

Description of *Cathorops mapale*, a new species of sea catfish (Siluriformes: Ariidae) from the Colombian Caribbean, based on morphological and mitochondrial evidence

RICARDO BETANCUR-R.^{1–2} & ARTURO ACERO P.³

¹ Department of Biological Sciences, Auburn University, 101 Cary Hall, Auburn, AL 36849, USA.
E-mail: betanri@auburn.edu.

² Naos (molecular laboratory), Smithsonian Tropical Research Institute, Apartado 2072, Balboa, Panamá.

³ Universidad Nacional de Colombia (Instituto de Ciencias Naturales), Cerro Punta Betín, A.A. 1016 (INVEMAR), Santa Marta, Colombia. E-mail: aacero@invemar.org.co.

Abstract

A new species of sea catfish (Ariidae), *Cathorops mapale*, is described from the central and southwestern Colombian Caribbean coast. The species is distinguished from other *Cathorops* species from the western Atlantic by the following combination of features: 20–24 anterior gill rakers on first gill arch, 18–21 anterior gill rakers on second gill arch; maxillary barbels 27.8–39.3% standard length; medial head groove long and deep, extending posteriorly almost to supraoccipital keel. This species has been widely misidentified as *C. spixii* (Agassiz), a species known from Brazil to the Guianas. Based on mitochondrial evidence (cytochrome *b* and ATP synthase 8/6), *C. mapale* is more closely related to the eastern Pacific *C. fuerthii* (Steindachner) species group (2.2–2.8% sequence divergence) than to the *C. spixii* clade (5.9–6.2% sequence divergence). *C. mapale* is distinguished from the *C. fuerthii* group by having higher anterior gill raker counts on the first (14–15 in the *C. fuerthii* group) and second (15–17 in the *C. fuerthii* group) gill arches, and by having a smaller mouth (8.3–10.6% standard length in *C. mapale* and 11.0–11.6% standard length in the *C. fuerthii* group).

Keywords: *Cathorops mapale*, Ariidae, sea catfishes, Colombian Caribbean, mitochondrial genes

Introduction

The family Ariidae (sea catfishes) is one of the two groups of siluriforms that have extensively invaded marine waters and the only one widespread on the world's tropical continental shelves. The nomenclature of the family has remained in a chaotic state because its

alpha taxonomy is clearly incomplete and the species frequently jump from one genus to another. Kailola (2004), in a pioneering effort, revised the generic classification of ariids based on morphological grounds. Some of the genera she accepted, however, are not supported by other phylogenetic studies (see Betancur-R., 2003; Marceniuk, 2003; Acero, 2004). Recent authors, such as Kailola (2000), Acero and Betancur-R. (2002a, 2002b), Ng (2003), Ng and Sparks (2003), Betancur-R. and Acero (2004) have addressed some of the remaining problems at the species level.

The genus *Cathorops* Jordan and Gilbert is a strongly supported clade of sea catfishes endemic to the New World (Marceniuk, 1997; Betancur-R., 2003; Betancur-R. et al., 2004; Kailola, 2004) that has been recently presented as including eleven species (Marceniuk and Ferraris, 2003; Kailola, 2004). Nevertheless, the genus probably includes several other unrecognized species from both American coasts. The Mapalé Sea Catfish, a *Cathorops* species important to artisanal fisheries, is a putative Colombian Caribbean endemic that lacks a scientific name. Traditional meristic and morphometric data, the molecular phylogeny of the genus *Cathorops* (Betancur-R., 2003), and mitochondrial genetic divergence values all support recognition of this new species, which previously was misidentified as *C. spixii* (Agassiz)

Materials and methods

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. Tissue material treated herein as “tissue tag” comprises part of the personal collection of the senior author.

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 calipers and recorded to the nearest 0.1 mm. The posterior width of the supraoccipital process was measured at its distal end; its length was measured from the origin of the supraoccipital keel to its distal end. Head depth was measured at the origin of the supraoccipital keel. SL is standard length, HL is head length, and TL is total length. Part of the type material was cleared and stained following the techniques of Potthoff (1984) and was used only for counting the teeth present in the left palatine patch (six females and six males) and ribs and vertebrae (two females and two males).

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 the holotype and a paratype. Amplification and sequencing protocols and primers used are listed in Betancur-R. (2003) and Betancur-R. and Acero (2004). The corrected genetic distance with the Kimura-2-parameter (K2) model was calculated for both haplotypes in PAUP*v.4.0b10 (Swofford, 2001).

