

## A new species of *Notarius* (Siluriformes: Ariidae) from the Colombian Pacific

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### Abstract

*Notarius armbrusteri* n. sp. is described from specimens purchased in the fish market of Buenaventura, Valle del Cauca, Colombia. The species is distinguished from other eastern Pacific species of *Notarius* by the following combination of features: mouth small, width 11.1–11.8% SL; eye large, diameter 4.3–4.9% SL; distance between anterior nostrils 6.1–6.9% SL, distance between posterior nostrils 5.9–6.9% SL; short maxillary barbels, length 20.5–22.2% SL; and gill rakers on first arch 3–4+8–9 (total 11–13). Based on mitochondrial evidence (cytochrome *b* and ATP synthase 8/6, total 1937 base pairs), the new species is closely related to *N. insculptus*, from the Pacific Panama. An updated key to identify the eight described species of *Notarius* from the eastern Pacific is provided.

**Key words:** *Notarius armbrusteri* n. sp., Ariidae, sea catfishes, eastern Pacific

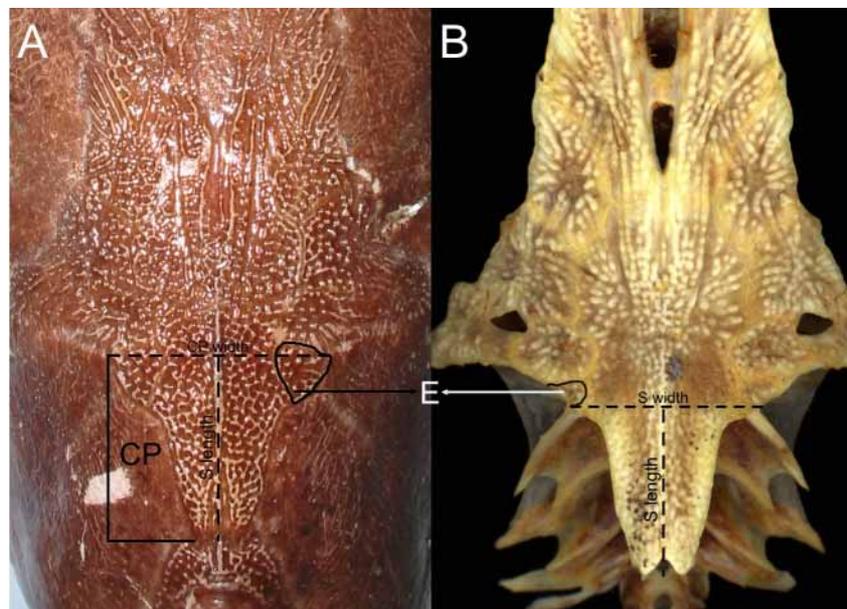
### Introduction

The amphiamerican sea catfish genus *Notarius* Gill was recently revised by Betancur-R. and Acero P. (2004). *Notarius* includes at least 14 species, with seven distributed in the eastern Pacific (EP). The monophyly of the genus is strongly supported by molecular evidence obtained from the sequences of five mitochondrial genes and one nuclear gene [3900 base pairs (bp)] (Betancur-R., 2003; Betancur-R. and Acero P., 2004). This claim was not supported by Kailola (2004), who placed the species of *Notarius sensu* Betancur-R. and Acero P. (2004) in the genera *Hemiarius* Bleeker, *Ariopsis* Gill, *Aspistor* Jordan & Evermann, and *Sciades* Müller & Troschel, as well as two species recognized as *incertae sedis* (Table 1). It is noteworthy, however, that none of the species assigned by Betancur-R.

and Acero P. (2004) in *Notarius* were included in Kailola (2004)'s phylogenetic analysis. Marceniuk and Ferraris (2003), based on the results of Marceniuk's (2003) unpublished dissertation, also proposed a different classification scheme for New World ariids, placing most of the species of *Notarius sensu* Betancur-R. and Acero P. (2004) in *Notarius* (only four species), *Aspistor*, *Arius Valenciennes*, and *Hexanematichthys* Bleeker (Table 1). In summary, despite the recent efforts to resolve the taxonomy of the Ariidae, its generic nomenclature is still unstable. The aim of this paper is to give formal description to a new species of *Notarius* from the Colombian Pacific.

### Material and methods

*Morphological data.* Counts and measurements were made following Allen and Fischer (1978). All measurements were taken in a straight line, made with either a ruler and recorded to the nearest millimeter (mm) or with dial calipers and recorded to the nearest 0.1 mm. Upper lip width was measured at the anterior edge. The width of the supraoccipital process was measured at the base of the process; the length of the process was measured from the midpoint of its base to its distal end (Fig. 1). Head depth was measured at the anterior end of the supraoccipital keel. Gill raker counts include rudimentary elements. SL is standard length, HL is head length, and TL is total length. Comparative material and GenBank accession numbers for sequence data are listed in Betancur-R. and Acero P. (2004).



