Zootaxa 4170 (1): 137–148
http://www.mapress.com/j/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://doi.org/10.11646/zootaxa.4170.1.7
http://zoobank.org/urn:lsid:zoobank.org:pub:1FB49F66-80A4-43E7-AD96-1CDFF90723F9

Cathorops festae (Boulenger 1898) (Siluriformes; Ariidae), a valid species from Ecuador and Peru

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Abstract

Over the past decade, the Sea Catfish (Ariidae) genus *Cathorops* has been the focus of a major taxonomic review, which has resulted in the revalidation of five synonymized nominal species, and the recognition of seven new species. With 21 valid species, *Cathorops* is currently the most species-rich genus of Ariidae in the New World. The principal lacuna in the taxonomic knowledge of genus species is the uncertain status of *Arius festae* Boulenger, 1898, described from Naranjal, in the Guayas River basin of Ecuador. In the present study *Cathorops festae* is redescribed as a valid species based on morphological and molecular data.

Key words: Sea Catfishes, molecular species delimitation, morphometrics, principal component analysis

Introduction

In the western Atlantic, species of the Sea Catfish (Ariidae) genus *Cathorops* are found between the Gulf of Mexico and southeastern Brazil, while in the eastern Pacific, the genus ranges from Baja California to northern Peru. The monophyly of the genus is well supported by morphological and molecular evidence (Betancur-R, 2009; Marceniuk *et al*., 2012). Over the past decade, *Cathorops* was the subject of a major taxonomic review (Marceniuk, 1997), based on the investigation of an extensive series of material which permitted a profound understanding of the morphological variability of the genus, in particular that related to sex (Marceniuk, 2007a), together with molecular analyses (Betancur-R *et al.*, 2007), which resulted in the revalidation of five synonymized nominal species, in addition to the recognition of seven new species (Marceniuk, 2007ab; Marceniuk & Betancur-R., 2008; Marceniuk, *et al*., 2009, 2012).

With 21 valid species, *Cathorops* is the most species rich genus of the family Ariidae in the New World, and this number is likely to grow even further when areas with little representative material in zoological collections, such as the Gulfs of Mexico and California, have been sampled more adequately (Marceniuk, 2007b; Marceniuk & Betancur-R., 2008). The considerable diversity of this group is related to its lifestyle, with populations being found preferentially in brackish waters and also restricted to freshwater, as well as its low dispersal capacity (Betancur-R *et al*., 2010). However, little is known about the biology (Etchevers, 1978; Arias de Diaz & Bashirullah, 1988; Melo & Teixeira, 1992) or life history strategies of the species of the genus (Tijano*, et al*., 1998; Castro-Aguirre, 1999; Dantas, *et al*., 2010), even though most of them occur in sympatry or even syntopy (Barletta *et al*., 2005).

The uncertain status of *Arius festae* Boulenger, 1898, described from Naranjal in the basin of the Guayas River in Ecuador (Marceniuk, *et al*. 2009; Betancur-R. *et al*., 2012), remains as the principal lacuna in the taxonomic knowledge of the genus. In the present study *Cathorops festae* is redescribed based on morphological and molecular data obtained from the type specimen and other specimens.

Accepted by J. Armbruster: 16 Aug. 2016; published: 22 Sept. 2016

Material and methods

The specimens examined for the morphological analysis were obtained from the zoological collections of the Fish Collection of the Laboratory of Fish Biology and Genetics (LBP) at São Paulo State University (UNESP) at Botucatu in São Paulo, and Museo Zoologico da Universita di Torino, Italy (MZUT). Measurements were taken as described by Marceniuk (2007a), either with a ruler (recorded to the nearest millimeter) or with dial calipers (to the nearest 0.1 mm). Unless otherwise stated, all measurements are given as a percentage of the standard length (SL). Individual measurements are presented for the primary type specimens. The dorsomedial groove of the neurocranium, as referred to in the present study, is formed by the anterior fleshy portion juxtaposed with the anterior cranial fontanel, and limited by the posterior branches of the mesethmoid and frontals, and a posterior bony portion formed by the mesial depression of the frontals and the anterior portion of the supraoccipital (Marceniuk *et al*., 2009). The term 'nuchal plate' refers to the fusion of the anterior and the medial nuchal plates (Royero, 1987). The term 'rarely', when used in the diagnoses, refers to uncommon conditions observed in only one or two specimens. The comparative morphological data, used in the diagnosis, is based on material cited on previous studies (Marceniuk, 1997; Marceniuk, 2007b; Marceniuk & Betancur-R., 2008; Marceniuk, *et al*., 2009, 2012).

TABLE 1. Genbank number of sequences used and added in the present study. The sampling location to the abbreviations corresponds to ISO-3166 country codes.

Specie	Sampling location	Genbank number ATP6/8 / Cytb
Cathorops agassizii	GY	DQ990646/DQ990474
Cathorops aguadulce	GT	DQ990648/DQ990476
Cathorops arenatus	BR	DQ990647/DQ990475
Cathorops dasycephalus	SV	DQ990639
Cathorops dasycephalus	PA	DQ990638/DQ990467
Cathorops festae	EC	FJ625868/FJ626161
Cathorops festae	PE	KX227613/KX227612
Cathorops fuerthii	PA	DQ990641/DQ990469
Cathorops cf. higuchii	NI	FJ625869/FJ626162
Cathorops hypophthalmus	PA	DQ990651/DQ990478
Cathorops manglarensis	CO	FJ625871/FJ626164
Cathorops mapale	CO	GQ982447/GQ982417
Cathorops multiradiatus	CO	FJ625873/FJ626166
Cathorops multiradiatus	PA	DQ990650/DQ990477
Cathorops raredonae	SV	DQ990640/DQ990468
Cathorops steindachenri	PA	DQ990644/DQ990472
Cathorops taylori	SV	DQ990643/DQ990471
Cathorops tuyra	PA	DQ990652/DQ990479
Cathorops wayuu	VE	GQ982468/GQ982438

A Principal Components Analysis (PCA), based on morphometric and meristic characters, was used to differentiate the *Cathorops* species found in Colombia, Ecuador and Peru. The PCA was based on a covariance matrix, with the objective of confirming the taxonomic status of the nominal species found on the Pacific coast of South America. The values that were constant or appeared to vary randomly in *C. festae*, *C. multiradiatus*, *C. manglarensis* and *Tachysurus equatorialis* were excluded from the PCA, with the PCA including the following variables: gill rakers on the first arch (GRFA), anal fin base length (ABL), distance between posterior nostrils (DPN), distance between posterior nostrils and orbit (DPNO), maxillary barbel length (MBL), nuchal plate length (NPL), nuchal plate width (NPW), orbital diameter (OD), snout length (SL), supraoccipital process length (SPL),

width of cephalic shield at supracleithrum (WCSS), and width of the supraoccipital process at the posterior end (WSPP).

