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Description of *Loraxichthys lexa*, new genus and species (Siluriformes: Loricariidae) from the Río Huallaga Basin, central Peru, with notes on the morphology of the enigmatic *Lipopterichthys carrioni* Norman, 1935

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Abstract

A new genus and species of armored catfish, *Loraxichthys lexa*, collected in 1955 by the Catherwood Foundation Peruvian-Amazon Expedition from the vicinity of Tingo María, Huánuco, is described herein. *Loraxichthys* is diagnosed by two uniquely derived characters: two to four robust evertible posterior cheek odontodes with hooked tips, longer than odontodes anterior to them but no more than twice their length; and skin folds on dorsal border along first pelvic-fin ray crenulated in mature males. *Loraxichthys lexa*, new species, is only known from clear water tributaries of the Río Huallaga in the vicinity of Tingo María. Additionally, notes on the morphology of the enigmatic species *Lipopterichthys carrioni* are included, and an artificial key for the genera *Chaetostoma*, *Cordylancistrus*, *Dolichancistrus*, *Leptoancistrus*, *Lipopterichthys*, and *Loraxichthys* is provided.

Key words: Ancistrinae, Andes, biodiversity, conservation, endemic

Resúmen

Un nuevo género y especie de carachama, *Loraxichthys lexa*, colectada en 1955 por la Catherwood Foundation Peruvian-Amazon Expedition en los alrededores de Tingo María, Huánuco, es descrita. *Loraxichthys* se diagnostica en base a dos características derivadas únicas: dos a cuatro odontodes evertibles de la mejilla robustos, con extremos ganchudos, más largos que los odontodes anteriores a ellos, pero no más de dos veces el largo de estos; y, pliegues carnosos en el borde dorsal del primer radio de la aleta pélvica festoneados, en especímenes machos maduros. *Loraxichthys lexa*, especie nueva, sólo se conoce de tributarios de aguas claras del Río Huallaga en los alrededores de Tingo María. Adicionalmente, se incluyen notas sobre la morfología de la enigmática especie *Lipopterichthys carrioni* y se provee una clave artificial para identificar a los géneros *Chaetostoma*, *Cordylancistrus*, *Dolichancistrus*, *Leptoancistrus*, *Lipopterichthys*, y *Loraxichthys*.

Introduction

While studying the morphological variation of extensive series of specimens from the Río Huallaga tentatively identified as *Chaetostoma marmorescens* Eigenmann and Allen, I came across several specimens that externally resembled a *Chaetostoma* species (naked snout with no tentacles) without an adipose fin, but with evertible cheek odontodes unlike any other *Chaetostoma* Tschudi species I had seen (Figs. 1–2). A closer look at these specimens revealed that characteristics common to *Chaetostoma* species are not present. Among these traits the presence of nuchal plate and dorsal-fin spinelet, both absent in the new species, *Lithogenes* Eigenmann, and *Pareiorhaphis nudulus* (Reis & Pereira); and the wide lateral anterior process of the basipterygia of *Chaetostoma* species, narrow in the new species, resembling the lateral anterior process of *Lasiancistrus heteracanthus* (Günther) and some species of *Ancistrus* Kner.

Lipopterichthys carrioni Norman, 1935 is another species without adipose fin that exhibits a naked snout and resembles some *Chaetostoma* species. *Lipopterichthys* Norman is a monotypic genus scarcely represented in

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museum collections in the United States. Howes (1983) studied the myology and osteology of *Lipopterichthys*, Schaefer (1986) included osteological characters of *Lipopterichthys* in a phylogenetic analysis of the Loricariidae, and Armbruster (2004) recognized *Lipopterichthys* as a synonym of *Chaetostoma* based on its overall external morphology (Armbruster 2004: 54), followed by Salcedo (2006).

Thus, the first objective of this work is to explore the phylogenetic position of *Lipopterichthys carrioni* and the new species among the Loricariidae, by evaluating the characters proposed by Armbruster (2004) for *Lipopterichthys carrioni* and the new species, and including them in an updated phylogenetic analysis. Since the derived characters that would diagnose *Chaetostoma*, *Cordylancistrus* Isbrücker, *Dolichancistrus* Isbrücker, *Leptoancistrus* Meek & Hildebrand, and *Lipopterichthys* have not yet been discovered nor described, and since the new species does not exhibit the synapomorphies proposed by Schaefer (1986) for a monophyletic group that includes *Chaetostoma*, *Dolichancistrus*, *Leptoancistrus*, and *Lipopterichthys*, the second objective is to name and describe a new genus to accommodate the new species. Finally, although the taxonomic revision of the genera *Chaetostoma* and *Cordylancistrus* are projects in progress, the third objective is to provide an artificial key for the identification of these genera and *Dolichancistrus*, *Leptoancistrus*, *Lipopterichthys*, and *Loraxichthys*, based on current morphological knowledge, excluding *Chaetostoma setosus* Boulenger, which is treated as *incertae sedis* (Ballen & Vari 2012).

Material and methods

Characters included in the phylogenetic analysis were coded following Armbruster (2004), with one character state added to Character 91 (state 3: four infraorbital plates) to fit the number of infraorbital plates observed for *Lipopterichthys carrioni*. Coded character states are presented in Appendix 1. An updated phylogenetic analysis was performed using the matrix in Armbruster (2008), with the addition of the character states of *Paulasquama callis* Armbruster & Taphorn 2011, and the methods presented in Armbruster (2008, modified from Armbruster 2004). A total of 153 taxa and 215 characters (19 ordered, 196 unordered) were included in a heuristic search with 1000 replicates, performed using PAUP ver. 4.0b10 (Swofford 2002) to find the most parsimonious trees. The topologies found were saved and summarized in a strict consensus tree. The first tree saved was manually modified to match the strict consensus tree, where character state evolution was examined using MacClade ver. 4.06 (Maddison & Maddison 2000).

Counts and measurements follow the methods outlined by Salcedo (2006, 2011), with fin-ray counts taken from whole specimens preserved in ethanol. Cleared and counterstained (CS) specimens were prepared following Taylor & Van Dyke (1985). Osteological nomenclature follows Schaefer (1987). Vertebral and pterygiophore counts were taken from radiographs and CS specimens. Vertebral counts include the five Weberian complex centra that precede the first rib-bearing vertebra, and a single complex ural centrum. Abbreviations in the text are standard length (SL) and head length (HL). An asterisk following a meristic value in the description indicates that of the holotype. Number of specimens exhibiting meristic values given in parenthesis. Institutional codes follow Ferraris (2007).

