



Research note

Occurrence of *Hydrolagus macrophthalmus* (Chondrichthyes: Holocephali: Chimaeridae) in the northeastern Pacific

Presencia de *Hydrolagus macrophthalmus* (Chondrichthyes: Holocephali: Chimaeridae) en el Pacífico nororiental

Adrián F. González-Acosta^{1*}, José Luis Castro-Aguirre¹, Dominique A. Didier², Rafael Vélez-Marín³ and Luis A. Burnes-Romo¹

¹Centro Interdisciplinario de Ciencias Marinas, Instituto Politécnico Nacional, Colección Ictiológica, Avenida Instituto Politécnico Nacional s/n, Col. Playa Palo de Santa Rita, 23096, La Paz, Baja California Sur, México.

²Department of Biology, Millersville University, P.O. Box 1002, Millersville, PA 17551, USA.

³Centro Regional de Investigación Pesquera, Manzanillo. Apartado postal 591, 28200, Manzanillo, Colima, México.

*Correspondent: aacosta@ipn.mx

Abstract. The southeastern Pacific chimaeroid *Hydrolagus macrophthalmus* De Buen, 1959, is reported for the first time in the northeastern Pacific on the basis of 1 male specimen (945 mm TL) caught on 13 April 1995 off Manzanillo, Colima (Mexico: 18° 30'N, 104° 15'W) at the surface above deep water (2 000 m). The first occurrence of this species increases the number of chimaeroid species known in the northeastern Pacific and expands their known range.

Key words: chimaerid fish, TEP, México, first record, range extension.

Resumen. Se registra por primera vez la presencia de la quimera *Hydrolagus macrophthalmus* De Buen, 1959, en aguas del Pacífico nororiental; especie cuya distribución se consideraba como exclusiva del Pacífico sur oriental. El 13 de abril de 1995, se recolectó 1 ejemplar macho (945 mm TL) en la superficie del mar frente a Manzanillo, Colima (México: 18° 30'N, 104° 15'O), en una zona de gran profundidad (2 000 m). Su presencia, incrementa el número de quimeras del Pacífico nororiental y asimismo, amplía su distribución hacia el hemisferio norte.

Palabras clave: quimera, POT, México, primer registro, ampliación de ámbito.

The family Chimaeridae (Subclass Holocephali) includes 25 species within 2 genera that can be distinguished by the presence (*Chimaera*, 7 species) or absence (*Hydrolagus*, 18 species) of an anal fin (Bigelow and Schroeder, 1953). Several species of *Hydrolagus* are present in every ocean except the Arctic and Antarctic seas (Didier, 1995, 2004). Eight species occur in the Indo-Pacific Ocean and 6 in the Atlantic. In the eastern Pacific, there are 4 described species: *H. alphas* Quaranta, Didier, Long and Ebert, 2006, *H. macrophthalmus* De Buen, 1959, *H. mccoskeri* Barnet, Didier, Long and Ebert 2006, and *H. colliei* (Lay and Bennett, 1839) is endemic to the northeastern Pacific from Alaska to latitude 24° N, with an isolated population in the north-central portion of the Gulf of California (Miller and Lea, 1972; Didier and Rosenberger, 2002; Castro-Aguirre et

al., 2005; Barnett et al., 2006).

We report the first occurrence of *H. macrophthalmus* in the northeastern Pacific. A single male specimen (945 mm TL; Fig. 1) was found floating dead on 13 April 1995 off Manzanillo, Colima (Mexico: 18° 30'N, 104° 15'W) at the surface by local fishermen over deep water (2 000 m). It was preserved with 10% formalin and identified using the description of De Buen (1959) and identification keys (Didier, 2004; Andrade and Pequeño, 2006; Quaranta et al., 2006). Body measurements (nearest mm) followed the methods, terms, and acronyms of Quaranta et al. (2006). The specimen is housed in the Ichthyological Collection of the Centro Interdisciplinario de Ciencias Marinas, Instituto Politécnico Nacional in La Paz, B.C.S. (CICIMAR-CI: 6370).