Mitochondrial DNA (mtDNA) sequences from two genes—cytochrome *b* (Cyt *b*) and ATP synthase 6 and 8 (ATPase 8/6) were examined. Most of the sequences are from previous studies (Betancur-R *et al*., 2007, 2012; Betancur-R., 2009), and the new sequences generated for this study have been deposited in GenBank (Table 1). The sequences were aligned using MAFFT (Katoh and Standley, 2013) and the mtDNA trees were generated with the maximum likelihood approach in RAxML v7.2.8 (Stamatakis, 2006), with codon partitioning. Nodal support was assessed using bootstrapping with 1000 pseudoreplicates. The RAxML tree obtained was compared to a previously estimated time-calibrated, multi-locus tree for the family Ariidae using Bayesian Inference (Betancur-R. *et al*., 2012).

Cathorops festae (Boulenger 1898)

Figure 1 and 2, Table 2 and 3

Arius festae Boulenger, 1898:5 (original description; Naranjal, western Ecuador).—Kailola & Bussing, 1995:866 (as status uncertain).—Marceniuk & Ferraris in Reis *et al*. 2003:453 (list, as species inquirenda).—Betancur-R. & Acero P., 2004:13 (as species inquirenda).—Ferraris 2007:56 (as species inquirenda).—Marceniuk & Menezes 2007:46 (as species inquirenda).—Marceniuk *et al*. 2009:274 (as species inquirenda).

Cathorops fuerthii (non Steindachner).—Sanchez, 2008:10, 20, 28 (list; in part).—Barriga, 2012: 113 (list; in part).—Moncayo & Noboa, 2014:2 (list; in part).—Jiménez-Prado *et al*., 2015: 399 (identification key; in part).

Diagnosis. *Cathorops festae* is distinguished from the eastern Pacific subcongeners by having a supraoccipital process broader on posterior portion (3.4−4.0% SL *vs*. 2.2−3.3% SL in all other representatives, excluded *C. fuerthii*), longer nuchal plate (7.2−7.9% SL *vs*. 4.7−7.1% SL in all other representatives, excluded *C. liropus*, *C. multiradiatus*, *C. taylori* and *C. tuyra*), and the edges of the distal third of the occipital process which present a marked anterior-posterior convergence (*vs*. parallel or subtly convergent in all other forms, except *C. fuerthii* and *C. raredonae*, Fig. 2f,g). The species can be further differentiated as follows: from *C. fuerthii*, which ranges from Costa Rica to Panama, by its shorter distance between anterior nostrils (3.3−4.2% SL *vs*.4.4−6.0% SL), shorter distance between posterior nostrils (4.1−5.8% SL *vs*. 5.7−7.3% SL, rarely 5.8%), larger orbital diameter (4.1−5.4% SL *vs*. 3.2−4.1% SL, rarely 4.2%), longer supraoccipital process (12.0−14.1% SL *vs*. 10.4−11.9% SL), and longer caudal-fin upper lobe (31.3−32.8% SL *vs*. 28.3−30.7% SL); from *C. hypophthalmus*, which is found in Panama, by having 17-18 gill rakers on first brachial arch (*vs*. 37−40), 16−19 rakers on second brachial arch (*vs*. 37−40), narrower mouth (9.5−11.1% SL *vs*. 13.1−13.2% SL), shorter distance between anterior nostrils (3.3−4.2% SL *vs*. 6.9−7.1% SL), shorter distance between posterior nostrils (4.1−5.8% SL *vs*. 8.2−8.5% SL), deeper caudal-peduncle (7.8−9.0% SL *vs*. 7.3−7.5% SL), and caudal-fin lobes wide, rounded posteriorly (*vs*. narrow and pointed posteriorly); from *C. liropus*, which is found in Mexico, by caudal-fin lobes wide, rounded posteriorly (*vs*. narrow and pointed posteriorly); from *C. manglarensis*, which ranges from Colombia to Peru (Fig. 3), by having 17−18 gill rakers on first brachial arch (*vs*. 13−16, Table 2), wider nuchal-plate (7.2−8.1 *vs*. 6.4−7.1, Fig. 4a), and shorter anal-fin base (15.3−19.3% SL *vs*. 21.0−24.4% SL, Fig. 4b); from *C. multiradiatus*, which ranges from Panama to Peru (Fig. 3), by its longer distance from snout to dorsal fin (36.1−40.6% SL *vs*. 31.2−34.8% SL, Fig. 4c), longer supraoccipital process (12.0−14.1% SL vs. 9.8−11.5% SL, Fig. 4d), and shorter anal-fin base (15.3−19.3% SL *vs*. 20.0−23.2% SL, Fig. 4b); from *C. raredonae*, which ranges from Mexico to El Salvador, by its longer supraoccipital process (12.0−14.1% SL *vs*. 8.7−10.5% SL), and wider nuchal-plate (7.2−8.1% SL *vs*. 5.9−7.1% SL); from *C. steindachneri*, which ranges from El Salvador to Panama, by its longer caudal-fin upper lobe (31.3−32.8% SL *vs*. 25.1% SL), longer caudal-fin lower lobe (29.7−32.8% SL *vs*. 23.8% SL), and caudal-fin lobes wide, rounded posteriorly (vs. narrow and pointed posteriorly); from *C. taylori*, which ranges from Guatemala to El Salvador, by its longer supraoccipital process (12.0−14.1% SL *vs*. 9.4−10.6% SL), and caudal-fin lobes wide, rounded posteriorly (vs. narrow and pointed posteriorly); from *C. tuyra*, which is found in Panama, by having 23−25 anal-fin rays (*vs*. 19−20); 17−18 gill rakers on first arch (vs. 19−22); and deeper caudal-peduncle (7.8−9.0% SL *vs*. 5.8−7.8% SL). Additionally, *Cathorops festae* is differentiated from the subgenus *Precathorops* [currently monotypic with *C.* (*P.*) *dasycephalus*] found in the eastern Pacific by having 17−18 gill rakers on first brachial arch (*vs*. less than 10), vomerine tooth plates absent (*vs*. present in *Precathorops*), and accessory tooth plates bearing molariform teeth (*vs*. conical in *Precathorops*).

