



Three new species of triplefin blennies of the genus *Enneanectes* (Teleostei, Tripterygiidae) from the tropical eastern Pacific with a key to Pacific species of *Enneanectes*

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Abstract

Three new species of the triplefin blenny genus *Enneanectes* found in the Pacific Ocean off southern Mexico are described. Two, *Enneanectes glendae* and *Enneanectes macrops*, are mainland species, while the third, *Enneanectes exsul*, is endemic to the Islas Revillagigedo. A key to the five species of *Enneanectes* known from the tropical eastern Pacific is provided.

Key words: Blennioidei, southern Mexico, Islas Revillagigedo

Introduction

The triplefin blenny genus *Enneanectes* Jordan & Evermann, 1896 currently includes two described species from the eastern Pacific and six from the western Atlantic (Rosenblatt 1960; Lubbock & Edwards 1981; Williams 2003). The genus is characterized by an interrupted lateral line with the anterior portion composed of pored scales originating above the pectoral girdle and the posterior portion, located along the midline, composed of notched scales. Palatine teeth are absent, the pelvic fins are separate, there is a single supraorbital cirrus on each eye, and the top of the head is covered with numerous small, close-set spines. The genus *Enneanectes* has a confused nomenclatural history, most recently discussed by Smith & Williams (2002) who invoked Article 70.3.2 of the Code of Zoological Nomenclature (ICZN 1999) to fix the type species as *Tripterygium carminale* Jordan & Gilbert, 1882 based on the designation of a neotype by Brock (1940). The present study formally describes three long recognized species found in the waters off southern Mexico (Rosenblatt 1959), and provides a key to the five species found in the tropical eastern Pacific. Additional undescribed species reportedly occur in the western Atlantic (Williams 2003).

Material and methods

Methods of counting and measuring generally follow Hubbs & Lagler (1958). The last ray of the dorsal and anal fins, divided at the base in most specimens, was counted as one. Pored and notched lateral line scales are reported separately. Scales in the notched series lacking a distinct notch were included in the count if the scales anterior and posterior to it were notched. “Lateral scale rows” is the number of rows above the pored lateral line, continuing posteriorly to the caudal fin. Scale rows above the lateral line were counted in an oblique row between the pored lateral line and the base of the third spine of the second dorsal fin. Scales below the lateral line were counted in an oblique row between the pored lateral line and the fourth soft ray of the anal fin. Upper or lowermost scales less than half the size of other scales were counted as ½. Measurements were made to the nearest 0.1 mm with dial

calipers or dividers and converted to thousands of standard length (SL). Mean values are given in parentheses. Head depth is the vertical distance between the occiput and isthmus; pectoral-fin length is the length of the longest ray; fin-base lengths are the distance between insertions of the first and last elements; caudal peduncle length is the oblique distance between the insertion of the last anal-fin ray and the hidden base of the middle caudal-fin ray. Meristic data are given in Table 1. Institutional abbreviations follow Levinton *et al.* (1985).

TABLE 1. Meristic data for eastern Pacific species of *Enneanectes*. Number of specimens with each count are indicated.

	Second Dorsal-Fin Spines						Dorsal-Fin Soft Rays				
	X	XI	XII	XIII	XVI	XV	7	8	9	10	11
<i>E. glendae</i>	-	-	1	5	34	1	-	4	34	4	-
<i>E. macrops</i>	-	4	62	1	-	-	-	7	65	1	-
<i>E. exsul</i>	-	-	22	-	-	-	-	21	2	-	-
<i>E. carminalis</i>	1	5	44	-	-	-	2	74	2	-	-
<i>E. reticulatus</i>	-	-	88	4	-	-	-	-	32	63	1

TABLE 1. (Continued)

	Right Pectoral-Fin Rays				Anal-Fin Soft Rays					
	14	15	16	17	15	16	17	18	19	20
<i>E. glendae</i>	-	3	29	4	-	-	-	-	30	10
<i>E. macrops</i>	6	104	2	-	-	4	38	5	-	-
<i>E. exsul</i>	-	21	-	-	1	22	-	-	-	-
<i>E. carminalis</i>	1	78	2	-	6	35	-	-	-	-
<i>E. reticulatus</i>	-	10	93	4	-	-	9	74	12	1

TABLE 1. (Continued)

	Pored Lateral Line Scales					Notched Lateral Line Scales							
	14	15	16	17	18	16	17	18	19	20	21	22	23
<i>E. glendae</i>	-	-	1	13	-	-	-	-	-	5	5	1	3
<i>E. macrops</i>	-	-	8	80	3	-	17	36	6	3	-	-	-
<i>E. exsul</i>	4	13	2	-	-	-	1	10	1	-	-	-	-
<i>E. carminalis</i>	32	43	4	-	-	2	9	46	19	2	-	-	-
<i>E. reticulatus</i>	2	41	65	10	-	-	-	-	35	61	15	1	-

TABLE 1. (Continued)

	Longitudinal Scale Rows								
	28	29	30	31	32	33	34	35	36
<i>E. glendae</i>	-	-	-	-	-	-	3	8	2
<i>E. macrops</i>	-	-	-	2	22	5	-	-	-
<i>E. exsul</i>	-	1	4	-	-	-	-	-	-
<i>E. carminalis</i>	2	22	46	5	1	-	-	-	-
<i>E. reticulatus</i>	-	-	-	1	26	58	15	-	-

***Enneanectes glendae* sp. nov.**

“Slender triplefin”

(Figs. 1 & 2)

Enneanectes “species C”: Robertson & Allen 2008, Erisman *et al.* 2011.

A total of 228 specimens from 16 collections, all from Pacific waters of Mexico.

Holotype. SIO 11-394 (formerly UCLA 58-10), 26.8 mm SL male; Mexico, Nayarit, Ensenada Chacala, off Punta Chacala; bottom of sand at foot of boulder slope at a depth of 12 m; collected 26 Jan. 1958 by F. Munz, J. Stephens & J. Quast.