Comparative material studied includes: *Chaetostoma venezuelae*, USNM 120752, X-ray, holotype, 72.5 mm SL, Venezuela; *Cordylancistrus torbesensis*, USNM 121001, X-ray, holotype, 64.8 mm SL, Venezuela; *Lasiancistrus heteracanthus*, MUSM 14313, 1 CS, 61.0 mm SL, Peru; *Lipopterichthys carrioni*, AUM 4233, 1, 50.1 mm SL; MCZ 51702, 1, 40.3 mm SL, 1 CS, 40.0 mm SL; USNM 101068, 1, 49.6 mm SL. The characteristics, mostly external, of species in the *Chaetostoma* group (Armbruster, 2008) were observed on digital images (Morris *et al*. 2006), as well as on X-rays when available, of the following specimens: *Chaetostoma setosus* BMNH 1880.2.26.9–10, syntypes, 78.0–97.0 mm SL, Colombia; *Cordylancistrus daguae*, FMNH 56052, holotype, 59.3 mm SL, Colombia; *C. nephelion*, MBUCV-V-21800, holotype, 129.0 mm SL, Venezuela; *C. perijae*, MBUCV V-21746, paratype, 84.7 mm SL, Venezuela; *C. platycephalus*, BMNH 1898.11.4.42, 1 syntype, 111.9 mm SL, Ecuador; *C. platyrhynchus*, ANSP 70512, holotype?, 67.8 mm SL, Colombia; *Dolichancistrus atratoensis*, ICNMHN 51, 81.0 mm SL, Colombia; *D. carnegiei*, FMNH 58350, holotype, 82.4 mm SL, Colombia; *D. cobrensis* USNM 121036, holotype, 78.7 mm SL, Venezuela; *D. fuesslii* NMW 48026, holotype, 96.6 mm SL, Colombia; *D. pediculatus* FMNH 58352, holotype, 82.7 mm SL, Colombia; *Leptoancistrus canensis*, FMNH 7581, holotype, 58.1 mm SL, Panama; *Lipopterichthys carrioni*, BMNH 1933.5.29.1, holotype, 58.0 mm SL, Ecuador.

Results of an updated phylogenetic analysis

Lipopterichthys carrioni and *Loraxichthys lexa* exhibit 18 and 11 unambiguously changing characters, respectively, listed in Appendix 2. Clade D (Fig. 3) includes *Lipopterichthys carrioni* and *Loraxichthys lexa*. Clade D is supported by nine unambiguously changing characters, listed in Appendix 2. Clades B, C, E, F, and G are not supported by unambiguously changing characters. Clade A includes *Chaetostoma* species, *Cordylancistrus*, *Dolichancistrus*, *Leptoancistrus canensis* Meek & Hildebrand, *Lipopterichthys carrioni*, *Loraxichthys lexa*, and *Paulasquama callis*. Clade A is supported by: basibranchial 2, ossified (C3.2); lateral wall of metapterygoid channel, long and rounded along entire length (C53.1); mesethmoid, flared anteriorly (C102.1); anteriorly directed transverse process on eighth vertebra, absent or short and broad (C119.0); and, nuchal plate, covered entirely by skin or plates (C147.1). All character states for these characters are unique within Clade A, but they are homoplastic within the Loricariidae, changing more than twice in the obtained tree topology (CI < 0.5).

The genera *Chaetostoma*, *Dolichancistrus*, *Leptoancistrus*, and *Lipopterichthys* were included in a monophyletic group supported by three synapomorphies by Schaefer (1986) namely: anguloarticular partially incorporated into the dentary ossification (C11.1); dentary broad and greatly elongated (C12.3); articulation of pterotic-supracleithrum and hyomandibula extremely reduced (C46.3). In contrast, *Loraxichthys lexa* exhibits an anguloarticular that projects off the dentary (Fig. 4B); a broad dentary, but not as broad as many *Chaetostoma* species; and, a conspicuous suture between the hyomandibula and the pterotic-supracleithrum along the medial portion of the posterior border of the hyomandibula. Furthermore, a clade that includes *Lasiancistrus* basal to *Chaetostoma*, *Dolichancistrus*, *Leptoancistrus*, and *Lipopterichthys* is supported by three synapomorphies (Schaefer 1986): the expanded quadrate buttress for contact with the canal plate (C25.2), the sculptured anterior margin of the anterohyal (C39.2), and the ventral process on the third branchiostegal ray (C42.1). *Loraxichthys lexa* exhibits these three synapomorphies, thus the new species is probably basal to all other genera in the *Chaetostoma* group. This hypothesis conflicts with the results of the updated phylogenetic analysis, which shows *Loraxichthys lexa* in a clade sister to a polytomy that includes *Chaetostoma*, *Cordylancistrus*, and *Dolichancistrus* species (Fig. 3).

Based on these findings, a new genus could be erected for the new species or the new species could be described as a highly autapomorphic one in *Lipopterichthys*. I opted for the former, not only because of the putative synapomorphies that the new species shares with *Chaetostoma*, *Dolichancistrus*, *Lasiancistrus*, *Leptoancistrus*, and *Lipopterichthys*, but also because of the intermediate character states it exhibits, which were not evaluated in the performed phylogenetic analysis. Intermediate characters states are: the projected anguloarticular that is intermediate between the long, very projected anguloarticular in *Lasiancistrus heteracanthus* (type species of *Lasiancistrus*), and the almost embedded anguloarticular in the dentary in species of the *Chaetostoma* group (Fig. 4); and the narrow, lateral anterior processes of basipterygia almost in contact with the medial anterior processes of basipterygia (more similar to *Lasiancistrus heteracanthus*), in contrast to the wide lateral anterior processes of basipterygia in species of the *Chaetostoma* group (Fig. 5).

Loraxichthys, new genus

Type species. *Loraxichthys lexa*, new species

Diagnosis. *Loraxichthys* is distinguished from all other loricariids by two uniquely derived characteristics: crenulated skin folds on dorsal border along first pelvic-fin ray in mature males (Fig. 1); and, posterior longest evertible cheek odontodes robust with hooked tips, less than twice the length of the odontodes immediately anterior to them (Fig. 2). Furthermore it is distinguished by the following combination of characters unique within the Loricariidae: naked snout with no tentacles; absence of nuchal plate; absence of first dorsal-fin spinelet; absence of adipose fin; three median unpaired plates in position of adipose fin; dentary wide with anguloarticular slightly projected dorsolaterally (Fig. 4B); lateral anterior process of the basipterygia narrow, almost in contact with the medial anterior process of the basipterygia at midline (Fig. 5B).