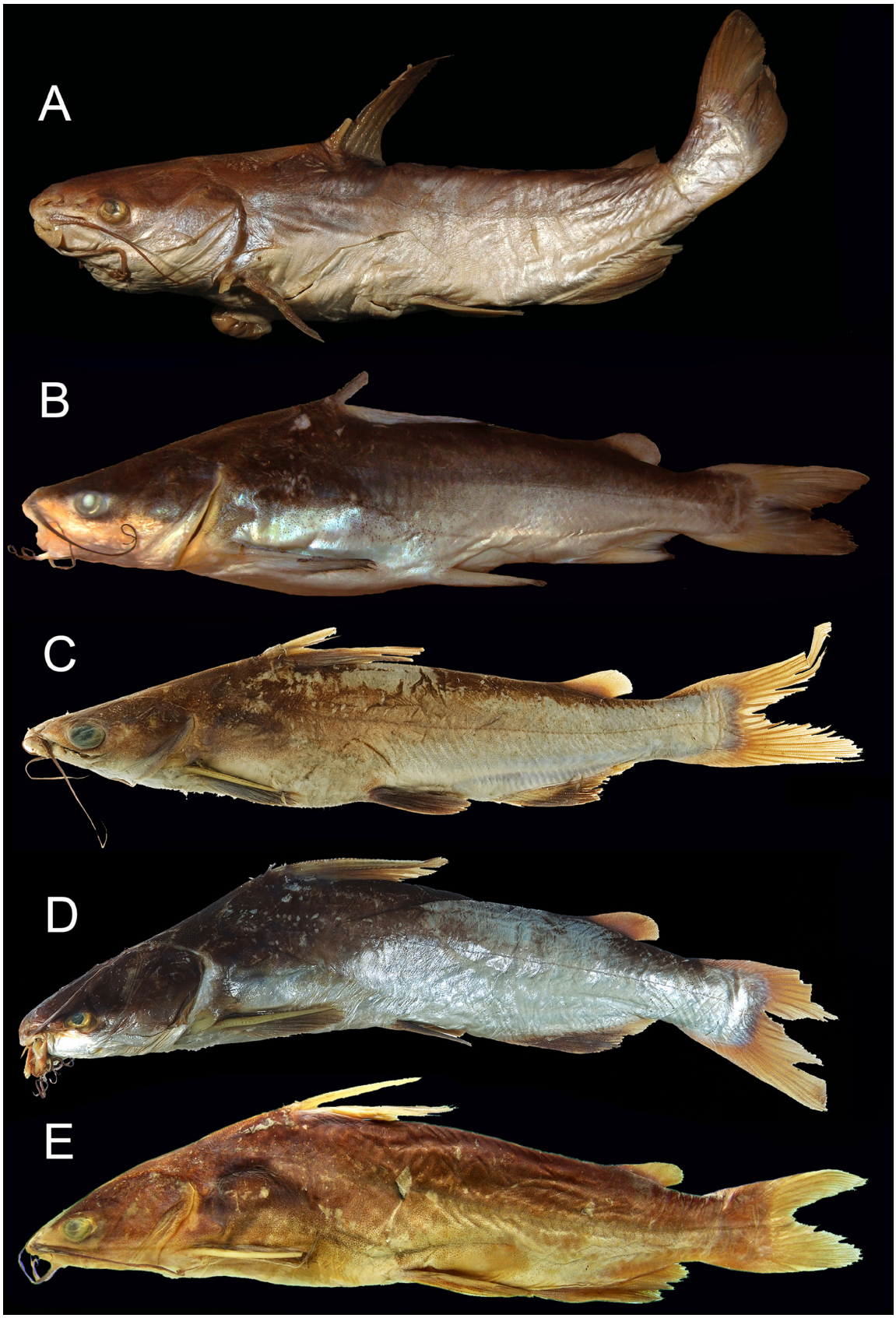


FIGURE 1. Body in lateral view. A. *Cathorops festae*, holotype MNHN 2002-0871, 83 mm SL; B. *Cathorops festae*, LBP 19381, 179 mm SL; C. *Cathorops equatorialis*, holotype USNM 53470, 158 mm SL; D. *Cathorops multiradiatus*, neotype USNM 79408, 192 mm SL; E. *Cathorops manglarensis*, holotype USNM 286392, 164 mm SL.

