anostomus* and in the remainder of *Pseudanos*. Because the variation in these characters is continuous and Winterbottom did not specify explicit character state criteria, these characters cannot be scored objectively in *P. winterbottomi*. This evidence suggests that the lateral ethmoidal notch may be a synapomorphy of a clade containing *Anostomus*, *Gnathodolus*, *Sartor*, *Synaptolaemus*, and *P. winterbottomi*, with *P. winterbottomi* as the basalmost member (Fig. 6, placement C).

Many of the characters that Winterbottom (1980) listed as diagnostic of *Pseudanos* are actually shared by more distantly related anosto-
mids such as Laemolyta taeniata and Schizodon fasciatus. Therefore, these characters appear to be plesiomorphic for the anostomines and are uninformative relative to the monophyly of Pseudanos or the precise placement of the new species near the root of the anostomine phylogeny. In several of the other characters, such as the depth of the supraoccipital sulcus and the breadth of the neural complex, the state exhibited by P. winterbottomi is intermediate to that possessed by the Pseudanos and Anostomus species examined by Winterbottom. In these cases, the proper coding of P. winterbottomi is uncertain. Pseudanos winterbottomi definitely lacks two of the character states that Winterbottom indicated to be shared by the three previously known species of Pseudanos, the loss of the fourth paired branchiostegal rays and the equal joining of the mesocoracoid to the coracoid and scapula. The new species and all three other species of Pseudanos also share at least one character state not formally recognized by Winterbottom: spots of contrasting pigmentation in the center of each scale that give the impression of thin dotted lines along the body. However, a similar condition may also be found in A. pli- catus, which has scales with iridescent centers in life (Winterbottom, 1974) but no noticeable spots in the preserved material. If the pigmentation at the center of the scales is a synapomorphy for Pseudanos, then the new species may represent the sister group to a clade containing P. gracilis, Pseudanos irinae and Pseudanos trimaculatus (Fig. 6, placement B).

The meristic counts and body shape of P. gracilis and P. winterbottomi are essentially identical. They are also extreme among anostomines in which no other species are as slender or possess so many lateral-line scales and vertebrae. The outgroup condition for these characters is not precisely known, but many species in Laemolyta, Schizodon, Rhytiodus, and Anostomoides (in which the immediate anostomine outgroup can probably be found) are approximately as slender as P. winterbottomi and P. gracilis and in some cases (Rhytiodus) are even longer. Therefore, among the Anostominae, it is likely that the shortened morphology with reduced vertebral and scale counts, typical of the lineage containing Anostomus, is the derived condition. This evidence also suggests a placement of P. winterbottomi within Pseudanos, most likely as sister species to P. gracilis (Fig. 6, placement A).

All three possible placements of P. winterbottomi within Winterbottom’s phylogeny (Fig. 6) lie near the root of the tree, and all of them will necessitate homoplasy in at least one character. In the absence of a phylogenetic reevaluation of the entire group, the choice of a generic placement is difficult. In the interest of making the description and name of the new species available as soon as possible, we tentatively place it within Pseudanos for the principal reason that two of the three logical phylogenetic placements would preserve a monophyletic Pseudanos. Were the new species to be placed in Anostomus, any of the three supported positions would create paraphyly with respect to the distinctive genera Sartor, Synaptolemaeus, and Gnathodolus, and one of the three would also create a paraphyletic Pseudanos. The situation could be obviated by creating a new monotypic genus for P. winterbottomi or by synonymizing the three distinctive genera with Anostomus. In the interest of nomenclatural stability, Pseudanos is the most conservative choice of genus, at least until ongoing phylogenetic analysis of the Anostomidae resolves the proper placement of P. winterbottomi.

REvised Key to the Genera and Species of the Anostominae

The following key updates that of Winterbottom (1980) to include P. winterbottomi and the two new species of Sartor described by Santos and Jégu (1987). It also adds some distributional information.

1. Symphyseal (medial) teeth of lower jaw enlarged; lower jaw (not including teeth) longer than wide; lips with distinct dermal papillae

   Symphyseal (medial) teeth of lower jaw essentially same size as those next (lateral) to them; lower jaw (not including teeth) as long as wide; lips without dermal papillae (may be corrugated)  

   2. Head depth 80–90% of HL; dentary with a
single highly elongate tooth (Orinoco) ——

Gnathodolus bidens

Head depth less than 80% of HL; dentary with three to four teeth ——

3.

Lower jaw about twice as long as wide, vertical when mouth fully closed, dentary with four teeth, symphyseal tooth about twice as high as wide. Transverse bands of yellow and dark brown or black alternating along whole body and extending below lateral line (Orinoco and lower Amazon tributaries) ——

Synaptolaemus cingulatus

Lower jaw five times longer than wide, inclined posterodorsally when mouth fully closed; three teeth in each half of lower jaw, symphyseal pair being five times as high as wide and projecting above upper jaw when mouth closed. Transverse markings, if present, not extending below lateral line ——

4.

