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Records of chimaeroid fishes (Holocephali: Chimaeriformes) from the Pacific coast of Costa Rica, with the description of a new species of *Chimera* (Chimaeridae) from the eastern Pacific Ocean

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Abstract

A new species of *Chimaera* Linnaeus 1758 is described from three specimens collected from off the Pacific coasts of Costa Rica and Peru. *Chimaera orientalis* **n. sp.**, the first species of the genus described from the eastern Pacific Ocean, is distinguished from its other congeners by a combination of coloration and morphology. Additionally, new records of occurrence for another four species of chimaeroid fishes (*Harriotta raleighana* (Goode & Bean 1895), *Rhinochimaera africana* Compagno, Stehmann & Ebert 1990, *Hydrolagus colliei* Lay & Bennett 1839, and *H. macrophthalmus* de Buen 1959) previously unknown for the continental shelf of the Pacific coast of Costa Rica and Central America are reported. A key to the eastern Pacific species of the order Chimaeriformes is also presented.

Key words: *Chimaera orientalis* **n. sp.**, *Harriotta raleighana*, *Rhinochimaera africana*, *Hydrolagus colliei*, *Hydrolagus macrophthalmus*, first record, tropical eastern Pacific

Introduction

Chimaeroids, in general terms, have been historically a poorly studied group (Didier 1995, Didier *et al.* 2012). The last ten years, however, has seen a resurgence of interest in these fishes and significant research advances (Didier *et al.* 2012, Holt *et al.* 2013). New discoveries have resulted in the description of several new species as well as new understanding of the distributions worldwide (*e.g.*, Soto & Vooren 2004, Moura *et al.* 2005, Barnett *et al.* 2006, Quaranta *et al.* 2006, Swing & Béarez 2006, Didier 2008, Didier *et al.* 2008, Last *et al.* 2008, Didier & Meckley 2009a, b, James *et al.* 2009, Gonzalez-Acosta *et al.* 2010, Kemper *et al.* 2010a, b, Luchetti *et al.* 2011, Bustamante *et al.* 2012, Aguirre-Villaseñor *et al.* 2013).

Currently, the order Chimaeriformes comprises three families, six genera and about forty-seven valid species (Didier *et al.* 2012, Eschmeyer & Fong 2014). The family Callorhinchidae, characterized by a prominent plow-shaped snout, is represented by a single genus (*Callorhinchus* Lacepède 1798) and three species, being the least diverse (Nelson 2006, Didier *et al.* 2012, Eschmeyer & Fong 2014). The family Rhinochimaeridae, characterized by a long, tapering fleshy snout extending anterior to head, is represented by three genera and eight valid species (*Harriotta* Goode & Bean 1895 with two species, *Neoharriotta* Bigelow & Schroeder 1950 with three species, and *Rhinochimaera* Garman 1901 also with three species) (Nelson 2006, Didier *et al.* 2012, Eschmeyer & Fong 2014). Finally, the family Chimaeridae, characterized by a conical fleshy snout that is bluntly pointed at the tip, is represented by two genera and at least thirty-six valid species (*Chimaera* Linnaeus 1758 with fourteen species, and *Hydrolagus* Gill 1862 with at least twenty-two species), being the most diverse (Nelson 2006, Didier *et al.* 2012, Eschmeyer & Fong 2014).

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Key to eastern Pacific species of the order Chimaeriformes

The following key is based on our research and data available in the literature (Didier & Nakaya 1999, Didier & Rosenberger 2002, Barnett *et al.* 2006, Nelson 2006, Quaranta *et al.* 2006, Didier & Meckley 2009a, b, James *et al.* 2009, González-Acosta *et al.* 2010, Bustamante *et al.* 2012, Didier *et al.* 2012).

