

A new species of chimaeroid, *Hydrolagus alphus* sp. nov. (Chimaeriformes: Chimaeridae) from the Galapagos Islands

KIMBERLY L. QUARANTA¹, DOMINIQUE A. DIDIER², DOUGLAS J. LONG^{3,4} &
DAVID A. EBERT⁵

¹Moss Landing Marine Laboratories, 8272 Moss Landing Road, Moss Landing, CA 95039, USA
E-mail: kquaranta@mml.calstate.edu

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

³Department of Biology, St. Mary's College, 1928 St. Mary's Road, Moraga, CA 94575, USA

⁴Research Associate, Department of Ichthyology, California Academy of Sciences, 875 Howard Street, San Francisco, CA 94103, USA

⁵Pacific Shark Research Center, Moss Landing Marine Laboratories, 8272 Moss Landing Road, Moss Landing, CA 95039, USA

Abstract

A new species of chimaerid belonging to the genus *Hydrolagus* Gill, 1862 is described from two specimens collected from the Galapagos Islands. This species was taken from depths ranging from 600 – 900 m. *Hydrolagus alphus* sp. nov. is distinguished from other members of the genus by having proportionately large eyes, dark brown coloration with a noticeable white spot on lateral side, paired fins with a bluish hue and white distal margins, and second dorsal fin with dark anterior and posterior sections separated by a middle portion indented and completely white. This new species is compared to *Hydrolagus macrophthalmus*, the most similar congener and *Hydrolagus mccoskerii* the only other known species within this genus to occur in the eastern South Pacific.

Key words: *Hydrolagus*, Chimaeriformes, Chimaeridae, Galapagos Islands, new species

Introduction

In recent years, increased deep water surveys have led to the discovery of several new species within the family Chimaeridae, particularly within the genus *Hydrolagus* (Didier, 2002; Didier and Seret, 2002; Soto and Vooren, 2004; Barnett et al., 2006). Recently, deep water exploration around the Galapagos Islands was undertaken using a manned submersible. This particular collecting method enabled researchers to explore rocky and volcanic terrain not accessible to conventional trawling methods (McCosker, 1997;

McCosker et al., 1997). As a result, several new species of chimaeroid fishes belonging to the genus *Hydrolagus* were captured off the Galapagos Islands of Fernandina, Seymour and San Cristobal (Barnett et al., 2006).

Hydrolagus is one of two genera found within the family Chimaeridae. Species in this family are typically characterized as having short fleshy snouts that are bluntly pointed at the tip, elongate bodies tapering to a whiplike tail with an elongate filament, and are uniform brown, gray, or black in color with the possibility of white spots or stripes (Didier, 2004). There is very little difference between *Hydrolagus* and *Chimaera*, the other genus within this family, other than the presence (in *Chimaera*) or absence (in *Hydrolagus*) of an anal fin. The anal fin is located anterior to the ventral caudal fin and is only separated from it by a small notch and can be very subtle, making it sometimes difficult to distinguish the two genera (Bigelow and Schroeder, 1953; Didier, 1995, 2004; pers. obs.).

Comprising 17 of the 24 known species within this family, species of *Hydrolagus* are found in every ocean, except the Arctic and Antarctic (Didier, 2004), with the greatest diversity known from the western Pacific. The only species of *Hydrolagus* known from eastern South Pacific is *Hydrolagus macrophthalmus* (de Buen, 1959), a poorly known species described from two specimens collected from off Valparaiso, Chile. The holotype (Figure 1), which was thought to be lost due to a tsunami that partially destroyed the museum it was previously contained in, was rediscovered and it is now part of the collection at the Museo Nacional de Historia Natural in Santiago, Chile (MNHNC P. 7282). There have also been specimens of *H. macrophthalmus* collected from off Peru and these are used for comparisons in this study (Chirichigno, 1968; Didier, unpubl. data). Morphometrics and morphological features confirm that *Hydrolagus alphus* sp. nov. is different from *Hydrolagus macrophthalmus*. This is the second new species of chimaeroid from the Galapagos Islands (Barnett et al., 2006) and adds a third species to the diversity of *Hydrolagus* in the eastern tropical Pacific.