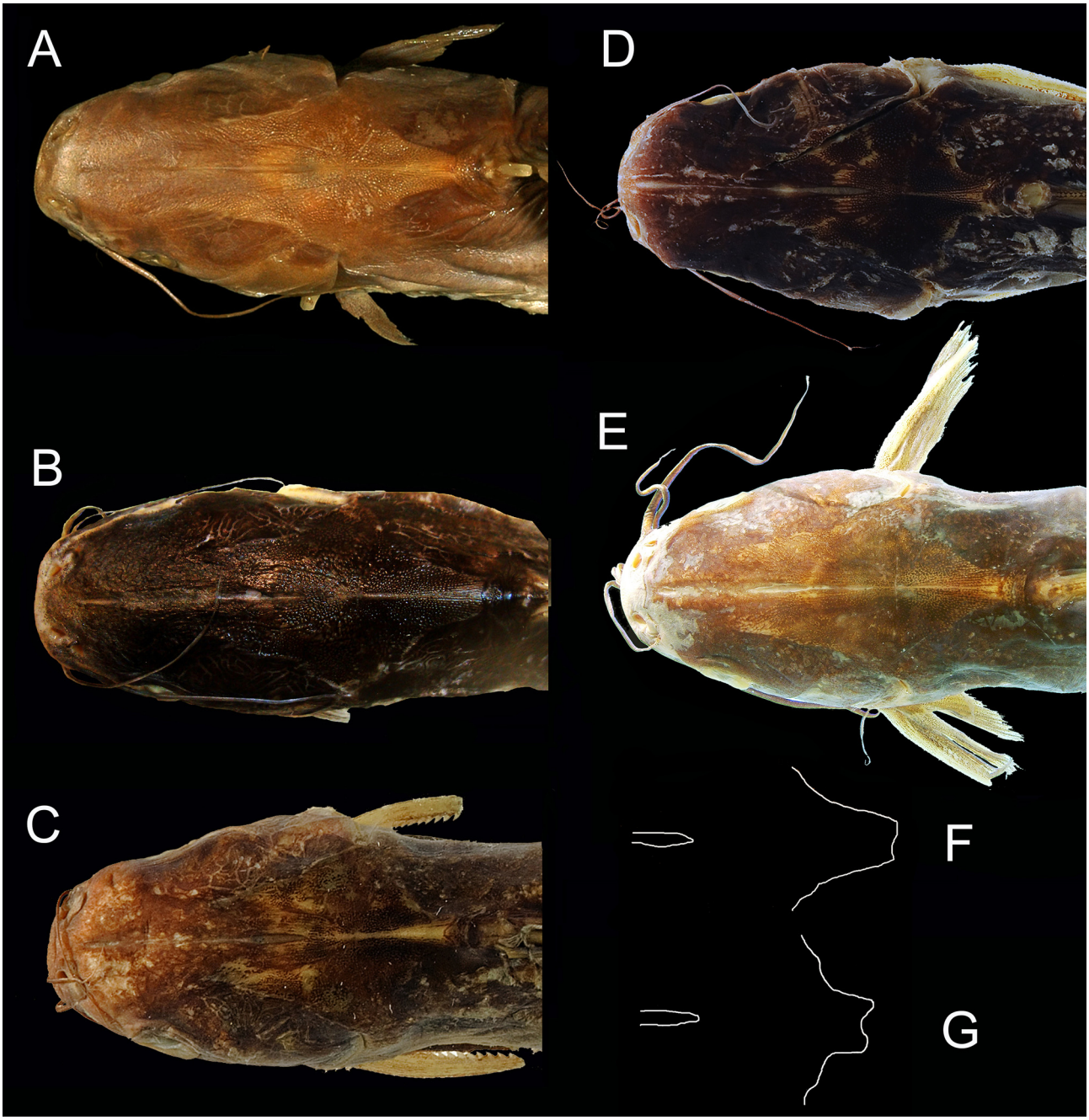


FIGURE 2. Head in dorsal view. A. *Cathorops festae*, holotype MNHN 2002-0871, 83 mm SL; B. *Cathorops festae*, LBP 19381, 159 mm SL; C. *Cathorops equatorialis*, holotype USNM 53470, 158 mm SL; D. *Cathorops multiradiatus*, neotype USNM 79408, 192 mm SL; E. *Cathorops manglarensis*, holotype USNM 286392, 164 mm SL; F. medial groove and occipital process of *Cathorops festae*; G. medial groove and occipital process of *Cathorops manglarensis* and *Cathorops multiradiatus*.

TABLE 2. Meristic frequencies of gill rakers on first arch for species from Ecuador and Peru. Bolded numbers indicates counts for Peru specimens.

Gill rakers on the first gill arch	13	14	15	16	17	18	19
C. festae					**1**	**3**	
C. manglarensis	1	**2**	4	2			
C. multiradiatus				1	1	2	3

Cathorops festae is distinguished from the Western Atlantic subcongeners by having a supraoccipital process broader on posterior portion (3.4−4.0% SL *vs*. 2.0−3.2% SL in all other representatives, excluded *C. arenatus* and *C. nuchalis*), and 17−18 gill rakers on first arch (*vs*. 14−16 or 19−24 in all other representatives, excluded *C. arenatus*, *C. melanopus*, *C. spixii*, and *C. wayuu*). The species can be further differentiated from the Western Atlantic subcongeners as follows: from *C. aguadulce*, which is found in Mexico, by having 23−25 anal-fin rays (*vs*. 21); from *C. arenatus*, from mouth of the Orinoco River to Brazilian north coast, by having osseous medial groove long and progressively larger to posterior-anterior direction (vs. short and narrow at middle portion), shorter distance between anterior nostrils (3.3−4.2% SL *vs*. 4.1−5.8% SL, rarely 4.2%); from *C. belizensis*, from Belize, by having 23−25 anal-fin rays (*vs*.18−20), shorter distance between anterior nostrils (3.3−4.2% SL *vs*. 5.1−6.1% SL); from *C. kailolae*, which ranges from Mexico to Guatemala, by its wider cephalic shield ate supracleithrum area (17.7−19.8% SL *vs.* 15.3−17.3% SL), and longer nuchal-plate (7.2−7.9% SL *vs*. 5.3−6.9% SL); from *C. mapale*, which is found in Colombia, by its longer nuchal-plate (7.2−7.9% SL *vs*.6.8−7.1% SL, rarely 7.2%); from *C. melanopus*, which is found in Guatemala, by having 23−25 anal-fin rays (*vs*. 19−20); from *C. nuchalis*, which ranges from Venezuela to Guyana, by its shorter distance between anterior nostrils (3.3−4.2% SL *vs*. 4.3−5.5% SL, rarely 4.2% SL); from *C. wayuu*, which ranges from Colombia to Venezuela, by its shorter distance between anterior nostrils (3.3−4.2% SL *vs*. 4.1−5.2% SL, rarely 4.2%), and longer supraoccipital process (12.0−14.1% SL *vs*. 9.1−11.5% SL).

Description. Morphometric data in Table 3. Head depressed, profile elevated posteriorly, straight at frontal and supraoccipital area. Snout short and transversely rounded. Anterior nostril round, with fleshy edge, posterior nostril covered by flap of skin; nostrils relatively close to one another and moderately close to orbit, not connected by fleshy furrow. Eye lateral and large; eyes distant to one another. Three pairs of moderately long teretiform barbels; maxillary barbel usually reaching or past base of pectoral-fin spine, lateral mental barbel reaching gill membrane edge, and mesial mental barbel not reaching gill membrane edge. Osseous bridge formed by lateral ethmoid and frontal long and slender, evident under skin. Cephalic shield exposed, rough and granulated; moderately long and large on lateral ethmoid, frontal, and supracleithrum areas. Anterior portion of dorsomedial groove of neurocranium fleshy, conspicuous and not continuous to level of posterior nares; posterior portion of osseous groove, deep and conspicuous, with straight margins, narrowing posteriorly. Supraoccipital process funnel-shaped, very long and wide on posterior portion, and profile straight. Nuchal plate crescent-shaped, very long and wide.

