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A Preliminary Review of the Eastern Pacific Species of *Elacatinus* (Perciformes: Gobiidae)

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Abstract: *Elacatinus limbaughi* is described as new from the Gulf of California. *Elacatinus digueti* is redescribed and *Elacatinus inornatus* Bussing is synonymyzed with *E. digueti*. Data are presented on geographical variation in *Elacatinus puncticulatus* and *E. digueti.* Species of the genus *Elacatinus* are normally associated with coral reefs and several of the species clean parasites from other fishes. *Elacatinus* is regarded as distinct from *Gobiosoma*, based on vertebral and other characteristics.

Key words: New species, description, taxonomy, *Elacatinus*

Species of the genus *Elacatinus* have often been regarded as congeneric with *Gobiosoma* or one of its current synonyms. Ginsburg, (1933, 1944) revised the species of the nominal genera *Garmannia* and *Gobiosoma*. Ginsburg (1933) recognised *Elacatinus* as a subgenus of *Gobiosoma*, and *Tigrigobius* as a subgenus of *Garmannia*. Böhlke and Robins (1968), dealing largely with Atlantic species, revised *Gobiosoma* and discussed its relationship to other seven-spined genera. They recognised a large genus, *Gobiosoma*, with five subgenera (*Gobiosoma, Garmannia*, *Austrogobius, Elacatinus*, and *Tigrigobius*) and a total of 36 species. They regarded loss of scales as convergent and based their classification largely on head pores and vertebral numbers.

The genus *Gobiosoma*, as defined by Böhlke and Robins (1968), is divided in this study into two genera, *Gobiosoma* and *Elacatinus*. *Gobiosoma* is interpreted as comprising 19 species, and 25 species are referred to *Elacatinus*. As recognized here, the genus *Elacatinus* includes *E. atronasus, E. chancei*, *E. dilepis*, *E. digueti*, *E. evelynae*, *E. figaro*, *E. gemmatus, E. genie, E. horsti, E. illecebrosus*, *E. janssi*, *E. louisae*, *E. macrodon*, *E. multifasciatus, E. nesiotes*, *E. oceanops*, *E. pallens, E. prochilos, E. puncticulatus*, *E. randalli, E. saucrus, E. tenox, E. xanthiprora, E. zebrella* and the species described here. These two and the 16 related genera are most probably confined to the New World (Hoese, 1971).

Atlantic species have been studied extensively (Böhlke and Robins, 1968; Colin, 1975) Recently a new species was added from Brazil (*Elacatinus figaro* Sazima, Moura and Rosa, 1997).

MATERIALS AND METHODS

Counts and measurements follow those given by Hubbs and Lagler (1958), except that the last ray in the second dorsal and anal fins is branched to the base and counted as a single ray. Measurements of eye length were based on the longest length of the eye, measured with an ocular micrometer to two decimal places. The interspinal membrane is the thin membrane connecting the two pelvic spines and is often referred to as the velum or pelvic frenum (Böhlke and Robins 1968). The interradial membrane is the thin membrane connecting the fifth pelvic rays of the two pelvic fins. Vertebral counts include the urostyle. The pterygiophore formula follows Birdsong (1975). Institution abbreviations for material used in this study follows Leviton *et al*. (1985). Material from the University of California, Los Angeles (UCLA) is currently being transferred to the Los Angeles County Museum.

The following comparative material was examined for osteological features:

Elacatinus atronasus, ANSP 112017 (2 specimens), Bahamas; *Elacatinus chancei*, ANSP 112641 (1), Bahamas; *Elacatinus digueti*, SIO 65-351 (8), Gulf of California; *Elacatinus gemmatus*, SIO 67-86 (1), Florida; *Elacatinus limbaughi*, SIO 65-287 (2), Gulf of California; *Elacatinus macrodon*, SIO 67-87 (3), Florida; *Elacatinus multifasciatus*, LACM 7864 (1), St. Thomas, Virgin Is.; *Elacatinus multifasciatus*, ANSP 72208 (1), Bahamas; *Elacatinus oceanops*, SIO 76-90 (3), Florida Keys; *Elacatinus puncticulatus*, SIO 65-336 (2), Gulf of California; *Elacatinus randalli*, ANSP 110674 (2), St. Vincent Is., Lesser Antilles.

Elacatinus **Jordan**

Elacatinus Jordan 1904 (type species, *Elacatinus oceanops* Jordan, 1904: 542, pl. 2, fig. 3, Tortugas Archipelago, Florida, by original designation). Holotype CAS-SU 8365.

Tigrigobius Fowler 1931 (type species, *Gobiosoma macrodon* Beebe and Tee Van, 1928: 226, fig., Port-au-Prince, Haiti, by original designation). Holotype USNM 170896 As subgenus of *Gobiosoma*.

Gobicula Ginsburg 1944 (type species, *Garmannia gemmata* Ginsburg, 1939: 3, fig. 2, Old Providence Island, Caribbean Sea, by original designation). Holotype USNM 107291 As subgenus of *Garmannia*.

The genus *Elacatinus* differs from *Gobiosoma* in having 28 vertebrae (versus 27), more compressed skull, supraoccipital without or with very short lateral wings (versus well developed), exoccipital meeting frontal (versus usually not meeting or with narrow connection only), in having the papillae numbers fixed early in development (versus increasing with size). Eastern Pacific species lack scales on the head and body, with some species having two small basicaudal scales. Some Atlantic species of the subgenus *Tigrigobius* have a few scale rows posteriorly on the body. Species of *Elacatinus* occur on coral reefs or rocky reefs, while species of *Gobiosoma* normally occupy coastal embayments and estuaries and are only rarely found on coral reefs.

Elacatinus limbaughi, **new species**

(Figs. 1, 2)

Elacatinus sp. Allen and Robertson, 1994: 263 (Gulf of California).