Methods

The submersible *Johnson Sea-Link II* (JSL) and its attending vessel the *R/V Seward Johnson* is operated by the Harbor Branch Oceanographic Institution (HBOI), and was led in joint expedition by John E. McCosker of the California Academy of Sciences (CAS) in November 1995 and June-July 1998. The submersible hovered near the bottom and scanned the seafloor for marine life using xenon arc lights which had the ability to illuminate specimens in near-daylight true color for photography, and was also able to retrieve samples after photography was complete. Observations of specimens prior to capture allowed for observations of their life color and behavior alive *in situ*. The types were then collected by a maneuverable suction hose that would intake specimens into a living chamber where they were kept at the ambient pressure and temperature until they were brought to the surface for analysis. Additionally, the vessel was able to document live

specimens using both a laser-aimed high-8 video camera, and a laser-aimed still camera using Kodachrome 64 slide film. Transparencies and videos of *Hydrolagus alphus* sp. nov. are on file in the Department of Ichthyology, California Academy of Sciences. Once specimens were brought aboard the *R/V Seward Johnson* they were photographed while still alive or recently dead using Fuji Velvia 100 slide film under natural sunlight. Soon after photography, the specimens were fixed in 10% formalin and later stored in 70% ethanol.

Measurements of the specimens were made using calipers to the nearest tenth millimeter (mm) or measuring tape to the nearest mm. All measurements were taken from preserved specimens and follow Didier (2002) and Didier and Seret (2002) as modified from Compagno et al. (1990). A total of 41 measurements of the body and 8 measurements of the head canals (Didier and Nakaya, 1999) were ultimately used. Body measurements made parallel along the body included: precaudal length (PCL), tip of snout to origin of dorsal caudal fin; head length (HDL), tip of snout to dorsal edge of gill opening; snout-vent length (SVL), tip of snout to cloaca opening; preorbital length (POB), tip of snout to anterior edge of orbit; pre-first dorsal length (PD1), tip of snout to origin of first dorsal fin; pre-second dorsal length (PD2), tip of snout to origin of second dorsal fin. Other body measurements were made point to point: total length (TL), tip of snout to tip of tail; body length (BDL), dorsal edge of gill opening to origin of upper caudal fin; trunk length (TRL), ventral edge of gill opening to cloaca; first dorsal fin base from origin to insertion (D1B); second dorsal fin base from origin to insertion (D2B); interdorsal space (IDS), insertion of first dorsal fin to origin of second dorsal fin; pectoral fin anterior margin (P1A); pelvic fin anterior margin (P2A); maximum height of anterior 1/3 of the second dorsal fin (D2AH); maximum height of the middle of the second dorsal fin (D2MH); maximum height of posterior 1/3 of second dorsal fin (D2PH); dorsal caudal space (DCS), second dorsal fin insertion to origin of dorsal caudal fin; posterior tail length (PTL), insertion of pelvic fins to origin of dorsal caudal fin; caudal peduncle height at insertion of second dorsal fin (CPH); dorsal caudal fin margin length (CDM); ventral caudal fin margin length (CVM); maximum height of dorsal caudal fin (CDH); maximum height of ventral caudal fin (CVH); total caudal fin length (CTL), from origin of upper caudal fin to tip of filament; first dorsal fin spine length along anterior margin (DSA); maximum height of first dorsal fin (D1H); anterior edge of first dorsal fin base to anterior edge of pectoral fin base (D1P1); anterior edge of first dorsal fin base to anterior edge of pelvic fin base (D1P2); anterior edge of second dorsal fin base to anterior edge of pectoral fin base (D2P1); anterior edge of second dorsal fin base to anterior edge of pelvic fin base (D2P2); pectoral to pelvic space (P2P), insertion of pectoral fin to origin of pelvic fin; eye length (EYL); eye height (EYH); pre-oral length (POR), snout tip to end of upper labial fold; pre-narial length (PRN), snout tip to anterior edge of nasal apertures; diameter of white spot on lateral side (WSD), horizontal diameter; total length of claspers from pelvic fin base to tip (CLT); length of medial branch of claspers from fork to tip (CLM); length of lateral branch

of claspers from fork to tip (CLL); frontal tenaculum length (FTL).