Comparative material. AUM 19407, four females, 118–159 mm SL, July/August 1979, shore at beach off Finca Carolina, Lago Izabal, Guatemala, *C. aguadulce* (Meek); AUM 32198, two females, 163–164 mm SL, June 1973, mouths of Río San Juan and Río Pucté, Río La Pasión, Guatemala, *C. aguadulce*; MCZ 7656, unsexed specimen, 100.8 mm SL, deposited in 1874, Guyana, *C. arenatus* (Valenciennes); MCZ 7691, unsexed specimen, July 1872, Gulf of Panamá, Panamá, three pictures of head and body (see <http://collections.oeb.harvard.edu/Fish>, accessed 17 January 2005), syntype of *C. fuerthii* (Steindachner) (no data were taken from this specimen); STRI 5720 (stri 17563–17564), two males, 321–332 mm SL, December 2002, Punta Patiño, Darién, Panamá (8°10' N, 78°17' W), *C. fuerthii*; STRI 5726 (stri 15949), unsexed specimen, 163 mm SL, December 2001, Jiquilisco, El Salvador (13°13' N, 88°32' W), *Cathorops* aff. *fuerthii*; BMNH 1865.4.29.51-53, unsexed specimen, 172 mm SL, Río Motagua, Guatemala, syntype of *C. melanopus* (Günther); MCZ 7683, two females and two unsexed specimens, 118–144 mm SL, Pará (Belém), Brazil (1°27' S, 48°29' W), *C. spixii*; MCZ 7709, unsexed specimen, 140 mm SL, August 1865, Pará (Belém), Brazil (1°27' S, 48°29' W), *C. spixii*; MCZ 7663, unsexed specimen, 154 mm SL, August 1865, Pará (Belém), Brazil (1°27' S, 48°29' W), *C. spixii*; MCZ 7685, two males, 175–195 mm SL, August 1865, Maranhao (São Luis), Brazil (2°31' S, 44°16' W), *C. spixii*; MCZ 7699, three unsexed specimens, 97–98 mm SL, July 1865, Bahia (Salvador), Brazil (12°58' S, 38°29' W), *C. spixii*; MCZ 7678, unsexed specimen, 153 mm SL, May 1865, Rio de Janeiro (Rio de Janeiro), Brazil (22°53' S, 43°17' W); INVEMAR-PEC 5734 (tissue tag 494), female, 251 mm SL, December 2003, NE Riohacha, Guajira, Colombia (CO) (11°35' N, 72°53' W), *Cathorops* sp.; INVEMAR-PEC 5735 (tissue tags 481–482), one female and two males, 218–247 mm SL, December 2003, Camarones, Guajira, CO (11°26' N, 73°05' W), *Cathorops* sp.; INVEMAR-PEC 1448, one male and two unsexed specimens, 94–105 mm SL, December 2003, Bahía Portete, Guajira, CO (12°12' N, 71°52' W), *Cathorops* sp. (only examined to count anterior gill rakers on first gill arch).

Cathorops mapale new species

Figs. 1–2

Arius spixii (non Agassiz); Dahl (1971): 49–50.

Cathorops spixii (non Agassiz); Taylor and Menezes (1978); Galvis (1983): 108–146; Santos-Martínez and Acero (1991): 254; Cervigón *et al.* (1992): 260 (in part); Grijalba-Bendeck (1998); Tijero *et al.* (1998): 87–102; Rueda (2001): 217–226; Acero (2002): 849 (in part); Marceniuk and Ferraris (2003): 449–450 (in part).

Cathorops sp.9; Marceniuk (1997): 127–134; Betancur-R. *et al.* (2004).

Cathorops sp.12; Marceniuk (1997): 135–142 (in part).

Holotype. INVEMAR-PEC 5333 (stri x3600), female, 183.5 mm SL, May 2003, Ciénaga Grande de Santa Marta (CGSM), Magdalena, CO (10°59' N, 74°17' W). Cyt *b*, ATPase 8

and ATPase 6 sequences are available in GenBank, accession numbers AY575016, AY575018 and AY575021, respectively.

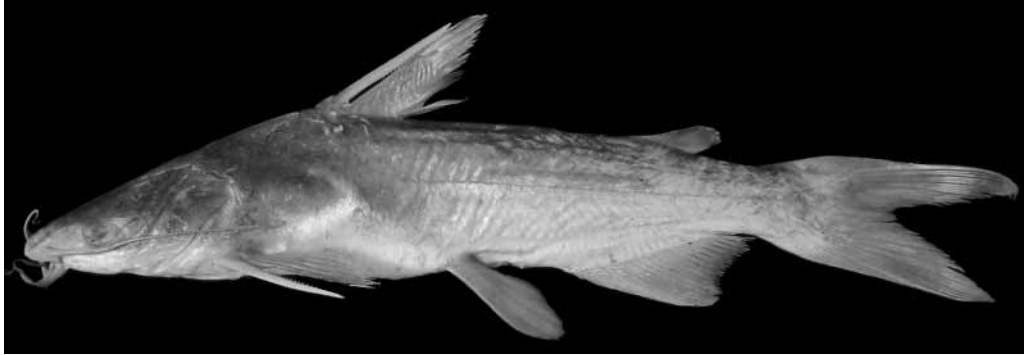


FIGURE 1. Lateral view of a female paratype (INVEMAR-PEC 5197, 192 mm TL) of *Cathorops mapale*, from the Colombian Caribbean.

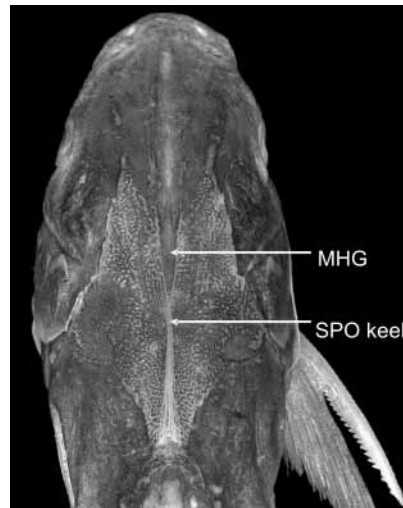


FIGURE 2. Dorsal view of head of a female paratype (INVEMAR-PEC 5197, 38 mm HL) of *Cathorops mapale*, from the Colombian Caribbean. MHG: medial head groove; SPO: supraoccipital.

