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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*

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Abstract

A new species of ariid catfish, *Notarius biffi* n. sp., from the eastern Pacific, is described. The species is distinguished from other eastern Pacific species of *Notarius* by the following features: mouth small (width 34.2–39.3% head length); eye large (diameter 3.8–4.5% standard length); mandibulary barbels short (length 10.2–13.1% standard length); distance between anterior nostrils short (17.9–20.8% head length); caudal peduncle relatively slender (depth 6.1–6.7% SL); gill rakers on the first arch 11–12. *N. insculptus* (Jordan and Gilbert, 1883) new combination is redescribed herein. This species is distinguished from other eastern Pacific *Notarius* as follows: highly developed, sculptured epioccipital bones, forming with the supraoccipital a basally wide complex process which tapers drastically posteriorly; supraoccipital process length 0.7–0.9 in the base of the complex process; predorsal plate narrow and crescent-shaped; mouth large (width 45.8–54.8% head length); maxillary barbels long (length 26.7–30.3% standard length). Based on mitochondrial phylogenetic evidence (combined cytochrome *b* and ATP synthase 8/6 data set with 1937 base pairs) and general morphology, the amphiamerican genus *Notarius* is expanded to include a total of 14 species, eight of which are presented as new combinations (*N. cookei*, *N. insculptus*, *N. kessleri*, *N. luniscutis*, *N. neogranatensis*, *N. phrygiatus*, *N. quadriscutis*, and *N. rugispinis*). The nomenclatural status of the eastern Pacific ariids *Hexanematichthys henni*, *Arius hassleriana*, *A. festae*, *A. labiatus*, *A. planiceps*, and *A. osculus* is discussed. Finally, a key to identify seven described species of *Notarius* from the eastern Pacific is presented.

Key words: *Notarius biffi*, *Notarius insculptus*, Ariidae, sea catfishes, eastern Pacific

Introduction

The family Ariidae is a monophyletic group of siluriform fishes that inhabits marine, brackish, and freshwater environments, and is widespread over the world´s tropical and

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suptropical continental shelves. The taxonomy of American ariids is in a chaotic state, since many genera lack adequate definition and some valid species remain undescribed or are synonymized. The genus *Arius* Valenciennes has been widely used to include many western Atlantic (WA) and eastern Pacific (EP) species. However, Betancur-R. (2003) presented phylogenetic evidence based on morphology that demonstrated that the type species of the genus, *Pimelodus arius* Hamilton from the Indo-West Pacific, has little affinity with American ariid lineages. Although Betancur-R. (2003) did not include the type species of the genus *Notarius* Gill (*Arius grandicassis* Valenciennes) in his analysis, he proposed its provisional use to group at least 14 neotropical *'Arius'* species. *Notarius* was recently resurrected by Marceniuk and Ferraris (2003), but they included only four species in it.

There are five aims to this paper: (1) to provide the formal description of an EP species of *Notarius*, which has been designated as *Arius* species A in the literature (see Bussing and López 1994; Kailola and Bussing, 1995; Robertson and Allen, 2002); (2) to redescribe *A. insculptus* Jordan and Gilbert 1883, which was considered by Kailola and Bussing (1995) and successive authors to be a junior synonym of *N. kessleri* (Steindachner) and was forgotten to science for more than 80 years; (3) to present mitochondrial evidence that points to a close affinity between the WA *N. grandicassis*, the new species and *N. insculptus*, and eight other ariids from the EP and WA; (4) to discuss the nomenclatural status of several EP ariid species in the light of the examination of their types; and (5) to present a key to identify seven described species of the genus *Notarius* from the EP.

Materials 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 or with dial caliper and recorded to the nearest 0.1 mm. Upper lip width was measured at front. For *Notarius biffi* and comparative material the width of the supraoccipital process was measured between the supraoccipital edges at the base of the process, where it originates from the skull. For *N. insculptus* the width of the complex process (see diagnosis) was measured between the epioccipital edges at the base of the process, where it extends from the skull. In both cases, the length of the supraoccipital process was measured from midpoint of its base to its distal end. Head depth was measured at the anterior end of the supraoccipital keel. To approximate the relative area of the humeral process in *N. insculptus*, an index (I_{hp}) was calculated, using as variables the maximum width (MW) and maximum length (ML) of the process and standard length (SL): Ihp = (MW*ML)/SL. Gill raker counts include rudimentary elements. HL is head length and TL is total length. Vertebrae were counted from radiographs taken from the type series of *N. insculptus* as well as from a nontype specimen.

Molecular data. Sequences of the partial cytochrome *b* [cyt *b*, 1095 base pairs (bp)] and complete ATP synthase 8/6 (ATPase 8, 168 bp; ATPase 6, 684 bp; 10 bp overlapped) mitochondrial gene regions were obtained from 11 *Notarius* species (12 specimens) as well as from three other ariids. Target regions were PCR-amplified and sequenced with the primers Glu-2 and Pro-R1 for cyt *b* (see Hardman and Page, 2003) and 8.2 L8331 and CO 3.2 H9407 (http://nmg.si.edu/bermlab.htm, accessed 17 June 2004) for ATPase 8/6. Several internal primers were also used to sequence the cyt *b* [ACytb-F1, ACytb-R1, OsCytb-F1, OsCytb-R1, Thr-R1 (cited in Hardman, 2002); A-Int cytb, C-Int cytb (Betancur-R., 2003)] and a single additional primer to sequence ATPase 8/6, 8.3 L8524 (http://nmg.si.edu/bermlab.htm, accessed 17 June 2004). Amplification and sequencing protocols using ATPase 8/6 in catfishes follow Perdices *et al.* (2002) and cyt *b* follow Hardman and Page (2003), see also Betancur-R. (2003). PAUP*v.4.0b10 (Swofford, 2001) was used to conduct the partition-homogeneity test of congruence among three data partitions (Farris *et al.*, 1994), 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 addition of STRI (fish collection) and stri (tissue collection), Smithsonian Tropical Research Institute, Balboa, Panamá (PA).

Notarius biffi **new species**
Figs. 1–3

Arius species A: Bussing and López, 1994: 62–63; Robertson and Allen, 2002.
"*Arius*" species A: Kailola and Bussing, 1995: 876.

Holotype. STRI 6674 (formerly STRI 5713; stri 15942), male, 200 mm SL, collected by D.R. Robertson and R. Cooke, 17 December 2001, research vessel (R/V) Urraca, 9 m depth, high salinity estuary, Bahía La Unión, El Salvador (SV) (13°20'42" N, 87°49'07" W). Cyt *b*, ATPase 8 and ATPase 6 sequences are available in GenBank, accession numbers AY688667, AY688654 and AY688641, respectively.

