



## *Acanthemblemaria aceroi*, a new species of tube blenny from the Caribbean coast of South America with notes on *Acanthemblemaria johnsoni* (Teleostei: Chaenopsidae)

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### Abstract

*Acanthemblemaria aceroi* new species is described from the upwelling region of the Caribbean coasts of Venezuela and Colombia. It differs from its closest relative, *Acanthemblemaria rivasi* Stephens, 1970, known from Panama and Costa Rica, in the posterior extent of the infraorbitals, details of head spination, and unique COI sequences. The description of *Acanthemblemaria johnsoni* Almany & Baldwin, 1996, heretofore known only from Tobago, is expanded based on specimens from islands offshore of eastern Venezuela.

**Key words:** Chaenopsidae, *Acanthemblemaria*, barnacle blennies, southern Caribbean, upwelling zone

### Introduction

*Acanthemblemaria rivasi* was described by John Stephens in 1970 based on specimens from the Caribbean coasts of Panama and Costa Rica (type locality, Puerto Limón, Costa Rica). The description of this species was expanded by Smith-Vaniz & Palacio (1974) based on additional specimens from Costa Rica and Panama and later by Acero (1984) based on specimens from Colombia and Venezuela. The latter study noted minor meristic and body size differences between individuals from South America and Central America and attributed these to cooler water temperatures along the northern coast of South America. Subsequent collections from the coasts of Venezuela permitted further study of specimens from this area including comparison of molecular sequence data with specimens from Panama (Eytan *et al.* 2012). These additional data revealed distinctive genetic differences that warrant recognition of the South American form as a new species. The current study documents morphological differences and describes the new species from northern South America. In addition, recent collections from off-shore islands of eastern Venezuela revealed several specimens of *Acanthemblemaria johnsoni*, previously known only from Tobago. These specimens expand the known range of this species and provide additional data on head spination and coloration of this poorly known species.

### Materials and methods

Measurements were made on preserved specimens using needle-point dial calipers. Head spination terminology follows Hastings (1990). Institutional abbreviations follow Sabaj (2019). Micro-CT scans of specimens were made with a Bruker 1173 scanner in the Karel Liem Imaging Facility at Friday Harbor Labs. Color photographs of specimens were provided by P. Humann, D.R. Robertson, and J. Van Tassell.

***Acanthemblemaria aceroi* sp. nov.**

“Blue-spotted Barnacle Blenny”

(Figs. 1–3)

**Synonymy:** *Acanthemblemaria rivasi* (in part): Acero 1984.

**Holotype.** SIO 02-106 (40.8 mm SL), Mochima National Park, Venezuela; approximately 10° 18.62' N, 64° 33.7' W; found within vacant barnacle tests.