Paratypes. ICN-MHN 8244, female, 166 mm SL, December 2003, CGSM, Magdalena, CO (10°59' N, 74°17' W); INVEMAR-PEC 277, female, 256 mm SL, March 1988, Tasa-jera, Magdalena, CO (11°0' N, 74°20' W); INVEMAR-PEC 1584, male, 166 mm SL, October 1988, Costa Verde, CGSM, Magdalena, CO (11°02' N, 74°15' W); ICN-MHN 8245, one female and one male, 196–164 mm SL, INVEMAR-PEC 5730, female, 157 mm SL, INVEMAR-PEC 5733, 14 males and 12 females cleared and stained, 110–144 mm SL, February 1998, 20 m depth, Golfo de Salamanca, Magdalena, CO (11°6' N, 74°18' 19'

W); INVEMAR-PEC 3654, female, 180 mm SL, August 2001, Ciénaga de Soledad, Córdoba, CO (9°20' N, 75°52' W); INVEMAR-PEC 5197, female, 156 mm SL, August 1995, mouth of Río Tinajones, Córdoba, CO (9°25' N, 75°48' W); ICN-MHN 8246, one female and one male, 165–179 mm SL, January 2004, mouth of Río Sinú, Córdoba, CO (9°26' N, 75°55' W); INVEMAR-PEC 5501, one female and one male, 151–152 mm SL, January 2003, 20 m depth, Golfo de Urabá, Antioquia, CO (8°29' N, 77°13' W); INVEMAR-PEC 5732, male, 157 mm SL, February 2003, 10 m depth, Golfo de Urabá, Antioquia, CO (7°56' N, 76°53' W); INVEMAR-PEC 5731, two females, 139–172 mm SL, February 2003, 10 m depth, Golfo de Urabá, Antioquia, CO (8°17' N, 76°48' W); INVEMAR-PEC 5348 (stri x3601), female, 118 mm SL, June 2003, Río Atrato, mouth El Roto, Golfo de Urabá, Antioquia, CO (76°58'W, 8°07' N), Cyt *b*, ATPase 8 and ATPase 6 sequences are available in GenBank, accession numbers AY575017, AY575019 and AY575020, respectively; ICN-MHN 8247, female, 143 mm SL, January 2004, Río Atrato, mouth El Roto, Golfo de Urabá, Antioquia, CO (76°58'W, 8°07' N).

Diagnosis. *Cathorops mapale* is distinguished from other *Cathorops* species inhabiting the western Atlantic by the following combination of features: anterior gill rakers on first gill arch 6–8+14–16 (20–24, mode 23), anterior gill rakers on second gill arch 5–6+13–15 (18–21, mode 20); maxillary barbels 27.8–39.3% (mean 32.3%) SL; medial head groove long and deep, extending posteriorly almost to supraoccipital keel (Fig. 2). The species is also distinguished from the *C. fuerthii* species group, its sister clade from the eastern Pacific, by having higher anterior gill raker counts on first (14–15 in the *C. fuerthii* group) and second (15–16 in the *C. fuerthii* group) gill arches and by having a smaller mouth (8.3–10.6% SL in *C. mapale* and 11.0–11.6% SL in the *C. fuerthii* group). Meristic and morphometric data of the type series are summarized in Table 1.

TABLE 1. Meristic and morphometric data for the holotype and part of the paratype series (17 specimens examined, data from cleared and stained specimens not included) of *Cathorops mapale*. Paratype data are presented by main sampling localities in the Colombian Caribbean. Numbers in brackets are numbers of specimens with each count. Holotype measurements are in millimeters, and the percents of SL appear in brackets. TL and SL are in millimeters, additional measurements are percents of SL. CGSM: Ciénaga Grande de Santa Marta; SMW: surrounding marine waters.

	Holotype		Paratypes	
	CGSM	CGSM and SMW	Mouth of Río Sinú	Golfo de Urabá
Locality	CGSM	CGSM and SMW	Mouth of Río Sinú	Golfo de Urabá
Sex	female	4 females, 2 males	3 females, 1 male	5 females, 2 males
Dorsal-fin elements	I,7	I,7	I,7	I,7
Pectoral-fin elements	I,11	I,10(3)–I,11(3)	I,10(3)–I,11(1)	I,10(4)–I,11(3)
Pelvic-fin elements	6	6	6	6

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TABLE 1 (continued)

	Holotype		Paratypes	
Anal-fin elements	23	21(1), 22(2), 23(1), 24(2)	23(2), 24(1), 25(1)	23(3), 24(4)
Anterior gill rakers on first arch	7+16	6(1), 7(4), 8(1)+16(6)	7(2)-8(2)+15(1)-16(3)	6(4)-7(3)+14(1), 15(4), 16(2)
Total gill rakers on 1st arch	23	22(1), 23(4), 24(1)	22(1), 23(1), 24(2)	20(1), 21(3), 22(1), 23(2)
Anterior gill rakers on second arch	5+14	5(4)-6(2)+13(1), 14(1), 15(3)	5(2)-6(2)+14(3)-15(1)	5(5)-6(2)+14(4)-15(3)
Total gill rakers on 2nd arch	19	18(1), 20(3), 21(1)	19(1)-20(3)	19(2)-20(5)
Total length	231	193-306	192-220	149-204
Standard length	183.5	157-256	156-180	118-172
Body depth	34 (18.5)	17.1-22.1	17.9-19.8	17.4-20.5
Body width	34.4 (18.7)	16.8-20.4	18.2-19.6	18.1-20.5
Head length	47 (25.6)	24.1-29.3	24.4-28.5	23.7-29.9
Head width	36.5 (19.9)	18.3-20.8	19.4-20.2	17.3-21.4
Head depth	28.5 (15.5)	15.3-17.7	15.6-17.3	15.3-18.3
Snout length	13 (7.1)	6.6-8.2	6.7-8.4	6.0-8.7
Mouth width	16.7 (9.1)	8.4-10.6	9.3-10.0	8.3-10.6
Upper lip width	2.9 (1.6)	0.6-1.2	0.9-1.1	0.8-1.5
Maxillary barbels	53.3 (29.0)	27.8-33.4	29.8-34.7	32.7-39.3
Mandibular barbels	38.7 (21.1)	18.7-22.5	20.4-25.8	21.5-26.4
Mental barbels	25.2 (13.7)	13.0-15.2	13.8-17.8	14.5-16.5
Anterior internarial distance	7.1 (3.9)	3.6-4.8	4.6-4.8	3.7-5.1
Posterior internarial distance	7.8 (4.3)	4.2-6.1	5.3-5.8	4.7-6.8
Distance from posterior nares to the eye	8.3 (4.5)	4.0-4.9	4.4-5.0	4.2-5.0
Interorbital distance	24.4 (13.3)	10.7-13.2	12.9-13.6	10.9-13.3
Eye diameter	7.9 (4.3)	3.7-4.2	4.0-4.4	4.1-5.2
Postorbital length	26.2 (14.3)	14.3-17.0	14.3-17.3	12.2-18.2
Posterior width of supraoccipital process	5.2 (2.8)	2.6-3.3	2.5-3.0	2.2-3.0
Length of supraoccipital process	21.6 (11.8)	10.5-11.5	10.2-11.7	10.0-12.2