Gobiosoma aff. limbaughi Burgess, Axelrod and Hunzinger, 1988: pl. 486 (nomen nudum).

Holotype: SIO 65-263, 28.5 mm male, Isla San José, 18-26 m, July 7, 1965, R. Rosenblatt & party.

Paratypes: GULF OF CALIFORNIA, MEXICO- CAS-SU 18427, 3(20-24), Isla Ildefonso, June 14, 1952; CAS-SU 18428, 7(17-23), Cabo San Lucas, June 20, 1952; LACM 31775-26, 5(14-19), Cerralvo Is., Feb. 3, 1976; LACM 31776-22, 18(13-26), Cerralvo Is., Feb. 7, 1971; LACM W61-030, 1(21), Cabo San Lucas, March 11, 1961; LACM W61-034, 1(21), Isla Cerralvo, March 22, 1961; SIO 61-227, 22(17-25) Cabo San Lucas, 0-23 m, June 12, 1961; SIO 61-272, 23(16-24), Isla Espíritu Santo, 0-15 m, June 24, 1961; SIO 65-263, 5(20-34), Isla San José, 18-26 m, July 7, 1965; SIO 65-270, 7(14-22), Punta Napolo, 0-1 m, July 8, 1965; SIO 65-273, 1(20-32), north of Punta Napolo, 3-9 m, July 8, 1965; SIO 65-280, 1(22), Punta Napolo, 0-11 m, July 9, 1965; SIO 65-299, 2(22-27), Isla Carmen, 15-23 m, July 13, 1965; SIO 65-306, 5(21-32), Isla Santa Inez, 15-18 m, July 14, 1965; SIO 65-312, 4(20-24), Punta Concepción, 8-11 m, July 15, 1965; SIO 65-322, 5(22-28) Isla Carmen, 0-11 m, July 17, 1965; SIO 65-326, 28(18-24), Isla Carmen, 9-12 m, July 18, 1965; SIO 65-329, 10(19-26), Isla Ildefonso, 24-32 m, July 19, 1965; SIO 65-346, 7(19-21), Cabeza de Mechudo, 0-5 m, July 23, 1965; SIO 65-354, 46(12-23), Isla Santa Cruz, 6-9 m, July 22, 1965; UAZ 69-41-22, 8(12-18), Isla San Peder Nolesco, Aug. 10, 1969; UAZ 681228, 1(16), Cabo San Lucas, Dec. 28, 1968: WESTCOASTOF MEXICO- SIO 62-29, 13(12-26), Bahía Banderas, Aug. 18, 1961:

Non-type material: GULF OF CALIFORNIA, MEXICO - Isla Ildefonso: SIO 65-330, 48(17-27); SIO

Key to Eastern Pacific Species of *Elacatinus*

1. Second dorsal fin usually I,11; anal fin usually I,10; head with dark horizontal stripe behind eye. Mexico to Ecuador. . . . . .*Elacatinus puncticulatus*

1. Second dorsal fin usually I,9-10; anal fin usually I,8-9; head with vertical bars, spotted or pale without distinct dark markings. 2

2. Head and body with small dark spots dorsally; base of caudal fin with an upper and lower basicaudal scale with slightly enlarged ctenii; second dorsal fin usually I,9; anal fin usually I,8; snout compressed. Mexico to Panama . . . .*Elacatinus janssi*

2. Head with vertical bars; base of caudal without scales; body with dark bars (often subcutaneous, appearing pale in preserved material); second dorsal fin usually I,10; anal fin usually I.9; snout broadly rounded in dorsal view . .3

3. Body with dark vertical bars externally on body, with smooth edges; dark bars broader than interspaces; pectoral rays usually 20-21. Gulf of California . . . . . *Elacatinus limbaughi*, n. sp.

3 Body with subcutaneous dark bars; if dark bars present externally, then dark bars with wavy margins; pectoral rays usually 17-20 4

4. Body with dark broad bars; pectoral rays 17-19. Galápagos and Isla del Cocos . . . . . .*Elacatinus nesiotes*

4. Body with thin wavy vertical bars, bars dark brown to orange; body often uniformly pale in preservative; pectoral rays usually 17-20. Gulf of California to Colombia. . . . . *Elacatinus digueti*

65-331, 17(19-26); SIO 65-332, 3(20-23). Punta Pulpito: SIO 65-317, 27(19-29); SIO 65-318, 6(19-24); SIO 65-319, 28(22-27). Punta Mangles: SIO 65-336, 38(13-30). Isla Carmen: SIO 65-301, 19(18-32); SIO 65-302, 21(19-24); SIO 65-321, 3(20-22); SIO 65-323, 7(24-26); SIO 65-325, 6(24-26); SIO 65-328, 3(33-36). Isla Santa Catalina: SIO 65-337, 9(22-25); SIO 65-338, 1(22); SIO 65-339, 2(20-22); SIO 65-340, 3(21-22). Bahía Aqua Verde: SIO 65-289, 3(21-40); SIO 65-290, 3(22-31); SIO 65-291, 15(18-28). Isla Santa Cruz: SIO 65-342, 3(19-24); SIO 65-343, 10(19-24). San Telmo: SIO 65-283, 3(19-21); SIO 65-284, 3(20-24); SIO 65-287, 31(18-27). Isla San Francisco: SIO 65-347, 12(13-28); SIO 65-348, 4(24-27). Cabeza de Mechudo: SIO 65-345, 4(20-25). Isla Espíritu Santo: SIO 61-269, 6(12-24); SIO 61-274, 5(18-24); SIO 61-276, 1(22); SIO 61-277, 3(19-20). Isla Cerralvo: SIO 61-262, 1(24). Bahía los Muertos: SIO 61-253, 15(12-23). Punta Pesadero: SIO 61-252, 11(12-22). Los Frailes: SIO 61-239, 4(14-21); SIO 61-242, 11(14-22). San José del Cabo: SIO 61-237, 3(17-19). Cabo San Lucas: SIO 59-215, 9(13-24); SIO 61-225, 1(17); SIO 65-186, 8(16-27). WESTCOASTOF MEXICO - Isla San Ignacio Farallón: SIO 59-228, 3(19-24). Isla Isabella: SIO 62-63, 1(17). Tres Marias Is.: SIO 62-19, 7(12-21); SIO 62-55, 12(13-20); SIO 62-56, 3(18-21); SIO 62-58, 5(15-20). Bahía Banderas: SIO 62-43, 2(13-18).