Diagnostic features are: anal fin absent; body slender with angular snout tip and very large eyes (22.4% HDL); pelvic claspers bifid, divided distally for one half their



Figure 1. *Hydrolagus macrophthalmus*, CICIMAR-CI: 6370, male 945 mmTL, from Manzanillo, Colima (Mexico: 18° 30'N, 104° 15'W).

length (Fig. 2A), bearing fleshy denticulate lobes at the tips; pelvic claspers extending posterior to the distal edge of pelvic fins; frontal tenaculum (18.18% HDL, 63% EYL) with hooks decreasing in size proximally and divided into three line of hooks (left: 12, central: 13, right: 11); lateral margins of the pre-pelvic tenacula containing three hooks; anterior lobe of the second dorsal fin higher than posterior lobe, with shallow notch at the midpoint; distance from insertion of pelvic fins to origin of dorsal caudal fin lobe long and slender (> 60% BDL); pectoral fins large (20.5% BDL), extending posterior to the insertion of pelvic fins; presence of five pores anterior to the occipital canal; oral and preopercular lateral line canals sharing a short common branch from the infraorbital canal (Fig. 2B); lateral line canal of the trunk without sinusoidal undulations; uniform brown coloration without white marks on flanks. Other comparative measurements based on the holotype, the specimen herein reported and other materials (see Material Examined section) are presented in Tables 1 and 2.

The specimen was compared with the other 2 species reported in the region: *H. alphus* and *H. mccooskeri*, which according to Quaranta et al. (2006) differ in their endemic distribution in the Galapagos Islands and by size and coloration. Also, *H. macrophthalmus* is distinguishable from *H. alphus* by its uniform brown coloration, pointed snout (not blunt), greater eye length, size (> 60% in body length vs. < 57%), an elongate and slender morphology of tail region (> 60% BDL), and the presence of three hooks

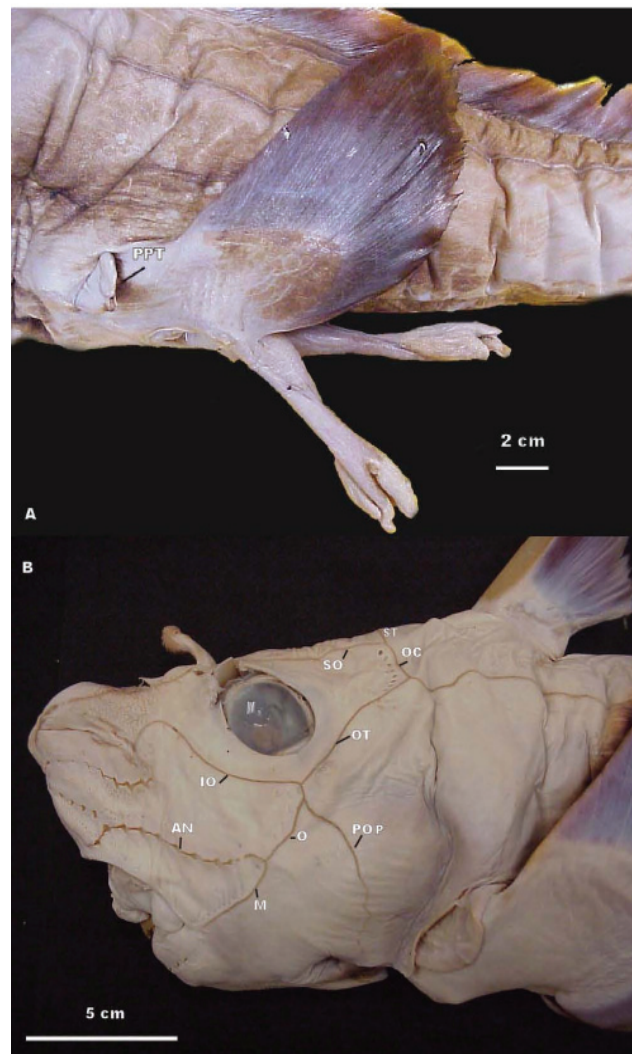


Figure 2. *Hydrolagus macrophthalmus*, CICIMAR-CI: 6370. A), bifid claspers (PPT = pre-pelvic tenacula); B), oral and preopercular lateral line canals (AN= angular, IO= infraorbital, M= mandibular, O= oral, OC= occipital, OT= otic, POP= preopercular, SO= suborbital, ST= supratemporal).