Paratypes. STRI 5713, two males, 201–298 mm SL, female, 234 mm SL, same collection data as holotype; UCR 2451-2 (voucher 95-6), female, 246 mm SL, UCR 2451-2 (voucher 95-7), female, 259 mm SL, collected by T. Aldare, May 1995, Tárcoles, Puntarenas, Costa Rica (CR) (9°46'00" N, 84°32'00" W); UCR 2452-3, female, 324 mm SL, collected by local fishermen, 13 February 1995, 100 m seine, mud flats, Costa de Pájaros, Golfo de Nicoya, Puntarenas, CR (10°06'05" N, 85°03'00" W), deposited by G. Klesson and D. Brooks; UCR 2386-15 (voucher 497), female, 190 mm SL, UCR 2386-15 (voucher 498), unsexed specimen, 191 mm SL, UCR 2386-15 (voucher 505), unsexed specimen, 175 mm SL, collected by M.I. Bussing and W.A. Bussing, 15 February 1994, 3 m dredge, R/V Victor Hensen, 10 m depth, off Manzanilla, upper Golfo de Nicoya, Puntarenas, CR

(10º06'48" N, 86º03'54" W); UCR 2387-23 (voucher 504), male 225 mm SL, collected by M.I. Bussing and W.A. Bussing, 16 February 1994, 3 m dredge, R/V Victor Hensen, 18 m depth, off Punta Morales, Golfo de Nicoya, Puntarenas, CR (10º02'06" N, 84º57'24" W).

FIGURE 1. Lateral view of *Notarius biffi*, from the Pacific coast of El Salvador (after Robertson and Allen, 2002).

FIGURE 2. Dorsal view of head of a female paratype (UCR 2451-2, voucher 95-7; 72 mm HL) of *Notarius biffi*, from the Pacific coast of Costa Rica.

FIGURE 3. Palatine teeth patches of *Notarius biffi* (after Kailola and Bussing, 1995).

Diagnosis. *Notarius biffi* is distinguished from other EP species of *Notarius* by the following combination of features: a small mouth, its width 34.2–39.3% (mean 36.2%) HL; eye large, its diameter 3.8–4.5% (mean 4.2%); short mandibulary barbels, their length 10.2–13.1% (mean 11.6%) SL; short anterior internarial distance, 17.9–20.8% (mean 19.4%) HL; relatively slender caudal peduncle, depth 6.1–6.7% (mean 6.4%) SL; and gill rakers on first arch 3–4+7–8 (mode 12). The combination of the following characters also distinguish this species from other EP ariids: triangular humeral process, three pairs of barbels present, fleshy furrow between posterior nostrils absent, fleshy groove in median depression of head absent, coarse to sharp granules or spinulations on anterior surface of head shield absent, and gill rakers on rear surfaces of first two gill arches absent. Meristic and morphometric data of the type series are summarized in Table 1.

Description. (based on combined data from type series) Body depth 5.4–6.9 in SL; body width 4.8–5.4 in SL. Head elongated, length 3.5–3.9 in SL, width 1.2–1.4 in HL, depth 1.6–1.8 in HL. Snout large, length 2.7–2.9 in HL. Mouth inferior to subterminal. Lips thin to moderately thick, upper lip width 14.1–21.0 in HL. Maxillary barbels short, usually not reaching pectoral fin bases, length 16.9–21.9% SL. Mental barbels 11.2–13.3 in SL. Distance between posterior nostrils short, 5.0–5.9 in HL. Interorbital distance short, 2.2–2.8 in HL. Eye diameter 5.9–7.6 in HL, 1.1–1.5 in distance between anterior nostrils, and 2.2–3.3 in interorbital distance. Postorbital length 1.9–2.1 in HL. Head shield exposed, covered posteriorly with large scattered granules, extending anteriorly as four ridges: lateral ridges rugose and reaching slightly forward of eyes, medial ridges smooth and extending into internarial space. Frontal depression broad. Supraoccipital process keeled; length 3.7–5.8 in HL and 14.1–20.1 in SL; width 3.9–5.2 in HL, 15.1–18.2 in SL, and 0.9–1.1 in its length. Epioccipital bones (= epiotics) sometimes slightly invade skull surface (mainly in large adults). Predorsal plate narrow and crescent-shaped. Premaxillary tooth patch with villiform teeth. Palatine with villiform teeth arranged in four patches: inner patches (vomerine) united medially and longer than wide, lateral patches broader, rounded anteriorly and with an indentation into which inner patches fit (Fig. 3). Predorsal fin length 2.6–2.9 in SL. Dorsal fin base 9.5–10.8 in SL, dorsal fin spine height 5.1–6.0 in SL. Distance between dorsal fin and adipose fin 3.4–4.0 in SL. Base of adipose fin 8.4–9.8 in SL, as long as, or somewhat longer than base of dorsal fin; height of adipose fin 9.5–11.8 in SL. Pectoral fin base 18.6–21.6 in SL; pectoral fin spine length 5.3–5.9 in SL, its inner margin with strong and curved serrations. Pelvic fin base 22.6–25.3 in SL in females and 29.6–33.3 in SL in males; pelvic fin length 6.2–6.7 in SL in females and 6.9–7.3 in SL in males. Anal fin base 6.5–7.9 in SL; anal fin height 5.6–6.7 in SL. Dorsal fin elements I,7; pectoral fin elements I,10–11; pelvic fin elements 6; anal fin elements 19–21; Gill rakers on second arch 3–4+7–9.

Coloration. In life, dorsum brown to grey, flanks and venter silver, dorsal fin pale, other fins dusky, barbels grey. In alcohol, brownish on dorsum, whitish below. Kailola and Bussing (1995) report a darker and duller coloration in breeding males of *"Arius"* species A (= *N. biffi*).

TABLE 1. Meristic and morphometric data on the type series (11 specimens examined) of *Notarius biffi*. For paratypes counts, figures between brackets indicate number of specimens with each count. Holotype measurements are presented in millimeters, and percents of the standard length appear between brackets. Paratypes measurements are given as a range; total lengths and standard lengths are expressed in millimeters, the additional measurements are presented as percents of the standard length.

	Holotype	Paratypes
Sex	male	6 females, 2 males, 2?
Dorsal fin elements	I,7	I,7
Pectoral fin elements	I,11	I,10(4)–I,11(6)
Pelvic fin elements	6	6
Anal fin elements	21	19(3), 20(4), 21(3)
Gill rakers on first arch	4+8	3(1)–4(9)+7(3)–8(7)
Total gill rakers on 1st arch	12	11(4)–12(6)
Gill rakers on second arch	4+9	3(3)–4(7)+7(2).8(5).9(3)
Total gill rakers on 2nd arch	13	10(1), 11(2), 12(5), 13(2)
Total length	243	213–385
Standard length	200	175–324
Body depth	30.1 (15.1)	14.5–18.5
Body width	40.8 (20.4)	18.5–21.0
Head length	54 (27.0)	25.6–28.7
Head width	43.5 (21.8)	19.2–23.2
Head depth	30 (15.0)	14.9–17.6
Snout length	19 (9.5)	8.9–10.2
Mouth width	21.2 (10.6)	9.0–11.0
Upper lip width	2.9 (1.5)	1.3–2.0
Maxillary barbels	37 (18.5)	16.9–21.9
Mandibulary barbels	20.4 (10.2)	10.5–13.1
Mental barbels	15 (7.5)	7.6–8.9
Anterior internarial distance	10.5 (5.3)	4.8–5.7
Posterior internarial distance	9.6 (4.8)	4.6–5.6
Interorbital distance	21.3 (10.7)	9.9–12.3
Eye diameter	8.8 (4.4)	3.8–4.5
Postorbital length	26.2 (13.1)	12.7–15.5
Width of supraoccipital process	13.1 (6.6)	5.5–6.6
Length of supraoccipital process	14.2 (7.1)	5.0–7.0
Predorsal fin length	74 (37.0)	35.1–38.6
Dorsal fin base	18.6 (9.3)	9.4–10.5
Dorsal fin spine height	35.9 (18.0)	16.6–19.7
Distance between dorsal and adipose fins	53 (26.5)	24.8–29.4
Preadipose fin length	143 (71.5)	71.7–74.5
Adipose fin base	20.8 (10.4)	10.2–11.9
Adipose fin height	17.5 (8.8)	8.5–10.5
Prepectoral fin length	43 (21.5)	20.9–27.2
Pectoral fin base	10 (5.0)	4.6–5.4
Pectoral fin spine length	–	16.9–18.9
Prepelvic fin length	103 (51.5)	51.1–55.2
Pelvic fin base	6 (3.0)	3.2–4.4
Pelvic fin length	28.1 (14.1)	13.7–16.1
Preanal fin length	142 (71.0)	70.0–72.6
Anal fin base	30.8 (15.4)	12.7–14.8
Anal fin height	34.9 (17.5)	15.0–17.9
Caudal peduncle depth	12.8 (6.4)	6.1–6.7