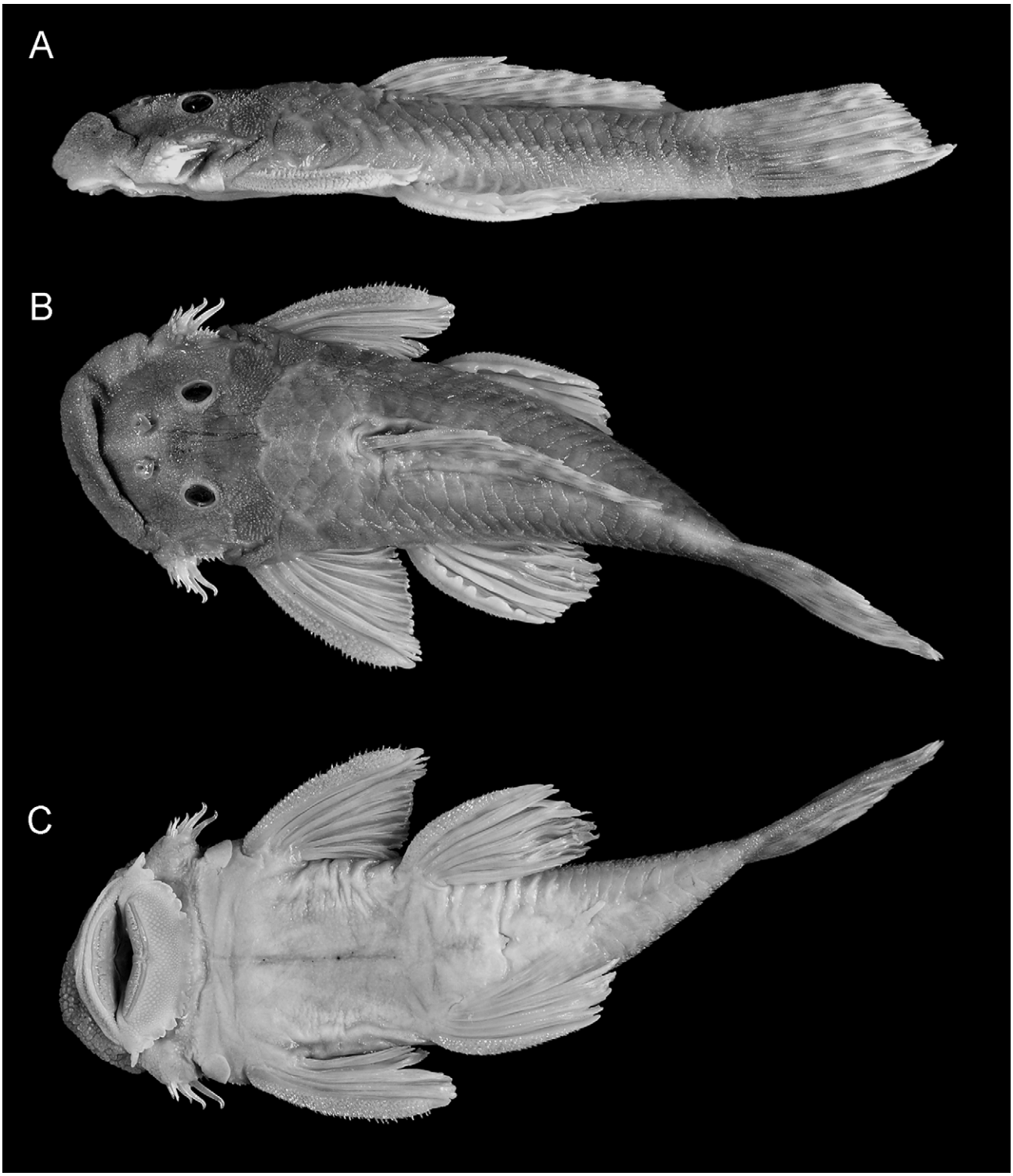

FIGURE 1. *Loraxichthys lexa*, holotype, ANSP 179128, 45 mm SL, male. A. Lateral view. B. Dorsal view. C. Ventral view.

***Loraxichthys lexa*, new species**
Figure 1; Table 1

Holotype. ANSP 179128, 45 mm SL, male; Peru: Departamento de Huánuco: Provincia de Leoncio Prado: Mariano Dámaso Beraun: vicinity of Tingo María, Cueva de las Pavas, Quebrada Luconyupe (09°22’15.1”S 75°58’32.7”W); Catherwood Foundation Peruvian-Amazon Expedition, 2 Oct. 1955.

Paratypes. All from Peru: ANSP 179129, 3, 45.4–48.9 mm SL, 1 CS, 49 mm SL; same as holotype. – ANSP 179124, 12, 15.7–40.6 mm SL, 1 CS, 33.2 mm SL; Departamento de Huánuco: Provincia de Leoncio Prado: Tingo María, vicinity of Tingo María, Río Rondos (09°15'00"S 76°05'00"W), Catherwood Foundation Peruvian-Amazon Expedition, 29 Sept. 1955.

Diagnosis. Same as for genus.

Description. Morphometric data in Table 1. Head and body robust, greatest body width at cleithrum. Cleithral width greater than head length. Head and body depressed, body depth greater than caudal peduncle depth. Head profile convex from posterior border of naked snout to posterior border of nares, straight from posterior border of nares to posterior border of supraoccipital. Trunk profile slightly convex from posterior border of supraoccipital to anterior border of dorsal fin, straight along base of dorsal fin to anterior border of caudal fin. Ventral profile straight. Caudal peduncle triangular in cross-section, with apex dorsally, caudal peduncle width 62–82 % of caudal peduncle length.

TABLE 1. Morphometric data of *Loraxichthys lexa*. Mean and Range based on the holotype and eight paratypes. Asterisk denotes measurements of six specimens with anal fins, including the holotype.

	Holotype	Range	Mean	Standard deviation
Standard length (mm)	45.0	31.2–48.9	41.2	
Percents of standard length				
Head length	32.2	29.1–32.4	31.0	1.2
Head depth	15.3	15.2–17.0	16.2	0.7
Body depth	16.0	16.0–18.3	17.1	0.8
Cleithral width	36.1	33.2–36.1	34.4	1.0
Interbranchial width	27.0	24.9–27.0	26.1	0.7
Pre-dorsal length	45.2	42.3–46.1	44.4	1.2
Base of dorsal-fin length	26.2	26.2–29.7	28.7	1.1
Pectoral-pelvic length	25.6	22.4–27.2	25.4	1.4
Pectoral spine length	27.0	22.1–28.0	24.4	1.9
First pelvic-fin ray length	26.1	20.8–26.1	23.0	1.6
Second pelvic-fin ray length	25.0	21.2–25.0	22.3	1.1
Caudal peduncle length*	24.8	23.0–24.8	24.1	0.7
Caudal peduncle depth	12.3	11.6–12.8	12.2	0.4
Percents of head length				
Snout length	62.0	57.7–62.9	60.2	1.6
Internaris width	10.1	8.8–12.6	10.5	1.1
Interorbit width	32.1	32.1–37.7	35.5	1.9
Orbit diameter	17.7	16.3–19.6	18.1	1.0
Premaxilla length	28.0	25.4–29.1	27.2	1.2
Dentary length	29.5	26.9–33.6	31.2	2.4

Body dorsally and laterally covered by plates with odontodes; odontodes on each plate of about the same size. Pectoral-fin spine with enlarged dorsally oriented odontodes on medial border. Body naked ventrally from tip of snout to third ventral plate posterior to origin of anal fin. Posterior half of caudal peduncle with four to five coalescent plates ventrally along midline. Dense fat pads underneath the snout skin.

Dorsal fin with 10* (16) to 11 (2) rays, first unbranched. Dorsal-fin base plates 8 (1), 9 (7) or 10* (2). Adipose fin absent, 2 (2) to 3* (16) unpaired plates on midline in place of adipose-fin region. Plates on adipose-fin region forming shallow ridge on specimens smaller than 30 mm SL, or indistinct to shallow ridge on specimens larger than 30 mm SL. These plates will be referred from now on to as adipose ridge. Dorsal fin reaching anterior edge of adipose ridge to first half of adipose ridge, when depressed. Plates between dorsal fin and adipose ridge 6 (8), 7*

(2). Plates between adipose ridge and caudal fin 4* (1), 5 (6), 6 (3). Anal fin absent (5) to inconspicuous* (13). When present anal fin with 1 (1), 2* (7) or 3 (1) rays, all unbranched (specimens less than 24 mm SL not included). First anal-fin ray with no odontodes. Plates between anal fin and caudal fin 8 (1), 9* (6), 10 (3). Caudal fin truncated, all specimens with two unbranched and 14 branched rays, dorsalmost and ventralmost rays unbranched (one specimen with 13 branched rays, one branched ray apparently fused with ventralmost unbranched ray). Posterior process of cleithrum partially exposed laterally; exposed part of cleithrum more or less rectangular, oblique, posterior margin straight. Pectoral fin with one spine and six branched rays. Pectoral-fin spine strong. Pectoral-fin spine not reaching origin of pelvic fin when adpressed in most specimens (females and immatures), pectoral-fin spine reaching origin of pelvic fin to slightly beyond origin of pelvic fin when adpressed in males. Pelvic fin with one unbranched and five branched rays. First unbranched pelvic-fin ray thick.