Paratypes. Nayarit: SIO 11-394, 6 specimens (14.6–26.4 mm SL), Ensenada Chacala, collected with the holotype; SIO 11-393 (formerly UCLA 58-5), 9 (12.8–22.4), Ensenada Chacala, S. edge of small point inside Punta Chacala, below village of Chacala; SIO 70-167, Nayarit, Bahía Chamela, 40 (25–30.5); CAS 235202, same as SIO 70-167, 2 (27–30); LACM 58001-1, same as SIO 70-167, 2 (28–29); USNM 410090, same as SIO 70-167, 2 (27–30). Islas Marias: SIO 62-19-61B, Isla María Madre, 5 (23–27); SIO 62-20-61E, Isla María Madre, 2 (24–25); SIO 10-134, Isla María Cleofas, 5 (23–24); SIO 62-55-61L, Isla María Cleofas, 51 (12.5–27); SIO 10-142, Isla San Juanito, 4 (15–22.5). Jalisco: SIO 01-182, Puerto Vallarta, 54 (12–29); SIO 70-169, Bahía Banderas, 7 (25–30); SIO 70-163, Bahía Navidad, 7 (25–30); UW 151893, same as SIO 70-163, 1 (28). Colima: SIO 70-158, Manzanillo, 12 (23–26.5). Guerrero: SIO 70-155, White Friars, 13 (25.5–29.5).



FIGURE 1. Holotype of *Enneanectes glendae* sp. nov. (SIO 11-394, 26.8 mm SL).

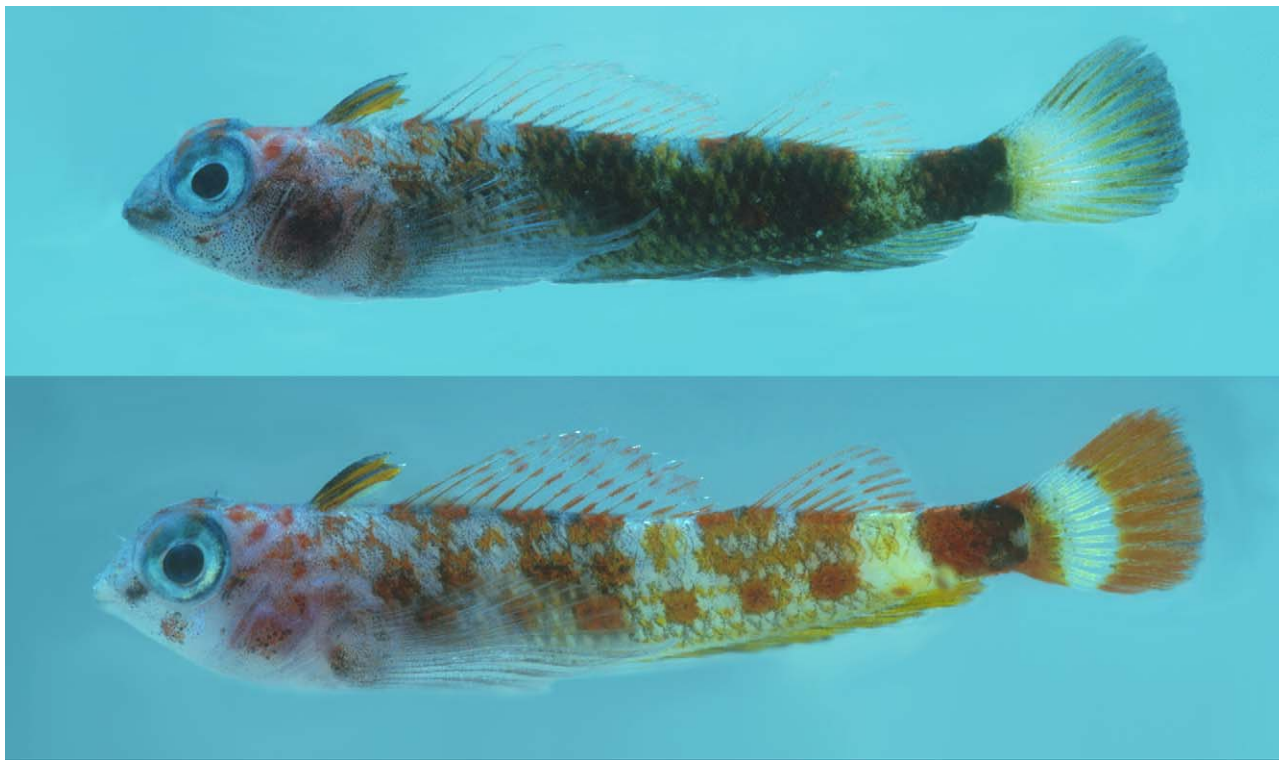


FIGURE 2. Color photographs of male (above) and female (below) of *Enneanectes glendae* sp. nov. (photographs by D.R. Robertson).

Additional material. SIO 10-139, Islas Marías, Isla María Madre, 2 (15.5–17); SIO 10-151, Islas Marías, Isla San Juanito, 1 (15.5); SIO 10-150, Isla San Juanito, 9 (14–19).

Diagnosis. A slender-bodied species of *Enneanectes* with a large eye, no scales on opercle, 34–36 longitudinal scale rows, 19–20 segmented anal-fin rays, no dorsal soft rays branched at tip, females weakly barred and breeding males almost black.

Description. First dorsal fin with three spines; second dorsal fin with 12–15 (13.8) spines; third dorsal fin with 8–10 (9) segmented rays. Anal fin with two spines and 19–20 (19.2) segmented rays. Pectoral fin with 15–17 (16) rays; central rays branched with upper 1–2 and lower 7–8 unbranched. Lateral line discontinuous with 16–17 (16.9) pored scales in upper portion and 20–23 (21.1) notched scales in lower portion. Lateral scale rows 34–36 (34.9); scales above pored lateral line 2 or 2 ½; scales below pored lateral line 5.