Size. Largest specimen examined 324 mm SL and 385 mm TL (UCR 2452-3, paratype). The maximum length reported by Kailola and Bussing (1995) and Robertson and Allen (2002) is 38 cm.

Distribution. The species is known in the tropical EP from central and north Costa Rica and El Salvador. Although Kailola and Bussing (1995) speculate that "*Arius*" species A extends southwards to Panamá, R. Cooke (pers. comm., 2004) doubts that this species is present in Panamá, at least from Parita Bay eastwards.

Habitat. Inshore marine and brackish waters, and high salinity estuaries. The type series was collected between 9 m and 18 m depth, but Robertson and Allen (2002) report a wider range of 10 m to 30 m.

Etymology. We name the species to honor Dr. Eldredge (Biff) Bermingham (STRI), for his important contribution to the knowledge of neotropical fish biogeography.

Common names. We propose the official English common name of "chomba sea catfish", given by Robertson and Allen (2002). In order to fulfill the need of official names in other languages, we also propose "cominata chomba" (Spanish) and "mâchoiron chomba" (French).

***Notarius insculptus* (Jordan and Gilbert 1883) new combination**
Figs. 4–7

Arius insculptus Jordan and Gilbert 1883: 41–42. Syntypes: USNM 29415 (1), 30977 (2).
Arius elatturus Jordan and Gilbert 1883: 45–46. Holotype: USNM 29408 (not found in 1985). Paratype: USNM 30995.
Tachisurus insculptus: Eigenmann and Eigenmann, 1888: 142.
Tachisurus elatturus: Eigenmann and Eigenmann, 1888: 142.
Netuma insularum Greene in Gilbert 1897: 439–440. Holotype: USNM 47577.
Netuma insculpta: Gilbert and Starks, 1904: 27; Meek and Hildebrand, 1923: 116–117.
Netuma elattura: Gilbert and Starks, 1904: 29; Meek and Hildebrand, 1923: 115–116.
"Arius" kessleri non Steindachner: Kailola and Bussing, 1995: 869 (in part).
Arius kessleri non Steindachner: ? Acero and Betancur-R., 2002: 137 (in part).
Hexanematichthys kessleri (non Steindachner): Marceniuk and Ferraris, 2003: 451 (in part).

FIGURE 4. Lateral view of a female specimen (STRI 5715, 236 mm SL) of *Notarius insculptus*, from the Pacific coast of Panamá (photo by D.R. Robertson).

FIGURE 5. Dorsal view of head of a female specimen (STRI 5715, 60 mm HL) of *Notarius insculptus*, from the Pacific coast of Panamá (photo by D.R. Robertson).

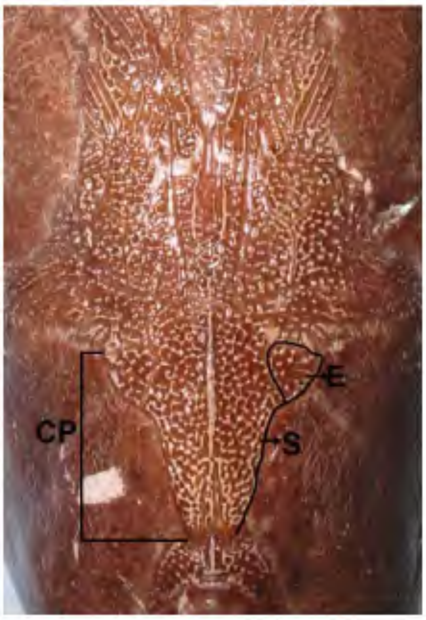

FIGURE 6. Head shield of a female specimen (STRI 5715, 16 mm supraoccipital process length) of *Notarius insculptus*. CP: complex process; E: epioccipital (= epiotic); S: supraoccipital.

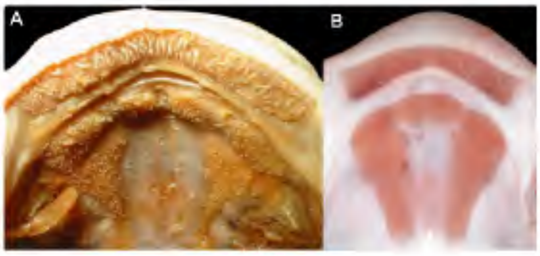

FIGURE 7. A: Palatine teeth patches (antero-ventral view) of an adult male of *Notarius insculptus* (USNM 30995, 260 mm SL). B: Palatine tooth patches (ventral view) of an adult female of *Notarius insculptus* (STRI 5715, 236 mm SL).

Lectotype. USNM 29415, female, 277 mm SL, collected by C.H. Gilbert, Panamá, PA.

Paralectotypes. USNM 30977, female, 253 mm SL, unsexed specimen, 190 mm SL, collected prior to 3 July 1882 by Rowell, Panamá, PA.

Other material. USNM 30995 (paratype of *Arius elatturus*), male, 260 mm SL, collected by Rowell, Panamá, PA; USNM 47577 (holotype of *Netuma insularum*), female, 231 mm SL, Albatross vessel, station 2800, Golfo de Panamá, PA [erroneous locality Galapagos Islands, corrected by Snodgrass and Heller (1905)]; USNM 216986 (formerly 170833), male, 241 mm SL, USNM 216987 (formerly 170833), male, 213 mm SL, collected in August 1888, Albatross vessel, Isla Clarión, Revillagigedo, Mexico (locality probably erroneous); USNM 38272, female, 255 mm SL, collected in June 1885, Panamá, PA; USNM 79424, female, 272 mm SL, collected by S.E. Meek and S.F. Hildebrand, 4 February 1912, Balboa, Panamá, PA; STRI 5715 (stri 17958), female, 236 mm SL, collected by D.R. Robertson, June 2003, R/V Urraca, Isla Gobernadora, Veraguas, PA (7°34' N, 81°12' W), Cyt *b*, ATPase 8 and ATPase 6 sequences are available in GenBank, accession numbers AY68866, AY688653 and AY688640, respectively.