Mouth subterminal to terminal, relatively large; lower jaw arched. Lips moderately thick, lower lip as thick as upper lip. Vomerine tooth plates absent. One pair of oval shaped accessory tooth plates, variable in size, closer to one another anteriorly, with molariform teeth. Premaxilla relatively long and narrow, with sharp teeth. Dentary separated at midline, with posterior expansion and sharp teeth on anterior portion, molariform teeth on posterior portion and some conical teeth interspersed. Gill membranes fused, attached to isthmus. Seventeen to 18 acicular gill rakers on first arch, 16–19 spike-shaped gill rakers on second arch. Mesial surfaces of all gill arches with developed gill rakers, lateral and mesial surfaces of first and second gill arches lacking fleshy papillae intercalated with gill rakers.

Body width greater than depth in pectoral girdle area, progressively more compressed from pectoral fin to caudal peduncle. Lateral line sloping ventrally on anterior one-third, extending posteriorly to caudal peduncle, bending abruptly onto dorsal lobe of caudal fin. Dorsal-fin spine moderately long and thick; anterior margin with granules; posterior margin with serrations along almost its entire length. Seven soft dorsal-fin rays. Pectoral-fin spine moderately long, shorter than dorsal-fin spine; anterior margin with granules on basal two-thirds and distal one-third with short serrations; posterior margin straight on basal one-fourth, distal three-fourths with serrations. Ten soft pectoral-fin rays. Posterior cleithral process exposed, smooth and triangular shaped, short and pointed posteriorly. Pelvic fin deep and long at base, with six rays. Adipose-fin base short, less than one-half the length of anal-fin base, anterior origin at level of anterior half of anal fin. Anal fin deep and moderately long at base, with 23–25 rays and distal margin slightly concave. Caudal peduncle relatively high. Caudal fin forked, dorsal and ventral lobes moderately long, wide and rounded posteriorly; dorsal lobe longer than ventral lobe.

Coloration. Grayish to dark brown on dorsum, silvery on flanks and white on abdomen. In alcohol, dark brown on dorsum, flanks brownish to silvery and white on venter; fins brownish. Maxillary barbel dark, mental barbel lighter (Fig. 1a,b, 2a,b).

Sexual dimorphism. Sexual dimorphism was not observed in the specimens examined (159–179 mm SL).

TABLE 3. Morphometrics for *Cathorops festae*. Standard length is expressed in millimeters, other measurements are percents of standard length. Range include non-type specimens only.

Cathorops festae	holotype	N	Mean	Range
Standard length (mm)	83	4		159−179
Head length	25.3	4	27.5	26.5−28.2
Snout length	8.4	4	7.7	7.0−8.6
Distance between anterior nostrils	3.3	4	4.0	3.9−4.2
Distance between posterior nostrils	5.2	4	5.1	4.1−5.8
Distance between anterior nostril and orbit		4	7.0	6.2−7.7
Distance between posterior nostril and orbit		4	5.1	4.4−5.8
Orbital diameter	5.4	4	4.3	4.1−4.4
Interorbital distance	12.3	4	14.4	13.4−15.0
Maxillary barbel length	30.4	4	28.1	26.5−31.0
Lateral mental barbel length	26.7	4	22.0	18.8−24.5
Mesial mental barbel length	19.4	2	13.7	12.4−14.9
Mouth width	9.5	4	10.4	9.7−11.1
Width of cephalic shield at lateral ethmoid area	13.8	4	12.6	12.0−13.3
Width of cephalic shield at frontals area	7.8	4	6.3	6.2−6.5
Width of cephalic shield at epioccipital area		4	12.7	12.4−13.2
Width of cephalic shield at supracleithrum area	17.7	4	19.5	19.1−19.8
Supraoccipital process length	12.0	4	13.2	12.7−14.1
Supraoccipital process width		4	3.7	3.4−4.0
Nuchal-plate length	7.2	4	7.5	7.3−7.9
Nuchal-plate width	7.2	4	7.8	7.6−8.1
Body depth	16.2	4	19.0	18.1−19.9
Body width	19.0	4	22.6	21.7−23.2
Distance from snout to pectoral fin	21.7	4	24.3	23.1−26.5
Distance from snout to dorsal fin	36.1	4	39.3	37.9−40.6
Distance from snout to pelvic fin	48.2	4	53.1	51.6−54.1
Distance from snout to adipose fin	70.0	4	79.5	77.8−80.8
Distance from snout to anal fin	66.3	4	71.9	71.3−72.4
Caudal-peduncle height	7.8	3	8.5	8.2−9.0
Pectoral-fin spine length	18.3			
Dorsal-fin spine length	20.6			
Pelvic-fin base length	4.2	4	4.3	3.7−4.9
Pelvic-fin height	13.1	4	15.5	13.9−16.4
Adipose-fin base length		4	7.1	6.4−7.6
Adipose-fin height		4	3.9	3.3−4.6
Anal-fin base length	19.3	4	15.9	15.3−16.5
Anal-fin height	17.2	4	12.9	12.1−13.7
Caudal-fin upper lobe length		4	31.9	31.3−32.8
Caudal-fin lower lobe length		4	30.6	29.7−32.8

Distribution and habitat. *Cathorops festae* has been described from freshwater environments in Ecuador. The new specimens collected (LBP 19381) indicate that the species also occurs in the estuaries of northern Peru (Fig. 3).