Diagnosis: This species is distinguished from all other species of *Elacatinus* by the following combination of characters: head plump, more or less rounded, dorsoventrally compressed, head broad, with the anterior outline of the head forming a smooth convex curve when viewed dorsally; most males with one, rarely two, dorsal-fin spines filamentous; first spine reaching to between last first dorsal-fin spine base to fifth second dorsal-fin ray base, occasionally to ninth second dorsal-fin ray base; pectoral rays usually 20-21; second dorsal fin usually I,10; anal fin usually I,9; no basicaudal scales; and body with broad dark brown bands, with smooth vertical margins.

Description: First dorsal-fin spines 7(in 70); segmented caudal rays 17(70); branched caudal rays 11(18), 12(24), 13(27), 14(1); dorsal, anal and pectoral-fin ray counts given in Tables 1 and 2. Mouth slightly oblique, forming an angle of about 30° to 35° with body axis. Maxilla reaching to under pupil, occasionally to rear margin of eye in specimens longer than 28 mm SL. Profile of snout steeply rounded in lateral view. Interorbital narrow, equal to or less than one-half eye

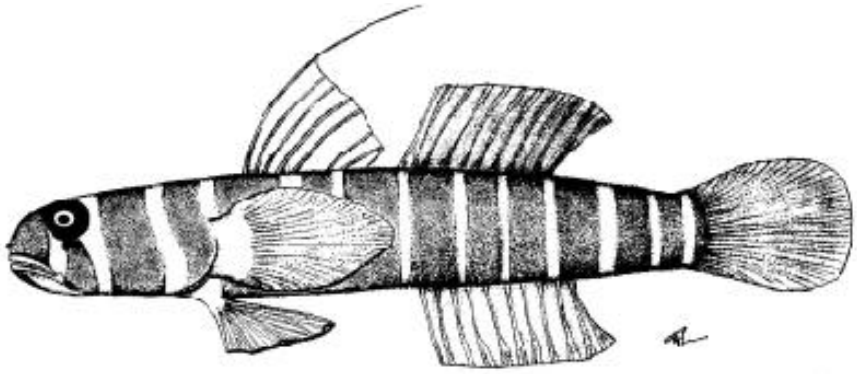

Fig. 1. Holotype of *Elacatinus limbaughi* (drawing by F.J. Hoese).

length. Gill-rakers on outer face of first arch short and slender; those on second and following arches shorter. Mandibular frenum present, without lobes. Anterior nostril with a short tube, posterior nostril with a raised rim. Head and body without scales, no scales at base of caudal fin.

Head pores: (Fig. 2) A posterior nasal pore anterior to each posterior nostril; anterior interorbital pore and posterior interorbital pore between eyes, an infraorbital pore behind eyes; a tubular lateral-canal extending from infraorbital pore over preoperculum to terminal lateral canal pore above and level with posterior preoperculum. Two preopercular pores on posterior preopercular edge.

Head papillae: (Fig. 2) A pair of papillae between nostrils. A single outer preopercular-mandibular row finishing below lower jaw half way to mandibular frenum and a distinct gap with no papillae behind end of jaws; a single inner preopercular-mandibular row finishing anteriorly at mandibular frenum. A vertical anterior opercular row, oblique longitudinal upper and lower opercular rows. A premaxillae row starts level with front of eye almost to corner of mouth. Five vertical lines radiating from eye; first from eye to jaw, followed by two short lines not in contact with eye, followed by fourth row, which intersects upper longitudinal line, fifth line below infraorbital pore. A short lower longitudinal line between third and fourth vertical lines. A short transverse row behind each eye, followed posteriorly by a short longitudinal line. To each side of midline a series of scattered papillae extending to first dorsal fin origin. A longitudinal row from rear of terminal lateral canal pore. Two parallel rows on the predorsal consisting of groups of 2-3 papillae. Other papillae developed as short vertical segments on midline of body, below first dorsal fin and on belly.

Dentition: Males: teeth conical; outer row of teeth in upper jaw wide set and larger than inner row teeth, four or five inner rows of smaller teeth; lower jaw with enlarged wide-set teeth along anterior margin of jaw to angle of dentary, four or five inner rows of smaller teeth; innermost row with 1-2 enlarged curved teeth on each side. Females: teeth similar but without distinctly enlarged teeth in upper and lower jaws.