Twelve circumpeduncular scales (upper Xingu) ——

Sartor respectus

Sixteen circumpeduncular scales ——

5.

Body dark and elongate, greatest body depth 14.3–20.4% of SL (Trombetas) ——

Sartor elongatus

Body yellowish and robust, greatest body depth 17.2–24.4% of SL (Tocantins) ——

Sartor tucuruiense

6.

Color pattern with more than one dark longitudinal stripe greater than one scale wide on a pale background ——

7.

Color pattern with one or no longitudinal lines greater than one scale wide; if no line present, with two to four dark blotches or spots along lateral line (except in individuals of P. gracilis over 130 mm SL, which have no longitudinal markings) ——

8.

Three branchiostegal rays, median, light longitudinal stripe along predorsal region, rows of light spots on anterodorsal region of body (southeastern Amazon tributaries, Orinoco and drainages east to Suriname) ——

Anostomus ternetzi

Four branchiostegal rays (fourth ray may be much reduced); a median dark longitudinal stripe along predorsal region, no spots on anterodorsal region of body ——

9.

Greatest body depth 27.5–29.5% (mean = 27.9) of SL; depth of head 78–85% (mean = 81.4) of head length; 12 caudal vertebrae (including aural centrum and vertebra of haemal spine that lies just anterior to first anal pterygiophore) (French Guiana) ——

Anostomus brevior

Greatest body depth 16.0–28.5% (mean = 22.6) of SL; depth of head 49.5–80.0% (mean = 66.2) of head length; usually 11 caudal vertebrae (12–13 rarely) (Amazon, Orinoco and drainages east to Suriname) ——

Anostomus anostomus

10.

Symphyseal dentary teeth truncate in specimens of 60 mm SL and larger; distance from snout to pelvic-fin origin greater than distance from dorsal-fin origin to caudal-fin origin ——

Symphyseal dentary teeth bicuspid (occa-

sionally truncate from wear in large specimens > 80 mm SL); distance from snout to pelvic origin equal to or less than distance from dor-
sal-fin origin to caudal-fin origin ——

11.

Snout length 39–42% of HL; vertical darkly pigmented areas absent below lateral line (southern tributaries of Amazon including Ja-
mari and Xingu) ——

Anostomus intermedius

Snout length 43–44% of HL, vertical darkly pigmented areas present below lateral line ——

12.

Four branchiostegal rays (occasionally three, fourth ray may be reduced or folded under others); color pattern with dark longitudinal stripe along lower half of lateral-line scale row and upper half of adjacent row (Orinoco and Tapajós) ——

Pseudanos winterbottomi

Three branchiostegal rays; color pattern of two to four large blotches or spots (covering more than one scale) centered on or just below lateral line ——

13.

Color pattern in alcohol without dark, vertical pigmented areas across dorsal midline; angle between posterior three primary radii on scales below dorsal fin 40–90° (Atabapo and upper Amazon inclusive of Negro) ——

Pseudanos gracilis

Color pattern in alcohol with dark, vertical pigmented areas across dorsal midline; angle between posterior three primary radii on scales below dorsal fin 110–180° ——

14.

Color pattern in alcohol with dark spots in centers of scales (Orinoco and drainages east to Guyana) ——

Pseudanos irinae

Color pattern in alcohol with centers of scales light (Amazon exclusive of Negro) ——

Pseudanos trimaculatus

COMPARATIVE MATERIAL EXAMINED

Anostomus anostomus.—FMNH 103869, 3 (42.3–

46.3 mm SL), Venezuela, Amazonas, Pool behind beach of Río Ventuari on south side of riv-
er approximately 12 km above mouth in Río Orinoco, Laguna Pavon (4°4’N, 66°56’W). FMNH 109876, 3 (62.8–74.2 mm SL; 1 speci-

men, 74.2 mm SL & S), Venezuela, Bolivar, En-
terrios, edge of Río Caura near mouth of Río Erebató (5°56’1”N, 64°25’40”W).

Anostomus intermedius.—INPA 15184, 16 (59.2–

72.1 mm SL), Brazil, Rondônia, Río Jamari, a above UHE Samuel, stony beach along river bank.
Anostomus plicatus.—FMNH 53396, COTYPE, 1 (60.3 mm SL), British Guiana, Tumatumari.

Anostomus ternetzi.—FMNH 109883, 42 (37.8–70.7 mm SL; 4 specimens, 38.0–59.2 mm SL C&S), Venezuela, Bolivar, a beach in Río Caura at El Playon (6°19′31″N, 64°31′37″W).