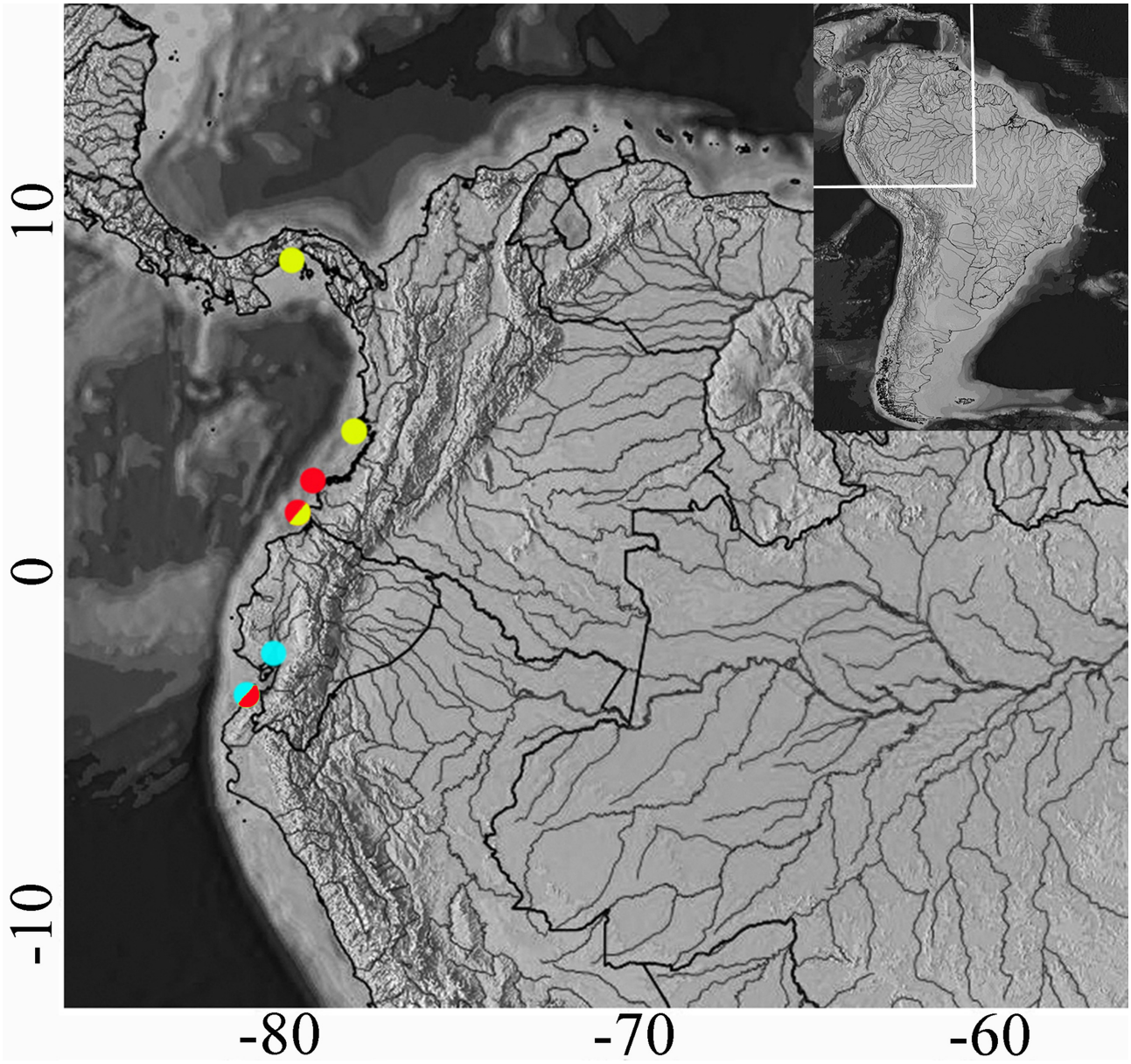


FIGURE 3. The Pacific coast of Central and South America, showing the geographic distribution of *Cathorops festae* (light blue), *Cathorops manglarensis* (red), and *Cathorops multiradiatus* (yellow).

Size. The largest examined specimen had a standard length of 179 mm (LBP 19381).

Molecular evidence and phylogenetic relationships. Based on the relationships among the 16 *Cathorops* species inferred from the mitochondrial sequences using the maximum likelihood approach in RAxML and Bayesian Inference, *C. festae* from Ecuador and Peru are conspecific and together with *C. multiradiatus*, found from Pacific Panama to Ecuador, represent the most basal group in the subgenus *Cathorops* (Fig 5).

Remarks. *Arius festae* Boulenger, 1898 was originally described from Naranjal, western Ecuador, remaining for a long time known only from the holotype (MZUT 1479), with its taxonomic status being considered uncertain (Kailola & Bussing, 1995), or as a species *inquirenda* (Marceniuk & Ferraris, 2003; Ferraris 2007; Marceniuk & Menezes 2007, Marceniuk *et al*. 2009). Its status has been challenged on the basis of third-party examination and photographs of the holotype, as well as molecular data obtained from specimens collected near the type locality (Marceniuk *et al*., 2009, Betancur-R., *et al*., 2012). In the present study, *Cathorops festae* is recognized as a valid species, distinct from the other members of the genus found in Ecuador and Peru, based on the analysis of the holotype and other, non-type specimens, in which the profile of the distal third of the occipital process is characterized by the marked anterior-posterior convergence of the edges (Fig. 2a,b,f), the wider nuchal plate, the