In addition to body measurements, eight measurements of the lateral line canals of the head were also taken: distance from anterior oronasal fold to center of nasal canal (ONC); length of the rostral canal (LRC); length of the nasal canal measured as a straight line distance from right to left side (LNC); 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 (IOA); distance between preopercular canal and main trunk canal measured from their junction with the infraorbital canal (OTM); distance between main trunk canal and supratemporal canal measured from their junctions with the infraorbital and postorbital canals, respectively (OCL); length of supratemporal canal measured across the head from its junctions with the postorbital canal (STL); distance from anterior base of spine to the center of the supratemporal canal (SPS).

Institutional abbreviations follow Leviton *et al.* (1985). Type specimens are deposited at the California Academy of Sciences (CAS) in San Francisco, California, USA.

***Hydrolagus alphas* sp. nov.**

(Whitespot ghostshark)

Figures 2, 3; Tables 1, 2

Holotype: CAS 201902, adult male, 419 mm TL, 249 mm BDL; Galapagos Islands, Ecuador, North end of Seymour Island (0°21'42"S, 90°15'0"W), 648 m, 25 July 1998, J. E. McCosker (CAS) and Carole Baldwin (USNM) by vacuum hose aboard the *Johnson Sea Link II* (JSL dive #3113).

Paratype: CAS 86425, sub-adult female, 480 mm TL, 244 mm BDL, Galapagos Islands, Ecuador, Fernandina Island (0°14.641'S 91°26.535'W–0°14.820'S 91°26.410'W), 731.52 m, 17 Nov. 1995, J. E. McCosker (CAS), R. Grant Gilmore (HBOI) and Bruce Robison (MBARI) by vacuum hose aboard the *Johnson Sea Link II* (JSL dive #3958).

Additional specimens observed but not collected: 26 November 1995, Galapagos Islands, Ecuador, Isla Santiago, James Bay, one specimen seen and photographed at a depth of 907 m (JSL dive #3977); 23 June 1998, Galapagos Islands, Ecuador, Isla Fernandina, Cabo Douglas, one specimen observed at a depth of 630 m (JSL dive #2900) and sketched by J.E. McCosker.

Diagnosis. Assigned to the genus *Hydrolagus* based upon the absence of an anal fin. *Hydrolagus alphas* is distinguished by being medium in size (average PCL 321 mm) and uniform dark brown in color with a distinct white spot (4%–6% BDL) on the lateral side above the pectoral fins. Paired fins with bluish hue and white margins. The dorsal spine longer than triangular shaped first dorsal fin and extends beyond the origin of the second dorsal fin when depressed. Eyes large (40.8–44.5% HDL) and pectoral fins reaching to or beyond insertion of pelvic fins when depressed. Pelvic claspers small, not extending beyond distal edge of pelvic fin, and divided distally for one half their length with slender

fleshy denticulate tips. The base of second dorsal fin is long, deeply depressed and light colored in the center, anterior and posterior regions dark, considerably greater in height than the white middle region.



FIGURE 1. Holotype of *Hydrolagus macrophthalmus* (de Buen, 1959) from the Museo Nacional de Historia Natural in Santiago, Chile (MNHNC P. 7282). Scale = 5 cm.

Description. Measurements and body proportions of the holotype and paratype are presented in Table 1. Small to medium sized species with stout trunk, uniform in height until insertion of pelvic fins, then quickly tapering posteriorly and extending to a thin caudal filament. Eyes large (40.8–44.5% HDL) and slightly oval in shape. Snout blunt, tip protruding slightly, squared off towards the mouth.

First dorsal fin triangular and attached to the dorsal spine at or below midpoint. Both spine and fin depress into a groove situated on dorsal ridge. Dorsal spine longer than the dorsal fin, serrated along the anterior side from just below the distal tip to above the base. Posterior side of dorsal spine has two rows of long serrations extending from the tip to the midpoint. When the dorsal spine is depressed, the tip reaches beyond the origin of the second dorsal fin. Base of the second dorsal fin is long, extending from mid-body to caudal fin, anterior and posterior regions are dark colored with a small band of white coloration on the distal margins and distinctly lobed, with the middle region white, indented for 1/4 the length of second dorsal fin. Anterior portion is greater in height (7.2% BDL) than the posterior portion (4.4 % BDL) with the middle portion less than 2% BDL in height. Second dorsal fin is separated from the caudal fin by a membrane.