Measurements of 16 specimens expressed as thousands of SL (means in parentheses). Head length 284–311 (299); postorbital length 126–149 (137); head depth 170–194 (183); head width 186–211 (197); snout length 85–104 (95); upper jaw length 99–116 (109); eye diameter 98–116 (106); first dorsal spine length 131–147 (138); second dorsal spine length 116–141 (127); third dorsal spine length 95–116 (106); length of third spine of second dorsal fin 180–205 (188); length of third ray of third dorsal fin 151–181 (167); length of second dorsal-fin base 295–338 (317); length of third dorsal-fin base 146–174 (162); length of anal-fin base 408–450 (434); distance from pelvic-fin insertion to anal-fin insertion 241–277 (263); pectoral-fin length 288–360 (320); pelvic-fin length 243–304 (256); caudal peduncle length 146–184 (159); caudal peduncle depth 84–96 (89).

Body slender, relatively elongate; dorsal and ventral outlines almost straight. Head narrowly triangular when viewed from above; outline from opercle to snout slightly convex and slightly constricted under orbits. Snout slightly pointed in lateral view, but not elongate. Profile gently convex between upper lip and orbit, then flat posteriorly to dorsal-fin origin.

Eye large and prominent, placed high on head. Maxilla extending posteriorly to level just under middle of eye. Jaws subequal; lower jaw slightly included in upper. Preopercle free from opercle except for upper one-third of vertical limb. Vertical limb of preopercle inclined posteriorly, gently sloping into horizontal limb. Margin of opercular bone evenly rounded and smooth. Top of head covered with closely set, short slender spinules. Dorsal margin of orbit with a row of spinules extending from level of upper edge of opercle forward to level of posterior nostril; remainder of interorbital margin smooth. Posterior margin of supratemporal canal of cephalic sensory system spinulose. Upper margin of opercle smooth or with a few feeble spines.

Teeth in jaws conical, recurved and sharply pointed, arranged in setiform bands. Teeth of outer rows in each jaw widely spaced and two or three times as large as inner teeth. Vomerine teeth small and closely set, in three irregular V-shaped rows. No teeth on palatine.

Eye with a small, narrowly triangular supraorbital cirrus, set on posterior edge of upper margin, its length less than or equal to interorbital width. Anterior nostril with a short tube surmounted by a simple cirrus, its length about equal to interspace between nostrils. Posterior nostril elliptical, without a tube or cirrus, its opening about twice as large as opening of anterior nostril.

Head pores in double rows on margin of preopercle, infraorbitals and lower jaw. A single median pit on chin, just posterior to symphysis. Two enlarged pores at anterior end of first infraorbital, and two small pores just above upper lip, one at end of each nasal bone. A pair of small interorbital pores, just behind level of posterior nostrils.

First dorsal-fin spine inserted just behind level of mid-opercle. First two spines subequal and set close together; third spine more widely spaced and shorter. Membrane between spines shallowly incised. Membrane between spinous dorsal fins deeply incised. Outline of second dorsal fin more or less even; first spine about two-thirds as long as longest, second to seventh or eighth similar in length, with more posterior spines decreasing in length; last spine about one-fourth length of third spine. Interspace between second and third dorsal fins two or three scales wide. First to fourth rays of third dorsal fin about equal in length; succeeding rays decreasing in length; last ray just less than one-half length of third ray. All dorsal-fin rays unbranched. Anal-fin spines set close together; first about two-thirds as long as second, which is about one-half as long as first anal-fin segmented ray. Outline of anal-fin even with anterior rays somewhat shorter than posterior rays. Antepenultimate ray longest, longer than first ray by one-third. Longest ray, when depressed, falls two scales short of caudal-fin base. Anal-fin membrane shallowly incised, distal one-fourth of anterior margin of each ray free. Pectoral fin extending to a point under last third of second dorsal fin. Pectoral-fin formula variable. In specimens larger than 20 mm SL, upper two to four rays unbranched, succeeding five to seven rays branched, and lower seven or eight rays unbranched. In specimens less

than 20 mm SL, a greater number of rays are unbranched. Pectoral fin pointed in outline; upper margin of fin almost flat, lower margin considerably more rounded; lower unbranched rays thickened. Pelvic fin long, inner ray extending to or almost to anal-fin origin; outer ray about two-thirds as long as inner ray.

Sides completely scaled. Belly and pectoral-fin base naked. No scales on cheek or opercle. Five or six cycloid scales on base of caudal-fin rays. Pored portion of lateral line ending under penultimate dorsal-fin spine. Notched portion of lateral line commencing one to three scales before end of pored lateral line and two scale rows below it.

Genital papilla of males short, conical, surmounted by two thin tentacles. Urogenital region of females much folded with many fleshy processes.

Color of males in alcohol. Body posterior to second dorsal fin dark, almost black. A band under third dorsal-fin slightly lighter. Dark coloration extends forward on lower sides below pored lateral line. Above lateral line body ground color light, with the scales outlined in dark brown by a line passing through outer third of each scale. Pectoral-fin base dark. Lower portion of head dark; head above midline lighter, with scattered melanophores. Snout, underparts of head, and belly light with dark punctulations. Pectoral fins clear, spotted with rather evenly spaced melanophores; spots densest basally and ventrally. Pelvic fins lightly dusted with black. Dorsal-fin rays outlined in black; fin membrane clear, or lightly dusted with melanophores; first dorsal fin darkest. Anal fin dusky. Caudal fin dusky, with basal and distal third darker. Juvenile males similar in coloration to females.

Color of females in alcohol. Body ground color light. Upper sides with three ill-defined dusky bars; first extending from end of first dorsal fin posteriorly to about fourth spine of second dorsal fin, second under middle third of second dorsal fin, and last extending from posterior end of second dorsal fin to middle of third dorsal fin. Caudal peduncle black. Variable number of olive spots outlined in black present along lateral midline. Head generally light, with dusky areas similar to dark areas in males. Belly and underside of head immaculate. Pectoral fin similar to, but lighter than, in males. Pelvic fins clear. First dorsal fin dark; second and third dorsal fins clear. Anal fin evenly and lightly dusted with melanophores. Caudal fin dark distally.

