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A Review of Species of the Atlantic and Eastern Pacific Genus *Ctenogobius* (Gobiiformes: Oxudercidae)

Frank L. Pezold [1*]

[1] *Department of Life Sciences, Texas A&M University - Corpus Christi, Corpus Christi, TX 78412-5800, USA*

Current address: Florida Museum of Natural History, University of Florida, Gainesville, Florida, 32611-7800, USA

ABSTRACT

The genus *Ctenogobius* Gill 1858 has had a confused history due to an inaccurate original description of the type species and lost type specimens. Many species were misassigned to the genus, especially from Asia. The genus was recently diagnosed by a unique combination of characters and restricted to the Atlantic and eastern Pacific regions. Fourteen species are redescribed here and a new species from Brazil is described. A single species, *Ctenogobius lepturus* occurs in estuaries of the eastern Atlantic Ocean. Two species are known from eastern Pacific Ocean estuaries, *C. manglicola* and *C. sagittula.* The remaining 12 species inhabit estuaries, seagrass beds and reefs of the western Atlantic Ocean. The western Atlantic species are *C. boleosoma, C. claytoni, C. fasciatus, C. phenacus, C. pseudofasciatus, C. saepepallens, C. shufeldti, C. smaragdus, C. stigmaticus, C. stigmaturus, C. thoropsis* and *C. apogonus,* a new species from Brazil. The genus is a member of the oxudercid *Stenogobius* Group and is most closely related to the genera *Evorthodus, Oligolepis,* and *Oxyurichthys.*

Keywords: *Gobionellus, Stenogobius* Group, gobies.

* Corresponding author, E-mail: frank.pezold@tamucc.edu

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1 INTRODUCTION

Gobies are small, primarily benthic fishes common in temperate and tropical estuaries and seas. They are also in found in freshwater streams on tropical islands. There are more than 2000 goby species in 200 genera belonging to two families, the Gobiidae and Oxudercidae (Thacker, 2009; Thacker et al., 2015, Betancur et al., 2017). In western Atlantic Ocean estuaries the oxudercid gobies show greater diversity, in particular species assigned to the genus Ctenogobius. Species of this genus typically occur over fine sediment substrates ranging from behind coral reefs to oligohaline estuaries associated with river deltas. The ranges and limits of some of these species are poorly understood whether from a lack of records (e.g. *C. stigmaticus*) or subtle diagnostic differences (e.g. the "freshwater gobies" of the western Atlantic). Fifteen species of *Ctenogobius* are known from the eastern Pacific Ocean and the Atlantic Ocean, including an undescribed species from Brazil (Pezold, 2004). There has also been historic confusion on the actual range of the genus which resulted in the mistaken addition of species described from the Indo-West Pacific. The intent of this paper is to delineate the monophyletic genus *Ctenogobius* and describe its included species.

The genus *Ctenogobius* Gill (1858) was established to recognize a freshwater goby species, C. *fasciatus,* captured in Trinidad. The overall description was similar to other gobies native to the western Atlantic estuaries, but the combination of fin ray counts was very different - there were only five spines in the first dorsal fin and there was one more ray in the second dorsal fin than in the anal fin. The number of spines in the first dorsal was later corrected as a typographic error, but the relative number of second dorsal and anal fin rays was unchanged (Gill, 1863).

In describing the new species and genus, Gill (1858) suggested that *Gobius (Acanthogobius) flavimanus* Temminck & Schlegel and other gobies from China and Japan might also belong to the genus or be closely related. Jordan & Snyder (1901) in a review of the fishes of Japan placed five genera in synonymy with *Ctenogobius - Euctenogobius, Rhinogobius, Coryphopterus, Acentrogobius* and *Zonogobius.* This gave the genus a global range in subtropical and tropical marine and fresh waters. Many species, particularly from the Orient, were added to or described for the genus over the last century. Regan (1906) assigned four specimens from Trinidad to *Gobius fasciatus*, gave a much better description of the species and assumed that Gill's fin counts were in error. He counted 12 second dorsal elements and 13 in the anal fin which along with other descriptors clearly associated it with other western Atlantic species. In fact, Ginsburg (1932) synonymized *Gobius fasciatus (sensu* Regan*,* not Gill) with *Gobionellus claytonii* (Meek, 1902) in a revision of the latter genus. He believed the species to differ from Gill's based upon the fin ray differences in the two descriptions.