**FIGURE 1.** Head shields of (A) *Notarius insculptus* (STRI 5715, 16 mm supraoccipital process length) and (B) *N. armbrusteri* (USNM 264834, 12.7 mm supraoccipital process length). S: supraoccipital process; CP: complex process; E: epioccipital (= epiotic).

**TABLE 1.** Species of *Notarius sensu* Betancur-R. and Acero P. (2004) and their generic placements according to Marceniuk and Ferraris (2003) and Kailola (2004). The inclusion of *Galeichthys bonillai* in *Notarius* follows Acero P. and Betancur-R. (2006) (= *Notarius* sp., Betancur-R. and Acero P., 2004). WA: western Atlantic; EP: western Pacific; K&B: Kailola and Bussing (1995).

Species (original name)	Authority	Basin
<i>Notarius biffi</i>	Betancur-R. and Acero	EP
<i>Arius cookei</i>	Acero and Betancur-R.	EP
<i>A. grandicassis</i>	Valenciennes	WA
<i>A. insculptus</i>	Jordan and Gilbert	EP
<i>A. kessleri</i>	Steindachner	EP
<i>A. luniscutis</i>	Valenciennes	WA
<i>A. neogranatensis</i>	Acero and Betancur-R.	WA
<i>A. phrygiatus</i>	Valenciennes	WA
<i>A. planiceps</i>	Steindachner	EP
<i>A. quadriscutis</i>	Valenciennes	WA
<i>A. rugispinis</i>	Valenciennes	WA
<i>A. troschellii</i>	Gill	EP
<i>Galeichthys bonillai</i>	Miles	WA
<i>Tachisurus lentiginosus</i>	Eigenmann and Eigenmann	EP

continued

Species (original name)	Marceniuk and Ferraris (2003)	Kailola (2004)
<i>Notarius biffi</i>	-	? <i>Aspistor</i> (= <i>Arius</i> sp. A of K&B)
<i>Arius cookei</i>	<i>Arius</i>	? <i>Aspistor</i> (= <i>Arius</i> sp. B of K&B)
<i>A. grandicassis</i>	<i>Notarius</i>	<i>Hemiaris</i>
<i>A. insculptus</i>	recognized as synonym of <i>A. kessleri</i>	<i>Ariopsis</i>
<i>A. kessleri</i>	<i>Hexanematichthys</i>	<i>Aspistor</i>
<i>A. luniscutis</i>	<i>Aspistor</i>	<i>Aspistor</i>
<i>A. neogranatensis</i>	<i>Arius</i>	? <i>Aspistor</i>
<i>A. phrygiatus</i>	<i>Arius</i>	<i>Incertae sedis</i>
<i>A. planiceps</i>	<i>Notarius</i>	<i>Aspistor</i>
<i>A. quadriscutis</i>	<i>Aspistor</i>	<i>Aspistor</i>
<i>A. rugispinis</i>	<i>Arius</i>	<i>Incertae sedis</i>
<i>A. troschellii</i>	<i>Notarius</i>	<i>Sciades</i>
<i>Galeichthys bonillai</i>	<i>Hexanematichthys</i>	<i>Ariopsis</i>
<i>Tachisurus lentiginosus</i>	<i>Notarius</i>	<i>Ariopsis</i>

**Molecular data.** Sequences of the partial cytochrome *b* (cyt *b*, 1095 bp) and complete ATP synthase 8/6 (ATPase 8, 168 bp; ATPase 6, 684 bp; 10 bp overlapped) mitochondrial gene regions were obtained from the holotype and a paratype of the new species. Molecular protocols and other material sequenced are specified in Betancur-R. and Acero P. (2004). PAUP\*v.4.0b10 (Swofford, 2001) was used to estimate genetic distances, compute a maximum parsimony topology, generate consistency and retention indices, and evaluate clade support with bootstrap pseudoreplicates.

Institutional abbreviations are as in Leviton *et al.* (1985) with the modification of INVEMAR and ICNMHN to INVEMAR-PEC and ICN-MHN, respectively. Additionally, STRI (fish collection) and stri (tissue collection) are abbreviations for Smithsonian Tropical Research Institute, Balboa, Panamá (PA).

### ***Notarius armbrusteri* new species**

Figs. 2–3

*Arius planiceps* non Steindachner: Acero P. and Betancur-R. (2002): 9, Fig. 3.