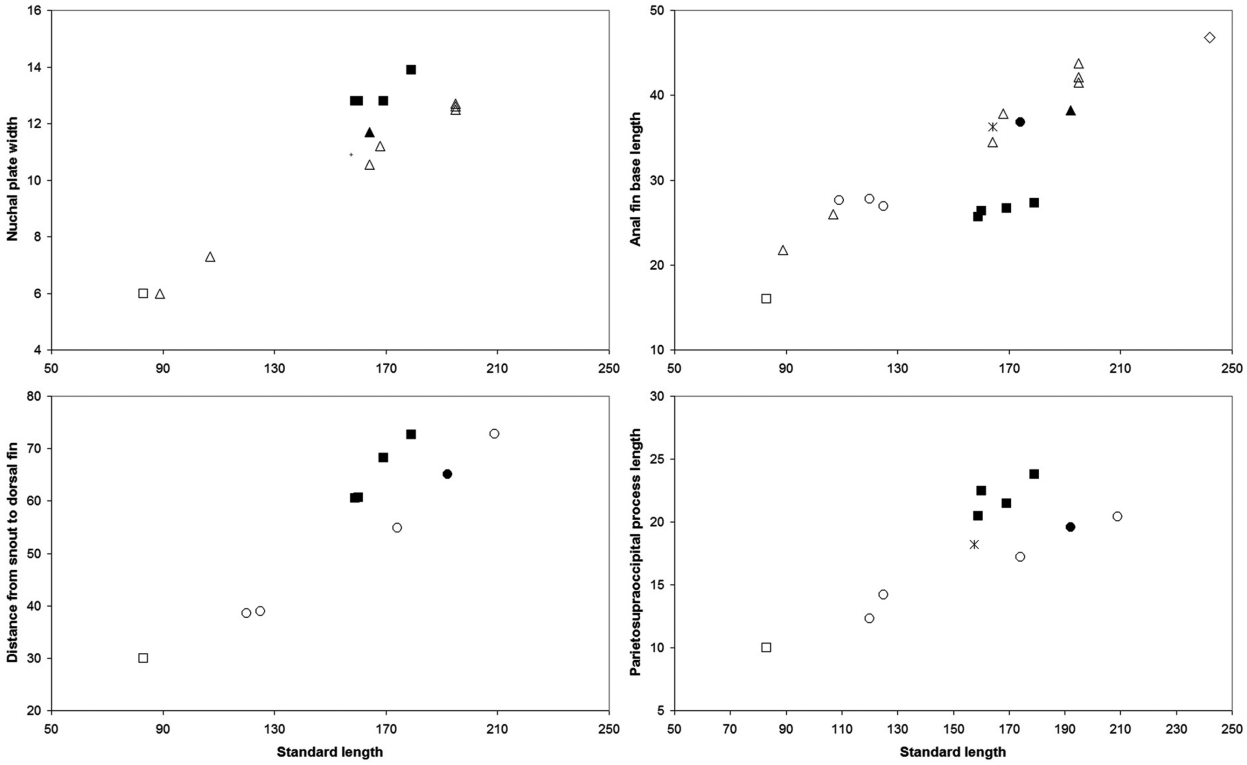


FIGURE 4. Plots of standard length *versus* nuchal plate width (A), anal fin base length (B), distance from snout to dorsal fin (C), and supraoccipital process length (D), in *Cathorops festae* (open square = type specimen; solid squares = non type specimens), *C. manglarensis* (solid triangle = holotype; open triangles = paratypes; open diamond = specimen from Peru), *C. multiradiatus* (solid circle = neotype; open circle = non-type specimens), and the *Tachysurus equatorialis* holotype (asterisk).

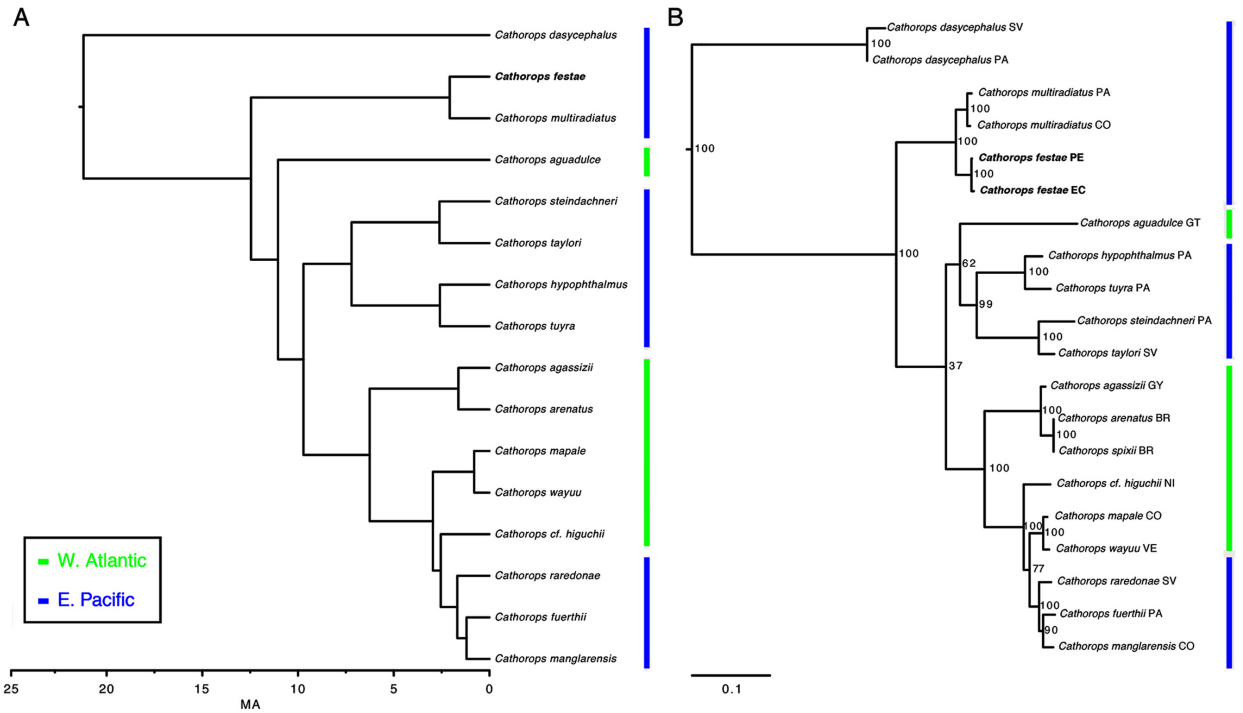
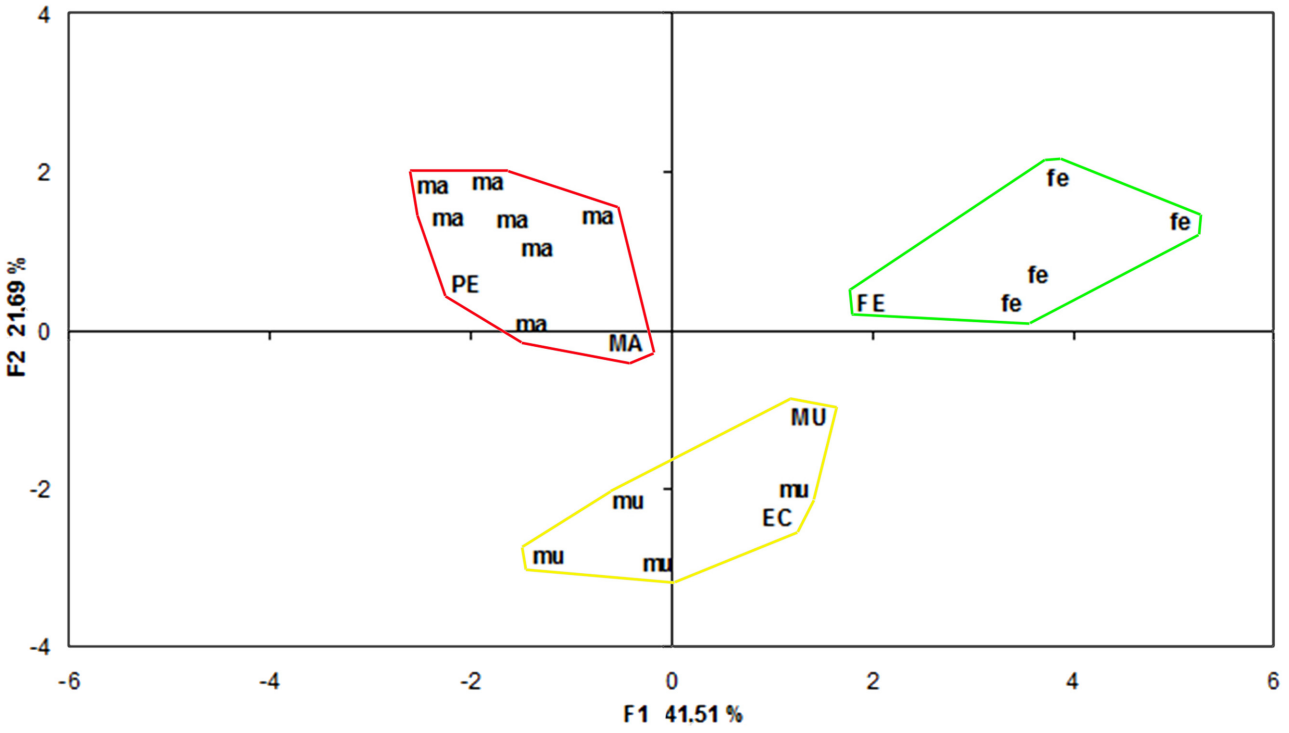