Diagnosis. Notarius insculptus is distinguished from other EP species of *Notarius* by the following combination of features: highly developed, sculptured epioccipital bones, forming with the supraoccipital a complex process that is very wide at its base and tapers drastically posteriorly (Fig. 6); supraoccipital process length 0.7–0.9 (mean 0.8) in the base of the complex process; predorsal plate narrow and crescent-shaped; large mouth, its width 45.8–54.8% (mean 49.6%) HL; and long maxillary barbels, reaching beyond pectoral fin bases, their length 26.7–30.3% (mean 28.0%) SL. The combination of the following characters also distinguish this species from other EP ariids: triangular humeral process, three pairs of barbels present, fleshy furrow between posterior nostrils absent, fleshy groove in median depression of head absent, coarse to sharp granules or spinulations on anterior surface of head shield absent, and gill rakers on rear surfaces of first two gill arches absent. Meristic and morphometric data of the material examined are summarized in Table 2.

Description. (based on combined data from type and nontype material) Body depth 5.4–6.5 in SL; body width 4.4–4.9 in SL. Head relatively broad, anteriorly depressed; length 3.4–3.9 in SL, larger in males (3.3–3.4 in SL) than females (3.8–3.9 in SL); width 1.1–1.3 in HL; depth 1.6–2.0 in HL. Snout rounded, length 3.0–3.5 in HL. Mouth inferior to subterminal. Lips thin to moderately thick, upper lip width 14.0–29.6 in HL, thicker in females (14.0–20.3 in HL) than males (one specimen 29.6 in HL). Mandibulary barbels 5.7–7.8 in SL. Mental barbels 8.8–11.2 in SL. Distance between anterior nostrils large, 3.4–4.3 in HL. Distance between posterior nostrils large, 3.4–4.3 in HL. Interorbital distance large, 1.9–2.3 in HL. Eye relatively large, diameter 6.3–6.9 in HL, 1.5–2.0 in distance between anterior nostrils, and 2.8–3.6 in interorbital distance. Postorbital length 1.8–2.1 in HL. Head shield exposed, covered posteriorly with scattered granules, extending anteriorly to opposite the eyes. Frontal depression broad. Supraoccipital process keeled,

TABLE 2. Meristic and morphometric data on the type series and additional material (AM) (six specimens examined) of *Notarius insculptus*. For paralectotypes and AM counts, figures between brackets indicate number of specimens with each count (some data are missing). Lectotype measurements are presented in millimeters, and percents of the standard length appear between brackets. Paralectotypes and AM measurements are given as a range; total lengths and standard lengths are expressed in millimeters, the additional measurements are presented as percents of the standard length.

	Lectotype	Paralectotypes and AM
Sex	female	3 females, 1 male, 1?
Dorsal fin elements	I,7	I,7
Pectoral fin elements	I,11	I,11
Pelvic fin elements	6	6
Anal fin elements	20	20(4), 21(1)
Gill rakers on first arch	3+9	3+8(2)–9(2)
Total gill rakers on 1st arch	12	11(3)–12(1)
Gill rakers on second arch	4+9	3(3)–4(1)+7(1),8(1),9(2)
Total gill rakers on 2nd arch	13	11(1), 12(1), 13(1)
Postweberian vertebrae	49	48 (1), 51(2)
Total length	325	220–300
Standard length	277	190–260
Body depth	47.6 (17.2)	15.4–18.6
Body width	57.5 (20.8)	20.2–23.0
Head length	73 (26.4)	25.4–29.6
Head width	64.4 (23.2)	20.7–24.1
Head depth	42.1 (15.2)	14.6–16.4
Snout length	24 (8.7)	7.6–8.5
Mouth width	40 (14.4)	12.3–13.6
Upper lip width	3.6 (1.3)	1.0–1.8
Maxillary barbels	74 (26.7)	27.1–30.3
Mandibulary barbels	44.8 (16.2)	12.9–17.4
Mental barbels	26.3 (9.5)	8.9–11.3
Anterior internarial distance	21.6 (7.8)	6.2–7.9
Posterior internarial distance	21.2 (7.7)	6.1–7.6
Interorbital distance	36.3 (13.1)	11.5–14.2
Eye diameter	10.8 (3.9)	3.8–4.3
Postorbital length	36.4 (13.1)	12.5–16.0
Width of complex process	20.1 (7.3)	7.5–8.2
Length of supraoccipital process	16.3 (5.9)	5.4–6.8
Predorsal fin length	95 (34.3)	34.4–36.5
Dorsal fin base	28.8 (10.4)	8.9–11.6
Dorsal fin spine height	–	20.7–21.8
Distance between dorsal and adipose fins	83.9 (30.3)	25.5–31.7
Preadipose fin length	204 (73.6)	70.1–74.6
Adipose fin base	30.7 (11.1)	10.6–13.2
Adipose fin height	–	7.9–10.7
Prepectoral fin length	56 (20.2)	20.5–22.7
Pectoral fin base	16.4 (5.9)	5.3–5.6
Pectoral fin spine length	–	21.3–21.8
Prepelvic fin length	140 (50.5)	49.4–52.7
Pelvic fin base	13.8 (5.0)	3.3–5.0
Pelvic fin length	50.8 (18.3)	13.2–20.9
Preanal fin length	192 (69.3)	67.9–70.0
Anal fin base	41.6 (15.0)	14.5–15.9
Anal fin height	49.2 (17.8)	15.7–20.6
Caudal peduncle depth	17.7 (6.4)	6.1–7.1

length 3.7–5.5 in HL and 14.7–18.4 in SL; complex process width 3.4–3.6 in HL and 12.3–13.8 in SL. Premaxillary tooth patches with villiform teeth. Palatine teeth villiform arranged in three pair of patches: a rounded to ovate inner pair, an ovate anterior lateral pair, larger than the inner pair, and a backward elongated triangular to trapezoidal lateral posterior pair, which is the largest of the three patches; the divisions between the patches clearly (juveniles and adult males, Fig. 7A) to barely (adult females, Fig. 7B) visible. Predorsal fin length 2.7–2.9 in SL. Dorsal fin base 8.7–11.2 in SL, dorsal fin spine height 4.6–4.8 in SL. Distance between dorsal fin and adipose fin 3.2–3.9 in SL. Base of adipose fin 7.6–9.5 in SL, as long as, or somewhat longer than base of dorsal fin; height of adipose fin 9.3–12.6 in SL. Pectoral fin base 16.9–19.0 in SL; pectoral fin spine length 4.6–4.7 in SL, its inner margin serrated. Humeral process more developed in females (Ihp 1.5–1.6) than in males (Ihp 1.0–1.1). Pelvic fin base 20.1–21.4 in SL in females and 29.9 in SL in males (one specimen); pelvic fin length 4.8–5.5 in SL in females and 6.5–7.6 in SL in males. Anal fin base 6.3–6.9 in SL; anal fin height 4.8–6.4 in SL. Caudal peduncle depth 14.0–16.5 in SL. Dorsal fin elements I,7; pectoral fin elements I,11; pelvic fin elements 6; anal fin elements 20–21; gill rakers on first arch 3+8–9; gill rakers on second arch 3–4+7–9; postweberian vertebrae 48–51.