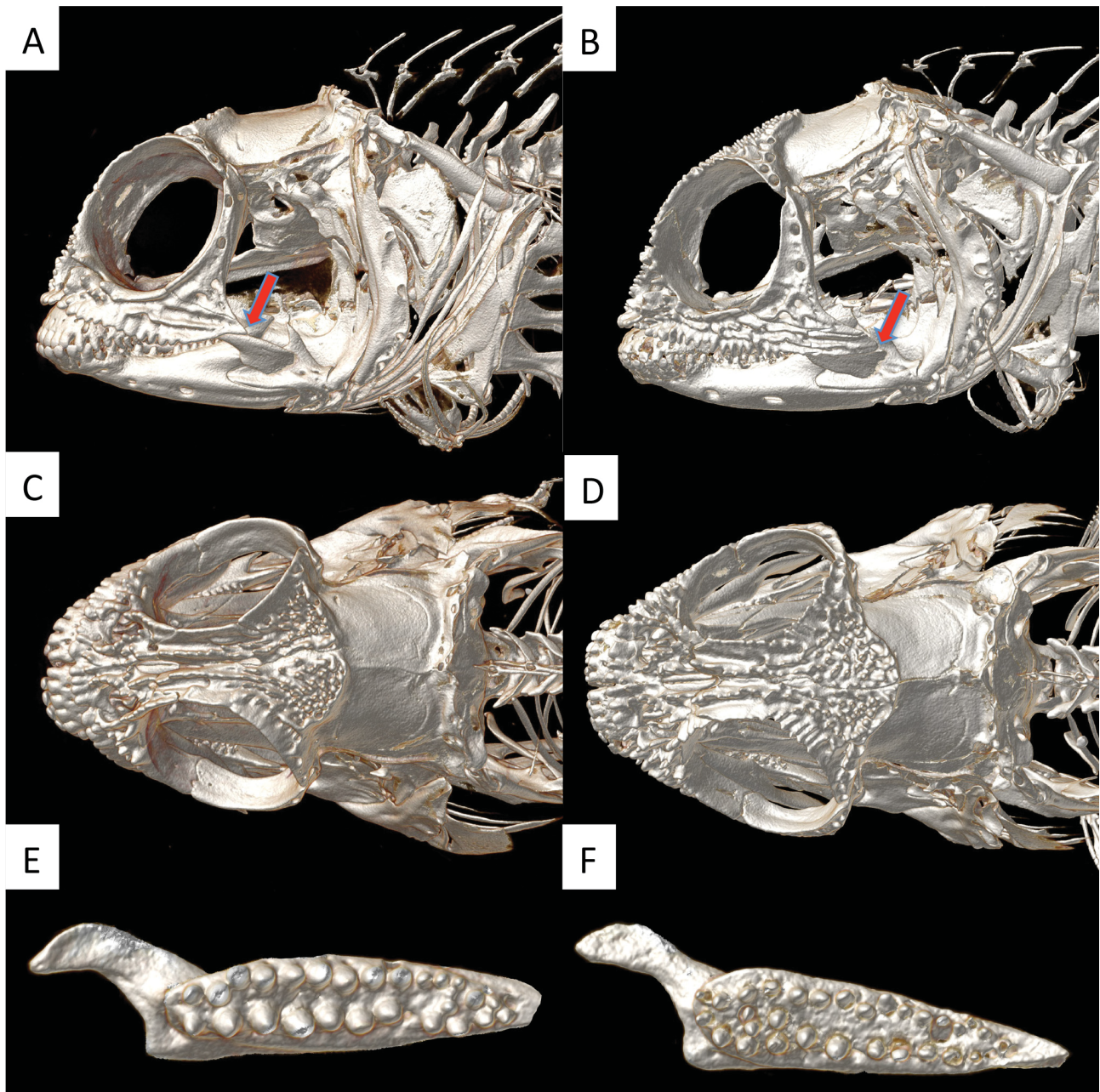
**Paratypes.** Venezuela: AMNH 241424 (1, 27.9 mm SL), La Cienga, Ocumare de la Costa, Aragua, 10° 29.3' N, 67° 48.2' W; AMNH 247576 (12, 22.1–29.1), Taguarumo, Isla Caracas, Parque Nacional Mochima, Sucre, 10° 15.83' N, 64° 28.85' W; AMNH 249352 (1) Islas Los Monjes del Sur, 12° 21.63' N, 70° 54.17' W; AMNH 249362 (3, 17.5–29.7), Isla Los Monjes del Norte, 12° 29.01' N, 70° 54.96' W; ANSP 147650 (5, 20.7–27.8), Punta Morón, approximately 10° 30' N, 68° 8.99' W; SIO 02-6 (1, 34), Mochima National Park near Puerto La Cruz, approximately 10° 18.62' N, 64° 33.7' W; SIO 02-106 (3, 28–33), collected with the holotype; SIO 06-277 (2, 25–27), Isla Caracas, Parque Nacional Mochima, approximately 10° 15.8' N, 64° 28.8' W; SIO 08-182 (4, 24–28), Los Monjes, 12° 29.1' N, 70° 54.93' W.

**Diagnosis.** Unique within the *hancocki* group of the genus *Acanthemblemaria* (*sensu* Hastings & Robertson, 1999) in having a combination of the following: a short posterior extent of the infraorbitals ending well before the posterior tip of the maxilla, a smooth supraorbital margin, field of frontal wedge spines intersecting orbit at the anteriormost supraorbital sensory pore well anterior to the junction of the upper infraorbital and frontal, and a profusion of fine blue dots on head and anterior body.



**FIGURE 1.** A) Holotype of *Acanthemblemaria aceroi* (SIO 02-106; preserved specimen); B) Radiograph of holotype of *A. aceroi*; C) Micro-CT scan of a paratype of *A. aceroi* (ANSP 147650, 27.8 mm SL).

**Description.** Dorsal fin with XXI–XXIII spines and 12–14 rays, 33–36 total elements (Table 1). Anal fin with II spines and 21–25 rays. Pectoral fin with 13 rays. Eleven to twelve precaudal vertebrae, 29–30 caudal vertebrae and 41–42 total vertebrae (holotype 11+30=41).



**FIGURE 2.** Micro-CT scans of two species of *Acanthemblemaria*. A) Lateral view of head of *Acanthemblemaria aceroi* (ANSP 147650, 27.8 mm SL); B) Lateral view of head of *A. rivasi* (SIO 03-141, 28.3 mm SL); C) Dorsal view of head of A); D) Dorsal view of head of B); E) Isolated palatine bone of A); F) Isolated palatine bone of B). Arrows in A) and B) indicate posterior extent of infraorbitals.