Koumans (1931), who may have been the last person to view the original type specimens of *C. fasciatus,* and made no mention of incorrect fin ray counts, reduced the synonymy to include *Rhinogobius* and *Amoya,* both Indo-West Pacific genera inhabiting fresh and brackish waters. He redescribed the genus and included a range of 8-13 rays for the second dorsal fin and 8-12 rays for the anal fin. Herre (1933) commented on the problematic original description and welcomed the amended description given by Koumans, but noted that it was still too inclusive and ignored the distinctive characteristics found in species of *Rhinogobius*. In particular he observed that the pelvic fin disk of *Rhinogobius* was nearly circular and had a thick bilobed or crenate frenum that approaches that seen in sicydiines, except that it is not fused to the body. The pelvic fin disk in *Ctenogobius* is more elongate and typical of gobies. He then went on to add nine species of estuarine and marine gobies to the genus and two of *Rhinogobius.*

A discovery in the United States National Museum of a collection of gobies from Trinidad taken by Gill gave greater clarity to the identity of the type species of the genus (Robins and Lachner, 1966). There was a note with the specimens that read

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"Gobionellus claytonii. *These may be the types of Ctenogobius fasciatus Gill, but there is a wide discrepancy in the fin ray counts as given in Gill's original description."*

The note was written by Isaac Ginsburg. No other gobies were reported from Trinidad by Gill. The features of the specimens agreed with those described by Regan (1906) and by Gill (1858) with the exception of the odd fin ray counts. They also fit the description of *Gobionellus claytonii* with which the species was synonymized and *Ctenogobius* became a junior synonym of *Gobionellus* (Robins and Lachner, 1966).

Despite the synonymy and new understanding of the type species of the genus, *Ctenogobius* continued to be recognized in its incorrect historical form. Ten additional marine/estuarine species and species of *Rhinogobius* were described as members of this genus after 1966. Meanwhile a new understanding of the genus began to emerge. Miller and Wongrat (1979) recognized *Ctenogobius,* presumably by differences of the free neuromast patterns. The only species mentioned in that work was *C. boleosoma* (Jordan and Gilbert, 1882). Miller (1981) later indicated that *C. lepturus* (Pfaff, 1933) was also included in his concept of the genus, as well as the *Gobionellus* subgenus *Gobica* (Ginsburg, 1932). In addition to *C. boleosoma, Gobica* included *C. claytonii, C. manglicola, C. shufeldti* and *C. stigmaticus.* Harrison (1989) recognized *C. boleosoma,* but retained *C. sagittula* (Günther, 1861) in *Gobionellus.* Additional species of *Ctenogobius* were recognized by Birdsong et al. (1988) based upon an unpublished PhD Dissertation (Pezold, 1984a). The genus comprised species included in *Gobionellus* by Ginsburg (1932), most of which belonged to a "coarse-scaled" species group as defined by Gilbert and Randall (1979). Birdsong et al.'s concept of the genera *Ctenogobius* and *Gobionellus* differed in part from that of Miller and Harrison, but was not explained and was not the focus of that work. In fact, there was no justification for the assignment of any particular species to *Ctenogobius* other than *Gobionellus fasciatus* (Robins and Lachner, 1966) until 2004 when the genus was diagnosed by a unique combination of features that included one synapomorphic condition (Pezold, 2004).

A morphological phylogenetic analysis of the genus *Gobionellus* (Pezold, 2004) and other gobionellid genera in the *Stenogobius* Group (Larson, 2001) demonstrated that *Gobionellus* as recognized by Ginsburg (1932), Mead and Böhlke (1958) and Gilbert and Randall (1979) was polyphyletic. Fifteen of 21 species, primarily species described a the "coarse-scaled species" group by Gilbert and Randall (1979), were recovered as more closely related to other gobionellid genera than to *Gobionellus.* These species included *Ctenogobius fasciatus,* type species of *Ctenogobius,* the senior synonym of other available names that could be applied to the "coarse-scaled" group (see synonymy below). A subsequent molecular study of nuclear genes was consistent with these findings (Tornabene et al., 2013). While McCraney et al. (2020) did not recover a monophyletic *Ctenogobius,* relationships in that study among genera within the major gobiid and oxudercid lineages were generally unresolved because of the incomplete nature of the matrix. This is expected when the species associated in the phylogeny are not examined for the same genes. *Ctenogobius* species *sensu* Pezold (2004) lack lobes or gill rakers on the anterior surface of the first epibranchial, a synapomorphy for the genus, and have an abbreviated oculoscapular canal that terminates above the preoperculum with an 'ABCDFH' pore pattern, a simple or triangulate fourth neural spine, and a diagonal posterior opercular neuromast row. Despite the diagnosis given, the genus continues to retain species lacking this combination of traits (e.g. Froese and Pauly 2022 [accessed 17 January 2022 - https://www.fishbase.se/identification/SpeciesList.php?genus=Ctenogobius]). This paper gives detailed descriptions for the species comprising the genus, including a new species from Brazil. Table 1 addresses the correct placement for species currently misassigned to *Ctenogobius* in Froese and Pauly (2022) and Fricke et al. (2022). Historically nearly 100 species were assigned to the genus; the corrected placement for species not listed in Table 1 can be found in the online Catalog of Fishes at the California Academy of Sciences (Fricke et al., 2022). To pull the list at that site, type the name *Ctenogobius* in the species search (not genus search). The holotype of *Ctenogobius vexillifer* (ANSP 68252) was examined by me and determined to be a species of *Drombus,* particularly due to the possession of an 'ABCDEFH"KL' sensory

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canal pattern, a gill opening restricted to the pectoral base, the oblique orientation of the jaws, and a transverse cephalic sensory papillae pattern typical of the genus.

Table 1. Present status of species misassigned to Ctenogobius by Fricke et al. (2022) and Froese & Pauly (2022).