Coloration. In life, dorsum brownish grey with metallic tinges, flanks and venter whitish; lower caudal fin lobe and tip of anal fin dark. In alcohol, brownish on dorsum, paler below.

Size. Largest specimen examined 275 mm SL and 325 mm TL (lectotype).

Distribution. The species has been recorded only from the Pacific coast of Panamá. Since no ariids are so far known to occur in atolls, the presence of the species in Revillagigedo, as indicated by the collecting data of the Albatross lot USNM 170833, seems unlikely.

Habitat. Known from coastal waters, no other data is available.

Common names. We propose the official English common name of "neglected sea catfish". We also propose "cominata olvidada" (Spanish) and "mâchoiron négligé" (French).

Discussion

The genus *Notarius* was originally described by T. N. Gill in 1863 to accommodate the WA *Arius grandicassis*. Marceniuk and Ferraris (2003) resurrected this generic name and also placed in it *Arius planiceps* Steindachner, *Sciades troschelii* Gill, and *Tachisurus lentiginosus* Eigenmann and Eigenmann. Following the well-supported phylogenetic hypothesis presented in Fig. 8, which is based on the combined mitochondrial data set cyt *b* and ATPase 8/6 (1937 bp), we believe that *Notarius* comprises at least 11 species (Table 3), most of which have been previously included in *Arius* or other genera (e.g. *Sciadeops* Fowler and *Aspistor* Jordan and Evermann). Furthermore, other neotropical species not sequenced by us, such as *A. phrygiatus* (similar to *N. rugispinis*), *A. luniscutis* (similar to

N. quadriscutis), and *T. lentiginosus*, are likely to be included in *Notarius*. However, it is noteworthy that *Notarius* is a complex taxonomic entity and possibly comprises two more undescribed EP species.

TABLE 3. Species listed in the genus *Notarius*. The generic designation is based on mitochondrial phylogenetic evidence or general morphology*. The previous treatment in other genera follows López and Bussing (1994), Kailola and Bussing (1995), Castro-Aguirre *et al.* (1999), Robertson and Allen (2002) and Marceniuk and Ferraris (2003). EP: eastern Pacific; WA: western Atlantic.

Species	Original genus	Authority	Other genera recently used	Current generic status	Basin
N. biffi	*Notarius*	Betancur-R. and Acero	–	original	EP
N. cookei	*Arius*	Acero and Betancur-R.	–	new combination	EP
N. grandicassis	*Arius*	Valenciennes	–	validated (type species)	WA
N. insculptus	*Arius*	Jordan and Gilbert	*Hexanematichthys*	new combination	EP
N. kessleri	*Arius*	Steindachner	*Hexanematichthys*, *Ariopsis*	new combination	EP
*N. lentiginosus**	*Tachisurus*	Eigenmann and Eigenmann	*Arius*	validated	EP
*N. luniscutis**	*Arius*	Valenciennes	*Aspistor*	new combination	WA
N. neogranatensis	*Arius*	Acero and Betancur-R.	–	new combination	WA
*N. phrygiatus**	*Arius*	Valenciennes	–	new combination	WA
N. planiceps	*Arius*	Steindachner	*Ariopsis*	validated	EP
N. quadriscutis	*Arius*	Valenciennes	*Aspistor*	new combination	WA
N. rugispinis	*Arius*	Valenciennes	–	new combination	WA
N. troschelii	*Sciades*	Gill	*Sciadeops*	validated	EP
N. sp.	–	–	–	–	WA

The monophyly of *Notarius* is supported due to the nested position of its type species, *N. grandicassis*, and the high bootstrap value of the clade (100%). From topology it is also clear that the neotropical sea catfish species treated herein under *Notarius* are not closely related to *A. arius*. This fact gives support to Betancur-R.´s (2003) hypothesis, which anticipated on morphological grounds that the genus *Arius* should not be used in the New World. Betancur-R. (2003) also proposed that the presence of a cranial fontanelle posteriorly limited by the frontals and the supraoccipital constituted an osteological synapomorphy of the *Notarius* group. However, because in *A. grandicassis* the supraoccipital does not participate in the cranial fontanele (unpublished data), this species exhibits the putative plesiomorphic state. Therefore, a morphological synapomorphy for *Notarius* species is still lacking. In any case, although Betancur-R. (2003) did not analyze either the osteology or molecular data of *N. grandicassis*, the monophyletic status of the branch conformed by several *Notarius* species, among different ariid lineages, was consistent with both mitochondrial and nuclear markers (≈3900 bp).

Under the phylogenetic assumption presented in Fig. 8, the systematic scheme of *Notarius sensu* Marceniuk and Ferraris (2003) is evidently paraphyletic. Those authors also accepted the genus *Aspistor* for *A. luniscutis* and *A. quadriscutis*, included *A. cookei*, *A. neogranatensis*, *A. phrygiatus*, and *A. rugispinis* in *Arius*, and *A. kessleri* and *A. osculus* Jordan and Gilbert in the polyphyletic genus *Hexanematichthys* Bleeker (see a detailed discussion about the nonmonophyly of *Hexanematichthys* in Betancur-R., 2003). The placement of the mentioned species in *Arius* and *Hexanematichthys* is rejected on the basis of molecular evidence. Our results show that the genera *Aspistor* and *Sciadeops* should be considered as junior synonyms of *Notarius*. Alternatively, it would be possible to accept *Aspistor* as the sister genus of *Notarius*. However, the low bootstrap value of such scenario (<60%) implies a weakly supported monophyletic *Notarius*. Moreover, in three of four mitochondrial topologies presented in Betancur-R. (2003), after combining two data sets (cyt *b* and ATPase 8/6 vs. cyt b, ATPase 8/6, 12S and 16S) and two reconstruction criteria (maximum parsimony vs. Bayesian inference), *A. quadriscutis* appears in a nested position within a clade of several *Notarius* species. Therefore, we reject the liberal action of accepting *Aspistor* as a valid genus, and accepting at least two other genera exclusive of *Notarius*. We herein opt for an inclusive *Notarius* and would accept *Aspistor* and *Sciadeops* only at a subgeneric level.