Live coloration: Head reddish, with 4 narrow translucent white bands alternating with reddish vertical bands; first white band extending from below eye to posterior end of jaws, second white band extending from behind jaws dorsally to posterior margin of eye continuing onto opposite side; third band extending dorsally from posteroventral margin of operculum, sloping slightly forward dorsally across midline of nape; fourth band at posterior end of head from or just behind dorsal attachment of operculum to midline of nape; interorbital region with thin white stripe broadening as it extends forward onto snout; a small red spot medially in white area on

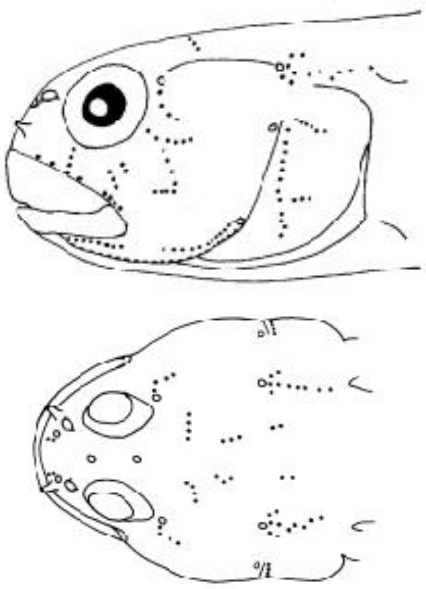

Fig. 2. Head of *Elacatinus limbaughi* showing pores and papillae based on 22.6 mm SLparatype SIO 61-272.

snout. Body usually with 9 or rarely 8 or 10 thin translucent white bands, interspersed with broad brown to black vertical bands; first three bands extending ventrally onto sides of belly, but not crossing midline of belly; first white band on body extending ventrally from below anterior part of first dorsal fin; second light band extending ventrally from below space between fifth and sixth dorsal-fin spines of first dorsal fin; third light band below interdorsal region; fourth to sixth extending between second dorsal and anal fins; seventh on caudal peduncle just behind second dorsal fin; ninth to tenth near posterior end of caudal peduncle; first broad dark band on body reddish brown, remaining broad bands pale brown to black. Dorsal fins translucent to transparent, with a fine black stripe on the distal and basal edges; anal fin translucent to transparent, with a thin black submarginal stripe near distal edge of fin, bordered by white margin stripe. Other fins translucent. Caudal fin with a narrow brown band at base of fin.

Coloration in alcohol: In freshly preserved material, thin light bands brownish white. Head and body with 13-14 tan or dark brown bands, beginning just posterior to eyes and ending at base of caudal fin, interspaces light brown. Two bands on dorsal head paler. Pigmentation of transverse bands on head most strongly concentrated at margins. Body bands not extending onto midline of belly. All fins pale to dusky tan. First dorsal fin with a darker longitudinal band toward the base, fading distally. Anal and second dorsal fins slightly darker than remaining fins, darkest near distal edges. Belly and ventral surface of head lighter than back, similar in color to narrow bands. Urogenital papilla of male and female clear, or with a few scattered melanophores at base and along lateral edges.

Distribution: Known only from the Gulf of California and west coast of Mexico south to Bahía Banderas, Jalisco, from the subtidal to depths of at least 35 m and commonly found below 15 m. The species has been observed cleaning other fishes (Thomson, Findley, and Kerstitch, 1979; Allen and Robertson, 1994, as *Elacatinus* sp.). It commonly occurs with *Elacatinus digueti.* While *Elacatinus limbaughi* is common on the Baja California coast of the Gulf of California, it is apparently rare on the eastern coast of the Gulf of California.

Derivation of Name: Named for Clyde Limbaugh, for his pioneering work on cleaning behaviour (Limbaugh, 1961), treated as a noun in the genitive case.

Elacatinus digueti

Gobiosoma digueti Pellegrin, 1901: 165 (floating sargassum, Gulf of California). Syntypes MNHN 01.294

Gobiosoma brocki Ginsburg, 1938: 58 (Los Frailes, Cape San Lucas, Baja California, Mexico). **Holotype** CAS-SU 36565.

Elacatinus inornatus Bussing, 1990: 109, fig. 5 (Isla Cocinero, Islas Murciélagos, Costa Rica). **Holotype** LACM 32493-43.

Description: First dorsal-fin spines 6(in 1), 7(in 69); segmented caudal rays 17 (70); branched caudal rays 11(11), 12(27), 13(19), 14(2), 15(2); dorsal, anal and pectoral-fin ray counts given in Tables 1 and 2. Head plump, more or less rounded, dorsoventrally com-

TABLE 1
Dorsal and anal-fin ray counts in Eastern Pacific species of Elacatinus

Species	Second dorsal-fin rays				Anal-fin rays			
	I,9	I,10	I,11	I,12	I,7	I,8	I,9	I,10
E. jansii	14	-	-	-	-	14	-	-
E. puncticulatus	-	2	57	5	-	-	-	64
E. digueti	2	84	2	-	-	6	81	1
E. limbaughi	3	90	-	-	1	1	90	1
E. nesiotes	1	16	-	-	-	1	15	1

pressed. Mouth slightly oblique, forming an angle of about 20° to 25° with body axis. Maxilla extending under middle to rear margin of eye, occasionally only to front of pupil. Profile of snout steeply rounded in lateral view. Interorbital narrow equal to or less than one-half eye length. Gill-rakers on outer face of first arch short and slender; those on second and following arches shorter. Mandibular frenum without lobes. Anterior nostril a short tube, posterior nostril with a raised rim. Most males with first, rarely second, first dorsal-fin spines filamentous, the first reaching to last first dorsal-fin spine base to second ray base of second dorsal fin, and occasionally to the ninth dorsal-fin ray base. Scales absent.

Head pores: A posterior nasal pore anterior to each posterior nostril; anterior interorbital pore and posterior interorbital pore between eyes; an infraorbital pore behind eyes; a tubular lateral-canal extending from infraorbital pore over preoperculum to terminal lateral canal pore above and level with posterior preoperculum. Two preopercular pores on posterior preopercular edge.

Head papillae: as for *Elacatinus lim - baughi.*

Dentition: Teeth conical, three series in upper jaw, four series in lower jaw. Larger males with the upper and lower anterior series as a single row of larger teeth.