Caudal fin consists of a rounded dorsal and ventral lobe, with the ventral lobe being slightly greater in height. The ventral portion of the caudal fin base is longer than the dorsal caudal fin base and has a fleshy membrane extending onto the posterior body region. Caudal fins are white distally around the margins. Anal fin absent. Pectoral fins are large (39.8% BDL) and triangular reaching just below the first dorsal fin when depressed dorsally and to the insertion of the pelvic fins when depressed horizontally. Posterior margin of pectoral fins are convex near base, progressing concavely to distal tip, anterior margin slightly convex. Pectorals moderately dark in color, preserved specimens have a purplish-blue hue on fins with a white border around the margins. Pelvic fins are large, oblong with convex margins. Coloration of pelvic fins in preservative is the same as

pectoral fins.

Oral and preopercular head canals extend ventrally sharing a common branch from the infraorbital canal. Trunk lateral line canal extends the length of the body until it reaches the caudal fin where it extends down ventrally onto the tail filament. Secondary sexual characteristics in males include a long frontal tenaculum (32.5 % HDL) moderately curved, ending in a bulbous tip with tenacular hooks starting below the dorsal surface and aligned vertically in rows with 6–8 denticles in each, getting larger ventrally, pre-pelvic tenacula with at least 4 hooks on the outer margin and pelvic claspers that are bifid, slender with wrinkled fleshy pads at tips and divided distally for one half of their length. Females with anal pads, not present in males.

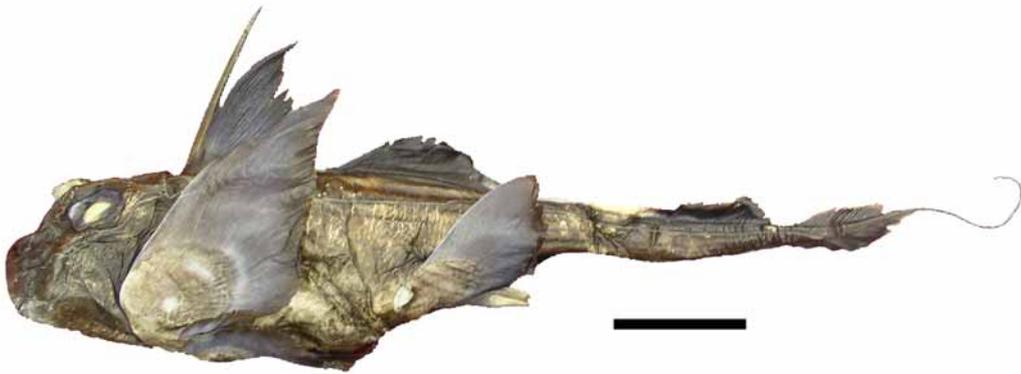


FIGURE 2. Preserved specimen from the Galapagos Islands designated as *Hydrolagus alphas*, holotype, CAS 201902, adult male, 419 mm TL, 249 mm BDL. Scale = 5 cm.



FIGURE 3. Picture of freshly caught *Hydrolagus alphas* sp. nov., paratype, CAS 86425 from Galapagos Islands.

TABLE 1. Measurements and body proportions of *Hydrolagus alphus* sp. nov., from the Galapagos Islands. Measurements not attainable (i.e. structure broken) or unavailable are represented with an en-dash (-).

Measurement	<i>H. alphus</i>			
	Holotype (male) CAS 201902		Paratype (female) CAS 86425	
	mm	% BDL	mm	% BDL
BDL	249	100.0	244	100.0
TL	419	168.3	480	196.7
PCL	292	117.3	350	143.4
HDL	53	21.3	61	25.0
SVL	156	62.7	152	62.3
POB	27	10.8	34	13.9
PD1	70	28.1	76	31.1
PD2	126	50.6	132	54.1
TRL	108	43.4	109	44.7
D1B	47	18.9	42	17.2
D2B	165	66.3	172	70.5
IDS	15.4	6.2	19	7.8
P1A	99	39.8	94	38.5
P2A	56	22.5	57	23.4
D2AH	18	7.2	22	9.0
D2MH	-	-	4.4	1.8
D2PH	11	4.4	14	5.7
DCS	6.1	2.4	1.7	0.7
PTL	136	54.6	138	56.6
CPH	6.9	2.8	9.2	3.8
CDM	46	18.5	41	16.8
CVM	66.1	26.5	62	25.4
CDH	6	2.4	9	3.7
CVH	8	3.2	11	4.5
CTL	123	49.4	109	44.7
DSA	75	30.1	81	33.2
D1H	67	26.9	52	21.3
D1P1	65.3	26.2	74	30.3
D1P2	97	39.0	104	42.6
D2P1	82	32.9	76	31.1