There are four EP ariid species listed as *inquirendae* in recent literature (see Kailola and Bussing, 1995; Marceniuk and Ferraris, 2003). The types of these species were examined to avoid nomenclatural chaos. The holotype of *Arius hassleriana* Borodin, described from Panamá, displays a large mouth, small eyes, relatively wide and triangular-shaped supraoccipital process, and numerous granulations on the rear surface of the skull. These features are similar to *N. kessleri* and suggest that this species is a senior synonym of the former. On the other hand, the presence of molariform teeth on the palatal tooth patches in the unique type of *A. festae* Boulenger, from Naranjal in Ecuador, indicates that this species is a member of the genus *Cathorops*. In addition, these teeth are large and globular, which suggests that it is a senior synonym of *C. tuyra* (Meek and Hildebrand). Finally, the types of *A. labiatus* Boulenger and *Hexanematichthys henni* Eigenmann, from Peripa and Daule rivers in Ecuador, lack inner palatine tooth patches and possess only rudimentary lateral palatine patches with villiform teeth, display a narrow and elongated snout, and present numerous gill rakers on rear surfaces of first two gill arches. Therefore, neither *A. labiatus* or *H. henni* are species of *Notarius*; they seem to be species of the freshwater genus *Potamarius* Hubbs and Miller, which is so far unknown from the EP. In conclusion, our new species is distinct from any of the above species, poorly diagnosed in the literature.

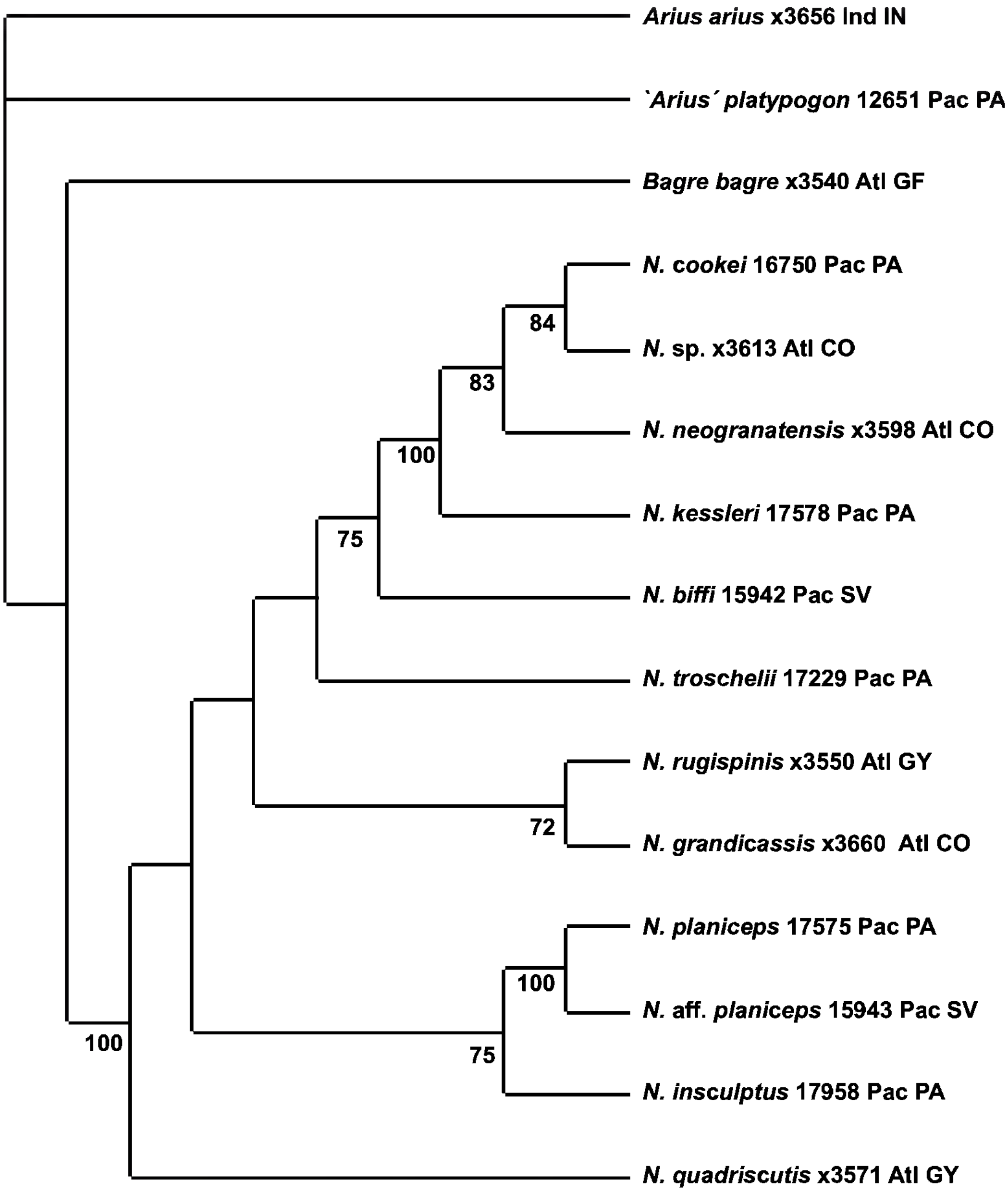

FIGURE 8. Phylogenetic hypothesis of 11 species of the genus *Notarius* and three other ariid taxa. The topology corresponds to a single optimal tree (1534 steps, CI = 0.56, RI = 0.54) obtained from the parsimony analysis of the cyt *b* and ATPase 8/6 combined data set (1937 bp), using branch-and-bound algorithm. The partition homogenity test conducted with 100 replicates did not reject phylogenetic congruence among three mitochondrial regions ($p = 0.94$). All characters were assigned equal weight and states were treated as unordered. Numbers in the base of the nodes indicate bootstrap percent values (>60%) calculated from 10000 pseudoreplicates, using tree-bisection-reconnection algorithm. Three hundred seventy characters were phylogenetically informative (19.1%) among *Notarius*. Tree is rooted at internal node with basal polytomy. Specimen tags indicate specimen voucher and/or tissue numbers in stri collection; Atl: Atlantic; Pac: Pacific; Ind: Indic; country codes follow ISO-3166.

After reading the original description of *N. planiceps* by Steindachner (1877) and examining several of the types of this species from Panamá and Altata, we conclude that its correct identity has been misunderstood, at least in recent literature (see Bussing and López, 1994; Kailola and Bussing, 1995; Robertson and Allen, 2002). The studied type specimens have small mouth (33.9–39.4% HL), thick lips (8.6–9.2% HL), and low gill raker counts on first arch (2–3+6–7). These are features that correspond mostly to the species identified by recent authors as *A. osculus*. However, a direct comparison with *A. osculus* cannot be accomplished, because Jordan and Gilbert´s (1883) original description is obscure, the type locality is not precise (Pacific Panamá) and the only type specimen (USNM 29476) have been lost for more than two decades. Therefore, due to the lack of reliable evidence, the status of *A. osculus* should be considered uncertain.

Although *N. biffi* had not been formally described, it is known to scientists working on the fish fauna of the tropical EP. Bussing and López (1994) presented a sketch of the head of *Arius* species A and a short description. Kailola and Bussing (1995) also gave a description, showed sketches of head and palatine teeth, and included it in their key to the EP ariids. Finally, Robertson and Allen (2002) presented key features and two pictures of the species. The phylogenetic hypothesis presented herein indicates a close affinity between *N. biffi* and the transisthmian lineage conformed by *N. kessleri* and *N. cookei* from the EP, and *N. neogranatensis* and *N.* sp. from the WA. Comparisons of select features distinguishing *N. biffi* from six other EP species of *Notarius* are summarized in Table 4.