Live coloration: of two females from Cabo San Lucas and female from Guaymas: head with broad reddish-orange bands, alternating with white bands; orange bands bordered with dark pigment; white bands not extending onto lower surface of head. Lips and snout reddish-orange. Body with narrow brown bands, margins light green, central portions of bands with very narrow orange band; interspaces between dark bands translucent green; dark bands not extending onto belly; central orange bands becoming fainter posteriorly. Subcutaneous dark bands between dark surface bands; subcutaneous bands often divided dorsally into a Y-shape. Throat dusky, with concentrated melanophores. Iris silvery, with guanine base, scattered melanophores and orange chromatophores. Pectoral fin clear, with scattered melanophores; body band extending onto base of pectoral fin, dark with orange and green; a green band at base of rays on dorsal half of fin only. Dorsal fins clear with scattered chromatophores; a dark band near base of fin with clear area between band and

TABLE 2

Pectoral-fin ray counts in eastern Pacific species of *Elacatinus.*
Data from Böhlke and Robins (1968) and Bussing (1990) included.

Species and General Locality	Pectoral Rays							
	17	18	19	20	21	22	23	Mean
E. jansii	2	7	4	-	-	-	-	18.2
E. punticulatus								
Bahía de los Angeles	-	-	-	-	7	9	1	21.6
Isla Ildefonso	-	-	-	-	12	37	11	22.0
Guaymas	-	-	-	12	42	6	-	20.9
BahíaAquaVerde	-	-	-	3	8	4	-	21.1
Banderas Blay	-	-	-	1	9	4	1	21.3
Cabeza Machudo	-	-	-	6	12	13	-	21.2
Cabo San Lucas	-	-	-	15	13	2	-	20.6
Tres Marías Is.	-	-	1	1	6	6	1	21.4
Costa Rica	-	-	-	-	11	8	1	21.5
Panama	-	-	1	7	13	9	-	21.0
Panama (B&R, 1968)	-	-	-	4	20	2		20.9
Ecuador (B&R, 1968)	-	-	-	-	4	22	2	21.9
E. digueti								
Gulf of California	1	4	16	8	-	-	-	19.1
Costa Rica	-	1	3	1	-	-	-	19.0
Panama	-	3	10	2	-	-	-	18.9
Costa Rica (Bussing 1990)	-	16	34	9	1	-	-	18.9
Colombia (Bussing 1990)	-	1	9	2	-	-	-	19.1
E. limbaughi	-	-	8	56	24	-	-	20.2
E. nesiotes								
Galápagos	1	6	6	-	-	-	-	18.4
Galápagos (Bussing, 1990)	-	8	2			-	-	18.2
Cocos	-	1	1	-	-	-	-	18.5
Cocos (Bussing, 1990)	3	36	21	-	-	-	-	18.3

body. Anal fin with distal submarginal dark band and clear margin, rest of fin with scattered chromatophores. Pelvic fins with scattered chromatophores, relatively clear in appearance or dusky. Melanophores scattered over entire body and fins, concentrated and larger in dark body bands, particularly at margins of dark bands, generally more concentrated dorsally in interspaces. Orange chromatophores on head; green chromatophores absent, except for few on isthmus and branchiostegal membranes.

Live coloration of juveniles and adults from Panama: Juvenile - head orange; body with narrow orange bands with even concentration of melanophores, few or no melanophores in interspaces; bands discontinuous, interrupted along midside. Adult similar to juvenile, with bands narrow orange, melanophores evenly distributed in bands and interspaces; body greenish orange; head reddish orange; snout red with no white patch.

Coloration in alcohol: Head and body light tan. Dorsal surface of head with 2 transverse reticulated bands. Body sometimes with 5-6 barely visible internal transverse bands beginning behind first dorsal fin origin, ending on caudal peduncle. Pigmentation of transverse bands on head most strongly concentrated at margins. Body bands forked dorsally, extending almost onto midline of belly. Pectoral, pelvic and caudal fins pale to dusky

tan. Anal and dorsal fins slightly darker. First dorsal fin with a pale longitudinal band at the base. Urogenital papilla of male and female clear, or with a few scattered melanophores.

Examination of the syntypes, although faded, clearly shows the thin dark bands on the body. Other features agree with the description above.

Variation: Based on material we have examined, the *Elacatinus digueti* complex contains 3 allopatric color forms: the first with thin dark wavy bars on the body (Gulf of California and Mexico), the second with broader wavy bars on the body (Galápagos and Isla del Coco) and a pale form with light body bands or no body bands (Central America to Colombia). The first form is clearly *Elacatinus digueti* (based on examination of the syntypes). Bussing (1990) recognises two additional species, *E. nesiotes* (the second form) and *E. inornatus* (third color form). Provisionally we recognise *E. nesiotes* here as distinct, based on the average lower pectoral ray counts, but cannot rule out the possibility that the form is an insular environmental variant. Separation of *E. digueti* and *E. inornatus* is more complex. We have been unable to separate the two forms based on preserved material. Allen and Robertson (1994) record *E. digueti* as extending south to Colombia, but we have not found material from the mainland of Central or South America with dark bands. We did find that in freshly preserved material from Panama there may be faint traces of dark bands in juveniles, but these disappear in adults. In preserved material, some specimens do have pale narrow bands (without any melanophores). However, the number of these bands is variable from none to 5 on the body, often within the same sample. An intermediate coloration was observed in specimens collected from Oaxaca, Mexico, examined shortly after collection. These specimens had very pale dusky bands, much lighter than specimens from northern areas. The only published color photos of specimens from the mainland of Central America (Burgess et.al., 1988, pl. 486 as *Gobiosoma* sp.; Allen and Robertson, 1994) are based on freshly collected, dead specimens. Other variation was also noted in preserved material from Central America and the Gulf of California. In some specimens from Central American, the thin white bands, have a denser concentration of chromatophores and the subcutaneous bands are often not divided dorsally (versus separated dorsally into 2 narrower bands in material from the Gulf of California).