Head with well-developed spines on several cranial bones of adults; spines smaller and less numerous in juveniles. Adults with postero-dorsal portion of frontals covered with short rounded spines extending in a wedge from well anterior of junction with dorsalmost infraorbital. Holotype (largest known specimen) with two spines on right side fused into a ridge perpendicular to posterior margin of wedge, otherwise all spines on frontal wedge separate. Supraorbital margin of frontal smooth to slightly crenulate anteriorly in holotype. Interorbital region of frontal with two well-developed central rows of 5–6 spines on raised ridge; lateral interorbital row absent. AFO spine large and bladelike. Nasal bones fused, each with a row of 4–6 well-developed, blunt spines that curve laterally around medial margin of posterior nostril. Anterior margin of nasals above upper lip with three blunt spines on each side. Orbital

margin of lateral ethmoid with a series of 3–4 blunt spines and a single enlarged spine ventrally. Orbital margin of anterior infraorbital with ridges and a single enlarged spine anteriorly; ventral margin with 15–16 well-developed knob-like spines along anterior two thirds of its length, posterior one third smooth, lacking spines. Central area of anterior infraorbital with a few blunt spines anteriorly and ridges posteriorly. Orbital margin of posterior infraorbital smooth. Lower and upper infraorbitals with a posterior extension ending well before posterior end of jaw (Fig. 2A); posterior extension with a prominent central ridge but no spines.

Body relatively deep, body depth 5.6 times in standard length. Head large, robust, its length approximately four times in standard length. One pair of typically unbranched supraorbital cirri, length one half to two thirds orbital diameter; occasionally shallowly branched in about 10 percent of specimens (Acero 1984). Nasal cirri on anterior nostrils branched. Posterior nostrils with a raised rim along anterior margin.

Dorsal fin single, slightly notched between spinous- and soft-rayed portions. Caudal fin truncate. Upper jaw large (length about 1.8 times in head length), extending beyond level of posterior margin of orbit. Palatine with a double row of teeth, about 13 in inner row and 11 in outer row (Fig. 2E)

Measurements (mm) of holotype: standard length 40.8; maximum head length 10.5; snout to opercular membrane insertion 9.0; upper jaw length 5.5; bony orbital diameter 2.5; iris diameter 2.2; snout length 2.0; interorbital width 1.2; predorsal length 8.0; preanal length 18.6; caudal peduncle depth 3.0; maximum body depth 7.3; body depth at anal-fin origin 6.6; supraorbital cirrus length 1.6 (left side, right side missing).

Cephalic pore counts (left side only except where noted for holotype; number of specimens in parentheses; \*holotype): mandibular: 4(21\*); common: 1(2\*), 2(19\*; holotype with 1 on right side); preopercular: 5(21\*); post-temporal: 4(21\*); lateral supratemporal: 3(16\*), 4(5\*; holotype with 4 on right side); median supratemporal: 3(21\*); anterior infraorbital: 3(21\*); posterior infraorbital: 3(1), 4(20\*); supraorbital: 2(1), 3(7), 4(13\*); frontal: 0(8), 1(3), 2(10\*), 3(4); commissural: 1(8), 2(13\*); anterofrontal: 1(1), 2(20\*); nasal: 1(21\*).

Coloration of male holotype in preservative (Fig. 1A): snout, upper jaw and lower jaw lightly pigmented with numerous small melanophores. Head from anterior orbit to posterior margin of operculum, dark with densely spaced and expanded melanophores. Black spots or blotches present at posterior tip of upper jaw, operculum and branchiostegal membranes: left side with one spot above posterior tip of jaw, three black blotches on lower operculum and four on branchiostegal membranes; right side with one black spot at posterior tip of lower jaw, one on lower preopercle, two on operculum and three on branchiostegal membranes. Body and abdomen densely covered with melanophores, those along lateral aspect of body concentrated in broad bars extending to dorsal midline: two over abdomen, five on body between anal-fin origin and insertion, becoming less distinct posteriorly; areas between bars less pigmented. Dorsal fin covered with dense melanophores, numerous anteriorly decreasing in density posteriorly. Membrane between first and second dorsal-fin spines with a prominent black spot covering most of membrane. Proximal anal fin covered with dense melanophores; distal tips of rays white. Caudal fin with melanophores along rays (none on membranes). Pectoral-fin base covered with dense melanophores extending outward onto fin, including rays and membrane. Pelvic fin with dense melanophores along rays and membranes, less dense along anterior margin of first ray. Very fine light spots evident on head and anterior dorsal fin (these correspond to blue dots seen in living specimens; Fig. 3).