Color in life. The following description is paraphrased from field notes by Boyd W. Walker, based on the holotype and the largest paratype from the same collection, after they had been in formalin for four hours: general color black on lower three-fourths of head and body except for an olive-green bar under posterior one-third of third dorsal fin. Upper one-fourth flushed with red and with brick-red bars. A spot of brick-red over upper anterior margin of eye and one on posterior one-third of eye. First dorsal fin yellow with some brick-red overwash. Second and third dorsal fins clear, with faint, narrow brick-red bars. Anal fin almost black. Caudal fin dark distally, fading at base to olive-yellow, sometimes darker.

Color from photographs (Fig. 2). Males are general very dark compared to females: ground color light with dense concentrations of melanophores, especially on the lateral body. Body mostly covered with dense melanophores with lighter areas (corresponding to those in females) under the anterior and posterior portions of the second dorsal fin, under the posterior portion of the third dorsal fin. Lateral line scales outlined with melanophores, but obscured in heavily pigmented areas. Dorsum with irregular blotches of pale red and yellow, somewhat obscured by melanophores. Caudal peduncle completely covered by a dark saddle, with a light notch at midline of its posterior margin. Caudal fin white proximally, with a dusting of melanophores on distal half. Head with black smudge on opercle, an indistinct subocular bar extending toward tip of snout, a faint spot of melanophores under eye, and pale reddish blotches on nape. First dorsal fin yellow-orange, with scattered melanophores mostly along spines. Second and third dorsal fins light. Anal fin and pectoral-fin base with dense melanophores. Females are more colorful than males: ground color light, with most scales outlined by melanophores, and orange saddles and orange and yellow blotches on body; lower body above anal fin with four orange blotches. Caudal peduncle saddle reddish brown anteriorly, grading to black posteriorly, with a light notch at midline of posterior margin, followed posteriorly by a distinct orange bar covering base of caudal fin, a distinct white bar covering proximal half of fin, and a broad, orange bar covering posterior half of fin. Head coloration similar to that of males, but less dark, with a subocular bar extending toward snout, a blotch of melanophores under eye and reddish blotches on nape. First dorsal fin similar to that of males: yellow-orange with melanophores along anterior spines. Second and third dorsal fins light with faint diagonal stripes formed by pigment on spines and rays. Anal fin yellow to yellow-orange posteriorly. Pectoral-fin base with scattered melanophores.

Comparisons. Among the eastern Pacific tripterygiids, *Enneanectes glendae* is most likely to be confused with the young of *Crocodilichthys gracilis*, but differs from that species in the lower dorsal- and anal-fin counts, spinose head, larger scales and lack of strong barring on the sides. In addition, the ranges of the two forms probably

do not overlap, *C. gracilis* being restricted to the Gulf of California. It is possible that very young of *Lepidonectes* would lack scales on the cheeks and opercles and could be confused with *E. glendae*, but *Lepidonectes* species have a much longer pored lateral line and a much shorter notched lateral line. *Enneanectes glendae* is quite distinctive compared to other species of *Enneanectes* (Rosenblatt 1959). Its slender body and head, large eye, lack of scales on the opercle, small scales, and simple dorsal-fin rays immediately distinguish it from all other eastern Pacific species of the genus. In addition, breeding males of *E. glendae* are black, while those of other eastern Pacific *Enneanectes* species are red ventrally. Similarly, *E. glendae* differs from all western Atlantic species in the genus in having a relatively slender body and high scale counts.

Range. Known from coastal areas of the eastern Pacific from Ensenada Chacala, Nayarit, Mexico southward to Guerrero and Islas Tres Marias, Mexico.

Etymology. Named in honor of Glenda Rosenblatt, wife of the senior author.

***Enneanectes macrops* sp. nov.**

“Mexican Triplefin”

(Figs. 3 & 4)

Enneanectes “species A”: Robertson & Allen 2008; Erisman *et al.* 2011.



FIGURE 3. Holotype of *Enneanectes macrops* sp. nov. (SIO 11-394, 36.6 mm SL).



FIGURE 4. Color photograph of *Enneanectes macrops* sp. nov. (photograph by D.R. Robertson).

A total of 399 specimens from 28 collections, all from the Pacific waters of Mexico.

Holotype. SIO 11-394 (formerly UCLA 58-10), 36.6 mm SL male; Mexico, Nayarit, Ensenada Chacala, off Punta Chacala; bottom of sand at foot of boulder slope at a depth of 12 m; collected 26 Jan. 1958 by F. Munz, J. Stephens & J. Quast.

Paratypes. Sinaloa: LACM 9333-5 (formerly UCLA 51-20), Mazatlán, 8 (29.3–37); SIO 11-397 (formerly UCLA 51-52), Mazatlán, Islas Venados, 10 (25–37); SIO 11-398 (formerly UCLA 51-29), Mazatlán, Islas Venados, S. end of Isla Lobos, 10 (25.7–37.4); SIO 11-399 (formerly UCLA 51-54), Mazatlán, Isla Venado, shoreward side of isthmus, 8 (26–36); SIO 11-400 (formerly UCLA 51-58), Mazatlán, Islas Venados, 10 (33–38).

Nayarit: SIO 11-394 (formerly UCLA 58-10), 1 (34.5), collected with the holotype; SIO 12-62 (formerly UCLA 58-2), Ensenada Chacala, N. side of Punta Chacala, 15 (12.9–37.5); SIO 11-393 (formerly UCLA 58-5), S. edge of small point inside larger point at Chacala Village, 70 (11–37); SIO 12-63 (formerly UCLA 58-11), $\frac{3}{4}$ mi. S. of point forming S. end of Ensenada Chacala 40 (9.5–28.5). Islas Tres Marias: SIO 62-19-61E, Isla Maria Madre, 18 (12–38); SIO 62-20-61F, Isla Maria Madre, 8 (21–35); SIO 62-55-61I, Isla Cleofas, 25 (20.5–38); SIO 62-56-61D, Isla Cleofas, 24 (13–38); SIO 62-58-61F, Isla Maria Magdalena, 4 (21–26); Jalisco: SIO 70-163, Bahia Navidad, 19 (11.3–41.5); SIO 70-165, Bahia Chamela, 12 (10–38); SIO 70-167, Bahia Chamela, 24 (12.5–38); UW 151894, same as SIO 70-167, 1 (34); SIO 70-169, Bahia Banderas, 11 (11.5–32.5); SIO 01-182, Puerto Vallarta, 22 (18–43). Colima: LACM 9051-32, N. of Manzanillo, 4 (23.5–37.3); LACM 50143 (formerly UCLA 56-231), Manzanillo, Ensenada Carrizal, across bay from Manzanillo, 1 (23.6); SIO 70-158, Manzanillo, 7 (19.5–32.5); SIO 12-64 (formerly UCLA 56-232), W. end of Playa de Santiago about 10 miles NW of Manzanillo, 10 (21.5–29.6). Guerrero: LACM 48727-6 (formerly UCLA 52-112), Puerto Marques, near Acapulco, 1 (34); LACM 49967-3 (formerly UCLA 56-18), Acapulco, Isla La Roqueta, 3 (20.8–32); SIO 70-155, Acapulco, White Friar, 31 (18–39.5); CAS 235203, same as SIO 70-155, 2 (33–40); LACM 58002-1, same as SIO 70-155, 2 (30–32); USNM 410091, same as SIO 70-155, 2 (32–36); USNM 65483, Acapulco, 1 (36).