1 Snout with elongate, flexible, hooklike process; lateral line canals closed; second dorsal fin not elongate; tail heterocercal (Ecuador to Argentina) . . . . . *Callorhinchus callorynchus* (Linnaeus 1758)
- Snout short and rounded or long and pointed, not hooklike; lateral line canals are open grooves; second dorsal fin elongate; tail diphycercal 2
2 Snout short and bluntly rounded; caudal-fin axis horizontal with the fin nearly symmetrical, epaxial and hypaxial lobes equal sized. 3
- Snout elongated and pointed; caudal-fin axis weakly raised with the fin asymmetrical, epaxial caudal-fin lobe narrower than hypaxial lobe 8
3 Anal fin present (Costa Rica to Peru, probably more widespread in the southeastern Pacific) . . . . *Chimaera orientalis* **sp. nov**.
- Anal fin absent 4
4 Anterior and posterior regions of second dorsal-fin considerably taller than middle region 5
- Second dorsal-fin uniform in height throughout 7
5 Anterior edge of dorsal-fin spine not serrated; uniform dark brown to reddish-brown across entire body with numerous white spots on the head and trunk (Gulf of Alaska to Costa Rica) . . . . . *Hydrolagus colliei* (Lay & Bennett 1839)
- Anterior edge of dorsal-fin spine serrated; uniform brown across entire body with or without a distinct white spot on the lateral side above the pectoral fins 6
6 Snout blunt; EYL more than 40% HDL; tail region short and stout, PCA less than 57% BDL; uniform brown across entire body with a distinct white spot on the lateral side above the pectoral fins (Galapagos Islands) . . . . . *Hydrolagus alphus* Quaranta, Didier, Long & Ebert 2006
- Snout pointed at tip; EYL less than 40% HDL; tail region elongate and slender, PCA more than 58% BDL; uniform brown across entire body with no white markings (Mexico to Chile) . . . . . *Hydrolagus macrophthalmus* de Buen 1959
7 EYL more than 10% BDL; two narrowly spaced columns of serrations on the posterolateral edges of the distal 66–75% of spine (in adults); uniform overall medium grey on dorsal and lateral parts extending to near the ventrum, and dorsum with many irregular circular and elongate white blotches (Galapagos Islands) . . . . . *Hydrolagus mccoskeri* Barnett, Didier, Long & Ebert 2006
- EYL less than 9% BDL; spine serrations very worn, posterior edge of spine serrated for last 6.5–13% of spine length (in adults); uniform dark brown to black across entire body with a lighter band over the snout (Southern California, U.S.A. to Chile). . . . . *Hydrolagus melanophasma* James, Ebert, Long & Didier 2009
8 Tooth-plates with ridges and knobs; eyes virtually above mouth; upper edge of caudal fin without denticles or tubercles (Southern California, U.S.A., to Peru). . . . . *Harriotta raleighana* Goode & Bean 1895
- Tooth-plates nearly smooth; eyes distinctly behind level of mouth; caudal tubercles present along the upper edge of caudal fin 9
9 Snout broad and paddle-shaped with fleshy tip; junction of supraorbital and infraorbital canals on ventral side of snout closer to the tip of the snout than to the nasal canal; ONC/TIO greater than 1.4, TIO/SWF less than 1.5, TIO/LNC less than 3.0; 25–47 dorsal caudal tubercles in mature specimens; even dark brown color over entire body (Costa Rica to Peru) . . . . . *Rhinochimaera africana* Compagno, Stehmann & Ebert 1990
- Snout narrow and conical shaped with the tip narrow and stiff; junction of supraorbital and infraorbital canals on ventral side of snout nearly equidistant between the tip of the snout and the nasal canal; ONC/TIO less than 1.4, TIO/SWF greater than 1.5, TIO/LNC greater than 3.0; 36–62 dorsal caudal tubercles in mature specimens; pale brownish-gray body color with fins darker (Peru). . . . . *Rhinochimaera pacifica* (Mitsukuri 1895)

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APPENDIX

Morphometric abbreviations are as follows:

Body measurements: TL= total length; PCL= pre-caudal length, snout tip to origin of dorsal lobe of caudal fin; BDL= body length, dorsal edge of gill opening to origin of dorsal lobe of caudal fin; SVL= snout-vent length, snout tip to vent opening; TRL= trunk length, ventral edge of gill opening to vent opening; HDL= head length, snout tip to dorsal edge of gill opening; SNL= snout length, tip of snout to oronasal fold; SWF= snout maximum width at distal end of nasal canal; SWB= snout width at base; SHB= snout height at base; PRN= pre-narial length, snout tip to anterior end of nasal apertures; POR= pre-oral length, snout tip to end of upper labial fold; POB= pre-orbital length, snout tip to anterior edge of orbit; EYL= eye length; EYH= eye height; PD1= pre-first dorsal length, snout tip to origin of first dorsal fin; PD2= pre-second dorsal length, snout tip to origin of second dorsal fin; D1B= length of first dorsal fin base; D2B= length of second dorsal fin base; DSA= dorsal spine height along anterior margin; D1H= maximum height of first dorsal fin; D2H= maximum height of second dorsal fin; IDS= interdorsal space, insertion of first dorsal to origin of second dorsal; DCS= dorsal caudal space, second dorsal insertion to