Table 1. Morphometric data of *Hydrolagus macrophthalmus*. Proportions based on body length (BDL) follow Quaranta et al. (2006). *Measurements based on specimens included in the Material examined section

Measurement	MNHC P. 7282		CICIMAR-CI: 6370		Other materials*	
	Holotype	(male)	(male, n=3)	(female, n=6)	mm	%BDL
	mm	%BDL	mm	%BDL	Mm	%BDL
Body length (BDL)	296	100.0	600	100.0	32.0-269	100.0
Total length	385	130.1	945	157.5	52.7-445	147-191
Precaudal length	360	121.6	765	127.5	35.5-365	99-123.3
Head length (HDL)	68	23.0	165	27.5	7.8-70.3	22.0-24.3
Snout-vent length	-	-	390	65.0	18.0-170	50.3-59.4
Preorbital length	32.7	11.0	77	13.0	3.4-36.2	9.5-12.3
Pre-first dorsal length	76	25.7	185	31.0	8.5-79.0	23.9-27.5
Pre-second dorsal length	141	47.6	290	48.3	14.6-142.0	40.8-49.0
Trunk length	-	-	242	40.3	11.2-102	31.3-41.2
First dorsal fin base from origin to insertion	46.3	15.6	41	6.8	5.0-52.8	13.9-17.8
Second dorsal fin base from origin to insertion	210	70.9	478	79.6	20.9-235.0	58.4-79.4
Interdorsal space	15.4	5.2	65	10.8	1.8-24.7	5.0-8.34
Pectoral fin anterior margin	90	30.4	238	39.6	10.2-113.2	28.5-38.2
Pelvic fin anterior margin	-	-	123	20.5	5.6-54.9	15.6-18.7
Maximum height of anterior 1/3 of the second dorsal fin	-	4.2-5.5	90	15.0	1.6-11.2	3.8-5.0
Maximum height of the middle of the second dorsal fin	-	-	68	11.3	0.3-0.4	0.7-1.25
Maximum height of posterior 1/3 of the second dorsal fin	-	-	50	8.3	0.8-0.9	1.7-2.8
Dorsal caudal space	-	-	8	1.3	0.2-5.0	0.6-3.1
Posterior tail length	-	-	562	93.6	-	-
Caudal peduncle height at insertion of second dorsal fin	6.3	2.1	17	2.8	0.8-8.2	2.2-2.81
Dorsal caudal fin margin length	-	-	119	19.8	7.0-8.0	19.5-25.0
Ventral caudal fin margin length	-	-	179	29.8	10.2-11.5	28.5-35.9
Maximum height of dorsal caudal fin	-	-	12	2.0	0.5-0.7	1.4-2.2
Maximum height of ventral caudal fin	-	-	12	2.0	0.5-0.7	1.4-2.2
Total caudal fin length	-	-	179	29.8	17.3-22.3	48.3-69.7
First dorsal fin spine length along anterior margin	-	-	142	23.6	31.4	10.6
Maximum height of first dorsal fin	-	-	134	22.3	4.2-6.4	11.7-20.0
Anterior edge of first dorsal fin base to anterior edge of pectoral fin base	50.1	16.9	111	18.5	5.1-76.6	14.2-25.9
Anterior edge of first dorsal fin base to anterior edge of pelvic fin base	69.3	23.4	235	39.2	11.3-99.0	31.6-40.6
Anterior edge of second dorsal fin base to anterior edge of pelvic fin base	91.7	31.0	146	24.3	8.0-124.4	22.3-42.0
Pectoral to pelvic space	70.7	23.9	202	33.6	8.6-69.1	23.3-32.2
Eye length	23	7.8	37	6.2	2.3-26.2	6.4-8.8
Eye height	16.6	5.6	31	5.3	1.5-16.6	4.2-6.2
Pre-oral length	36	12.2	55	9.2	-	-
Pre-narial length	29.8	10.1	56	9.3	-	-
Total length of claspers from pelvic fin base to tip	48.8	16.5	99	16.5	4.0-50.3	11.7-17.0
Length of medial branch of claspers from fork to tip	19.7	6.7	22	3.6	2.0-24.2	6.1-8.2
Length of lateral branch of claspers from fork to tip	22.2	7.5	24	4.0	2.0-23.7	6.2-8.0
Frontal tenaculum length	13.8	4.7	30	5.0	1.3-13.3	3.6-4.5