Diagnosis. A thick-bodied species of *Enneanectes* with a large eye, no enlarged scale in pectoral axil, lower sides body with a prominent brown network outlining scales and lacking horizontal brown lines.

Description. First dorsal fin with three spines; second dorsal fin with 11–13 (11.9) spines; third dorsal fin with 8–10 (8.9) segmented rays. Anal fin with two spines and 16–18 (17) segmented rays. Pectoral fin with 14–16 (15.0) rays; central rays branched with upper 1–2 and lower 7–8 unbranched. Lateral line discontinuous with 16–18 (16.9) pored scales in upper portion and 17–20 (17.9) notched scales in lower portion. Lateral scale rows 31–33 (32.1); scales above pored lateral line $2\frac{1}{2}$; scales below pored lateral line $5\frac{1}{2}$.

Measurements of 26–46 specimens expressed as thousands of SL (means in parentheses). Head length 326–358 (337); postorbital length 151–177 (162); head depth 155–212 (188); head width 227–270 (251); snout length 97–112 (105); upper jaw length 145–165 (156); eye diameter 95–125 (106); first dorsal spine length 129–170 (147); second dorsal spine length 112–183 (134); third dorsal spine length 85–123 (116); length of third spine of second dorsal 154–191 (176); length of third ray of third dorsal 145–202 (167); length of second dorsal-fin base 286–332 (302); length of third dorsal-fin base 151–186 (172); length of anal-fin base 382–435 (410); distance from pelvic-fin insertion to anal-fin insertion 285–346 (302); pectoral-fin length 282–343 (317); pelvic-fin length 151–236 (176); caudal peduncle length 122–153 (144); caudal peduncle depth 89–112 (94).

Body relatively stout. Head broadly triangular when viewed from above; outline convex from opercle to anterior margin of orbit, slightly constricted at this point; snout broadly rounded. Upper lip well in advance of eye. Profile between upper lip and eye with a gradual slope when viewed from side; outline from eye to dorsal-fin origin flat.

Eye large and prominent, placed high on head; entire upper margin entering outline of head; lower margin opposite eighth or ninth pectoral-fin ray. Upper and lower jaws similar in length; upper jaw ending between a vertical from midpoint of eye and rear margin of pupil. Upper one-fourth to one-third of vertical limb of preopercle adnate to opercle. Upper limb of preopercle vertical and straight. Preopercular angle broadly rounded. Shape of rear margin of opercle variable, sometimes evenly rounded, but often flat or concave above level of pectoral-fin base. Rear margin of opercle spiny above pectoral-fin base, smooth below.

Top of head posterior to interorbital area covered with small, closely-set spines. Nasals and entire orbital margin (frontals, lateral ethmoids and infraorbitals) spinose in large specimens. Spinose increases with growth: small specimens (25 mm SL and below) have fewer head spines; spines on nasals and infraorbitals present only in large specimens.

Supraorbital cirrus well developed, flaplike with a low distal fringe, a little broader than long, its length about equal to interorbital width. Anterior nostril with a short tube bearing a cirrus on its posterior margin; nasal cirrus flaplike, its length approximately equal to pupil diameter. Posterior nostril oval, lacking a tube or cirrus.

Teeth in jaws conical, recurved and sharply pointed, arranged in setiform bands. Teeth of outer rows in each jaw widely spaced and two or three times as large as inner teeth. Vomerine teeth small, conical and closely set, in two irregular V-shaped rows. No teeth on palatine.

First dorsal-fin spine inserted over level of anterior third of opercle. First dorsal fin low; first spine much shorter than third spine of second dorsal fin; spines graduated, third notably shortest. Small spinules sometimes present along anterior margin of first spine and distal tips of more posterior spines. Outline of second dorsal fin

even; first spine only a little shorter than longest spine (third or fourth). Third through ninth spines about equal in length and succeeding spines shorter; last spine slightly less than half as long as third. Second ray of third dorsal fin longest. Middle five to seven dorsal soft rays usually branched, although there may occasionally be as few as four or as many as eight branched rays in third dorsal fin; last element typically double. Anal-fin spines set close together; first from two-thirds to three-fourths as long as second, which is a little more than half as long as first anal-fin soft ray. Posterior rays of anal fin longer than anterior rays. Antepenultimate ray longest, about one and one-eighth times as long as first ray. Longest ray, when depressed, falls about one-half scale short of caudal-fin base. Anal-fin membrane shallowly incised; distal one-fourth of anterior margin of each ray free. Last anal-fin element typically double. Pectoral fin short, extending posteriorly to under penultimate dorsal-fin spine. Though rather pointed in outline, pectoral fin more rounded than in most species of *Enneanectes*. Pectoral fin typically with one (rarely two) upper unbranched rays, seven branched rays and seven lower unbranched rays (rarely 6 or 8). Pelvic fin short, ending about one-half pupil diameter before anus.