Anterior margin of snout rounded (most specimens, particularly females) to irregularly rounded (particularly males, depending on preservation) in dorsal view. Snout naked, covered with blister-like, round-shaped papillae, particularly conspicuous in mature males.

Head with shallow medial ridge from posterior border of naked snout towards anterior border of nares, wide shallow ridges from nares to anterior border of eyes. Head flat from posterior border of nares to posterior border of supraoccipital, covered with thick layer of skin. Odontodes absent on frontals and supraoccipital. Oral disk densely covered by blister-shaped papillae, smaller than papillae on snout. Posterior lip margin with irregular lobes along its edge. Maxillary barbels short, conspicuous. Posterior soft border of each premaxilla smooth. Roof of mouth between premaxillae without buccal papilla. Anterior border of dentary with one to five blister-shaped papillae on middle third.

Teeth arranged in one row on premaxilla (31–41) and dentary (41–50), more numerous in dentary. Teeth slender, asymmetrically bifid, cusp tips sharp. Medial tooth cusp twice as long as lateral tooth cusp. Lateral tooth cusp not juxtaposed over medial cusp.

Hypertrophied odontodes on evertible cheek-plates embedded in soft connective tissue overlaying short, thin fleshy flap anterior to opercular flap. Fleshy flap inconspicuous in females and juvenile specimens. Evertible cheek-plates formed by three thick plates supporting seven to 21 hypertrophied odontodes. None to many slender odontodes with straight to slightly curved tips, five to nine longer odontodes with slightly curved tips and two to four (at least two) longest and robust odontodes with hooked tips. Exposed part of opercle triangular, its posterior free border with enlarged odontodes. Small opercular opening covered by fleshy opercular flap, bordered posteriorly by exposed cleithrum.

Infraorbital sensory canal extending beyond the anterior border of first infraorbital canal-bearing plate (IO1). First infraorbital plate (IO1) with lateral laminar projections, one third to half the length of infraorbital sensory canal section (Fig. 2). Second infraorbital plate (IO2) approximately two times larger than first infraorbital. Third infraorbital plate (IO3) along lateral rim of nostril. Fourth infraorbital plate (IO4) through sixth infraorbital plate (IO6) along anterolateral margin of orbit. Nasal plate expanded medially, nasal-plate lamina as wide or slightly wider than canal. Frontal large and elongated, along posteromedial rim of nostrils and medial margin of orbit. Sphenotic rectangular, with wide lateral projection in contact with IO6, along posteromedial margin of orbit. Pterotic-supracleithrum not in contact with posterior margin of orbit. Suprapreopercle with wide lateral projections. Suprapreopercle in contact with IO6.

Lateral line extending from posterior border of suprapreopercle to base of caudal fin or to one plate before last plate on median lateral series. Lateral-line plates 24 (3) to 25* (7). First median plate of lateral series half length of second median plate, second median plate half length of third median plate, third median plate about same size as fourth median plate.

Vertebrae 28. Ten to 11 pairs of ribs (holotype with 11 ribs on left side and 10 on right side), first pair thick and articulating directly to sixth centrum, second pair articulating to eighth centrum. Epural bladelike, articulating dorsally to base of two posteriormost procurrent rays and ventrally to 27th and 28th centra, separated from fused hypurals (hypurals 3–5 + uroneural).

Nuchal plate absent. First dorsal-fin spinelet absent. Dorsal fin supported by ten pterygiophores (1), with first pterygiophore articulating with neural spine of seventh vertebra. Anal fin supported by 1* (8) or 2 (1) pterygiophores, with first pterygiophore contacting hemal spine of sixteenth vertebra.

Color in alcohol. Head and body brown dorsally. Dark line between posterior margin of pterotic-supracleithrum and exposed cleithrum. Longitudinal dark stripe along median lateral series. Black spot present on

base of membrane between first unbranched and first branched dorsal-fin rays. Four to five dark bars on each dorsal-fin ray, membrane not pigmented (SL > 30 mm). Dark brown first dorsal-fin ray, three to four dark bars on each ramified dorsal-fin ray, membrane not pigmented (SL<30 mm). Two dark bands dorsally on caudal peduncle, one anterior and one posterior to adipose ridge. Adipose ridge light brown on dark brown background. Dorsal procurrent rays light brown on dark brown background. Caudal fin with four to six dark bars on each ray. Body yellowish-brown ventrally. Anal fin not pigmented. Some melanophores around urogenital region and anal-fin base. Pectoral-fin spine and rays light brown dorsally, membrane not pigmented. Pectoral fin yellowish-brown ventrally. Pelvic-fin rays with three brown bars dorsally along their lengths when high concentration of melanophores present, membranes not pigmented. Pelvic fin yellowish-brown ventrally. Ventral plates of caudal peduncle yellowish-brown.