**Holotype.** INVEMAR-PEC 6677 (undeposited tissue tagged as 527), female, 194 mm SL, purchased by R. Betancur-R. and A. Acero P., 28 May 2004, fish market of Buenaventura, Valle del Cauca (VC), Colombia (CO); cyt *b*, ATPase 8 and ATPase 6 sequences are available in GenBank, accession numbers DQ373045, DQ373041, and DQ373043, respectively.

**Paratypes.** INVEMAR-PEC 6678 (undeposited tissue tagged as 529), male, 177 mm SL, same collection data as holotype; cyt *b*, ATPase 8 and ATPase 6 sequences are available in GenBank, accession numbers DQ373046, DQ373042, and DQ373044, respectively. ICN-MHN 14829, female, 208 mm SL, unsexed specimen, same collection data as holotype. USNM 292738, female, 205 mm SL, purchased by W.R. Taylor, 17 October 1970, fish market of Buenaventura, VC, CO. USNM 264834, skeletonized specimen, 69 mm skull length, purchased at fish market of Buenaventura, VC, CO, catalogued 25 January 1984.

**Diagnosis.** *Notarius armbrusteri* is distinguished from other EP species of *Notarius* by the following combination of features: mouth rather small, its width 11.1–11.8% SL; eye large, diameter 4.3–4.9% SL; distance between anterior nostrils 6.1–6.9% SL, distance between posterior nostrils 5.9–6.9% SL; short maxillary barbels, barely reaching pectoral-fin bases, their length 20.5–22.2% SL; and gill rakers on first arch 3–4+8–9 (total 11–13). Meristic and morphometric data of the type series are summarized in Tables 2 and 3, respectively. Selected features distinguishing *N. armbrusteri* from the seven other EP species of *Notarius* are summarized in Table 4. See key section at the end for diagnostic characters distinguishing the new species from other EP ariid taxa.



**FIGURE 2.** Fresh (top) and preserved (bottom) aspects of *Notarius armbrusteri* (INVEMAR-PEC 6677, holotype, 194 mm SL).



**FIGURE 3.** Head of *Notarius armbrusteri* (INVEMAR-PEC 6677, holotype, 194 mm SL).

*Description (based on combined data from type series).* Body depth 5.0–5.4 in SL; body width 4.7–5.2 in SL. Head not elongated, moderately depressed anteriorly, posterior profile slightly convex, length 3.7–4.1 in SL, width 1.1–1.2 in HL, depth 1.5–1.7 in HL. Snout rounded, length 3.1–3.4 in HL. Mouth inferior to subterminal, width 2.1–2.4 in HL. Lips thin to moderately thick, upper lip width 9.8–18.5 in HL. Maxillary barbels 1.2–1.3 in

HL; mandibular barbels 1.6–1.8 in HL, passing gill membrane; mental barbels 2.2–2.4 in HL, not reaching gill membrane. Distance between anterior nostrils 3.9–4.0 in HL; distance between posterior nostrils 3.9–4.2 in HL, no fleshy furrow connecting nostrils. Interorbital distance 1.9–2.2 in HL. Eyes lateral, diameter 5.1–6.2 in HL, 2.6–3.0 in interorbital distance. Postorbital length 1.8–2.0 in HL. Head shield exposed, covered posteriorly with dense layer of tiny granules extending anteriorly to opposite eyes (granules sometimes not very apparent). Frontal depression broad, with large pale spot on anterior margin immediately after interorbital space. Supraoccipital process keeled, rather short, slightly convex; length 3.6–4.7 in HL; width 3.6–4.0 in HL, 0.8–1.0 in length. Epioccipital bones (= epiotics) not invading or slightly invading skull surface (Fig. 1B). Predorsal plate narrow, crescent-shaped. Premaxillary teeth villiform, arranged in two subrectangular bands forming wide arrow point (Fig. 4). Palate with villiform teeth, arranged in four patches: inner patches (vomerine) united medially, longer than wide; lateral patches broader, triangular, projected posteriorly, with an indentation into which fit inner patches (Fig. 4).