Consequently, we provisionally regard *E. inornatus* as a junior synonym of *E. digueti.*

Distribution: Pacific coast of Mexico, Baja California, Gulf of California to Colombia. The species is known to clean other fishes (Thomson et.al., 1979; Allen and Robertson, 1994; Hobson, 1968). The species occurs from the subtidal to a depth of 21 m, although rarely found in depths below 15 m.

Material Examined: Syntypes - MNHN 01.294, 2(22.6-25.8) Gulf of California. GULF OF CALIFORNIA, BAJACALIFORNIA- Bahía Los Angeles: SIO 62-212, 1(15). Punta Concepción: SIO 65-311, 1(21). Punta Mangles: SIO 65-336, 1(23). Isla Santa Catalina: SIO 65-337, 2(7-7). Bahía Aqua Verde: SIO 65-290, 3(19-28); SIO 65-291, 2(19-27); SIO 65-296, 1(22). Punta Napolo: SIO 65-270, 1(21). Cabeza de Mechudo: SIO 65-345, 9(28-43); SIO 65-346, 3(17-22). Isla Espíritu Santo: SIO 65-352, 2(21-22); SIO 61-272, 5(17-20); SIO 61-278, 2(12-22); SIO 61-279, 2(14-23); SIO 61-280, 12(11-26); SIO 65-351, 174(11-32). Isla Cerralvo: CAS 36897, 2(22-23); LACM 31775-26, 2(14-19); LACM 31775-27, 8(13-22). Los Frailes: CAS-SU 36565, 1(26). San José del Cabo: SIO 61-237, 1(23). Cabo San Lucas: SIO 59-210, 1(21); SIO 59-215, 1(22). WESTCOASTOF MEXICO - Guaymas: SIO 68-243, 1(24); UAZ 190, 1(21); UAZ 192, 1(24); UAZ 68-409, 2(16-18); UCLA51-062, 2(17-18); UCLA52-041, 3(20-23); UCLA55-282, 3(21-23); UCLA56-078, 3(15-23). San Blas: UCLA58-005, 2(18-20). Tres Marias Is.: SIO 62-025, 1(19). Bahía Banderas: SIO 62-029, 1(14); SIO 62-043, 1(11). Manzanillo: SIO 70-158, 1(18). Nayarit; Isla Jaltemba: SIO 70-260, 1(17). Puerto Escondido, Oaxaca: UAZ 70-23, 5(12-19). COSTA RICA- Isla Cocinero: LACM 32492-50 1(21). Bahía Jobo: LACM 32490-28, 1(23).). Punta Santa Elena: LACM 32499-40, 17(13-24). Port Parker: CAS-SU 60384, 1(14); CAS-SU 67587, 1(12). Viradores Norte: LACM 32503-16, 2(10-11). Bahía Potrero: LACM 32506-46, 1(17). Bahía los Huevos: LACM 32504-38, 1(17). Isla Alcatraz: LACM 32516-44, 1(13). Bahía Ballena: LACM 32510-26, 1(14). Bahía Herradura: LACM 32524-42, 5(14-23); LACM 32525-35, 1(12). Isla Salera: LACM 32539-14, 1(13). Isla del Caño:

LACM 32546-39, 3(15-18); LACM 32547-40, 4(13-19); LACM 32551-31, 1(25); LACM 32562-39, 6(18-22); LACM 32566-41, 3(21-25). Golfo Dulce: LACM 32574-43, 1(17). PANAMA - ANSP 110683, 8(21-24); CAS 14041, 1(16); UMML 23455, 1(21); UMML 23455, 1(20). Gulf of Chiriquí: SIO 70-359, 9(15-22); SIO 71-046, 1(19). Isla Uva Panama: SIO 71-040, 1(22). Perlas Archipelago: SIO 67-037, 5(13-22); SIO 67-039, 6(11-22); SIO 67-040, 6(12-18); SIO 71-248, 4(13-21); SIO 71-258, 1(21). Isla Pacheca: CAS 35585, 1(16)

Elacatinus nesiotes

Elacatinus nesiotes Bussing 1990: 110, fig. 6 (Cabo Descubierto, Isla del Coco) **Holotype** LACM 44821-3.

This species is most similar to *Elacatinus digueti*, differing in lower average pectoral ray counts and in having broader dark bands on the surface of the skin. The species has been adequately described by Bussing (1990).

First dorsal-fin spines 7(in 15); segmented caudal rays 17(15); branched caudal rays 12(9), 13(4); dorsal, anal and pectoral-fin ray counts given in Tables 1 and 2.

Material Examined: GALÁPAGOS: LACM(UCLA 64-016), 1(22); LACM(UCLA 64-034), 10(16-30); USNM(Ref 289), 1(21); USNM(STA 291), 2(23-27). Isla del Coco, Costa Rica: UCLA 64-045, 1(21); UCLA64-046, 1(18).

Elacatinus janssi

Elacatinus janssi Bussing 1982: 251, fig. 1 (Bahía Herradura, south of Gulf of Nicoya, Costa Rica). **Holotype** LACM 32534-45.

This species is distinctive in having fewer second dorsal and anal-fin rays than other species, a spotted head and body, and a distinctive head shape. When viewed dorsally, the head is narrow and compressed anterior to the eyes, broadening posteriorly due to the thick cheek muscles. Males typically have a large mouth extending beyond the end of the eye. It has been adequately described by Bussing (1982) and illustrated in Allen and Robertson (1994). The range is extended northward to Punta Escondido, Mexico. It is typically found in depths greater than 10 m and is known to depths of 25 m.