Sides completely scaled; first two scales above lateral line equal in size. Opercular scale patch well-developed, extending ventrally to opposite fourth pectoral-fin ray insertion (opposite lower margin of pupil); three or four scales wide dorsally tapering to one scale wide ventrally. Cheek and pectoral-fin base naked. Belly squamation variable, from completely covered with cycloid scales (including the holotype) to scales present only along sides, to occasional specimens with no belly scales. No enlarged scale in pectoral axil.

Genital papilla of males short, conical, lacking tentacles. Urogenital region of females much folded with many fleshy processes.

Color in alcohol. Body ground color light, almost white. Sides with five dark brown bars. First bar under first to fourth spines of second dorsal fin, second under sixth to ninth spines of second dorsal fin, third under posterior half of interdorsal space, fourth under fourth or fifth to seventh or eighth rays of third dorsal fin, last covering posterior third to half of caudal peduncle. Anterior three bars extend ventrally slightly below level of notched lateral line; fourth bar may reach anal-fin base or may end one or two scales above it. Caudal peduncular bar complete and usually widest medially with anterior margin curved to straight. Melanophores between lateral bars and on nape, aligned so as to outline scales. Interspaces between last four bars with melanophores concentrated in narrow secondary bars, especially posteriorly. No horizontal lines on lower sides. Top of head with two main concentrations of melanophores: one just behind eyes roughly in a diamond-shaped patch of dark brown, and a second along a strip-like arc of brown between orbits; this pattern quite striking in some, but obscured with additional pigmentation in others. No large black spot on nape. Interorbit, snout, and upper lip lightly dusted with melanophores. Posterior half of first infraorbital and upper lip just in advance of tip of maxilla lightly pigmented to immaculate. Anterior half of first infraorbital densely pigmented in some, but no well-defined bar present. Coloration of lower lip and chin variable from almost immaculate to dusky. Lower jaw with three or four bar-like pigment concentrations in some, first two extending across chin. Branchiostegal membrane clear, or with a few black dots laterally. Nasal cirrus lightly spotted; supraorbital cirrus densely spotted with black. Lower cheek with a brown bar, which begins beneath pupil and runs down and posterior to rear corner of mouth. A light, diffuse mark just dorsal to cheek bar. Dark brown spot on last infraorbital and a dark brown spot on middle third of preopercular margin. Remainder of cheek with black spots marginally and some clear areas centrally. Opercle lightly spotted with black superficially, and with a deeper brown circular blotch on central third. Pectoral-fin base with irregular brown blotches. Pectoral-fin rays with three to five broad, ill-defined brown bars. Pelvic fins clear. Belly white or with some dark brown spots. Membrane of first dorsal fin blotchy posterior to first two spines, with irregular light and dark areas; clear posterior to third spine. Membrane of second dorsal fin lightly spotted; spots tending to line up as faint oblique bars. Spines of second dorsal fin banded with brown. Three black dots along second dorsal-fin base: first dot between second and third spines, second between sixth and seventh spines, third between eighth and ninth spines. Third dorsal fin lightly and rather evenly dusted with melanophores. Anal fin evenly and lightly spotted with melanophores. In some specimens, anal fin appears barred when folded. Caudal fin of most males black basally, then with a narrow light zone, followed by a black area covering posterior two-thirds. Light area variable in size; width may be one-third of the caudal-fin length. Caudal fin of females basically light, either with three or four narrow brown bars or with brown reticulations.

Color in life (from photograph, Fig. 4). Live specimens similar to preserved specimens except that most dark colors more brown than black, white areas more vibrant and other areas tinged with yellow. Fine melanophores and yellow outlining lateral body scales especially evident. Lateral bars on body tinged with yellow. Iris with radiating

yellow-orange lines. Two subocular bars: one angled forward to middle of jaw; second, more prominent, vertical, angled toward posterior tip of jaw.

Comparisons. Within the eastern Pacific species of *Enneanectes*, *E. macrops* is most similar to *E. reticulatus*, but the two can be distinguished by several features. First, they differ in cheek squamation. Although there is considerable variation in *E. reticulatus*, that species typically has some scales on the cheek while scales are always absent from the cheek of *E. macrops*. Second, in *E. reticulatus* the first scale above the lateral line is much larger than the scale above it, and there is an enlarged scale in the pectoral axil; in *E. macrops* the first two scales above the lateral line are the same size, as are the scales in the pectoral axil. Third, the snout of *E. macrops* is longer, flatter, and less blunt in outline, the eye is larger, and the head bars are not as well developed. Finally, *E. reticulatus* has a series of narrow lines of pigmentation on the body above the anal fin that are lacking in *E. macrops*. Among the western Atlantic *Enneanectes* species, *E. macrops* most closely resembles *E. boehlkei* and *E. atrorus* in lacking enlarged scales above the lateral line and none (or few) scales on the belly. It differs from those species in growing to a larger body size and having the central rays of the second dorsal fin branched (Rosenblatt 1959).

Range. Coastal eastern Pacific Ocean from Mazatlán, Sinaloa, southward to Acapulco, Guerrero, Mexico, including Islas Tres Marias.

Etymology. From the Greek *macros*, long, and *ops*, eye, in reference to the comparatively large eye of this species.

Enneanectes exsul sp. nov.

“Island triplefin”

(Figs. 5 & 6)

Enneapterygius carminalis (not of Jordan & Gilbert 1882). Brock 1940 (in part, Socorro material only).

Enneanectes “species B”. Robertson & Allen 2008.

A total of 31 specimens from 9 collections, all from Pacific waters of Mexico.

Holotype. SIO 11-392 (formerly UCLA 55-156), 25.4 mm male; Mexico, Islas Revillagigedo, Isla Socorro; front point marking southwest end of first cove north of Caleta Binner at a depth of 0 to 3 m, bottom of lava sand, old lava flow and coral with predominant alga *Ralfsia* sp.; collected 5 May, 1956 by R. Rosenblatt and B. Brattstrom.