**TABLE 2.** Meristics of *Notarius armbrusteri*, frequencies are indicated in brackets.

	Holotype	Paratypes
Sex	female	2 females, 1 male, 1?
Dorsal fin elements	I,7	I,7(4)
Pectoral fin elements	I,12	I,11(1); I,12(3)
Pelvic fin elements	6	6(4)
Anal fin elements	20	19(1), 22(3)
Gill rakers on first arch	3+8	3(3)–4(1)+8(2)–9(2)
Total gill rakers on first arch	11	11(2), 12(1), 13(1)
Gill rakers on second arch	4+9	3(2)–4(2)+9(4)
Total gill rakers on second arch	13	12(2)–13(2)

Predorsal fin length 2.6–3.1 in SL. Dorsal-fin base 8.3–9.0 in SL; dorsal-fin spine long, rather thin, longer than pectoral-fin spine, with small serrations along external margin, inner margin slightly serrated only in distal end; height 4.4–4.7 in SL. Distance between dorsal fin and adipose fin 3.5–3.9 in SL. Base of adipose fin 8.0–8.6 in SL, as long as or somewhat longer than base of dorsal fin, 0.9–1.0 in dorsal-fin base; height of adipose fin 9.1–10.2 in SL. Pectoral-fin base 15.5–16.7 in SL; pectoral-fin spine long, thin, slightly serrated along external margin, serrations on inner margin smaller and absent near proximal end; length 4.6–5.0 in SL. Pelvic-fin base 20.0–21.3 in SL; pelvic-fin length 5.3–5.7 in SL in females and 7.1 in SL in one male. Anal-fin base 6.0–6.5 in SL; anal-fin height 5.2–5.7 in SL. Caudal peduncle depth 13.5–14.3 in SL. Caudal fin deeply forked, lower lobe shorter than upper lobe. Lateral line originating below predorsal plate, tilting

ventrally to mid-body line at about level of pelvic-fin origin, running posteriorly, bending dorsally before caudal fin. Gill rakers on second arch 3–4+9 (total 12–13). Dorsal fin elements I,7; pectoral fin elements I,11–12; pelvic fin elements 6; anal fin elements 19–22.

**TABLE 3.** Morphometrics of *Notarius armbrusteri*.

	Holotype	Paratypes	N (paratypes)
Total length (mm)	240	213–250	2
Standard length (mm)	194	177–208	3
Head length (mm)	52	48–54	4
Percents of head length			
Head width	84.2	80.2–92.9	4
Head depth	64.8	60.5–68.9	4
Snout length	32.7	29.6–32.7	4
Mouth width	41.5	42.3–48.1	4
Upper lip width	10.2	5.4–8.5	4
Maxillary barbels	82.9	76.0–84.0	4
Mandibular barbels	63.8	55.8–58.3	4
Mental barbels	42.9	40.8–44.6	4
Anterior internarial distance	25.8	25.1–25.4	4
Posterior internarial distance	24.6	24.1–25.4	4
Interorbital distance	46.3	47.0–51.8	4
Eye diameter	16.2	16.5–19.8	4
Postorbital length	52.1	50.7–56.0	4
Width of supraoccipital process	26.3	24.8–28.1	4
Length of supraoccipital process	21.2	21.7–28.0	4
Percents of standard length			
Head length	26.8	24.4–27.1	3
Body depth	19.9	18.6–20.1	3
Body width	21.1	19.2–20.9	3
Predorsal fin length	34.5	32.7–37.9	3
Dorsal-fin base	11.2	11.2–12.0	3
Dorsal-fin spine height	22.5	21.1	1
Distance between dorsal and adipose fins	26.1	25.4–28.5	3
Preadipose fin length	73.2	69.5–70.7	3
Adipose-fin base	11.6	11.9–12.5	3
Adipose-fin height	10.3	9.8–11.0	3
Prepectoral fin length	21.6	20.5–22.6	3

to be continued.

TABLE 3 (continued).

	Holotype	Paratypes	N (paratypes)
Pectoral-fin base	6.3	6.0–6.4	3
Pectoral-fin spine length	21.2	20.2–21.5	2
Prepelvic fin length	52.6	50.0–53.1	3
Pelvic-fin base	5.0	4.7–5.0	3
Pelvic-fin length	18.5	14.1–18.8	3
Preanal fin length	69.1	66.3–68.4	3
Anal-fin base	15.6	15.5–16.6	3
Anal-fin height	18.2	17.5–19.3	3
Caudal peduncle depth	7.2	7.0–7.4	3

TABLE 4. Comparisons of selected features distinguishing *Notarius armbrusteri* from the seven other eastern Pacific species of the genus *Notarius*. Data in bold indicate differences from *N. armbrusteri*. Country codes follow ISO-3166.