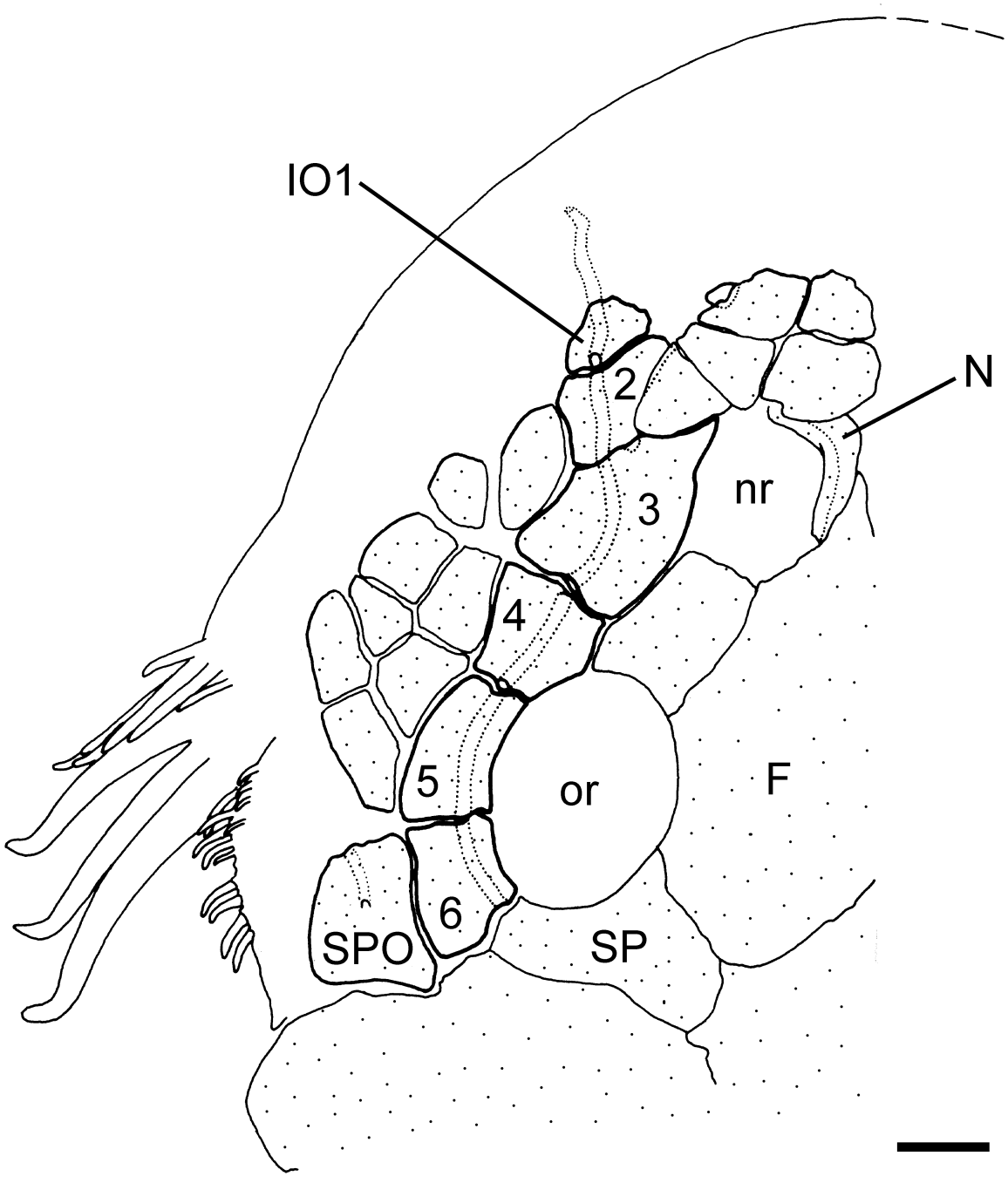

FIGURE 2. Dorsal view of left infraorbital series and associated dermal bones of *Loraxichthys lexa*, paratype, ANSP 179129, 49 mm SL. Abbreviations: F = frontal, IO1-6 = infraorbital plates, N = nasal, SP = sphenotic, SPO = suprapreopercle, nr = nostril, or = orbit. Anterior toward top. Scale bar = 1 mm.

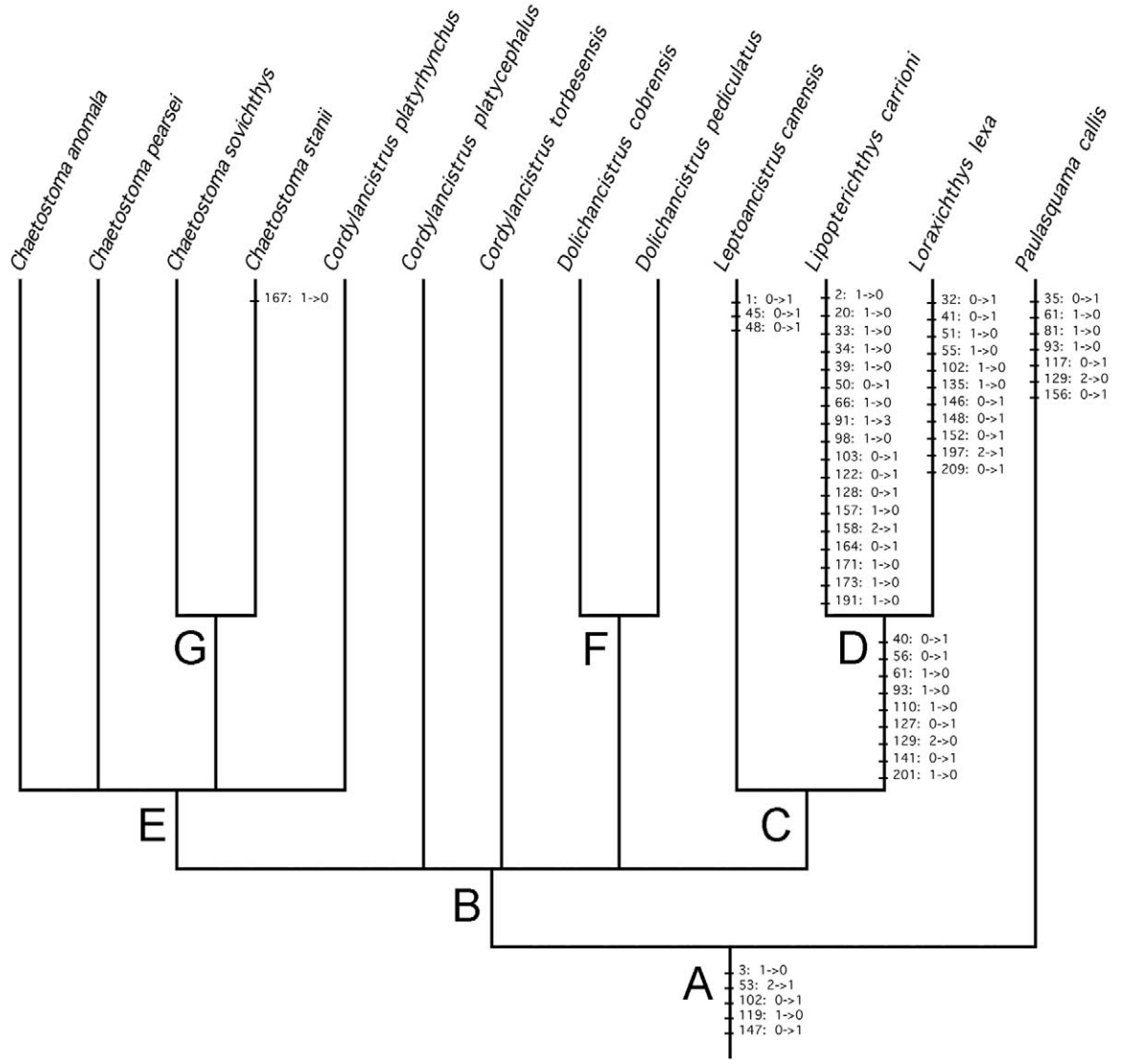

FIGURE 3. Partial cladogram of the strict consensus of 16123 equally parsimonious trees (length 1558; CI=0.18; RI=0.76), based on the evaluation of 215 characters (Armbruster, 2004) on *Lipopterichthys carrioni*, *Loraxichthys lexa*, and subsequent addition of these and the character states of *Paulasquama callis* to the matrix in Armbruster (2008). Unambiguously changing characters, including the character state change, are mapped onto the tree.

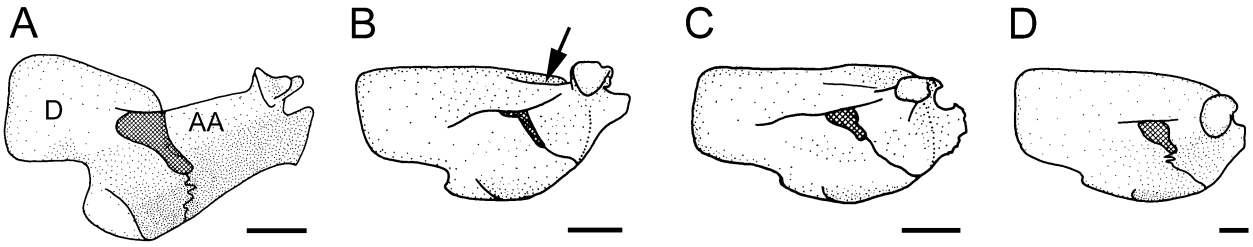

FIGURE 4. Posterior view of right mandible of: A) *Lasiancistrus heteracanthus*, MUSM 14313, 61 mm SL; B) *Loraxichthys lexa*, same specimen as in Fig. 2; C) *Lipopterichthys carrioni*, MCZ 51702, 40 mm SL, left mandible reversed; D) *Chaetostoma taczanowskii*, MUSM 5186, 65 mm SL. Cartilages indicated by crossed hatching. Abbreviations: D=dentary; AA=anguloarticular. Arrow in B points to projected anguloarticular. Dorsal toward top. Scale bars = 1 mm.