Paratypes. Mexico, Islas Revillagigedo, Isla Socorro: LACM 31783-7, 5 (13–28); SIO 70-392, 9 (10–30); CAS 235204, same as SIO 70-392, 1 (24); USNM 410092, same as SIO 70-392, 1 (23); SIO 11-395 (formerly UCLA 53-49), Caleta Binner, 1 (18.5); SIO 12-65 (formerly UCLA 55-124), first cove E. of Bahia Braithwaite, 2 (13.9–26); SIO 11-396 (formerly UCLA 55-152), N. edge of Caleta Binner, ½ mile N. of Cabo Rule, 1 (11.2). Islas Revillagigedo, Isla San Benedicto: SIO 70-394, 5 (17–32). Islas Revillagigedo, Isla Clarion: LACM 32096-18, 3 (12–23); LACM 32097-43, 4 (11–23).

Diagnosis. A robust species of *Enneanectes* with a patch of ctenoid scales on opercle, an enlarged scale covering upper 2/3 of pectoral fin axil, first scale above pored lateral line much larger than next scale above it, nasal bones with a row of small spines, and a dark distal spot on second dorsal fin.

Description. First dorsal fin with three spines; second dorsal fin with 12 spines; third dorsal fin with 8–9 (8.1) segmented rays. Anal fin with two spines and 15–16 (15.9) segmented rays. Pectoral fin with 15 rays; central rays branched with upper 1 and lower 7–8 unbranched. Lateral line discontinuous with 14–16 (14.9) pored scales in upper portion and 17–19 (18) notched scales in lower portion. Lateral scale rows 29–30 (29.8); scales above pored lateral line 1½; scales below pored lateral line 4½.

Measurements of four specimens expressed as thousands of SL (means in parentheses). Head length 331–344 (336); postorbital length 154–172 (161); head depth 181–208 (196); head width 246–256 (254); snout length 96–114 (106); upper jaw 140–146 (143); eye diameter 104–116 (110); first dorsal spine length 114–123 (118); second dorsal spine length 102–111 (107); third dorsal spine length 80–82; length of third spine of second dorsal fin 160–164; length of third ray of third dorsal fin 154–173 (162); pectoral fin length 340–390 (364); pelvic fin length 248–265 (257); length of second dorsal-fin base 315–324 (318); length of third dorsal-fin base 160–176 (167); length of anal-fin base 404–429 (422); distance from pelvic-fin insertion to anal-fin insertion 136–150 (144); caudal peduncle length 136–150 (144); caudal peduncle depth 100–112 (104).



FIGURE 5. Holotype of *Enneanectes exsul* **sp. nov.** (SIO 11-392, 25.4 mm SL).



FIGURE 6. Color photograph of *Enneanectes exsul* **sp. nov.** (photograph by D.R. Robertson).

Body relatively stout. Head bluntly triangular when viewed from above; outline strongly convex from opercle to orbit; constricted beneath eye; snout varying from rather narrowly to broadly rounded. Snout not particularly blunt when viewed from side; profile between upper lip and eyes gently sloping. Outline of head between eyes and dorsal origin flat or slightly convex.

Eye large and prominent, placed high on head; upper margin entering outline of top of head; lower margin opposite eighth to tenth pectoral-fin ray. Upper jaw ending posteriorly to a vertical slightly before midpoint of eye. Upper one-fourth or less of preopercle adnate to opercle. Vertical limb of preopercle slightly convex; usually slightly inclined posteriorly. Angle of preopercle broadly rounded. Rear margin of opercle flat or slightly convex from upper corner to a point opposite first or second pectoral-fin ray, then broadly rounded. Flat or concave part of opercular margin spinulose, remainder smooth.

Top of head and posterior one-third to one-half of interorbit covered with closely set spines. Dorsal orbital margin with widely spaced spines. Posterior orbital flange with few spines. Anterior orbital flange smooth, except for a single spine just anterior and ventral to posterior nostril in some specimens. Nasals with a single row of spines. Posterior two infraorbitals with weak spines.

Supraorbital cirrus well-developed, flap-like, about as broad as long; its length just equal to interorbital width. Tip of cirrus flat, but bearing two to four short, finger-like projections. Anterior nostril with a short tube bearing a cirrus on its posterior margin; nasal cirrus flaplike, its length approximately equal to pupil diameter. Posterior nostril oval, lacking a tube or cirrus.

Teeth in jaws conical, recurved and sharply pointed, arranged in setiform bands. Teeth of outer row in each jaw widely spaced and two or three times as large as inner teeth. Vomerine teeth small, conical and closely set, in one or two irregular V-shaped rows. No teeth on palatine.

First dorsal-fin spine inserted just posterior to preopercle (rarely over midpoint of opercle). First dorsal fin low; first spine much shorter than third spine of second dorsal fin; second spine slightly shorter than first; third much shorter than first two. Small spinules sometimes present along anterior margin of first spine and distal tips of more posterior spines. Second and third rays of third dorsal fin equal and longest; first ray about seven-eighths, and last ray about two-thirds as long as second or third rays. Number of branched rays 1–4. Anal-fin spines set close together; first about two-thirds as long as second, which is somewhat less than half as long as first anal-fin soft ray. Posterior rays of anal fin slightly longer than anterior rays; antepenultimate ray longest, about one and one quarter times as long as first ray and when depressed, reaches to caudal-fin base. Anal-fin membrane shallowly incised; distal one-fourth of anterior margin of each ray free. Last element typically double. Pectoral fin extending posteriorly to under, or slightly behind, last dorsal-fin spine, pointed to rounded in outline. Pectoral fin with one upper unbranched ray, seven branched rays and seven lower unbranched rays. Pelvic fin short, ending just before anus.

Sides completely scaled. Under second dorsal fin, scales in first row above lateral line much larger than scales in second row. Opercular scale patch well developed; three scales wide dorsally tapering to one scale wide ventrally and extending ventrally to a point opposite tenth to twelfth pectoral-fin ray (well below lower margin of eye). Cheek with a few tiny, nonimbricate, cycloid scales. Pectoral-fin base naked. An enlarged scale covers upper two-thirds of pectoral-fin axil. Belly fully scaled.

Genital papilla of males short, conical, lacking tentacles. Urogenital region of females much folded with many fleshy processes.