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TABLE 1 (continued)

	Holotype		Paratypes	
Width of predorsal plate	14.2 (7.7)	6.3–7.5	6.7–7.1	6.5–7.8
Length of predorsal plate	9.6 (5.2)	4.3–5.6	4.7–5.2	4.5–5.4
Predorsal fin length	63 (34.3)	34.3–38.4	36.1–38.2	33.8–38.9
Dorsal-fin base	18.0 (9.8)	9.3–10.4	9.1–10.7	8.9–10.5
Dorsal-fin spine height	43.0 (23.4)	18.7–23.2	26.5	19.2–19.8
Distance between dorsal and adipose fins	48.9 (26.6)	24.9–30.1	27.5–29.9	26.4–32.7
Preadipose fin length	131 (71.4)	71.7–75.0	73.1–74.5	71.3–75.0
Adipose-fin base	16.9 (9.2)	5.4–9.2	6.1–7.9	5.5–10.4
Adipose-fin height	19.8 (10.8)	8.5–11.4	10.1–10.8	7.6–12.8
Prepectoral fin length	41 (22.3)	19.9–23.8	21.8–24.4	20.1–24.5
Pectoral-fin base	8.2 (4.5)	4.3–5.2	3.9–5.2	4.0–4.9
Pectoral-fin spine length	–	17.5–17.8	19.1	17.2–18.5
Prepelvic fin length	89 (48.5)	46.4–51.5	50.0–52.7	47.5–51.7
Pelvic-fin base	7.0 (3.8)	3.3–4.5	3.0–4.5	3.4–4.4
Pelvic-fin length	32.9 (17.9)	13.4–18.4	12.4–18.6	13.6–16.7
Preanal fin length	122 (66.5)	65.1–67.3	63.3–68.5	64.0–69.2
Anal-fin base	35.6 (19.4)	16.4–19.2	17.6–20.0	15.6–20.6
Anal-fin height	37.7 (20.5)	17.3–21.4	17.6–20.5	16.3–21.8
Caudal peduncle depth	13.9 (7.6)	6.9–8.0	7.1–8.1	7.1–8.2

Description (based on combined data from type series). Body depth 4.5–5.9 in SL, slightly deeper in females than in males; body width 4.9–5.9 in SL, slightly wider in females than in males. Head moderately depressed, posterior profile slightly convex; depth 5.5–6.6 in SL and 1.4–2.0 in HL; length 3.3–4.2 in SL, slightly longer in males than in females. Snout rounded in transverse section, length 3.1–4.3 in HL. Mouth width 2.5–3.2 in HL. Lips thin to moderate, upper lip width 16.2–46.0 in HL. Maxillary barbels 0.6–1.0 in HL and 2.5–3.6 in SL, reaching beyond pectoral fin bases; mandibular barbels 0.9–1.5 in HL and 3.8–5.3 in SL, passing gill membrane; mental barbels 1.4–2.2 in HL and 5.6–7.7 in SL, not reaching gill membrane. Distance between anterior nostrils 5.3–7.3 in HL; distance between posterior nostrils 4.2–6.0 in HL; fleshy furrow between posterior nostrils absent. Eyes lateral; diameter 19.3–26.9 in SL, 4.6–7.3 in HL, and 2.1–3.5 in interorbital distance. Interorbital distance 7.3–9.4 in SL and 1.9–2.6 in HL. Postorbital length 1.6–2.0 in HL, slightly longer in males than in females. Head shield exposed, covered pos-