to be continued.

TABLE 1 (continued).

Measurement	<i>H. alphus</i>			
	Holotype (male)		Paratype (female)	
	CAS 201902		CAS 86425	
	mm	% BDL	mm	% BDL
D2P2	59	23.7	65	26.6
P2P	81	32.5	82	33.6
EYL	23.6	9.5	24.9	10.2
EYH	16	6.4	21	8.6
POR	26.3	10.6	33.6	13.8
PRN	21	8.4	28.7	11.8
WSD	10.3	4.1	13.5	5.5
CLT	38	15.3	–	–
CLM	18	7.2	–	–
CLL	17	6.8	–	–
FTL	17.2	6.9	–	–

TABLE 2. Measurements of the lateral line canal system of *Hydrolagus alphus* sp. nov. from the Galapagos Islands and *H. macrophthalmus* from Chile.

Measurement	<i>H. alphus</i>				<i>H. macrophthalmus</i>	
	Holotype (male)		Paratype (female)		n = 4	
	CAS 201902		CAS 86425		Chile	
	mm	% HDL	mm	% HDL	mm	% HDL
ONC	2.7	5.1	4.7	7.7	4.4–6.7	6.3–9.1
LRC	2.3	4.3	3.1	5.1	1.9–3.7	2.7–4.6
LNC	14.3	27.0	15.4	25.2	14.3–24.2	21.0–30.8
IOA	14.2	26.8	16.6	27.2	11.2–18.9	16.5–22.5
OTM	25.4	47.9	29.6	48.5	26.3–34.5	38.7–41.2
OCL	15.1	28.5	18.1	29.7	10.3–17.9	15.1–24.2
STL	11.4	21.5	12.6	20.7	10.4–16.6	14.8–22.4
SPS	6.0	11.3	7.6	12.5	5.5–10.5	8.1–14.2

Color. Uniform chocolate brown when live, with superficial bluish sheen depending on angle of light. Areas around the opercular, rostral, predorsal, and abdominal regions may be slightly darker. Medial, pectoral, pelvic, and caudal fins are dark slate or blackish grey with a slight bluish hue, and all the fins have a narrow white band on the terminal edge. The low median area between the anterior and posterior sections of the second dorsal

is entirely white. The first dorsal, pectoral and pelvic fins show a narrow blackish band on the posterior edge of the fins adjacent to the white terminal band. The dorsal axial area of the pectoral region is usually whitish, and specimens have one well-defined white spot on their lateral sides above the pectoral fin, sometimes one or more white spots not as well-defined may occur in the abdominal or anterior caudal regions also. The pigment around the outer margins of the eye is a blackish brown, and the tapetum lucidum reflects a celadon green. Coloration of the main body in preserved specimens is a uniform brown to dark brown, with white margins on the tips of the fins and a distinct white spot (4%–6% BDL) on the lateral side, mid-body above the pectoral fin. Second dorsal fin is dark anteriorly and posteriorly, center region distinctly white in color.

Habitat. The adjacent substrate at sites of capture varied between slopes and ledges containing large volcanic boulders, cobbles, and gravels, frequently overlain by, or interspersed with, patches of sand and coarse silt. The rocky areas were completely devoid of algae, but often had sparse to dense encrustations of benthic invertebrates such as stony corals, sponges, crinoids, hydroids, gorgonians, and bryozoans. Holothurans and ophiuroids were also present. All four specimens of *Hydrolagus alphas* were caught or observed within three meters of the substrate.

Etymology. The specific name, *alphus* (Latin, adj.), means white spot on the skin and is in reference to a key characteristic found in this species.