In their summary of the EP ariids, Jordan and Gilbert (1883), described three new species, two of which were *Arius insculptus* and *A. elatturus.* They justified their separation on the basis of the continuity of the palatine teeth patches (fully confluent in *A. insculptus* vs. separated by a narrow interspace in *A. elatturus*) and on the size of the humeral process (more developed in *A. insculptus*). However, they did not notice at that time that both features in fact reflect sexual dimorphism, since two of the three types of *A. insculptus* are females (the smaller specimen remains unsexed) and the existing paratype of *A. elatturus* is a male. *N. insculptus*, as probably all sea catfishes, can be easily sexed by the size of the pelvic fins, which are larger in females (18.3–20.9% SL) than in males (13.2–15.4% SL). After examining the type series of *A. insculptus/elatturus* and additional material (one female and two males), sexual differences in adults associated with the shape of the palatine teeth patches (Fig. 7) and with the relative area of the humeral process (Ihp 1.5–1.6 in females vs. 1.0–1.1 in males) were consistent. Furthermore, HL seems to be larger in males (29.6–30.3% SL vs. 25.4–26.4% SL in females) and the pelvic fin bases larger (4.7–5.0% SL vs. 3.3% SL in one male) and lips thicker (4.9–7.2% HL vs. 3.4% HL in one male) in females. In their review of the marine fishes of Panamá, Meek and Hildebrand (1923) were apparently the last authors who validated *Netuma insculpta* and *N. elattura.* After that, the species remained forgotten to science until Kailola and Bussing (1995) and subsequent authors (see Acero and Betancur-R., 2002; Marceniuk and Ferraris, 2003) treated both names together with *Netuma insularum* as junior synonyms of *Notarius* *kessleri*. Gilbert and Starks (1904) commented that *N. insculptus* was a rare species. Additionally, we located few specimens deposited in museums. This probably explains its omission in the literature through most of the 20th and early 21st centuries. As Fig. 8 clearly indicates, *N. insculptus* is sister species of *N. planiceps* clade. Comparisons of select features distinguishing *N. insculptus* from six other EP species of *Notarius* are summarized in Table 5.

TABLE 4. Comparison of select features distinguishing *N. biffi* from six other EP species of *Notarius*. Data in bold indicate differences from *N. biffi*. Standard length is expressed in millimeters, the additional measurements are presented as percents of the standard length. F: female(s); M: male(s).

	N. biffi	*N. cookei*	*N. insculptus*	*N. kessleri*	*N. lentiginosus*	*N. planiceps*/ **aff.** *planiceps*	*N. troschelii*
Examined specimens	6 F, 3 M, 2?	1F, 2M, 1?	4F, 1M, 1?	1F, 1M, 4?	1F, 1M	4F, 4?	2F, 2?
Standard length	175–324	343–428	190–277	238–374	283–319	140–290	216–318
Anal fin elements	19–21	17–21	20–21	19–21	**24–26**	18–22	18–20
Gill rakers on first arch	3–4+7–8	**4–5+8–10**	3+8–9	3–4+8–9	**3+4–5**	**2–3+6–7**	3–4+8
Total gill rakers on 1st arch	11–12	**12–15**	11–12	11–13	**7–8**	**8–10**	11–12
Gill rakers on second arch	3–4+7–9	**3–5+10–11**	3–4+7–9	**3–6+9–10**	**1+4–5**	2–3+6–8	2–3+8–10
Total gill rakers on 2nd arch	10–13	**13–16**	11–13	**13–15**	**5–6**	8–11	10–13
Mouth width	9.0–11.0	**14.1–16.8**	**12.3–14.4**	**12.6–14.1**	10.7–10.8	8.4–11.3	**13.2–15.9**
Maxillary barbels	16.9–21.9	15.9–23.7	**26.7–30.3**	**21.1–25.5**	**24.7–26.1**	**20.1–30.2**	**21.9–25.6**
Mandibulary barbels	10.2–13.1	**13.3–15.9**	**12.9–17.4**	11.5–15.7	**13.6–15.2**	**13.7–17.7**	**13.6–15.2**
Anterior internarial distance	4.8–5.7	**8.6–10.0**	**6.2–7.9**	**7.1–8.7**	**5.6–6.0**	4.9–6.3	**8.0–9.5**
Posterior internarial distance	4.6–5.6	**8.0–9.0**	**6.1–7.7**	**6.0–8.0**	**6.0**	4.6–6.1	**7.9–9.2**
Interorbital distance	9.9–12.3	**12.7–13.7**	11.5–14.2	**12.3–13.9**	**12.6–13.1**	10.1–13.5	**14.3–17.3**
Eye diameter	3.8–4.5	**2.5–3.1**	3.8–4.3	**2.9–3.7**	**2.9–3.0**	3.5–4.5	3.8–4.0
Width of supraoccipital/ complex process	5.5–6.6	**5.0–5.2**	**7.3–8.2**	**6.9–7.6**	**4.2**	4.5–6.1	**7.5–8.8**
Length of supraoccipital process	5.0–7.1	**8.0–8.6**	5.4–6.8	**7.5–9.1**	**7.0–7.5**	6.3–7.9	4.7–6.7
Caudal peduncle depth	6.1–6.7	**5.2–6.1**	6.1–7.1	6.1–6.5	**7.7–7.8**	**6.8–7.4**	**6.6–7.0**
Size and shape of predorsal plate	narrow, crescent	narrow, crescent	narrow, crescent	narrow, crescent	narrow, crescent	narrow, crescent	**large, hexagonal**
Epioccipitals widely invasive?	no/slightly	no	**yes**	no	no	no	no

TABLE 5. Comparison of select features distinguishing *N. insculptus* from six other EP species of *Notarius*. Data in bold indicate differences from *N. insculptus*. Standard length is expressed in millimeters, the additional measurements are presented as percents of the standard length. F: female(s); M: male(s).