teriorly with scattered granules, extending anteriorly to opposite eyes; coarse to sharp bony spines on its anterior surface absent. Bony ridges formed by frontals and lateral ethmoids sharp and evident on the skin. Supraoccipital process keeled and slightly convex; length 8.2–9.8 in SL and 1.9–2.8 in HL; posterior width 30.6–44.8 in SL, 7.7–11.5 in HL, and 3.4–4.8 in its length. Predorsal plate narrow and crescent-shaped, width 3.3–4.5 in HL, length 4.7–6.7 in HL. Dentary teeth villiform, relatively coarse, and molariform. Palatine teeth molariform, arranged in two elliptical patches; patches larger and with higher tooth counts in females (46–84) than in males (33–48). Vomerine tooth patches absent. Gill rakers well developed and uniformly distributed along rear surfaces of all gill arches. Predorsal fin length 2.6–3.0 in SL. Dorsal-fin base 9.4–11.2 in SL; dorsal-fin spine thick and long, its anterior margin slightly granular, its posterior margin almost totally serrated, longer than pectoral-fin spine, height 3.8–5.3 in SL. Distance between dorsal fin and adipose fin 3.1–4.0 in SL. Base of adipose fin 9.6–18.5 in SL; height of adipose 7.8–13.1 in SL. Prepectoral fin length 4.1–5.0 in SL. Pectoral-fin base 19.2–25.4 in SL; pectoral-fin spine wide and long, its anterior margin granular, its posterior margin serrated, length 5.2–5.8 in SL. Prepelvic fin length 1.9–2.2 in SL. Pelvic-fin base 22.2–33.1 in SL, slightly larger in females than in males; pelvic-fin length 5.4–7.0 in SL in females and 7.1–8.1 in males. Anal-fin base 4.9–6.4 in SL, slightly larger in females than in males; anal-fin height 4.6–6.1 in SL, slightly higher in females than in males. Caudal peduncle depth 12.2–14.5 in SL, slightly deeper in females than in males. Caudal fin deeply forked, its lower lobe shorter than upper lobe. Dorsal-fin elements I,7; pectoral-fin elements I,10–11; pelvic-fin elements 6; anal-fin elements 21–25; ribs 10–13, postweberian vertebrae: 10 precaudal and 34 caudal (two females and two males).

Coloration. In alcohol, dark gray to brown on dorsum, silvery to white below. Individuals living in freshwaters are said to have dark golden cast (Galvis, 1983).

Size. Largest specimen examined 256 mm SL and 306 mm TL (INVEMAR-PEC 277, paratype). The maximum length reported by Galvis (1983) in the CGSM is 31 cm TL.

Etymology. The specific epithet *mapale* refers to the common name (chivo mapalé) given to the species by artisanal fishers in most Colombian localities. This is also the name of a Colombian rhythm of African origin typical of the fishery community of the Colombian Caribbean. The specific name should be treated as a noun in apposition.

Common names. We propose the official English common name of Mapalé Sea Catfish for *Cathorops mapale*. To fulfill the need of official names in other languages, we also propose chivo mapalé (Spanish) and mâchoiron mapalé (French).

Habitat and distribution. The examined material of *C. mapale* comes from the central and southwestern coasts of the Colombian Caribbean, including CGSM and its surrounding marine waters, mouth of Río Sinú, and the Golfo de Urabá (Fig. 3). The species seems to be endemic to Colombia, and it inhabits fresh and brackish waters in coastal lagoons and near-shore marine waters. Examined paratypes from Golfo de Salamanca and INVEMAR-PEC 5501 from Golfo de Urabá were collected at 20 m depth.

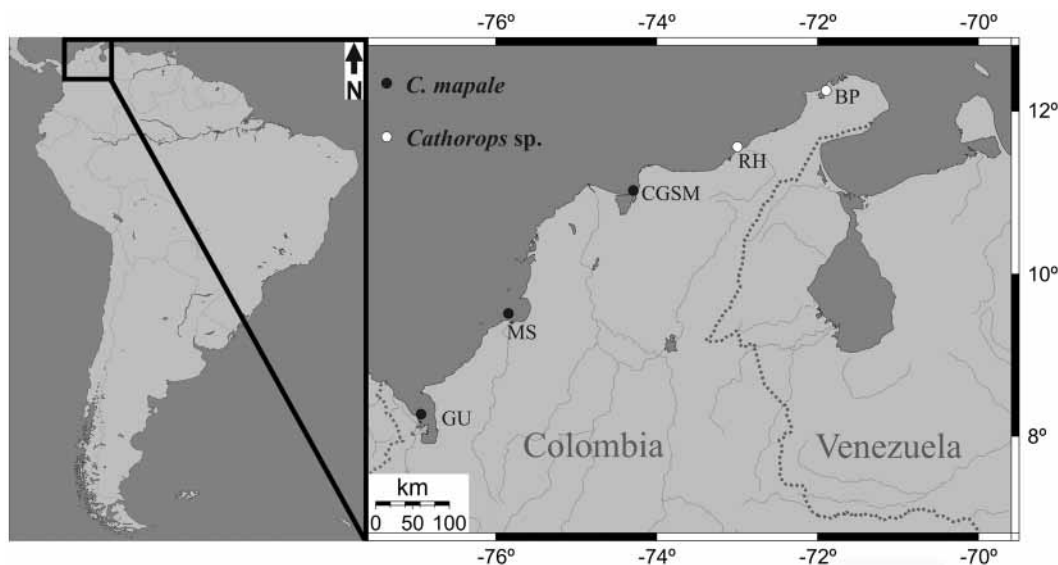


FIGURE 3. Sampling localities of *Cathorops mapale* and *Cathorops* sp. in the Colombian Caribbean. GU: Golfo de Urabá; MS: deltaic mouth of Río Sinú; CGSM: Ciénaga Grande de Santa Marta and surrounding marine waters; RH: Riohacha and surrounding waters; BP: Bahía Portete (map from <http://www.aquarius.geomar.de/>).

Discussion

Cathorops spixii was described by Agassiz in Spix and Agassiz (1829) from equatorial Brazil; however, the original description is unclear and apparently no type material was designated. The name *spixii* has been employed to include other species of the genus *Cathorops* with uncertain status that occur in the western and southwestern Caribbean Sea and even in the southern Gulf of Mexico. This confusion can be traced back at least to Dahl (1971) and Taylor and Menezes (1978), who extended the species' distribution to Colombia and to the eastern coast of Middle America, respectively. Marceniuk (1997), in his unpublished M.Sc. thesis, presented a taxonomic revision of *Cathorops* species from both American coasts, using morphometry and multivariate statistics. He stated that *C. spixii* is a valid species, but restricted its distribution to the region from Brazil to the Guianas. Marceniuk (1997) also proposed that in the Caribbean Sea there are three undescribed species, one of which is our Mapalé Sea Catfish (Marceniuk's *Cathorops* sp.9). We examined material of *C. spixii* collected by L. Agassiz in Brazil at several latitudes ranging from 1°S to 22°S and found morphological differences between that species and *C. mapale*. The latter can be distinguished from the former by having modally higher anterior gill raker counts on first (23 in *C. mapale*, 19 in *C. spixii*) and second (20 in *C. mapale*, 18 in *C. spixii*) gill arches (see also Table 2).