Common name. We propose the English common name of “whitespot ghostshark” in keeping with the Latin translation and key characteristic.

Interspecific Comparisons. There is at least one additional species that occurs within the Galapagos Islands region in addition to *Hydrolagus alphas*. A new *Hydrolagus* species, *Hydrolagus mccoskeri*, was discovered during the same surveys of the Galapagos Islands as in this study (Barnett *et al.*, 2006). *Hydrolagus mccoskeri* is distinct from *H. alphas* in coloration and fin sizes. Most notably, *H. mccoskeri* contains numerous white markings on the body different than the single white spot found on *H. alphas*. The second dorsal fin is uniform in height in *H. mccoskeri* with a marginal rise in the anterior portion, whereas in *H. alphas* the anterior and posterior regions of the second dorsal fin are considerably taller than the middle region, with the middle region white in *H. alphas*. The pectoral and pelvic fins are smaller in *H. mccoskeri*. Distribution of the two species also differs. *Hydrolagus alphas* occurs in deep pre-abyssal waters (about 600–800 m), while *H. mccoskeri* occurs in more shallow waters, at depths of 400 m (Barnett *et al.*, 2006).

Hydrolagus alphas is distinct from *Hydrolagus macrophthalmus*, most notably in coloration and the appearance of a white spot on the lateral side. In addition, the size of the tail region from insertion of pelvic fins to origin of dorsal caudal fin, the structure (shape and size) of the second dorsal fin, eye length, snout morphology, lengths of lateral line canals in the head and secondary sexual characteristics also differ. Coloration of preserved *Hydrolagus macrophthalmus* is an even brown with no white markings or white coloration pattern. *Hydrolagus alphas* is also brown, but with a distinctive white spot found on the

lateral side above the pectoral fin or abdominal region. The tail region from insertion of pelvic fins to origin of dorsal caudal fin in *H. macrophthalmus* is elongate and slender and always greater than 60% BDL. The tail region in *H. alphas* is short and stout and always less than 57% BDL. The second dorsal fins in *H. alphas* and *H. macrophthalmus* have anterior and posterior regions that are lobed and significantly taller than the middle region. However, the anterior region in *H. alphas* is 7.2–9.0% BDL as compared to 3.8–5.6% BDL in *H. macrophthalmus*, and posterior regions are taller in *H. alphas*, 4.4–5.7% BDL versus 2.2–3.8% BDL in *H. macrophthalmus*. The eyes are larger in *H. alphas* (greater than 40% HDL) than in *H. macrophthalmus* (less than 39.5% HDL). The snout of *H. macrophthalmus* is clearly more pointed at the tip, whereas in *H. alphas* it is blunt. Lateral line canals in the head, particularly IOA, OTM, and OCL of *H. alphas* are longer than in *H. macrophthalmus* (table 2). Lastly, secondary sexual characteristics differ between species in that the length of the frontal tenaculum is longer in *H. alphas* (32.5% HDL) than in *H. macrophthalmus* (16.5–20.3% HDL). The pre-pelvic tenacula in *H. alphas* contains four hooks on the outer margin whereas in *H. macrophthalmus* it contains three hooks. However, it is important to note that number of hooks on the pre-pelvic tenacula varies intraspecifically, so this feature alone is not sufficient to distinguish the two species.

Discussion

The new species *Hydrolagus alphas* sp. nov. may be restricted to the Galapagos as this is the only locality in which it is found. Endemism of fishes in the Galapagos Islands with low dispersal capabilities has been shown to be high (Grove and Lavenberg, 1997), and preliminary data from deepwater fishes (McCosker et al., 1997) also indicates a high degree of endemism. This suggests that *Hydrolagus alphas* sp. nov. may likely be endemic to the Galapagos Archipelago as well, but only thorough deepwater surveys of the Pacific coasts of Central and South America will bear this out. Chimaeroids have features consistent with species that tend to be more geographically restricted. They are oviparous, depositing large egg cases in mud or attached to stones on the sea floor (Bigelow and Schroeder, 1953). This mode of reproduction in chimaeras is not affected by ocean currents which normally facilitate dispersal of eggs and larval fishes in the open ocean. In addition, chimaeroids have a morphology consistent with slow swimming. Their large wing-like pectoral fins and flapping motion do not promote speed or the ability to swim long distances, thus their potential for long-distance dispersal is limited.