	N. insculptus	*N. biffi*	*N. cookei*	*N. kessleri*	*N. lentiginosus*	*N. planiceps*/ aff. *planiceps*	*N. troschelii*
Examined specimens	4F, 1M, 1?	6 F, 3 M, 2?	1F, 2M, 1?	1F, 1M, 4?	1F, 1M	4F, 4?	2F, 2?
Standard length	190–277	175–324	343–428	238–374	283–319	140–290	216–318
Anal fin elements	20–21	19–21	17–21	19–21	**24–26**	18–22	18–20
Gill rakers on first arch	3+8–9	3–4+7–8	**4–5+8–10**	3–4+8–9	**3+4–5**	**2–3+6–7**	3–4+8
Total gill rakers on 1st arch	11–12	11–12	**12–15**	11–13	**7–8**	**8–10**	11–12
Gill rakers on second arch	3–4+7–9	3–4+7–9	**3–5+10–11**	**3–6+9–10**	**1+4–5**	**2–3+6–8**	2–3+8–10
Total gill rakers on 2nd arch	11–13	10–13	**13–16**	**13–15**	**5–6**	**8–11**	10–13
Mouth width	12.3–14.4	**9.0–11.0**	14.1–16.8	12.6–14.1	**10.7–10.8**	**8.4–11.3**	13.2–15.9
Maxillary barbels	26.7–30.3	**16.9–21.9**	**15.9–23.7**	**21.1–25.5**	**24.7–26.1**	20.1–30.2	**21.9–25.6**
Anterior internarial distance	6.2–7.9	**4.8–5.7**	**8.6–10.0**	7.1–8.7	**5.6–6.0**	**4.9–6.3**	**8.0–9.5**
Posterior internarial distance	6.1–7.7	**4.6–5.6**	**8.0–9.0**	6.0–8.0	6.0	**4.6–6.1**	**7.9–9.2**
Eye diameter	3.8–4.3	3.8–4.5	**2.5–3.1**	**2.9–3.7**	**2.9–3.0**	3.5–4.5	3.8–4.0
Width of complex/ supraoccipital process	7.3–8.2	**5.5–6.6**	**5.0–5.2**	6.9–7.6	**4.2**	**4.5–6.1**	7.5–8.8
Length of supraoccipital process	5.4–6.8	5.0–7.1	**8.0–8.6**	**7.5–9.1**	**7.0–7.5**	6.3–7.9	4.7–6.7
Size and shape of predorsal plate	narrow, crescent	narrow, crescent	narrow, crescent	narrow, crescent	narrow, crescent	narrow, crescent	**large, hexagonal**
Epioccipitals widely invasive?	yes	**no/ slightly**	**no**	**no**	**no**	**no**	**no**

Key to described species of the genus *Notarius* from the eastern Pacific

The species of the genus *Notarius* are distinguished from other EP ariid taxa by the following combination of features: humeral process pointed, triangular to elongated, but never fan-shaped; three pairs of barbels present; fleshy furrow between posterior nostrils absent; fleshy groove in median depression of head absent; coarse to sharp granules or spinulations on anterior surface of head shield absent; gill rakers on rear surfaces of first two gill arches absent. Some of the data ranges showed below are based on wider ranges proposed by Kailola and Bussing (1995).

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 extensively invasive over skull surface, and forming with the supraoccipital a basally wide complex process which tapers drastically posteriorly (Fig. 6); supraoccipital process length shorter than base of complex process width; maxillary barbels relatively long, their length in adult specimens 26.7–30.3% SL........ .... *N. insculptus*
- Epioccipital bones not invasive or only slightly invasive over skull surface (Fig. 2); supraoccipital process length as long as or longer than its width at base; maxillary barbels relatively short, their length in adult specimens 26.1% SL or less 4
4 Mouth small, its width 33.9–42.5% HL; anterior internarial distance 17.9–24.0% HL; eye relatively large, its diameter 3.5-4.5% SL 5
- Mouth large, its width 44.1–54.2% HL; anterior internarial distance 25.3–32.2% HL; eye relatively small, its diameter 2.5-3.7% SL 6
5 Gill rakers on first arch 11–13; lips thin; mandibulary barbels comparatively short, their length 10.2–13.1% (mean 11.6%) SL; caudal peduncle relatively slender, its depth 6.1–6.7% (mean 6.4%) SL .... *N. biffi*
- Gill rakers on first arch 8–10; lips usually thick; mandibulary barbels comparatively long, their length 13.7–17.7% (mean 16.1%) SL; caudal peduncle relatively deep, its depth 6.8–7.4% (mean 7.1%) SL .... *N. planiceps*/aff. *planiceps*
6 Supraoccipital process elongated, its base width 1.6–1.7 in its length ....*N. cookei*
- Supraoccipital process relatively wide and triangular-shaped, its base width 1.0–1.3 in its length .... *N. kessleri*

Comparative material

Types. material of *A. cookei* is listed in Acero and Betancur-R. (2002) (data of UCR 314-3 not included); MZUT P3258 (formerly 1479), female?, 225 mm TL, Narrangal (probably Naranjal), Ecuador (EC), holotype of *A. festae*; MCZ 33213, three pictures of head and body, Golfo de Panamá, PA, holotype of *A. hassleriana*; NMW 42112, female, 374 mm SL, NMW 48249, two unsexed specimens, 252–269 mm SL, Panamá, PA, syntypes of *A. kessleri*; MZUT P472 (formerly 1540), female, 475 mm SL, Río Peripa, EC, holotype of *A. labiatus*; NMW 48194–48195, two females, 289–290 mm SL, Altata, Mexico?, syntypes of *A. planiceps*; NMW 48199, female?, 215 mm SL, Panamá, PA, syntype of *A. planiceps*; CAS 60620, unsexed holotype, 139 mm SL, CAS 60621, two unsexed paratypes, 117–122 mm SL, Río Daule, Colimes, EC, *H. henni*; MCZ 4790, male, 319 mm SL, Golfo de Panamá, PA, syntype of *T. lentiginosus*.

Nontypes. INVEMAR-PEC 3762, one male and two unsexed specimens, 238–319 mm SL, Buenaventura market, CO, *N. kessleri*; USNM 079392, female, 283 mm SL, Panamá City market, PA, *N. lentiginosus*; STRI 5737, unsexed specimen, 230 mm SL, Punta Chame, Panamá, PA, *N. planiceps*; STRI 5712 (stri 17575), female, 216 mm SL, Punta Patiño, Darién, PA, *N. planiceps*; UCR 2386-15 (voucher 506), unsexed specimen, 140 mm SL, Golfo de Nicoya, Puntarenas, CR, *N. planiceps*; STRI 5714 (stri 15943), female, 150 mm SL, STRI 5742, unsexed specimen, 143 mm SL, Golfo de Fonseca, SV, *N.* aff. *planiceps*; INVEMAR-PEC 5334 (undeposited tissues tagged as 516–517), two females, 314–318 mm SL, Tumaco market, CO, *N. troschelii*; INVEMAR-PEC 5335, two unsexed specimens, 216–234 mm SL, Buenaventura market, CO, *N. troschelii*.

Sequenced. Sequences are available in GenBank, accession numbers AY582860–AY582865 and AY688636–AY688674. USNM 376608 (stri x3656), Chilika lake, Orissa, India, *Arius arius*; STRI 5728 (stri 12651), Bahía de Parita, Herrera, PA, *'Arius' platypogon* Günther; MHNG 2608.096 (stri x3540), Le Mahury, French Guiana, *Bagre bagre* (Linnaeus); STRI 5709 (stri 16750), Rio Santa María, Herrera, PA, *Notarius cookei*; undeposited specimen (stri x3660), picture available, Camarones, Guajira, CO, *N. grandicassis*; STRI 5710 (stri 17578), Punta Patiño, Darién, PA, *N. kessleri*; INVEMAR-PEC 5337 (stri x3598), Cispatá, Córdoba, CO, *N. neogranatensis*; STRI 5712, data above; STRI 5714, data above; ANSP 178740 (24J6) (stri x3571), Georgetown market, Guiana, *N. quadriscutis*, ANSP 178749 (stri x3550), Georgetown market, Guiana, *N. rugispinis*; STRI 5716 (stri 17229), Isla Majagual, Darién, PA, *N. troschelii*; INVEMAR-PEC 5342 (stri x3613), mouth Rio Atrato, Urabá, CO, *Notarius* sp.

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