TABLE 2. Comparison of selected features distinguishing *Cathorops mapale* from six other species of the genus *Cathorops*. Data mode (counts) and data mean (measurements) appear between brackets (whenever available). SL is in millimeters; other measurements are percents of SL. Data in bold indicate differences from *C. mapale*.

	<i>Cathorops</i> sp.						<i>C. fuerthii</i> group	
	<i>C. mapale</i>		<i>C. aguadulce</i>		<i>C. arenatus</i>			<i>C. spixii</i>
Basin	Western Atlantic	Western Atlantic	Western Atlantic	Western Atlantic	Western Atlantic	Western Atlantic	Western Atlantic	Eastern Pacific
Examined specimens	13 females, 5 males	2 females, 3 males, 2?	6 females?	1?	1?	2 females, 2 males, 8?	2 males, 2?	
Standard length	118–256	218–251	118–164	172	100.8	97–195	163–332	
Anterior gill rakers on first arch (upper limb)	6–8 (7)	5–6 (6)	4–5 (5)	5	7	6	4	
Anterior gill rakers on first arch (lower limb)	14–16 (16)	13–14 (13)	10–11 (10)	12	14	11–14 (13)	10–11 (11)	
Total gill rakers on 1st arch	20–24 (23)	18–20 (19)	14–16 (15)	17	21	17–20 (19)	14–15 (15)	
Anterior gill rakers on second arch (upper limb)	5–6 (5)	5	4–5 (4)	—	6	4–5 (5)	4–5 (4)	
Anterior gill rakers on second arch (lower limb)	13–15 (14)	13–14	10–12 (11)	—	14	11–13 (13)	11–12	
Total gill rakers on 2nd arch	18–21 (20)	18–19	14–17 (15)	—	20	16–18 (18)	15–16	
Mouth width	8.3–10.6 (9.5)	8.9–9.7 (9.5)	8.1–8.9 (8.6)	10.4	11.5	8.7–12.5 (10.2)	11.0–11.6 (11.4)	
Maxillary barbels	27.8–39.3 (32.3)	21.8–26.0 (23.9)	29.0–31.8 (30.7)	—	35.7	27.2–39.2 (34.8)	27.7–31.8 (30.2)	
Mandibular barbels	18.7–26.4 (22.4)	15.9–19.4 (17.2)	18.9–22.4 (20.2)	—	24.0	20.3–27.0 (24.3)	19.3–22.8 (21.0)	
Mental barbels	13.0–17.8 (15.1)	11.1–13.5 (12.4)	13.0–14.5 (13.4)	—	16.2	13.9–19.0 (16.4)	10.8–13.9 (12.7)	
Eye diameter	3.7–5.2 (4.4)	3.7–4.1 (3.9)	5.9–6.6 (6.3)	5.0	4.1	4.3–5.3 (4.8)	3.2–4.0 (3.5)	
Medial groove	Deep, long, extending posteriorly almost to supraoccipital keel	Deep, long, extending posteriorly almost to supraoccipital keel	Shallow, long, extending posteriorly almost to supraoccipital keel	—	Deep, short, posterior limit well anterior to supraoccipital keel	Deep, long, extending posteriorly almost to supraoccipital keel	Deep, long, extending posteriorly almost to supraoccipital keel (sometimes interrupted)	