Table 2. Comparative measurements of the lateral canal system of *Hydrolagus macrophthalmus*, from Mexico, Chile and Peru. Measurements in millimeters follow Quaranta et al. (2006), proportions based on head length are in brackets [%HDL]. *Measurements based on specimens from HUMZ included in the Material examined section

Measurement	CICIMAR-CI: 6370	Quaranta et al. Chile	Peru*
Distance from anterior oronasal fold to center of nasal canal	13.0 [7.9]	4.4-6.7 [6.3-9.1]	0.6-1.5 [7.0-17.0]
Length of the nasal canal measured as a straight line distance from right to left side	36 [21.8]	14.3-24.2 [21-30.8]	1.5-2.3 [19.0-26.1]
Distance between infraorbital and angular canal measured as the straight line distance from junction of the oral and infraorbital canal to the junction of the oral and angular canal	29.0 [17.6]	11.2-18.9 [16.5-22.5]	0.2-0.5 [2.3-6.3]
Distance between preopercular canal and main trunk canal measured from their junction with the infraorbital canal	55 [33.3]	26.3-34.5 [38.7-41.2]	2.9-3.7 [36.3-46.2]
Distance between main trunk canal and supratemporal canal measured from their junctions with the infraorbital and postorbital canals, respectively	37 [22.4]	10.3-17.9 [15.1-24.2]	1.2-1.5 [15.2-18.7]
Length of supratemporal canal measured across the head from its junctions with the postorbital canal	31 [18.8]	10.4-16.6 [14.8-22.4]	1.3-1.8 [16.4-21.2]
Distance from anterior base of spine to the center of the supratemporal canal	21 [12.7]	5.5-10.5 [8.1-14.2]	1.0-1.6 [12.6-18.8]

in the pre-pelvic tenacula (Quaranta et al., 2006). Some differences in morphometrics between *H. macrophthalmus* from South and Central America could be consequence of an unequal ontogenetic stage.

The presence of *H. macrophthalmus* had been previously reported only from the southeastern Pacific, based on type specimens from Chile and material from Peru (De Buen, 1959; Chirichigno, 1968; Quaranta et al., 2006). Therefore, the new occurrence constitutes a very large range extension for this species and the second record of chimaeroid species from the northeastern Pacific. The discovery of *H. macrophthalmus* increases knowledge of our marine ichthyofauna and provides evidence of a broader distributional pattern of this group, as commonly observed in some chimaeroid species (Quaranta et al., 2006). More exploration in this area will be welcomed to explore the submarine canyons and mountains in the deep pre-abyssal waters inhabited by this species which could contribute to confirm its distribution in the eastern Pacific as a whole.

Material examined. *Hydrolagus macrophthalmus*: Museo Nacional de Historia Natural de Chile: M.NHNC.P 7282 (Holotype), male 385mmTL; M.NHNC.P 5724, male 445 mmTL and M.NHNC.P 6421(A), female 627 mmTL, Chile. CICIMAR-CI: 6370, male 945 mmTL, Manzanillo (Mexico). Hokkaido University Museum of Zoology: HUMZ 167128, male 612 mmTL, HUMZ 167443, female 636 mmTL, HUMZ 167820, female 594 mmTL, HUMZ 167821, female 515 mmTL.; HUMZ 173320, female 540

mmTL; HUMZ 185708, female 560 mmTL, and HUMZ 185709, male 527 mmTL (Peru).