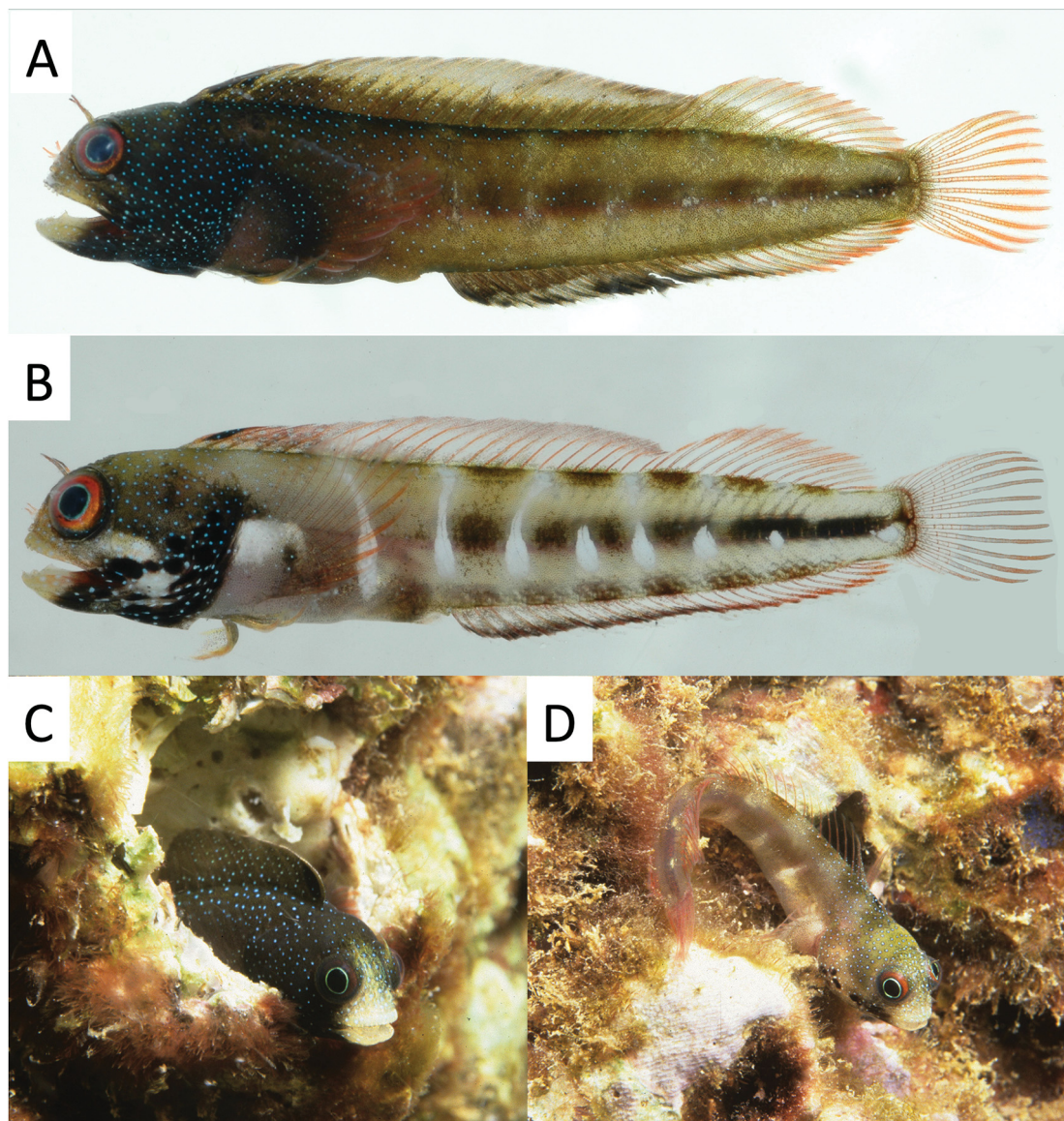
Coloration of other specimens in preservative variable, especially in extent and concentration of melanophores. Prominent black spots on lower posterior portion of head variable in number, size and location. One to three spots near posterior tip of jaw; some specimens with spots both above and below jaw, and some with large and variously fused spots. Operculum with one to five spots, preopercle area with none to three spots, and branchiostegal membranes with three to twelve spots. Some specimens with branchiostegal membranes densely covered with melanophores and no evident spots. Smaller males and females less dark on head and body but bars present on body.