First dorsal-fin spines 7(in 14); segmented caudal rays 17(13); branched caudal rays 12(8), 13(3), 14(2); dorsal, anal and pectoral-fin ray counts given in Tables 1 and 2.

In the general head shape, color pattern, squamation, and dentition, this species is most similar to the Atlantic species *Elacatinus saucrus* and *E. dilepis.* It differs from *E. saucrus* in having only two basicaudal scales (four in *E. saucrus*) and differs from both species in having fewer anal and second dorsal-fin rays and more numerous pectoral rays.

Material Examined: COSTA RICA: LACM 32547, 1(12), Isla del Caño; LACM 32524-42, 5(15-24), Bahía Herradura; USNM 228001, 16(9-20), Isla Alcatraz. PANAMA: SIO 67-037, 1(15); SIO 67-039, 1(14); MEXICO: UAZ 70-22, 1(16), Puerta Escondido; UAZ 70-23, 2(9-10) Puerta Escondido.

Elacatinus puncticulatus

Gobiosoma puncticulatum Ginsburg 1938:57 (Los Frailes, Mexico, Baja California). **Holotype** CAS-SU 36564.

Gobiosoma rubrifrons Fowler 1944: 282, 383, 518, fig. 237 (Saboga, Perlas Is., Panama). **Holotype** ANSP 70075.

This species differs from all other eastern Pacific *Elacatinus* with 2 basicaudal scales in having, second dorsal fin typically I,11, more numerous branched caudal rays, and longitudinal dark stripe on head that typically extends onto the body.

First dorsal-fin spines 7(in 30); segmented caudal rays 16(1), 17(81), 18(1); branched caudal rays 12(1), 13(52), 14(30), 15(1); dorsal, anal and pectoral-fin ray counts given in Tables 1 and 2.

Böhlke and Robins (1968) have adequately redescribed and illustrated the species. They suggested that there might be two distinct forms based on higher pectoral ray counts and occasional absence of basicaudal scales in specimens from Ecuador. However, additional data provided here (Table 2) indicates considerable geographical variation

in pectoral ray counts, with the highest counts typically at the extremes of distribution.

Males of this species typically reach a larger size (around 40 mm SL) than females (rarely exceed 27 mm SL). Difference in standard length between males and females increases with latitude. Males from Isla Ildefonso in the Gulf of California average 33 mm SL and females 24 mm SL, while males from Central America average only 24 mm SL and females 22 mm SL. The largest specimens examined from Central America are 30 mm SL for males and 26 mm SL for females and from the Gulf of California males 40 mm SL and females 33 mm SL.

Distribution: Pacific coast of Mexico, Baja California, Gulf of California to Ecuador. This species occurs from the subtidal to depths of 21 m.

Material Examined: Holotype - CAS-SU 36564, 1(19), Los Frailes, Mexico. GULF OF CALIFORNIA, BAJACALIFORNIA- Bahía Los Angeles: SIO 62-212, 14(16-30); SIO 62-233, 1(26); UCLA 55-283, 4(12-15). Isla Santa Inez: SIO 65-306, 1(26). Isla Ildefonso: SIO 65-331, 42(22-36). Punta Pulpito: SIO 65-319, 24(21-30). Isla Santa Catalina: SIO 65-337, 16(11-24); SIO 65-338, 8(12-29); SIO 65-339, 3(22-24); SIO 65-340, 12(13-37). Isla Santa Cruz: SIO 65-354, 4(22-24). Isla Santa Cruz: SIO 65-341, 3(11-23). San Telmo: SIO 65-283, 1(23). Isla San José: SIO 65-260, 2(10-23); SIO 65-261, 1(22) ; SIO 65-265, 3(11-23). Isla San Francisco: SIO 65-347, 9(12-26); SIO 65-348, 5(22-29). Cabeza de Mechudo: SIO 65-345, 13(19-31); SIO 65-346, 19(20-29). Isla Lobos: SIO 65-352, 28(10-28). Isla Espíritu Santo: SIO 61-269, 6(11-18); SIO 61-272, 81(10-26); SIO 61-274, 6(11-28); SIO 61-276, 8(10-24); SIO 61-277, 9(9-20); SIO 61-278, 154(11-33); SIO 61-279, 55(12-34); SIO 61-280, 59(11-30); SIO 65-351, 343(9-27). Isla Cerralvo: SIO 61-256, 13(9-12). Bahía Los Muertos: SIO 61-253, 13(12-18). Punta Pescadero: SIO 61-252, 47(11-27). Los Frailes: CAS-SU 36564, 1(19); SIO 61-239, 5(11-22); SIO 61-242, 27(11-14); SIO 61-243, 1(14); SIO 61-248, 3(12-13); SIO 61-249, 42(11-25); SIO 61-250, 1(16); SIO 62-271, 2(11-12). San José del Cabo: SIO 61-237, 75(11-23). Cape San Lucas: SIO 59-210, 6(12-26); SIO 59-215, 10(13-19); SIO 61-225, 49(11-21); SIO 61-227, 43(10-18); SIO 61-232, 135(9-26); LACM 9339-004, 2(11-15). WEST COAST OF MEXICO - Guaymas: CAS-SU 18448, 2(23-25); CAS W51-010, 12(18-30); CAS W52-028, 4(19-20); CAS W52-043, 1(29); LACM 30015-1, 1(29); LACM 9326-005, 1(14); LACM 30016-1, 1(1318-20); UCLA50-033, 2(24-25); UCLA 50-037, 46(14-34); UCLA 55-246, 9(21-28); UCLA 56-078, 4(19-24); UAZ 190, 1(22); UAZ 192, 1(28). Tres Marias Is.: SIO 62-019, 1(19); SIO 62-055, 60(9-24). Banderas Bay: SIO 62-029, 286(9-25). Manzanillo: LACM 9051-44, 1(13). Isla San Ignacio Farallón: SIO 59-228, 8(21-31). Southern Mexico: SIO 59-350, 1(14). COSTA RICA - CAS-SU 63141, 9(11-25). PANAMA - Perlas Archipelago: ANSP 70075, 1(27) (holotype of *Gobiosoma rubifrons*); SIO 67-034, 10(10-22); SIO 67-035, 28(11-24); SIO 67-036, 3(13-21); SIO 67-038, 1(11); SIO 67-039, 19(11-18); SIO 67-040, 1(11); UCLA 53-283, 1(12). Morro de Pinas: UMML23469, 1(16). Ecuador: UAZTV1801, 4(22-24); UMML23471, 7(15-28).