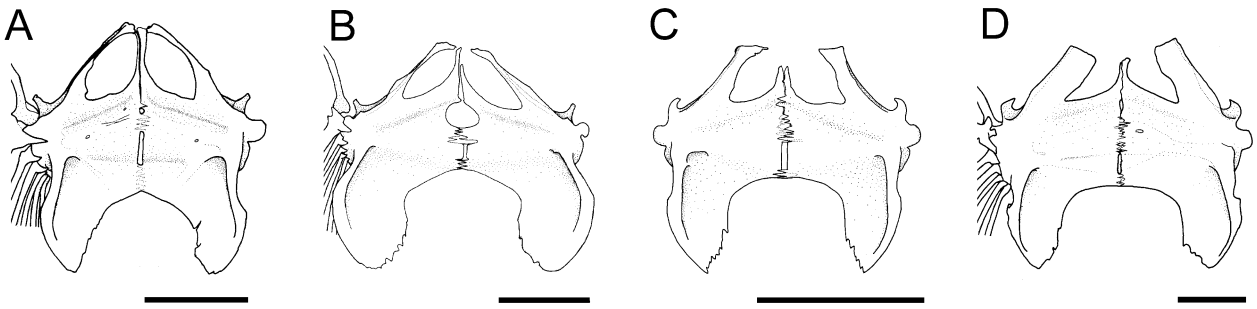

FIGURE 5. Dorsal view of pelvic girdle of: A) *Lasiancistrus heteracanthus*, same specimen as in Fig. 4; B) *Loraxichthys lexa*, same specimen as in Fig. 2; C) *Lipopterichthys carrioni*, same specimen as in Fig. 4; D) *Chaetostoma marmorescens*, MUSM 13251, 86 mm SL. Anterior toward top. Scale bars = 1 mm.

Sexual dimorphism. Mature males have well-developed naked snout, first four pelvic-fin rays with fleshy folds along their dorsomedial edges. Fleshy fold along dorsomedial border of first pelvic-fin ray thick, crenulated, with four to six bumps. Tuft of well-developed odontodes present on dorsal margin of the most-medial section of first, second, and third branched pelvic-fin rays. Pelvic fins reach anal-fin origin and extend past length of anal fin. Posterior margin of pelvic fin convex, with branched pelvic-fin rays gradually longer towards third branched pelvic-fin ray. Females and immatures have shorter naked snout, posterior margin of pelvic fins truncated, and pelvic fins barely reach origin of anal fin.

Etymology. *Lorax* is the name of a fictitious character, created by Theodor Seuss Geisel, that plights for the environment. *Ichthys* is based on a Greek noun meaning fish. *Loraxichthys* refers to the fish that speaks for other fishes. The species *lexa* is in recognition of Alexandra Keane, sustainability activist, currently a Political Sciences student at the College of Charleston. The specific epithet is used as a noun in apposition.

Distribution. *Loraxichthys lexa* is only known from clear water tributaries of the Río Huallaga near Tingo María (725–780 m), Departament of Huánuco, Peru (Fig. 6).

Habitat. All habitat notes and comments are based on the Catherwood Foundation Peruvian-Amazon Expedition's field notes and the limnological and systematic studies that report the results of the expedition in the Río Rondos (Patrick *et al*. 1966). The specimens were collected from Qda. Luconyupe, Cueva de las Pavas and Río Rondos by using rotenone in pools and fast water channels. There are no field data for the Cueva de las Pavas collection locality, taken during the Catherwood Foundation Peruvian-Amazon Expedition, so the habitat description corresponds only to the Río Rondos collection locality.

At the time of the Catherwood Foundation Peruvian-Amazon Expedition, the Río Rondos was a small tributary of the Río Huallaga in a relatively broad valley covered with forest. The area studied was owned by Sindicato Monzón, not many people lived along the banks of the river because it was private property, but some areas had been cleared for planting bananas. The substrate of the main channel of the Río Rondos was composed largely of sand, rubble, and rocks, with sandy mud here and there along its shallow banks and in the deep pools. The maximum width of the collection area was 46 m approximately (Patrick *et al*. 1966: 16, fig. 6). The depth of the collection area varied from around 10 cm in banks and riffles, to 1.2 m or more in pools. The speed of the water was variable through time as well, from slack (1.6 m/s on average, n=10) and slow riffles (1.7 m/s on average, n=10) to rapids (3.6 m/s on average, n=10). Methods for water chemistry measurements are described in Patrick *et al*. (1966). The Río Rondos was a clear acid water river (pH 5.0), with total transparency (approximately 2 m in a pool). Dissolved oxygen was high (7.88 ppm) compared to the Río Bella (7.60 ppm), affluent of Río Rondos, but slightly lower than two other rivers in the vicinity (8.96–9.46 ppm). The total hardness, as $CaCO_3$, (14 ppm) was lower than that of rivers in the vicinity (36.4 ppm in Río Bella, 241.2–247.2 ppm in two white water rivers), but higher than the Río Nanay (3 ppm), another clear water river studied by the Catherwood Foundation Peruvian-Amazon Expedition that year. The concentration of total dissolved solids was the lowest (23 mg/L) compared to other rivers in the vicinity (49.5mg/L in Río Bella; 242.6–309.8 mg/L in two white water rivers), even lower than the Río Nanay (36.4 mg/L).