Color in alcohol. Body ground color light tan. Sides with five brown bars. First bar under first to third spines of second dorsal fin, second under seventh to ninth spines, third under interdorsal space, fourth under fourth to seventh dorsal-fin rays, and fifth covering posterior half of caudal peduncle. First bar extends ventrally to level of first pectoral-fin ray, second to slightly below midline, third and fourth to anal-fin base. Caudal peduncular bar darker than others, extending from dorsal to ventral surfaces, widest at midline, slightly narrower ventrally than dorsally. Between bars, brown pigment outlines scales; this reticulated pattern more apparent on lower sides; no secondary bars or lines along scale rows. Top of head dusted with superficial melanophores. Nape with a concentration of deeper-lying brown pigment, which forms a broad V, and a small black spot just in front of dorsal-fin origin. Interorbit and snout lightly and evenly dusted with black. Sides of snout and posterior half of first infraorbital unpigmented. Upper lip dusky medially and, at corner of mouth, typically with an intervening unpigmented area corresponding to an unpigmented area on snout (pigment on sides of snout and upper lip evenly pigmented in the holotype). Pigmentation of lower lip corresponds with that of upper lip. Chin with a few scattered melanophores and lower jaw vaguely mottled. Branchiostegal membrane unpigmented. Nasal cirrus very lightly spotted; suprarbital cirrus densely spotted with black and brown. Lower cheek with a brown bar extending from under middle of pupil posteroventrally to rear corner of mouth. Few scattered melanophores dorsal to this, but second bar absent. Diffuse brown spot present at upper rear corner of orbit; preopercle outlined in dark brown; remainder of cheek unpigmented. Opercle lightly and evenly dusted with black and brown. Pectoral-fin base with a large brown blotch ventrally, otherwise spotted with black. Pectoral-fin rays with four or five irregular brown bars. Pelvic fin and belly unpigmented. Membrane of first dorsal fin brownish black; unpigmented posterior to third spine. Membrane of second dorsal fin with evenly distributed dark brown spots; a dark brown spot distally between second and fifth spines. No discrete spots along second dorsal-fin base. Third dorsal fin with two faint oblique brown bars. Anal fin with six or seven rather indistinct brown bars. Caudal fin evenly brown.

Life colors (from photograph; Figure 6). Coloration similar to preserved specimens except that most dark areas are brown and tinged with yellow or cream. Rust-colored lines radiating across iris. Light areas between bands on body with brown and yellow pigment partially outlining scales. First dorsal fin mottled with cream and brown; second dorsal fin with a dark blotch on membrane between anterior spines and a strong diagonal band of light pigment posteriorly; third dorsal fin similarly banded. Caudal fin with light proximal and distal bands, intervening area brown. Anal fin banded with brown and yellow. Pectoral fin with brown and cream-colored bands.

Comparisons. *Enneanectes exul* is most similar to *E. carminalis* (Jordan & Gilbert 1882) of the eastern Pacific, differing only in the color of the second dorsal fin: a dark blotch is present in *E. exul*. This difference is regarded as indicating specific differentiation, in as much as none of the over 250 specimens of *E. carminalis* examined have a dark blotch on the second dorsal-fin membrane (Rosenblatt 1959). *Enneanectes exul* may be distinguished from the other eastern Pacific species of *Enneanectes* by the presence of a patch of ctenoid scales on

the opercle, an enlarged scale covering the upper 2/3 of the pectoral-fin axil, the first scale above the pored lateral line much larger than the next scale above it, and a row of small spines on the nasal bones. It differs from the western Atlantic species *E. atrorus* and *E. boehlkei* that lack enlarged scales in the pectoral-fin axil and above the lateral line, and from the remaining species in having more numerous pored scales in the lateral line (15–16 versus 11–13).

Range. Restricted to the Islas Revillagigedo where it has been collected from Isla Socorro, Isla Clarion, and Isla San Benedicto.

Etymology. From the Latin *exsul*, an exile, in reference to the island habitat of this species.

Key to eastern Pacific species of *Enneanectes*

- 1a. Opercle naked; scales moderate, in 34–36 longitudinal rows; anal soft rays 19–20; no dorsal soft rays branched at tip; body slender and elongate; head slender; belly naked; females weakly barred; breeding males with pectoral base, lower part of head and most of sides dark, almost black. *Enneanectes glendae* **sp. nov.** (Southern Mexico)
- 1b. A patch of ctenoid scales on upper portion of opercle; scales large, in 28–34 longitudinal rows; anal soft rays usually 15–19 (rarely 20); usually some dorsal soft rays branched at tip (variable); body robust; head broad; scales present or absent from belly; all species strongly barred; breeding males red ventrally 2
- 2a. No enlarged scale in pectoral-fin axil; first two scales above lateral line equal in size; nasal bones smooth or with a few small spines. 4
- 2b. An enlarged scale covering upper 2/3 of pectoral-fin axil; first scale above pored lateral line much larger than the next scale above it; nasal bones with a row of small, distinct spines. 3
- 3a. Membrane of second dorsal fin with a large dark brown spot distally, between second and fifth spines; belly partially scaled *Enneanectes exsul* **sp. nov.** (Islas Revillagigedo)
- 3b. Membrane of second dorsal fin with scattered pigment and a few irregular oblique bars, never with a dark blotch; belly completely scaled *Enneanectes carminalis* Jordan & Gilbert, 1822 (Gulf of California to Panama)
- 4a. Lower sides with horizontal brown lines which parallel scale rows; pored scales in lateral line usually 14–17; notched scales in lateral line 19–22; pectoral fin rays 16 (15–17), with lower 8 rays unbranched (occasionally 15 with lower 7 branched); anal soft rays usually 18 (17–20); eye small, head narrow; belly naked *Enneanectes reticulatus* Allen & Robertson, 1991 (Gulf of California)
- 4b. Lower sides with a brown network which outlines scales, never with horizontal brown lines; pored scales in lateral line 16–18; notched scales in lateral line usually 17–20; pectoral fin rays usually 15 (14–16), with lower 7 rays unbranched; anal soft rays usually 17 (16–18); eye large, head wide; belly naked or with 2–3 rows of scales anterior to anus *Enneanectes macrops* **sp. nov.** (Southern Mexico)

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