In life, sexually mature males (Fig. 3A,C) melanistic with black obscuring underlying coloration except for upper and lower jaws and interorbit that lack pigment, and faint whitish bars along body. Numerous blue dots cover body, head, and anterior dorsal fin. Iris dark with narrow yellowish internal ring around pupil (Fig. 3C). Anterior dorsal fin with a narrow reddish margin; posterior dorsal fin with red along fin rays. Anal fin with a dark distal margin; proximal anal fin dark anteriorly, with red along rays posteriorly. Caudal fin with red along rays. Non-melanistic individuals (Fig. 3D) light brown with evident lateral bars, distinct black spots on posterior jaw and across branchiostegal membranes. Iris orange with an inner blue ring. Fine blue spots cover head and anterior body.

The underlying pigment pattern of freshly caught males and females variable. Female photographed shortly after capture (Fig. 3B) with melanophores on head concentrated in a narrow ring around posterior margin of orbit, on

operculum and ventrally across branchiostegal membranes and posterior half of lower jaw. Dark spots present along posterior jaw and on branchiostegal membranes. Distinct white areas on head and body located in a crescent from lower orbit to branchiostegal membranes, anterior of pectoral fin, and laterally along body in seven bars separating dark bars and extending to dorsal midline anteriorly, restricted to midline posteriorly. Dark bars interrupted posteriorly, appearing as dark saddles dorsally, dark blotches along midline (elongate along caudal peduncle) and dark blotches above anal fin. Head and anterior body covered with fine blue dots. Iris distinctly orange with inner blue ring. Supraorbital cirrus dark, nasal cirrus reddish. Anterior dorsal fin with a black spot between first and second spines, few faint melanophores anteriorly and distally on spinous portion, with red along spines and rays. Similar red along rays of pectoral, caudal, and anal fins. Anal fin with a dark distal margin, grading to reddish posteriorly. A dark spot at base of pectoral fin. Pelvic fin tinged with yellowish orange.

**Distribution.** *Acanthemblemaria aceroi* occurs along the northern coast of South America including Colombia and Venezuela. It appears to be restricted to the southern Caribbean upwelling system that extends from Trinidad (61.1° W) to Barranquilla, Colombia (75.51° W; Rueda-Roa & Muller-Karger 2013). A significant biogeographic break in this region has been identified for other groups including catfishes of the genus *Cathrops* (Betancur *et al.* 2010)



**FIGURE 3.** Color photographs of *Acanthemblemaria aceroi*. A) Freshly caught male, AMNH 249352, Monje del Sur; B) Freshly caught female, 25 mm SL, AMNH 249362, Monje del Norte; C) Photograph of living presumed male; D) Photograph of living presumed female or juvenile. A) and B) provided by James van Tassell; C) and D) provided by Paul Humann.

**Etymology.** *Acanthemblemaria aceroi* is named for Arturo Acero Pizarro, who first documented meristic differences between populations of “*A. rivasi*” from Central and South America, in recognition of his contributions to ichthyology, including the systematics of chaenopsid blennies. The common name “Blue-spotted Barnacle Blenny” refers to the profusion of fine blue spots on the head, anterior body and dorsal fin.

**Comparisons.** *Acanthemblemaria aceroi* can be distinguished from other Atlantic members of the genus (excluding its closest relative, *A. rivasi*) by its stout body, relatively short, rounded head spines, simple typically unbranched supraorbital cirrus, and distinctive red to orange iris with a narrow, bright blue inner ring. It differs from the similar *A. rivasi* in having: 1) a shorter posterior extent of the infraorbitals ending well short of the posterior tip of the maxilla (extending to near the tip in *A. rivasi*; Fig. 2A,B); 2) a smooth supraorbital margin (spines or serrations present in *A. rivasi*; Fig. 2C,D); 3) a smaller frontal wedge of spines that intersects the orbital margin at the anteriormost supraorbital sensory pore well anterior to the junction of the upper infraorbital with the frontal (frontal wedge intersects the orbital margin at the posteriormost supraorbital pore and at the junction with second infraorbital with the frontal in *A. rivasi*; Fig 2A-D); 4) fewer, larger teeth on the palatine (Fig. 2E,F); and 5) modally higher meristic counts, especially of the total dorsal-fin elements (Table 1). In addition, the COI sequence of the new species differs from that of *A. rivasi* by 4.4–4.7 percent (Eytan, pers. observ.). Based on data from several genes, Eytan *et al.* (2012) estimated the divergence time of the two species as 0.97 million years (range = 0.38–1.71).