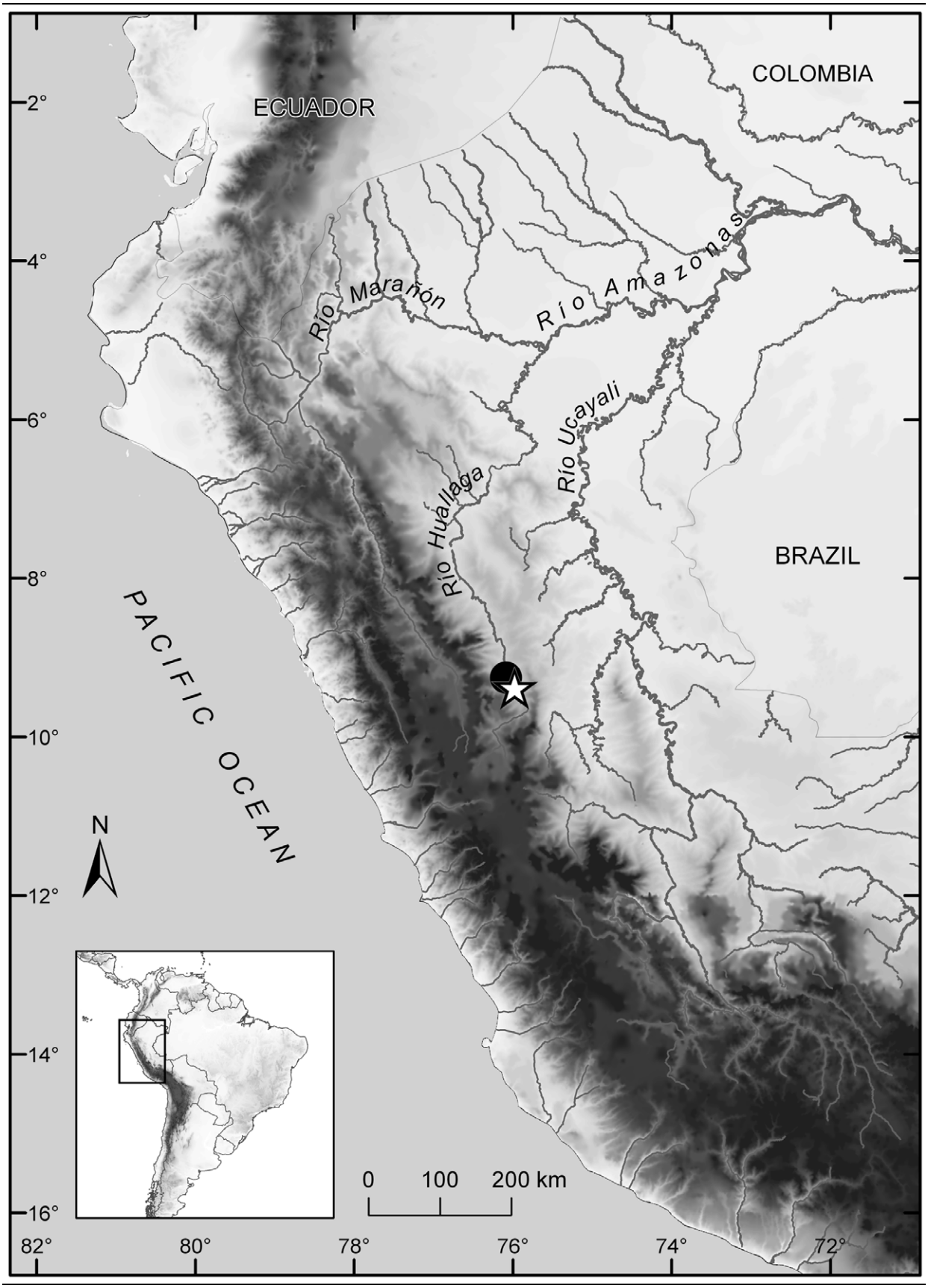

FIGURE 6. Map of West Central South America, showing Peruvian Andes and main tributaries of the Amazon River, with collection localities of *Loraxichthys lexa*. Star indicates type locality.

Discussion

The monotypic genus *Lipopterichthys* was considered by Howes (1984) and Schaefer (1986) as a valid genus, and included as such in their phylogenetic studies. Armbruster (2004) considered *Lipopterichthys* as a synonym of *Chaetostoma*, because of the resemblance of its overall external morphology to the latter. Salcedo (2006) followed Armbruster (2004) in considering *Lipopterichthys* as a synonym of *Chaetostoma*. To date I have studied only four specimens of *Lipopterichthys carrioni*, including one disarticulated CS specimen (thus 20% of the characters for *Lipopterichthys carrioni* in Appendix 1 are coded as "?"). Despite the missing information, the performed morphological study was particularly useful for supporting the validity of the genus *Lipopterichthys*. The 18 unambiguously changing characters (Fig. 3; Appendix 2) and new character states found, suggest that the genus *Lipopterichthys* has traits that require the re-evaluation of characters previously included in phylogenetic studies to include the intermediate states of *Lipopterichthys*.

The genera *Chaetostoma*, *Cordylancistrus*, *Dolichancistrus*, *Leptoancistrus*, and *Lipopterichthys* probably represent a monophyletic clade that could be referred to as the *Chaetostoma* group (Armbruster 2008), supported by synapomorphies proposed by Schaefer (1986) and unambiguously changing characters presented by Armbruster (2004). All genera in the *Chaetostoma* group are currently valid, but to date none of them have been diagnosed based on synapomorphies. However, the lack of synapomorphies in phylogenetic studies of higher-level taxa (Howes 1983; Schaefer 1986; Armbruster 2004, 2008) does not preclude the existence of synapomorphies for lower-level taxa. One phylogenetic study at the genus level proposed one synapomorphy for the weakly supported clade that includes *Chaetostoma* species: naked snout with no tentacles (Salcedo 2003), but this character is apparently a homoplasy as *Lipopterichthys* and *Loraxichthys* also exhibit a naked snout with no tentacles.

Loraxichthys lexa differs from all *Cordylancistrus*, *Dolichancistrus*, and *Leptoancistrus* by the absence of plates on the snout (cf. presence of plates on the snout in *Cordylancistrus*, *Dolichancistrus*, and *Leptoancistrus*), and from *Leptoancistrus canensis* and *Cordylancistrus platyrhynchus* (Fowler) by the absence of an anterior projection of the quadrate buttress (cf. presence of this projection *L. canensis* and *C. platyrhynchus*, C17.1 in Salcedo 2003). *Loraxichthys lexa* shares the absence of adipose fin with *Leptoancistrus*, but differs from it by the narrow anterior tip of the mesethmoid (cf. flared anterior tip of mesethmoid in *L. canensis*), and in the posterior evertible cheek odontodes that are less than twice the length of the odontodes immediately anterior to them (cf. long posterior evertible cheek odontodes that is more than twice the length of the odontodes immediately anterior to it in *L. canensis*).

Loraxichthys lexa shares the naked snout with no tentacles with the genera *Chaetostoma* and *Lipopterichthys*. It differs from all *Chaetostoma* species, but *C. venezuelae* Schultz in the absence of adipose fin (cf. presence of a rudimentary to well-developed adipose fin in all other *Chaetostoma* species). It differs from *C. venezuelae* by the presence of more than three robust and long evertible cheek odontodes with hooked tips (cf. two robust and short evertible cheek odontodes in *C. venezuelae*), and the narrow lateral anterior processes of basipterygia in contact with the medial anterior processes of the basipterygia (cf. wide lateral anterior processes of basipterygia not in contact with the medial anterior processes of the basipterygia in *C. venezuelae*). *Loraxichthys lexa* also shares the absence of adipose fin with *Lipopterichthys carrioni*. It differs from *L. carrioni* by the hooked evertible odontodes (cf. straight in *L. carrioni*), and 14 branched caudal-fin rays (cf. 12 branched caudal-fin rays in *L. carrioni*).

Novel morphological traits described in this work and in the recent taxonomic revision of *Dolichancistrus* (Ballen & Vari 2012) are potential characters to be evaluated in future phylogenetic studies. Furthermore, the taxonomic revision and phylogenetic analyses of the genera *Chaetostoma* and *Cordylancistrus* are ongoing projects, which will probably lead to nomenclatural changes. It is possible that *Chaetostoma*, *Cordylancistrus*, *Dolichancistrus*, and *Leptoancistrus* do not represent monophyletic taxa, but to date these genera, together with *Lipopterichthys* and *Loraxichthys*, can be differentiated from each other based on external morphology. I provide a table that summarizes the information available on these genera (Table 2), together with a key to identify species belonging to each of them at the end of this work.

The monotypic loricariid genera *Loraxichthys*, together with *Fonchiiloricaria* Rodriguez, Ortega and Covain are possibly endemic to a section of the Río Huallaga (Rodriguez *et al.* 2011). The genus *Chaetostoma* is represented in this same section of the Río Huallaga by *C. daidalmatos* Salcedo, *C. stroumpoulos* Salcedo, *C. changae* Salcedo, and another undescribed species, all from the vicinity of Tingo María, and probably with very restricted distributions. Tectonism is most probably correlated with the isolation of drainages as it has been shaping

the Andean valleys for at least the last 60 million years (Hoorn *et al*. 2010), exposing different types of rock that give the water its chemical characteristics. The high and unique fish diversity in the western Andean slopes could be directly correlated to the geological history of the Andes. The isolation of drainages along the Andean slopes, together with the high chemical diversity of its water bodies, might be particularly important factors when considering the low vagility of fish adapted to high oxygen levels and coarse substrates, such as many fish species in the *Chaetostoma* group.