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RESUMEN

Se describe una nueva especie, *Elacatinus lim - baughi*, del Golfo de California. Se redescribe *Elacatinus digueti* y se considera *Elacatinus inornatus* Bussing sinónimo de *E. digueti*. Se presenta información biogeográfica y ecológica. Se considera *Elacatinus* diferente de *Gobiosoma*.

REFERENCES

Allen, G.R. and D.R. Robertson, 1994. Fishes of the Tropical Eastern Pacific. Crawford House Press, Bathurst, 332 pp.

Beebe, W. and J. Tee-Van, 1928 . The Fishes of Port-au-Prince Bay, Haiti. With a summary of the known species of marine fishes of the Island of Haiti and

Santo Domingo. Zoologica 10: 1-279.

Birdsong, R.S. 1975. The osteology of *Microgobius sig - natus* Poey (Pisces: Gobiidae), with comments on other gobiid fishes. Bull. Fla. State Mus. (Biol. Sci.) 19(3): 135-186.

Böhlke, J.E. & C.R. Robins. 1968. Western Atlantic seven-spined gobies, with descriptions of ten new species and a new genus, and comments on Pacific relatives. Proc. Acad. Nat. Sci. Philad. 120(3): 45-174.

Burgess, W.E., H.R. Axelrod & R.E. Hunzinger III. 1988. Dr. Burgess's Atlas of Marine Aquarium Fishes. T.F.H. Publications, Neptune City, New Jersey, 736 pp.

Bussing, W.A. 1982. *Elacatinus janssi*, a new gobiid fish from Costa Rica. Rev. Biol. Trop. 29(2): 251-256.

Bussing, W.A. 1990. New species of gobiid fishes of the genera *Lythrypnus*, *Elacatinus* and *Chriolepis* from the eastern tropical Pacific. Rev. Biol. Trop. 38(1): 99-118.

Colin, P.L. 1975. The Neon Gobies, The Comparative Biology of the Gobies of the Genus *Gobiosoma*, Subgenus *Elacatinus*, (Pisces: Gobiidae) in the Tropical Western North Atlantic Ocean. T.F.H. Publications, Neptune City, New Jersey, 304 pp.

Fowler, H.W. 1931. Fishes obtained by the Barber Asphalt Company in Trinidad and Venezuela in 1930. Proc. Acad. Nat. Sci. Philad. 83: 391-410.

Fowler, H.W. 1944. Results of the Fifth George Vanderbilt Expedition (1941) (Bahamas, Caribbean, Panama, Galapagos Archipelago and Mexican Pacific Islands). The Fishes. Acad. Nat. Sci. Philad. Mem. 6: 57-529.

Ginsburg, I., 1933. A revision of the genus *Gobiosoma* (family Gobiidae) with an account of the genus *Garmannia*. Bull. Bingham Ocean. Coll. 4(5): 1-59.

Ginsburg, I. 1938. Two new gobiid fishes of the Genus *Gobiosoma* from Lower California . Stan. Ichthyol. Bull. 1(2): 57-59.

Ginsburg, I. 1939. Two new gobioid fishes collected on the presidential cruise of 1938. Smithson. Misc. Coll. 98(14): 1-5.

Ginsburg, I. 1944. A description of a new gobiid fish from Venezuela, with notes on the genus *Garman - nia*. J. Acad. Sci. Wash. 34(11): 375-380.

Hobson, E.S. 1968. Predatory behaviour of some shore fishes in the Gulf of California. Fish and Wildlife Ser. Res. Rep. 73: 1-92.

Hoese, D.F. 1971. A revision of the eastern Pacific species of the gobiid fish Genus *Gobiosoma*, with a discussion of relationships of the genus. Ph.D. dissertation, Univ. California, San Diego, 213 pp.

Hubbs, C.L. & K.F. Lagler 1958. Fishes of the Great Lakes region. Bull. Cranb. Instit. Sci. 26: 1-251

Jordan, D.S. 1904 . Notes on fishes collected in the Tortugas Archipelago. Bull. U. S. Fish Comm. 22: 539-544.

Leviton, A.E., R.H. Gibbs, E. Heal & C.E. Dawson. 1985. Standards in Herpetology and Ichthyology: Part 1. Standard symbolic codes for institutional resource collections in Herpetology and Ichthyology. *Copeia* 1985(3): 802-832.

Limbaugh, C. 1961. Cleaning symbiosis. Sci. Am. 205(2): 42-49.

Pellegrin, J. 1901. Poissons recueillis par M.L. Diguet dans le Golfe de Californie. Bull. Mus. Paris 1901: 160-167.

Sazima, I., R.L Moura & R.S. Rosa, 1997. *Elacatinus figaro* sp. n. (Perciformes: Gobiidae), a new cleaner goby from the coast of Brazil. J. Ichthyol. Aq. Biol. 2(3): 33-38.

Thomson, D.A., L.T. Findley & A.N. Kerstitch. 1979. Reef Fishes of the Sea of Cortez. John Wiley and Sons, New York, 302 pp.