	<i>N. armbrusteri</i>	<i>N. insculptus</i>	<i>N. biffi</i>	<i>N. cookei</i>
Known distributions	CO	PA	CR–SV	CO–CR
Examined specimens	3F, 1M, 1?	4F, 1M, 1?	6F, 3 M, 2?	1F, 2M, 1?
SL (mm)	177–208	190–277	175–324	343–428
Anal fin elements	19–22	20–21	19–21	17–21
Total gill rakers on 1st arch	11–13	11–12	11–12	12–15
Total gill rakers on 2nd arch	12–13	11–13	10–13	<b>13–16</b>
Mouth width as %SL	11.1–11.8	<b>12.3–14.4</b>	<b>9.0–11.0</b>	<b>14.1–16.8</b>
Maxillary barbels as %SL	20.5–22.2	<b>26.7–30.3</b>	16.9–21.9	15.9–23.7
Anterior internarial distance as %SL	6.1–6.9	6.2–7.9	<b>4.8–5.7</b>	<b>8.6–10.0</b>
Posterior internarial distance as %SL	5.9–6.9	6.1–7.7	<b>4.6–5.6</b>	<b>8.0–9.0</b>
Eye diameter as %SL	4.3–4.9	<b>3.8–4.3</b>	3.8–4.5	<b>2.5–3.1</b>
Width of supraoccipital/complex process as %SL	6.7–7.1	<b>7.3–8.2</b>	<b>5.5–6.6</b>	<b>5.0–5.2</b>
Length of supraoccipital process as %SL	5.7–7.3	5.4–6.8	5.0–7.1	<b>8.0–8.6</b>
Dorsal-fin base as %SL	11.2–12.0	<b>8.9–11.6</b>	<b>9.3–10.5</b>	<b>9.7–10.7</b>
Dorsal-fin spine length as %SL	21.1–22.5	<b>20.7–21.8</b>	<b>16.6–19.7</b>	<b>14.5–14.9</b>
Caudal peduncle depth as %SL	7.0–7.4	<b>6.1–7.1</b>	<b>6.1–6.7</b>	<b>5.2–6.1</b>
Size and shape of predorsal plate	narrow, crescent	narrow, crescent	narrow, crescent	narrow, crescent
Epioccipitals visible in skull surface?	no/slightly	<b>yes</b>	no/slightly	no

to be continued.

TABLE 4 (continued).

	<i>N. kessleri</i>	<i>N. lentiginosus</i>	<i>N. planiceps</i> / aff. <i>planiceps</i>	<i>N. troschelii</i>
Known distributions	PE–MX	PA	?PA–MX	PE–MX
Examined specimens	1F, 1M, 4?	1F, 1M	4F, 4?	2F, 2?
SL (mm)	238–374	283–319	140–290	216–318
Anal fin elements	19–21	<b>24–26</b>	18–22	18–20
Total gill rakers on 1st arch	11–13	<b>7–8</b>	<b>8–10</b>	11–12
Total gill rakers on 2nd arch	<b>13–15</b>	<b>5–6</b>	<b>8–11</b>	10–13
Mouth width as %SL	<b>12.6–14.1</b>	<b>10.7–10.8</b>	<b>8.4–11.3</b>	<b>13.2–15.9</b>
Maxillary barbels as %SL	21.1–25.5	<b>24.7–26.1</b>	20.1–30.2	21.9–25.6
Anterior internarial distance as %SL	<b>7.1–8.7</b>	<b>5.6–6.0</b>	<b>4.9–6.3</b>	<b>8.0–9.5</b>
Posterior internarial distance as %SL	6.0–8.0	6.0	<b>4.6–6.1</b>	<b>7.9–9.2</b>
Eye diameter as %SL	<b>2.9–3.7</b>	<b>2.9–3.0</b>	3.5–4.5	<b>3.8–4.0</b>
Width of supraoccipital/complex process as %SL	6.9–7.6	<b>4.2</b>	<b>4.5–6.1</b>	7.5–8.8
Length of supraoccipital process as %SL	<b>7.5–9.1</b>	7.0–7.5	6.3–7.9	4.7–6.7
Dorsal-fin base as %SL	<b>9.–10.4</b>	<b>10.0–10.8</b>	10.3–12.5	<b>10.0–11.2</b>
Dorsal-fin spine length as %SL	<b>17.9–20.1</b>	<b>16.6</b>	18.0–23.0	-
Caudal peduncle depth as %SL	<b>6.1–6.5</b>	<b>7.7–7.8</b>	6.8–7.4	6.6–7.0
Size and shape of predorsal plate	narrow, crescent	narrow, crescent	narrow, crescent	<b>large, hexagonal</b>
Epioccipitals visible in skull surface?	no	no	no	no