**Remarks.** Acero (1984) indicated that specimens of “*A. rivasi*” from South America are larger than those from Central America. The largest known specimen of *A. aceroi* from Venezuela is the 40.8 mm SL holotype (SIO 02-106) and the largest reported from Colombian waters is 40.4 mm SL (Acero 1984), while the largest specimen of *A. rivasi* from Panama is 32.0 mm SL (SIO 07-69). The larger body size of the new species may be related to its occurrence in colder, more productive waters compared to the closely related species from Central America. Acero (1984) noted similar meristic and body size differences in Central and northern South American populations of *Acanthemblemaria betinensis*. The genetics of this form have not been examined but may reveal significant differences that warrant recognition of two separate species in the southern Caribbean.

**Comparative material examined:** *A. rivasi*. Panama: SIO 67-45 (1, 16 mm SL; paratype) Toro Point; SIO 71-272 (3, 23–28) San Blas; SIO 71-286 (3, 20.5–28.5) San Blas; SIO 01-09 (1, 24), San Blas; SIO 03-141 (7, 22–28) Bahia Azul, Bocas del Toro; SIO 07-69 (3, 26–32), Portobello.

**TABLE 1.** Frequency of meristics for *A. aceroi* and *A. rivasi*. Data for *A. aceroi* from Colombia and Venezuela (Col. & Ven.), and *A. rivasi* from Central America (C. America) are from Acero (1984). \* = holotypes.

	Dorsal-fin spines			Dorsal-fin rays				Total dorsal-fin elements					Anal-fin rays				
Number of elements	21	22	23	11	12	13	14	32	33	34	35	36	21	22	23	24	25
<i>A. aceroi</i> (Venezuela)	-	10*	19	-	1	22	3*	-	-	-	10	17*	-	-	7	19*	2
<i>A. aceroi</i> (Col. & Ven.)	5	81	21	-	9	78	20	-	1	3	73	30	1	8	48	49	-
<i>A. rivasi</i> (C. America)	14	22*	-	1	12*	23	-	1	1	23*	11	-	1	17	17*	1	-

### *Acanthemblemaria johnsoni* Almany & Baldwin 1996

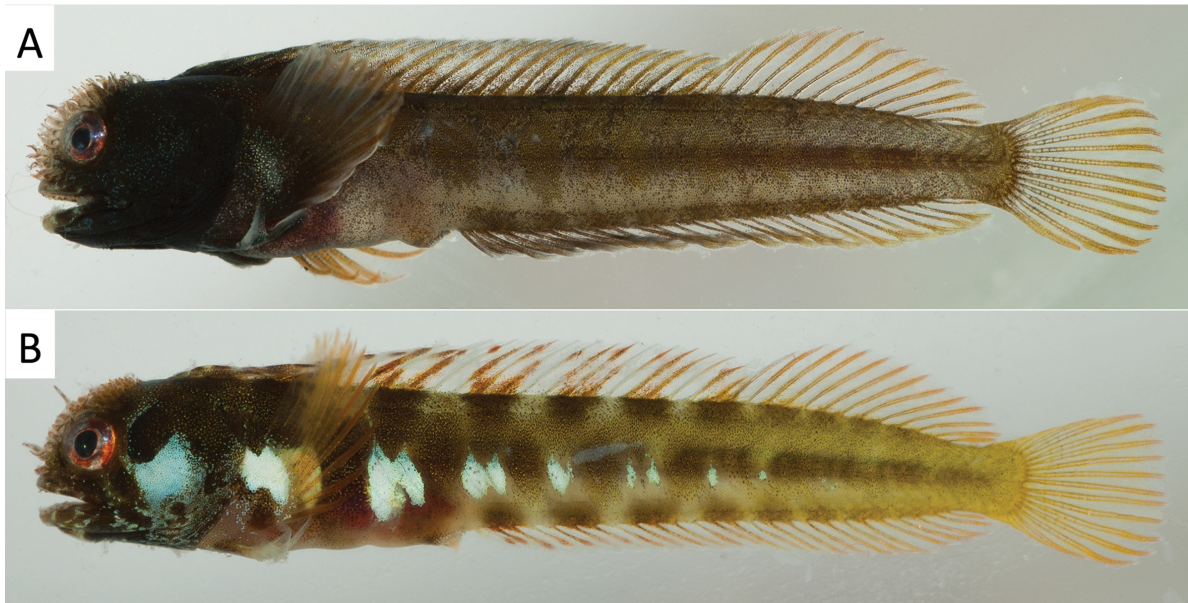
“Black Barnacle Blenny”

(Fig. 4)