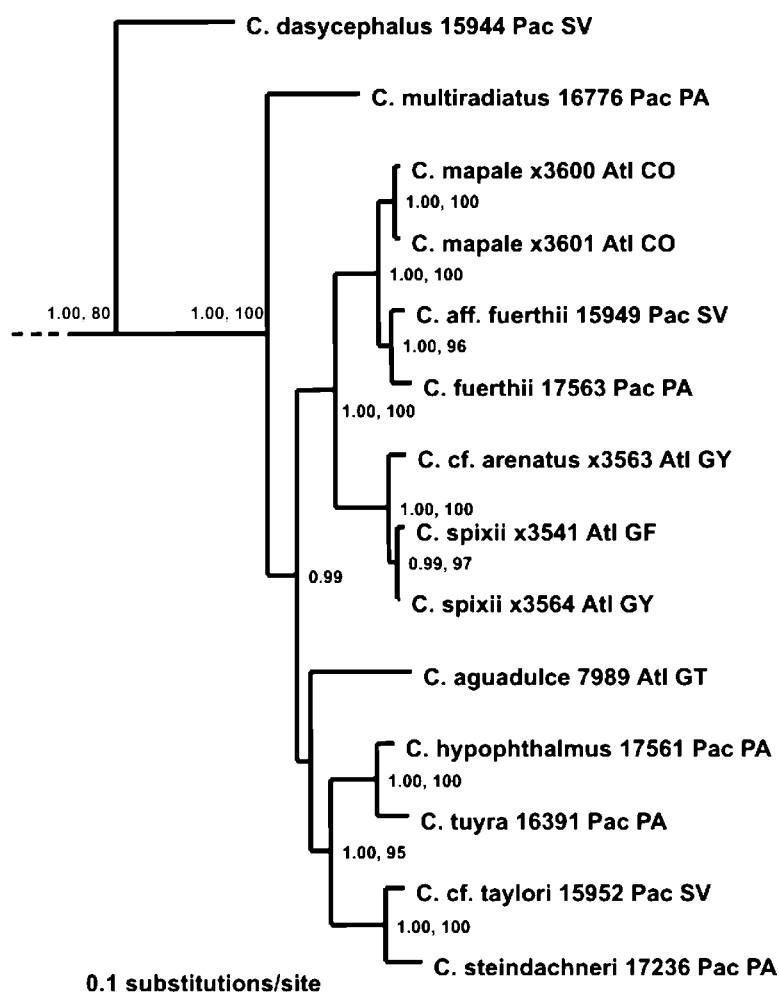


FIGURE 4. Phylogenetic relationships of 11 species of the genus *Cathorops*, based on the combined cytochrome *b* and ATP synthase 8/6 dataset (1937 bp). The topology of the phylogram shown was identical under Bayesian inference (BI) and maximum parsimony (MP) reconstruction criteria. Left node numbers indicate clade support by BI posterior probabilities (<0.95 not shown). Right node numbers indicate clade support by MP bootstrap pseudoreplicates (<70% not shown). Specimen tags indicate specimen voucher and/or tissue numbers in stri collection; Pac: Pacific; Atl: Atlantic; country codes follow ISO-3166 [clade shown follows Betancur-R.'s (2003) phylogenetic schemes of New World ariids].

Cathorops mapale can be differentiated from *C. spixii* not only by external morphology, but also by taking into account the species' genealogical histories. Betancur-R. (2003), in his study of the systematics of New World sea catfishes using *cyt b* and ATPase 8/6 mitochondrial markers, presented a relatively complete phylogenetic hypothesis of at least 11 species of the genus *Cathorops* (including *Arius dasycephalus* Günther) (Fig. 4). From his hypothesis it is evident that the Mapalé Sea Catfish is more closely related to the *C. fuerthii* species group from the eastern Pacific (posterior probability support = 1.0; Bootstrap

support = 100%) than to the *C. spixii/C. cf. arenatus* clade from the western Atlantic. Also, the K2 genetic divergence values of the combined mitochondrial genes are lower between *C. mapale* and the *C. fuerthii* group (2.21–2.81%) than between *C. mapale* and the *C. spixii/C. cf. arenatus* group (5.88–6.22%) (Betancur-R., 2003). The genetic divergences found within the transisthmian *C. mapale/C. fuerthii* clade are close to those found in other sister-species of fishes implicated in vicariant speciation due to the Pliocenic rising of the Panamá isthmus (see Bermingham et al., 1997). Alternatively, it might be possible to accept a single transisthmian species of *Cathorops*, comprising the *C. fuerthii* group and *C. mapale*. Nevertheless, because *C. mapale* is unambiguously separated from *C. fuerthii* by external characters (see diagnosis and Table 2), such a hypothesis is supported neither by morphology nor by the relatively high genetic distances between lineages (see other K2 divergence values within sister-species of *Cathorops* in Table 3). The Mapalé Sea Catfish is also separated from other congeners by 8.09–13.37% combined K2 sequence divergence (see details in Table 3).

TABLE 3. Percents of genetic divergence in three mitochondrial loci calculated among sister-terminals of *Cathorops* and between *C. mapale* and other congeners (data from Betancur-R., 2003). Corresponding values are expressed as divergences corrected by the Kimura-2-parameter model. Specimen tags indicate specimen voucher and/or tissue numbers in stri collection; country codes follow ISO-3166; CGSM: Ciénaga Grande de Santa Marta.

Units of comparison		Cyt <i>b</i>	ATPase 8	ATPase 6	Combined
Among sister-terminals					
<i>C. mapale</i> x3600 (CGSM)	<i>C. mapale</i> x3601 (G. Urabá)	0.55	0.00	0.90	0.62
<i>C. hypophthalmus</i> 17561 (PA)	<i>C. tuyra</i> 16391 (PA)	2.62	1.20	2.90	2.60
<i>C. fuerthii</i> 17563 (PA)	<i>C. aff. fuerthii</i> 15949 (SV)	1.48	1.20	2.27	1.73
<i>C. steindachneri</i> 17236 (PA)	<i>C. cf. taylori</i> 15952 (SV)	2.91	3.07	2.58	2.81
<i>C. spixii</i> x3541 (GF), x3564 (GY)	<i>C. cf. arenatus</i> x3563 (GY)	1.58–1.77	1.82	1.20–1.50	1.46–1.68
<i>Cathorops mapale</i> vs. congeners					
<i>C. mapale</i> x3600 (CGSM), x3601 (G. Urabá)	<i>C. dasycephalus</i> 15944 (SV)	11.52–11.63	12.50	16.60	13.31–13.37
	<i>C. fuerthii</i> 17563 (PA)	2.43–2.62	1.20	3.47–3.78	2.81
	<i>C. aff. fuerthii</i> 15949 (SV)	2.24	0.00	2.70–3.01	2.21–2.32
	<i>C. cf. arenatus</i> x3563 (GY)	5.78–5.98	4.35	6.65–7.31	6.10–6.22
	<i>C. spixii</i> x3541 (GF), x3564 (GY)	5.47–5.88	3.71	6.32–7.33	5.88–5.99
	<i>C. aguadulce</i> 7989 (GT)	7.69	7.62	10.09–10.44	8.56–8.68
	<i>C. hypophthalmus</i> 17561 (PA)	6.47–6.67	6.98	10.95	8.09–8.21
	<i>C. tuyra</i> 16391 (PA)	7.29–7.50	8.36	9.88–10.24	8.45
	<i>C. steindachneri</i> 17236 (PA)	8.15	9.06	9.72	8.83
	<i>C. cf. taylori</i> 15952 (SV)	8.78–9.00	6.98	8.52	8.58–8.70
	<i>C. multiradiatus</i> 16776 (PA)	7.61	9.12	10.07–10.43	8.64–8.76