FIGURE 5. A, *Cathorops* clade extracted from the Ariidae tree of Betancur-R. *et al*. (2012), including one individual of *C. festae* (shown in bold). The complete time tree was estimated using a Bayesian analysis of five mitochondrial and six nuclear gene fragments and 19 calibration points (both inside and outside Ariidae). B, RAxML tree estimated with expanded specimen sampling for *Cathorops* (including two individuals of *C. festae*, shown in bold), but based on the analysis of only two mitochondrial genes (Cyt b and ATPase 8/6). Nodal numbers indicate bootstrap support values. Two letter country codes follow ISO-3166.



	DPN	DPNO	WCSS	SL	WSPP	SPL	NPW	NPL	ABL	GRFA	OD	MBL
F1	-0,540	0,453	0,376	0,548	0,779	0,755	0,899	0,889	-0,837	0,597	0,186	-0,418
F2	0,408	-0,346	0,845	0,410	0,564	0,161	-0,016	-0,133	-0,150	-0,565	-0,511	0,686

FIGURE 6. Scatterplots of the principal components PC1 and PC2, obtained from the analysis of eleven morphometric and one meristic variables, with factor loadings for the first and second principal components. Abbreviations: *Cathorops festae* (FE = holotype, fe = non-type specimens), *C. manglarensis* (MA = holotype, ma = paratypes, PE = specimen from Peru), and *C. multiradiatus* (MU = neotype, mu = non-type specimens), EC = holotype of *Tachysurus equatorialis*.

shorter base of the anal fin, the greater distance between the snout and the dorsal fin, and the greater length of the occipital process (Fig. 4). Differences in morphometric ratios between the holotype from Ecuador (83 mm SL) and non-type specimens from Peru (159-179 mm SL) are probably the result of ontogenetic variation, which is common in other species of *Cathorops*.

Material examined. Type-specimen: holotype, MZUT 1479, Naranjal, Ecuador. Non-type specimens: LBP 19381 (4, 159−179), Tumbes, Peru, in November 2014.

Discussion

Besides the revalidation of *Cathorops festae*, two other important aspects of the taxonomy and biogeography of the genus *Cathorops* are defined here. The status of *Arius equatorialis* as a junior synonym of *Cathorops multiradiatus*, as suggested by Marceniuk (2007b), is confirmed (Fig. 4b,d, 6). In addition, the registration of the occurrence of *C. manglarensis* on the northern coast of Peru, represents the first record of the species outside Colombia (Marceniuk, 2007b). The identification of the specimen (LBP 19383) is based on the Principal Components Analysis (Fig. 6), as well as the profile of the supraoccipital process (Fig. 2e,g) and the number of gill rakers on the first arch (14 *vs.* 16−19 in *C. festae* and *C. multiradiatus*).

The recognition of the occurrence of *C. festae* and *C. manglarensis* in northern Peru reinforces the need for the revision of the original identification of the specimens of this genus collected on the coast of Peru. This would includes, for example, the specimens collected in Puerto Pizarro and Paita, Peru, which were identified by Hildebrand (1946) as *Cathorops multiradiatus*.

Acknowledgements

The authors are extremely grateful to Claudio de Oliveira (UNESP) for depositing the specimens from Peru in the Fish Collection of the Laboratory of Fish Biology and Genetics (LBP) at São Paulo State University (UNESP), and also Raquel Siccha-Ramirez for sequencing the molecular markers used in the present study, of the specimen collected in Peru, generated in the same laboratory, at UNESP Botucatu. We would also like to thank the curator at the Museo Zoologico da Universita di Torino, Italy, for providing the morphometric data on the holotype of *Arius festae*. This study was supported by the Fundação de Amparo á Pesquisa do estado de São Paulo (FAPESP, Proc. 03/04509-3 to APM), and the National Science Foundation (NSF) grants (DEB-147184, DEB-1541491 to R.B.R.).

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