Key to the Eastern South Pacific species of *Hydrolagus*

- 1a. Light brown or tan coloration with numerous white markings on body.... *H. mccoskeri*
- 1b. Uniform dark brown coloration with few or no white markings on body 2
- 2a. Body with no white markings on lateral side; snout tip pointed; slight raise in anterior

- portion of second dorsal fin with shallow notch medially; eyes 33.8-39.3% HDL; tail region from insertion of pelvic fins to origin of dorsal caudal fin extremely long and slender (always > 60 % BDL)..... *H. macrophthalmus*
- 2b. Body with one white spot on lateral side above pectoral fin or in abdominal region; snout tip blunt; anterior and posterior regions of second dorsal fin lobate with indented white middle region; eyes large (40.8-44.5% HDL); tail region from insertion of pelvic fins to origin of dorsal caudal fin short and stout (always < 57 % BDL)
.....*H. alphas*

Comparative material

Hydrolagus mccoskeri — 1 specimen. **CAS** 86558, juvenile female, 381 mm TL, 274 mm PCL, 211 mm BDL, southeast of San Cristobal Island, Galapagos (01°5.981'S, 89°12.235'W), 396.24 m, collected by J.E. McCosker (CAS), R. Grant Gilmore (HBOI) and Bruce Robison (MBARI), 17 Nov. 1995 (JSL dive 3934)

Hydrolagus macrophthalmus — 4 specimens (Chile). **MNHNC P.** 7282 (E.B.M.Ch.10.192), **holotype**, adult male, at time of description 625 mm TL, currently 385 mm TL (due to damage of specimen), 360 mm PCL, 296 BDL, preabyssmal zone off Valparaiso, January, 1959; **MNHNC P.** 5724, adult male, about 445 mm TL, 365 mm PCL, 296 BDL, off Valparaiso (33°02', 71°39'W), determined by Ismael Kong U., 15 Sept 1974; **MNHNC P.** 6421 (A), adult female, 627 mm TL, 425 mm PCL, 355 mm BDL, vessel R/V Academic Knipovich, (41°04'5" S, 74°16'1" W), determined by Augusto Cornejo C., 300 m, 02 Mar 1973; **MNHNC P.** 6421 (B), adult female, 572 mm TL (tail broken), 493 mm PCL, 424 mm BDL, same information as (A).

Hydrolagus macrophthalmus — 7 specimens (Peru). **HUMZ** 185708, adult female, 560 mm TL, 415 mm PCL, 342 mm BDL, Eastern Pacific, Peru (9-42.5'S - 9-43'S, 79-35.5'W - 79-43.5'W), 785 m; **HUMZ** 185709, adult male, 527 mm TL, 355 mm PCL, 358 BDL, Eastern Pacific, Peru, (9-42.5'S - 9-43'S, 79-35.5'W - 79-43.5'W), 787 m; **HUMZ** 167821, adult female, 515 mm TL, 420 mm PCL, 346 mm BDL, Eastern Pacific, Peru (10-12.2'S - 10-10.8'S, 79-06.3'W - 79-06.7'W), 1056 m; **HUMZ** 167443, adult Female, 636 mm TL, 424 mm PCL, 357 mm BDL, Eastern Pacific, Peru (9-20.5'S - 9-19.5'S, 79-47.7'W - 79-48.4'W), 1160 m; **HUMZ** 167820, adult female, 594 mm TL, 425 mm PCL, 353 mm BDL, Eastern Pacific, Peru (10-12.2'S - 10-10.8'S, 79-06.3'W - 79-06.7'W), 1056 m; **HUMZ** 167128, adult male, 612 mm TL, 391 mm PCL, 320 mm BDL, Eastern Pacific, Peru (9-03.7'S - 9-06.5'S, 80-00.7'W - 80-00.6'W), 872 m; **HUMZ** 173320, adult female, 540 mm TL, 420 mm PCL, 346 mm BDL, Eastern Pacific, Peru (3-56.2'S - 4-03.4'S, 81-16.8'W - 81-11.8'W), 590 m.

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