Gnathodus bidens.—ANSP 159389, 9 (55.0–76.1 mm SL), Ecuador, Napo, Río Yasuni, Río Salado, approximately 7 min from mouth in Río Suripa; small island and small arms of river. FMNH 33932, PARATYPE, 1 (56.0 mm SL), British Guiana, Rockstone.

Laemolyta garmani.—FMNH 102133, 1 (124.9 mm SL), Ecuador, Napo, Río Yasuni, Río Salado, approximately 100 m upstream from mouth (0°58′36″S, 75°26′6″W). FMNH 92498, 5, (56.0–86.2 mm SL; 1 specimen, 74.1 mm SL C&S) Peru, Loreto, Iquitos, Río Nanay, Avacacocha, alt 20 m.

Laemolyta taeniata.—FMNH 105777, 2 (94.2–97.8 mm SL), Venezuela, Amazonas, Pozo Azul approximately 20 km south of Puerto Ayacucho. FMNH 103866, 2, (60.0–72.8 mm SL; 1 specimen, 72.8 mm SL C&S), Venezuela, Amazonas, pool behind beach of Río Ventuari on south side of river approximately 12 km above mouth in Río Orinoco, Laguna Pavon (4°4′N, 66°56′W).

Pseudanos gracilis.—CAS 20105, 4 (85.1–137.8 mm SL), CAS 20107, 1 (96.7 mm SL) and SU 16280, 6 (67.5–159.6 mm SL), Venezuela, Amazonas, Río Orinoco Basin, Río Atabapo. CAS 168314, 1 (C&S), Venezuela, Amazonas, Río Orinoco drainage, Río Atabapo, San Fernando de Atabapo. FMNH 104021, 1 (154.4 mm SL), Venezuela, Amazonas, Caño Guasuriapana at Guasuriapana, caño and backwater approximately 7 min from San Fernando de Atabapo, tributary of Río Atabapo (4°0′N, 67°42′W). FMNH 103454, 32 (53.0–102.1 mm SL; 2 specimens, 70.9–81.6 mm SL, C&S), Venezuela, Amazonas, Río Atabapo, rocks at shore and inlet of Isla de Sapó, approximately 1.2 h above San Fernando de Atabapo. SU 16277, 1 (116.6 mm SL), Brazil/Venezuela, Río Negro between Cucui, Brazil and San Carlos, Venezuela. SU 16278, 1 (153.2 mm SL), Venezuela, Amazonas, Río Orinoco, Río Atabapo into Río Orinoco, San Fernando de Atabapo.

Pseudanos irinae.—FMNH 103867, 1 (46.9 mm SL), Venezuela, Barinas, Río Anaro approximately 10 min from mouth in Río Suripa; small island and small arms of river. FMNH 33932, PARATYPE, 1 (56.0 mm SL), British Guiana, Rockstone.

Anostomus ternetzi.—FMNH 102122, 13 (63.7–162.9 mm; 2 specimens, 74.2–78.1 mm C&S), Ecuador, Napo, Río Yasuni, Río Jatuncocha, about 2 km upstream from Laguna Jatuncocha (1°0′18″S, 75°31′24″W). FMNH 69592, 19 (47.0–92.2 mm), Brazil, Maciel, Río Guapure. FMNH 100355, 5 (39.1–72.6 mm), Ecuador, Napo, outflow of Laguna Jatuncocha, (0°59′42″S, 75°27′12″W), D. Stewart et al., 23 October 1981.

Sartor elongatus.—INPA 1168, PARATYPES, 4 (72.0–91.0 mm SL), Brazil, Río Trombetas, Caçoeira Porteira.

Sartor tucuruense.—INPA 1166, PARATYPE, 1 (100.0 mm SL), Brazil, Pará, Río Tocantins, city of Tucurúi, approximately 2 km below Tucurúi dam, pools of water with rocky bottoms.

Schizodon fasciatus.—FMNH 111351, 5 (112.2–182.1 mm SL; 1, 96.4 mm SL, C&S), Peru, Loreto, Cocha and Caño Atun, tributary to Río Samiria just below ranger’s station, approximately 59 km from mouth in Río Maranon (5°5′S, 74°30′W).

Synaptolaemus cingulatus.—FMNH 103455, 9 (48.8–79.2 mm SL; 3, 52.6–70.1 mm SL, C&S), Venezuela, Amazonas, rocks and rapids in Río Orinoco, Isla Cupaven. FMNH 109915, 1 (67.5 mm SL), Venezuela, Amazonas, pool behind beach of Río Ventuari on south side of river approximately 12 km above mouth in Río Orinoco, Laguna Pavon (4°4′N, 66°56′W).

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