TABLE 2. Characters of external morphlogy for the genera *Chaetostoma*, *Cordylancistrus*, *Dolichancistrus*, *Leptoancistrus*, *Lipopterichthys*, and *Loraxichthys*.

	Chaetostoma	*Cordylancistrus*	*Dolichancistrus*
Plates on snout	absent	present	present
Tip of posterior evertible cheek odontodes	Straight, slightly curved, hooked	Slightly curved	hooked
Evertible cheek odontodes more robust on posterior row.	absent	absent	present
At least one evertible cheek odontode more than twice the length of the odontodes anterior to it.	absent	absent	present
Adipose fin	absent, rudimentary, present	present	present
Anal fin	present	present	present
Number of branched caudal-fin rays	14	14	14

TABLE 2. (Continued)

	Leptoancistrus	*Lipopterichthys*	*Loraxichthys*
Plates on snout	present	absent	absent
Tip of posterior evertible cheek odontodes	hooked	straight	hooked
Evertible cheek odontodes more robust on posterior row.	present	absent	present
At least one evertible cheek odontode more than twice the length of the odontodes anterior to it.	present	absent	absent
Adipose fin	absent	absent	absent
Anal fin	absent	absent	absent-rudimentary
Number of branched caudal-fin rays	14	12	14

The high degree of endemism for this single geographic area has also been recognized for plants, with nine endemic *Anthurium* species described in a single work (Croat & Lingán Chávez 2008). Most of these *Anthurium* species are only know from the type locality and the distributions are tentatively considered as restricted. Particularly one of them, *A. debilipeltatum*, is abundant but restricted to the slopes on the Eastern margin of the Río Huallaga in the vicinity of Tingo María, based on which, Croat & Lingán Chávez (2008) suggested it to be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN 2001). Croat & Lingán Chávez (2008) suggested that the area in the vicinity of Tingo María could qualify for protected status, as the region of La Divisora has many endemic species. In fact, the Western margin of Río Huallaga is protected to date, Qda. Luconyupe and Río Rondos are inside the Parque Nacional Tingo María, which belongs to Peru's National System of State Protected Natural Areas. However, the physical and chemical conditions that support the high biological diversity in the Río Huallaga drainage might change as pressures of human development increase (Finer & Jenkins 2012).

Key to the genera in the *Chaetostoma* group

1a. Snout naked with no tentacles 2
1b. Snout covered with plates 4
2a. Caudal fin with 12 ramified rays . . . . . *Lipopterichthys*
2b. Caudal fin with 14 ramified rays 3
3a. Anal fin absent or rudimentary (up to three unbranched rays), longest evertible cheek odontodes reach anterior border of exposed cleithrum . . . . . *Loraxichthys*
3b. Anal fin always present, longest evertible cheek odontodes never reach anterior border of exposed cleithrum . . . *Chaetostoma*
4a. Numerous evertible cheek odontodes with no particularly elongated ones . . . . . *Cordylancistrus*
4b. Numerous evertible cheek odontodes with at least one posterior hyperthrophied odontode more than twice the length of the odontodes immediately anterior to it 5
5a. Adipose fin present . . . . . *Dolichancistrus*
5b. Adipose fin absent . . . . . *Leptoancistrus*

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APPENDIX 1. Character states for characters described by Armbruster (2004) for *Lipopterichthys carrioni* and *Loraxichthys lexa*.

Lipopterichthys carrioni
00????22?????10???001????200???000010101000200000112101120000101101 00?????21200?????????0130000020020110?
000000000001000021101011000100 1?10201100101014000000010101?1001110000 0?0100001220000010110132000000000000
00??????

Loraxichthys lexa
010001220110010011011000020001111101011110020000000210012000000111100000012120010111100201100000210200
001000000000010000201010100001000010201100 11?1?401000012010110000100101020100001220000011110131000000000
00001??????

APPENDIX 2. Unambiguosly changing characters for *Lipopterichthys carrioni* and *Loraxichthys lexa* based on Armbruster (2004, 2008).

Clade D

Posterior part of the hyomandibula beyond opercle, from not well developed to developed into a shelf (40:0->1); section of the metapterygoid dorsal to the anterior process, from short to very tall (56: 0->1); orientation of the preopercle, from almost vertical to horizontal (61: 1->0); ridge formed by Baudelot's ligament, from a shelf to a slightly rounded ridge (93: 1->0); anterior process of the pterotic-supracleithrum, from present to absent (110: 1->0); trifid neural spines posterior to dorsal fin, from absent to present (127: 0->1); ribs beyond enlarged rib of the sixth vertebral centrum, from thick to thin (129: 2->0); connecting bone, from contact with nuchal plate to connects with the transverse process of the second dorsal-fin pterygiophore and/or the nuchal plate (141: 0->1); snout, from covered with plates to naked from just anterior to nares down to lip (201: 1->0).

Lipopterichthys carrioni

Anterohyal shape, from anterior edge sinusoidal to anterior edge flat or with a single hump (2: 1->0); width of hypohyal, from narrow, greatest width less than length to wide, greatest width approximately equal to or greater than length (20: 1->0); contact of medial surface of hyomandibula with quadrate posteroventrally, from project toward one another or sutured to none

(33, 1->0); hyomandibula sutured to pterotic-supracleithrum posterior to cartilaginous condyle of hyomandibula, from present to absent (34, 1->0); thin, posterior process on hyomandibula just dorsal to opercle, from present to absent (39, 1->0); zipperlike connection of metapterygoid to lateral ethmoid, from absent to present (50, 0->1); quadrate with flap extending below symplectic foramen, from present to absent (66, 1->0); number of infraorbitals, from five to four [state 3 added as it was not available] (91, 1->3); pouch on ventral surface of lateral ethmoid, from present to absent (98: 1->0); mesethmoid anterior edge serrate, from absent to present (103: 0->1); bifid hemal spines, from absent to present (122: 0->1); shape of exposed cleithral process, from reduced to large (157: 1->0); distal end of posterior process of coracoid, from elongated, thin, pointed to about as wide as shaft (158: 2->1); space between posterior process of coracoid strut and posterior process of coracoid, from large to absent to small (164: 0->1); fenestra present anterior to cartilaginous section, from present to absent (171: 1->0); posteroventral ridge of the basipterygium, from present to absent (173: 1->0); number of caudal-fin rays, from 14 to 10 or 12 (191: 1->0).

Loraxichthys lexa

Lateral edge of posterohyal, from pointed, forming pouch with lateral wall to lateral wall of pouch absent or reduced so that the posterohyal forms a half cylinder (32: 0->1); posterior process of hyomandibula incorporated within hyomandibula, from present to either absent or not incorporated (41: 0->1); anterior connection between metapterygoid and lateral ethmoid, from present to absent (51: 1->0); walls of metapterygoid channel, from medial wall much taller to lateral wall slightly smaller or just slightly larger than medial wall, or absent (55: 1->0); mesethmoid flares anteriorly, from yes to no (102: 1->0); tip of transverse processes of Weberian complex centrum, from not contacting the pterotic-supracleithrum to at least partially contacting the pterotic-supracleithrum (135: 1->0); nuchal plate, from present to absent (146: 0->1); spinelet, from v-shaped to reduced and rectangular or absent (148: 0->1); adductor fossa, from incomplete to complete(152: 0->1); number of predorsal plates, from four or more to two or three (197: 2->1); tentacules on pectoral fins, from absent to small, partially detached from odontodes (209: 0->1).