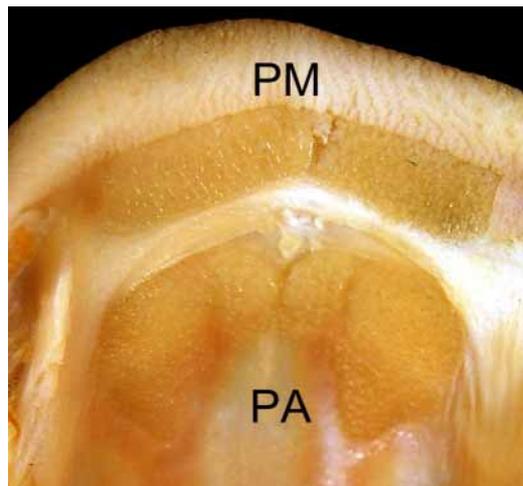


FIGURE 4. Premaxillary (PM) and palatal (PA) tooth patches of *Notarius armbrusteri* (ICN-MHN 14829, paratype, 208 mm SL).

*Coloration.* In life, dorsum brownish grey with metallic tinges, flanks and venter whitish. Lower caudal fin lobe and tip of anal fin dark; pectoral and pelvic fins dark, distal tips pale. In alcohol, coloration fades, metallic tinges disappear.

*Size.* Largest female specimen examined 208 mm SL (ICN-MHN 14829, paratype), largest male 177 mm SL (INVEMAR-PEC 6678, paratype). Female ariids have a greater development of pelvic fins than have males, and this dimorphism exhibits a positive allometry becoming more evident in mature specimens (Acero P. *et al.*, 2005). Given that there is a clear difference in the size of pelvics between female (17.5–18.5% SL) and male (14.1% SL) specimens, it seems likely that *Notarius armbrusteri* reaches maturity below 200 mm SL and is probably the smallest known species of *Notarius*.

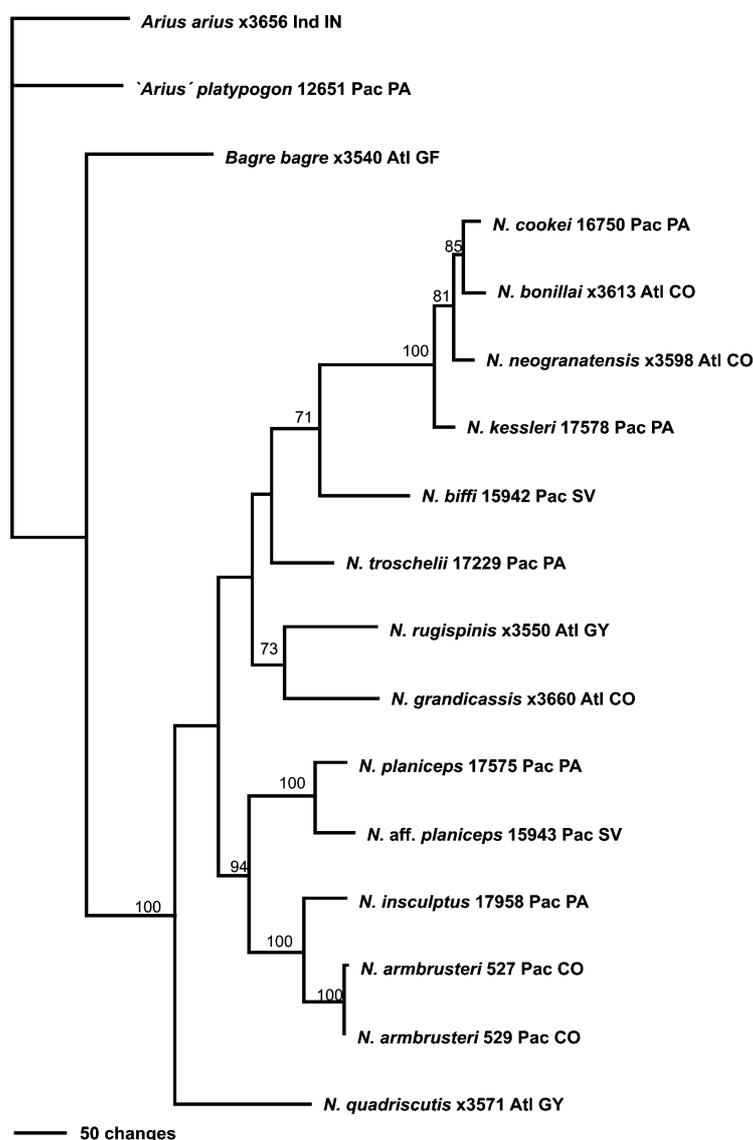
*Distribution and habitat.* *Notarius armbrusteri* is known only from Buenaventura, Valle del Cauca, Colombian Pacific. The species has not been recorded from Tumaco, Nariño, CO, about 300 km southwestwards from Buenaventura (pers. obs.). Habitat preferences are unknown.