Marceniuk (1997) reported *Cathorops* sp.9 from the central and northeastern coasts of Colombia (Ciénaga de la Virgen and CGSM) and western Venezuela (Iago de Maracaibo). He also reported another undescribed Caribbean species (Marceniuk's *Cathorops* sp.12) occurring from Río Sinú and Golfo de Urabá, Colombia, to Honduras. Because part of the material of *C. mapale* that we examined was collected at the mouth of Río Sinú and Golfo de Urabá (Fig. 3), southwest of the locations reported by Marceniuk (1997) for his *Cathorops* sp.9, it would correspond to Marceniuk's (1997) *Cathorops* sp.12. After comparing topotype material of *C. mapale* from CGSM and surrounding marine waters with type material from both southwestern locations slight differences are found. The three pairs of barbels and the eye tend to be smaller in topotype material (Table 1); however, those differences could be reflecting allometry, because CGSM material examined is larger (157–256 mm SL) than southwestern material (118–180 mm SL). Nevertheless, even if the differences are consistent after examining additional material, we conclude that they are only valid at the population level. This hypothesis is also confirmed by the mitochondrial genetic divergence values. In Table 3 are presented K2 genetic distances among several sister-species pairs within the genus *Cathorops* (see clades in Fig. 4) from the three loci sequenced by Betancur-R. (2003). The combined mitochondrial divergence value between the holotype and a Golfo de Urabá paratype (INVEMAR-PEC 5348) seems too small (0.62%) to represent specific differentiation. Such a value corresponds to less than half of those observed in the closest sister species pairs of *Cathorops* studied by Betancur-R. (2003), *C. spixii* and *C. cf. arenatus*, with 1.46–1.68% combined K2 distances. However, it is possible that Marceniuk's (1997) *Cathorops* sp.12 is a valid species different from *C. mapale*. If so, the species probably occurs farther north in the Caribbean Sea. The distribution given for *Cathorops* sp.12 by Marceniuk (1997) is also rejected in the light of the distributional pattern revealed by other ariids inhabiting in the southern Caribbean, which western limit is the Golfo de Urabá [e.g. New Granada Sea Catfish (*Ariopsis* sp.), *Notarius neogranatensis* (Acero and Betancur-R), *Bagre bagre* (Linnaeus), *Sciades proops* Valenciennes].

Another undetermined species of *Cathorops* occurs along the northeastern coast of Colombia (Guajira) (Fig. 3). This species can be easily separated from the Mapalé Sea Catfish by having modally lower anterior gill raker counts on first (19 in *Cathorops* sp., 23 in *C. mapale*) and second (18–19 *Cathorops* sp., 20 in *C. mapale*) gill arches and shorter maxillary (21.8–26.0% SL, mean 23.9, in *Cathorops* sp.; 27.8–39.3% SL, mean 32.3, in *C. mapale*), mandibular (15.9–19.4% SL, mean 17.2, in *Cathorops* sp.; 18.7–26.4% SL, mean 22.4, in *C. mapale*), and mental (11.1–13.5% SL, mean 12.4, in *Cathorops* sp.; 13.0–17.8% SL, mean 15.1, in *C. mapale*) barbels (see also Table 2). Due to the apparent absence of *C. mapale* along the northeastern coast of Colombia, its presence in western Venezuela, as reported by Marceniuk (1997), needs confirmation. Further studies should include material of *Cathorops* species from Venezuela and the Guianas in order to establish the identity of *Cathorops* sp.

Other *Cathorops* species described from the western Atlantic, such as *Arius fissus* Valenciennes, *A. pleurops* Boulenger, *Tachisurus agassizii* Eigenmann and Eigenmann, and the *inquirendae* (see Marceniuk and Ferraris, 2003) *A. laticeps* Günther, *A. nuchalis* Günther, *A. puncticulatus* Valenciennes, and *A. variolosus* Valenciennes, were not examined in this work. Nevertheless, the type localities of all of them are between Guyana and Argentina. Because the northeastern distributional limit of *C. mapale* seems to be the CGSM in the Colombian Caribbean, more than 2500 km of coastline away from Guyana, it is most unlikely that *C. mapale* is conspecific with any of those species. Material from two putative new species of *Cathorops* reported from the Centro American Caribbean [*Cathorops* sp.10/*Cathorops* sp. from the coast of Belize (Marceniuk, 1997; Greenfield and Thomerson, 1997), and *Cathorops* sp.12 (Marceniuk, 1997)] was neither examined. Comparisons of select features distinguishing *C. mapale* from five western Atlantic and one eastern Pacific species of *Cathorops* are summarized in Table 2.

Several Colombian authors have gathered a considerable amount of biological and fishery information about the Mapalé Sea Catfish. Galvis (1983) reported that it spawns throughout the year in the CGSM, with a peak between November and March, and that each female lays 24–30 eggs, which average 9 mm in diameter. He also established that females mature after reaching 20 cm TL and the sex ratio is 4.4 females/male. Grijalba-Bendeck (1998) calculated the biomass of the species to be 141 tons in the CGSM. Following a survey in 1994, Tíjaro et al. (1998) estimated the size of female maturity to be 23 cm and stated that the species is being overfished in the CGSM. INVEMAR (2003) reported that the average size of capture has been below the average size of female maturity between 2000 and 2002 in the CGSM. This information suggests that the Mapalé Sea Catfish is in need of protection, not only due to its restricted distribution, but because it is threatened by overfishing.

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