We thank the fishermen of Manzanillo, Colima (México) for the donation of the specimen. Also, to the Centro Regional de Investigaciones Pesqueras (CRIP-Manzanillo) for preserving the specimen, as well as to D.A. Ebert (CSU-MLML) for his helpful comments on the identity of the specimen and D. Catania (CAS), and J. Maclaine (BMNH) for lending pictures for comparison. This research was partially supported by COFAA, EDI-IPN and SNI-CONACYT grants. I Fogel edited the text.

Literature cited

- Andrade, I. and G. Pequeño. 2006. Primer registro de *Hydrolagus pallidus* Hardy and Stehmann 1990 (Chondrichthyes: Chimaeridae) en el Océano Pacífico, con comentarios sobre los holocéfalos de Chile. *Revista de Biología Marina y Oceanografía* 41:111-115.
- Barnett, L. A. K., D. A. Didier, D. J. Long and D. A. Ebert. 2006. *Hydrolagus mcoskeri* sp. nov., a new species of chimaeroid fish from the Galápagos Islands (Holocephali: Chimaeriformes: Chimaeridae). *Zootaxa* 1328:27-38.
- Bigelow, H. B. and W. C. Schroeder. 1953. Chimaeroids. *Fishes of the western north Atlantic. Memoirs of the Sears Foundation for Marine Research* 1:515-562.
- Castro-Aguirre, J. L., A. F. González-Acosta and J. De La Cruz-Aguero, 2005. Lista anotada de las especies ícticas anfipacíficas, de afinidad boreal, endémicas y anfipeninsulares del Golfo de California, México. *Revista Universidad y*

- Ciencia 21:87-108.
- Chirichigno F., N. 1968. Nuevos registros para la ictiofauna marina del Perú. Boletín del Instituto del Mar del Perú 1:377-504.
- De Buen, F. 1959. Notas preliminares sobre la fauna marina preabismal de Chile, con descripción de una familia de rayas, dos géneros y 7 especies nuevas. Boletín del Museo Nacional de Historia Natural de Chile 27:171-201.
- Didier, D. A. 1995. Phylogenetic systematics of extant chimaeroid fishes (Holocephali, Chimaeroidei). American Museum Novitates 3119:1-86.
- Didier, D. A. 2004. Phylogeny and classification of extant Holocephali. In Biology of sharks and relatives, J. C. Carrier, J. A. Musick and M. R. Heithaus (eds.). CRC Press, Florida, p. 115-135.
- Didier, D. A. and L. J. Rosenberger. 2002. The spotted ratfish, *Hydrolagus collieri*: notes on its biology with a redescription of the species (Holocephali: Chimaeridae). California Fish and Game 88:112-125.
- Miller, D. J. and R. N. Lea. 1972. Guide to the coastal marine fishes of California. California Department of Fish and Game, Fish Bulletin 157:1-249.
- Quaranta, K. L., D. A. Didier, D. J. Long and D. A. Ebert. 2006. A new species of Chimaeroid, *Hydrolagus alphas* sp. nov. (Chimaeriformes: Chimaeridae) from the Galapagos Islands. Zootaxa 1377:33-45.

NOTE: After this report was accepted for publication, a paper by James et al. (2009) describing a new *Hydrolagus* (*H. melanophasma*) was published. This new species, as far as known, is distributed off both coast of Baja California peninsula, also in very deep water. So, in the eastern Pacific, until now, there are 5 chimaerid described species. [James, K.C., D.A. Ebert., D.J. Long and D.A.Didier. 2009. A new species of chimaera, *Hydrolagus melanophasma* sp. nov. (Chondrichthyes: Chimaeriformes: Chimaeridae), from the eastern north Pacific. Zootaxa 2218:59-68].