*Etymology.* Named for Dr. Jonathan W. Armbruster, curator of the Auburn University Museum, in recognition of his important contributions to the taxonomy of neotropical catfishes. We suggest the common names of “Ñato Sea Catfish”, “bagre ñato” (Spanish, name given by fishermen in the area), and “mâchoiron ñato” (French).

## Discussion

A new molecular phylogeny for the species of *Notarius*, inferred from the combined *cyt b* + ATPase 8/6 dataset, is presented in Fig. 5. The mitochondrial evidence suggests that *N. armbrusteri* is the sister species of *N. insculptus*, from the Pacific coast of Panama; the bootstrap supporting this clade is strong (100%). The combined mitochondrial K2P distances between haplotypes of *N. armbrusteri* and *N. insculptus* are 4.1–4.2%. Both species are also related to the *N. planiceps*/aff. *planiceps* group (bootstrap 94%), known from the Pacific Panama to Mexico. Despite the few specimens in the type series (five complete and one skeletonized), the fact that *N. armbrusteri* is well discriminated as a separate and monophyletic entity among EP species of *Notarius* in the phylogram, gives strong support for its specific status.

*Notarius armbrusteri* can be separated from its sister species, *N. insculptus*, by the following features: epioccipitals not invading or only slightly invading skull surface (Fig. 1B) (vs. widely invading in *N. insculptus*, Fig. 1A), complex process (formed by the epioccipitals and the supraoccipital) absent (Fig. 1B) (vs. present in *N. insculptus*, Fig. 1A); two pairs of palatal tooth patches present (vs. three pairs in *N. insculptus*); smaller mouth (11.1–11.8% SL in *N. armbrusteri* vs. 12.3–14.4% SL in *N. insculptus*); shorter maxillary barbels (20.5–22.2% SL in *N. armbrusteri* vs. 26.7–30.3% SL in *N. insculptus*); and larger eyes (4.3–4.9% SL in *N. armbrusteri* vs. 3.8–4.3% SL in *N. insculptus*). Other EP species of *Notarius* are compared in Table 4.



**FIGURE 5.** Phylogenetic hypothesis for 12 species of *Notarius* and three other ariid taxa. The topology of the phylogram corresponds to a single optimal tree (1576 steps, CI = 0.55, RI = 0.59) obtained from the parsimony analysis of the *cyt b* and ATPase 8/6 combined data set (1937 bp), using branch-and-bound algorithm. All characters were assigned equal weight and states were treated as unordered. Base node numbers indicate bootstrap percent values (>50%) calculated from 1000 pseudoreplicates, using tree-bisection-reconnection algorithm with random addition of sequences (10 replicates). Tree is rooted at internal node with basal polytomy. Specimen tags indicate specimen voucher and/or tissue numbers in stri collection (not for *N. armbrusteri*); Atl: Atlantic; Pac: Pacific; Ind: Indic; country codes follow ISO-3166.

Updated key to described species of the genus *Notarius* from the eastern Pacific

[Modified from Betancur-R. and Acero P. (2004)]

The EP species of the genus *Notarius* are distinguished from other EP ariid taxa by the following combination of features: humeral process pointed, triangular to elongated (vs. fan-shaped in *Galeichthys peruvianus* Lütken); three pairs of barbels present (vs. only two pairs in *Bagre* Cloquet); fleshy furrow between posterior nostrils absent [vs. present in *Sciades dowii* (Gill)]; no narrow groove in median depression of head (vs. present in 'Arius' *platypogon* Günther, *Ariopsis* Gill, and *Cathorops* Jordan & Gilbert); no granules or spinulations on anterior surface of head shield [vs. present in *Cathorops dasycephalus* (Günther)]; presence of vomerine tooth patches (vs. absent in *Cathorops*, 'Arius' *labiatus* Boulenger and 'Hexanematchthys' *henni* Eigenmann) and no gill rakers on rear surfaces of first two gill arches (vs. present in *Cathorops*, except for *C. dasycephalus*).