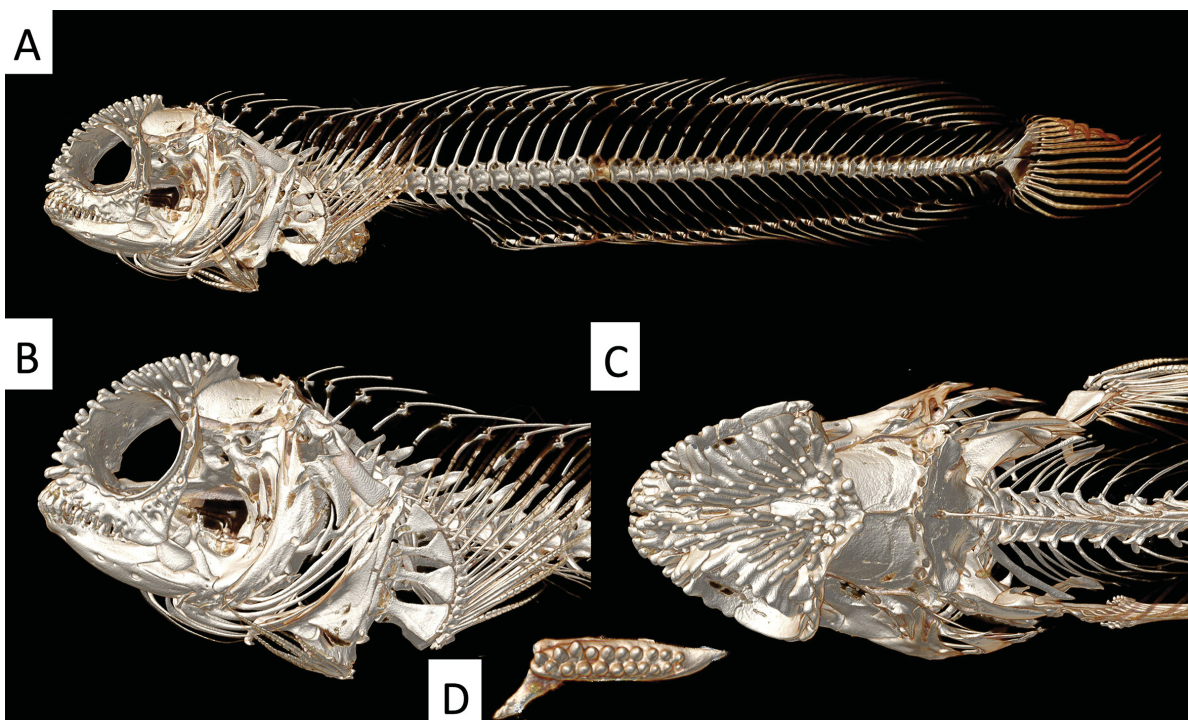
This species was described based on six small specimens (14.1–24.0 mm SL) from Tobago (Almany & Baldwin 1996). Recent collections from islands off the eastern coast of Venezuela revealed several additional specimens, including large adults. Examination of these and photographs of freshly caught specimens warrant additional notes on this species.

Meristics of specimens from Venezuela are similar to those from Tobago but expand the known range slightly: dorsal-fin spines XXIII–XXV (XXIV in type specimens); 12–13 dorsal-fin rays (12–13); 36–37 total dorsal-fin elements (36–37); and 23–25 anal-fin rays (24–25). The head spination is dense in this species, especially on the

frontal wedge and interorbital region (Fig. 4). The tips of the frontal spines in the smallest specimens are fleshy, as described for the holotype and paratypes (Almany & Baldwin 1996). However the largest specimens have the entire spines fully ossified all the way to the blunt tips. This implies an ontogenetic trajectory of ossification of spines within this species and is analogous to the phylogenetic trajectory of head-spine ossification hypothesized within *Acanthemblemaria* (Böhlke 1957; Hastings 1990).



**FIGURE 4.** Color photographs of freshly caught *Acanthemblemaria johnsoni*, AMNH 247613, from Isla Testigo Grande. A) Male; B) Presumed female. Provided by James van Tassell.



**FIGURE 5.** CT-scans of *Acanthemblemaria johnsoni*, SIO 06-274. A) Lateral view of entire specimen; B) Lateral view of head; C) Dorsal view of head; D) Isolated palatine bone.

**Coloration.** Large males completely black on head and body (Fig. 4A). Lateral body densely covered with melanophores with hints of bars. Anterior spinous dorsal fin black, grading to less pigmented posteriorly. Soft dorsal-fin rays, caudal-fin rays and posterior anal-fin rays tinged with yellow. Anterior anal fin dark with a darker

band distally and a light distal margin. An apparent female (Fig. 4B) is much lighter in coloration with a series of seven white blotches along midline starting on cheek and extending to below origin of soft dorsal fin, decreasing in size posteriorly. Those on body set off above and below with dark blotches, two over abdomen and eight above anal fin. Lateral blotches reflected in mottled reddish pigment along spinous dorsal fin. Soft dorsal-fin and anal-fin rays reddish, grading to yellowish posteriorly; caudal-fin rays and caudal peduncle yellowish; pectoral fin reddish. Iris orange with scattered blue.

**Distribution and remarks.** *Acanthemblemaria johnsoni* is now known to range from Tobago to islands off-shore of eastern Venezuela. It appears to be restricted to the eastern portion of southern Caribbean upwelling system that extends from Trinidad (61.1° W) to Barranquilla, Colombia (75.51° W; Rueda-Roa & Muller-Karger 2013). The common name of “Black Barnacle Blenny” is proposed in reference to the coloration of mature males and the group of tube blennies to which it apparently belongs.

**Specimens examined.** *Acanthemblemaria johnsoni*: Tobago: USNM 317211 (4, 19.5–25.5 mm SL; paratypes), North Point; Venezuela: AMNH 249131 (13, 23.5–35.0 mm SL), North end of Cayo Nordeste, 11° 24.75' N, 63° 02.83' W; SIO 01-176 (1, 34.5), Islas Testigos, approximately 11° 22.34' N, 63° 7.12' W; SIO 06-274 (3, 28–30 mm SL), Isla Testigo Grande, 11° 23.2' N, 63° 7.4' W.

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## References

- Acero P., A. (1984) The chaenopsine blennies of the southwestern Caribbean (Pisces: Clinidae: Chaenopsinae). II. The genera *Acanthemblemaria*, *Ekemblemaria* and *Lucayablennius*. *Revista de Biología Tropical*, 32, 35–44.
- Almany, G.R. & Baldwin, C.C. (1996) A new Atlantic species of *Acanthemblemaria* (Teleostei: Blennioidei: Chaenopsidae): morphology and relationships. *Proceedings of the Biological Society of Washington*, 109, 419–29.
- Betancur-R., R., Acero P., A., Duque-Caro, H. & Santos, S.R. (2010) Phylogenetic and morphologic analyses of a coastal fish reveals a marine biogeographic break of terrestrial origin in the Southern Caribbean. *PLoS ONE*, 5 (7), e11566. <https://doi.org/10.1371/journal.pone.0011566>
- Böhlke, J.E. (1957) The Bahaman species of emblemariid blennies. *Proceeding of the Academy of Natural Sciences, Philadelphia*, 109, 25–57.
- Eytan, R.I., Hastings, P.A., Holland, B.R. & Hellberg, M.E. (2012) Reconciling molecules and morphology: molecular systematics and biogeography of Neotropical blennies (*Acanthemblemaria*). *Molecular Phylogenetics and Evolution*, 62, 159–173. <https://doi.org/10.1016/j.ympev.2011.09.028>
- Hastings, P.A. (1990) Phylogenetic relationships of tube blennies of the genus *Acanthemblemaria* (Pisces: Blennioidei). *Bulletin of Marine Science*, 47, 725–38.
- Hastings, P.A. & Robertson, D.R. (1999) *Acanthemblemaria atrata* and *Acanthemblemaria mangognatha*, new species of eastern Pacific barnacle blennies (Chaenopsidae) from Isla del Coco, Costa Rica, and Islas Revillagigedo, Mexico, and their relationships with other barnacle blennies. *Revue Française d'Aquariologie Herpétologie*, 25, 107–18.
- Rueda-Roa, D.T. & Muller-Karger, F.E. (2013) The southern Caribbean upwelling system: Sea surface temperature, wind forcing and chlorophyll concentration patterns. *Deep-Sea Research*, 78, 102–114. <https://doi.org/10.1016/j.dsr.2013.04.008>
- Sabaj, M.H. (2019) *Standard symbolic codes for institutional resource collections in herpetology and ichthyology: an online reference. Version 7.1. 21 March 2019*. American Society of Ichthyologists and Herpetologists, Washington, D.C. Electronically accessible. Available from: <https://www.asih.org/> (accessed 29 June 2020)
- Smith-Vaniz, W.F. & Palacio, F.J. (1974) Atlantic fishes of the genus *Acanthemblemaria*, with description of three new species and comments on Pacific species (Clinidae: Chaenopsinae). *Proceeding of the Academy of Natural Sciences, Philadelphia*, 125, 197–224.
- Stephens, J.S. Jr. (1970) Seven new chaenopsid blennies from the western Atlantic. *Copeia*, 1970, 280–309. <https://doi.org/10.2307/1441651>