- 1 Predorsal plate large, square or hexagonal and shaped like a forward pointing arrow ...  
..... *N. troschelii*
- Predorsal plate narrow and crescent-shaped ..... 2
- 2 Gill rakers on second arch 5–6; anal fin rays 23–28 ..... *N. lentiginosus*
- Gill rakers on second arch 8 or more; anal fin rays 17–22 ..... 3
- 3 Epioccipital bones invading skull surface, where they cover a broad area; epioccipitals and supraoccipital forming a basally wide complex process that tapers drastically posteriorly (Fig. 1A); maxillary barbels long, their length in adult specimens 26.7–30.3% SL ..... *N. insculptus*
- Epioccipital bones not invading skull surface, or invading only a small area (Fig. 1B); complex process absent; maxillary barbels short, their length in adult specimens 25.6% SL or less ..... 4
- 4 Mouth width 8.4–11.8% SL; gill rakers on second arch 8–13; eye diameter 3.5–4.9% SL ..... 5
- Mouth width 12.6–16.8% SL; gill rakers on second arch 13–16; eye diameter 2.5–3.7% SL ..... 7
- 5 Gill rakers on first arch 8–10 ..... *N. planiceps*/aff. *planiceps*
- Gill rakers on first arch 11–13 ..... 6
- 6 Mandibular barbel length 14.1–17.1% SL; anterior internarial distance 6.1–6.9% SL; caudal peduncle depth 7.0–7.4% SL ..... *N. armbrusteri* n. sp.
- Mandibular barbel length 10.2–13.1% SL; anterior internarial distance 4.8–5.7% SL; caudal peduncle depth 6.1–6.7% SL ..... *N. biffi*
- 7 Supraoccipital process elongated, its base width 1.6–1.7 in its length ..... *N. cookei*
- Supraoccipital process wide and triangular in shape, its base width 1.0–1.3 in its length ..... *N. kessleri*

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## References

- Acero P., A. & Betancur-R., R. (2002). Description of *Arius neogranatensis*, a new species of sea catfish from Colombia, with an identification key for Caribbean ariid fishes. *Aqua, Journal of Ichthyology and Aquatic Biology*, 6(1), 5–10.
- Acero P., A. & Betancur-R., R. (2006) Real identity of the northern Colombian endemic sea catfish *Galeichthys bonillai* Miles, 1945 (Siluriformes: Ariidae). *Cybium* 30 (3), in press.
- Acero P., A., Betancur-R., R., Polanco F., A. & Chaparro, N. (2005) Diferenciación sexual temprana a nivel óseo en dos géneros de bagres marinos (Pisces: Ariidae). *Memoria Sociedad de Ciencias Naturales de la Salle*, 163, 37–43.
- Allen, G.R. & Fischer, W. (1978) Bony fishes. In: Fischer, W. (Ed). *FAO Species Identification Sheets for Fishery Purposes, Western Central Atlantic (Fishing Area 31)*. Vol. 1, FAO, Rome.
- Betancur-R., R. (2003) *Filogenia de los Bagres Marinos (Siluriformes: Ariidae) del Nuevo Mundo*. Thesis M.Sc., Universidad Nacional de Colombia, Bogotá, 121 pp. Also available from: <https://acsi.acnatsci.org/index.html/> (accessed 17 June 2004).
- Betancur-R., R. & Acero P., A. (2004) Description of *Notarius biffi* n. sp. and redescription of *N. insculptus* (Jordan and Gilbert) (Siluriformes: Ariidae) from the eastern Pacific, with evidence of monophyly and limits of *Notarius*. *Zootaxa*, 703, 1–20.
- Kailola, P.J. (2004) A phylogenetic exploration of the catfish family Ariidae (Otophysi; Siluriformes). *The Beagle (Records of the Museums and Art Galleries of the Northern Territory)*, 20, 87–166.
- Kailola, P.J. & Bussing, W.A. (1995) Ariidae. In: Fischer, W., Krupp, F., Schneider, W., Sommer, C., Carpenter, K.E. & Niem, V. (Eds.). *Guía FAO Para Identificación de Especies Para los Fines de la Pesca, Pacífico Centro-Oriental*. Vol 2, FAO, Rome, pp. 860–886.
- Leviton, A.E., Gibbs, R.H. Jr., Heal, E. & Dawson, H.E. (1985) Standards in herpetology and ichthyology: Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia*, 1985, 802–832.
- Marceniuk, A.P. (2003) *Relações Filogenéticas e Revisão dos Géneros da Família Ariidae (Ostariophysi, Siluriformes)*. Ph.D. thesis, Universidade do São Paulo, São Paulo, 383 pp.
- Marceniuk, A.P. & Ferraris, C.J. (2003) Family Ariidae (Sea catfishes). In: Reis, R.E., Kullander, S.O. & Ferraris, C.J. (Eds.). *Check List of the Freshwater Fishes of South and Central America*. EDIPUCRS, Porto Alegre, pp. 447–455.
- Swofford, D.L. (2001) *PAUP\*, Phylogenetic Analysis Using Parsimony (\*and Other Methods)*. Version 4.0, Sinauer Associates, Sunderland, Massachusetts, 128 pp.