Nominal species	Present status	Primary reference(s)
Ctenogobius aestivaregia (Mori, 1934)	*Rhinogobius fukushimai* (Mori, 1934)	Wu and Zhong (2008)
Ctenogobius calamianensis (Herre, 1934)	*Acentrogobius calamianensis* (Herre, 1934)	Koumans (1940)
Ctenogobius cervicosquamus (Wu, Lu and Ni, 1986)	*Rhinogobius leavelli* (Herre, 1935)	Wu and Zhong (2008)
Ctenogobius chengtuensis (Chang, 1944)	*Rhinogobius szechuanensis* (Tchang, 1939)	Wu and Zhong (2008)
Ctenogobius chusanensis (Herre, 1940)	*Acentrogobius chusanensis* (Herre, 1940)	Zhong (1997), Wu and Zhong (2008)[1]
Ctenogobius clarki (Evermann and Shaw, 1927)	*Acanthogobius hasta* (Temminck and Schlegel, 1845)	Birdsong et al. (1988), Shibukawa and Iwata (2013)
Ctenogobius fukushimai (Mori, 1934)	*Rhinogobius fukushimai* (Mori, 1934)	Wu and Zhong (2008)
Ctenogobius horai (Fowler, 1925)	*Amoya horai* (Fowler, 1925)	Redetermined by H. K. Larson per ANSP
Ctenogobius punctatus (Oshima, 1926)	*Acentrogobius caninus* (Valenciennes, 1837)	Suzuki et al. (2017) with question mark
Ctenogobius shennongensis (Yang and Xie, 1983)	*Rhinogobius shennongensis* (Yang and Xie, 1983)	Wu and Zhong (2008)
Ctenogobius szechuanensis (Liu, 1940)	*Rhinogobius liui* (Chen and Wu, 2008)	Wu and Zhong (2008)
Ctenogobius vexillifer (Fowler, 1937)	*Drombus vexillifer* (Fowler, 1937)	Suzuki et al. (2017), this study

[1]Synonym of *Amoya brevirostris* according to Jaafar (2008).

2 RESEARCH METHODS

Comparative collections used for the examination of the cephalic lateralis and free sensory papillae are listed in Pezold (1993). Canal and canal pore terminology follows Takagi (1957) and Akihito et al. (1984). The system of Akihito et al. (1984) has been modified such that when interorbital pores are single and median in position they are underlined (as C and/or D). Free neuromast patterns are described in reference to topographic location unless otherwise indicated. All drawings were made using a Wild M-5 dissecting microscope and camera lucida.

Features of the post-cranial osteology were examined from radiographs and cleared and stained specimens noted in Birdsong et al. (1988). Characters examined were: placement of the first pterygiophore of the spinous dorsal fin; the placement of the first pterygiophore of the second dorsal fin; the number of precaudal anal fin pterygiophores; the number of precaudal vertebrae; the number of caudal vertebrae; the relative number of segmented rays to vertebrae; the form of the fourth neural spine; the extent of neural arch completion over the caudal vertebrae; the number of epurals; and the first dorsal fin pterygiophore insertion pattern. The first dorsal fin pterygiophore insertion pattern is given as a formula following Birdsong (1975) and Birdsong et al. (1988). Condition of the basihyal and third neural spine was determined from cleared and stained material and by dissection.

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Counts and measurements are described in Pezold (1991). All measurements were made with dial calipers and recorded to the nearest tenth of a millimeter. All fish lengths are given as standard lengths (SL). Materials examined are given with each species account. Karyotypes were done for *Ctenogobius pseudofasciatus* from gill epithelium cells using methods developed by Kligerman and Bloom (1977). Museum codes follow Sabaj (2020). Life colors were obtained from photographs in the collection of James Van Tassell and others available through FishBase or the Smithsonian Tropical Research Institute websites for the Shorefishes of the Greater Caribbean and the Shorefishes of the Eastern Pacific. Fricke (2022) and Fricke et al. (2022) were used extensively to verify references and to review the status of species misassigned to *Ctenogobius.*

3 RESULTS AND DISCUSSION

SYSTEMATICS

3.1 *Ctenogobius*

Ctenogobius Gill, 1858:374 (type species *Ctenogobius fasciatus* by monotypy).

Smaragdus Poey, 1860:279 (type species *Smaragdus smaragdus* by absolute tautonymy).

Gobiex Ginsburg, 1932:44 (as a subgenus of *Gobionellus*, type species *Gobionellus stigmaturus* by original designation).

Gobica Ginsburg, 1932:45 (as a subgenus of *Gobionellus,* type species *Gobionellus boleosoma* by original designation).

Gobidus Ginsburg, 1953:25 (as a subgenus of *Gobionellus,* type species *Gobionellus longicaudus* by original designation).

Diagnosis. First dorsal pterygiophore formula 3(12210). One more ray in the anal fin than in the second dorsal fin. No gill rakers or lobular structures on the epibranchial of the first gill arch, one triangular raker at the angle of the arch and three or four triangular rakers on the first ceratobranchial parallel to its axis. Lateral cephalic canal abbreviated, terminating at intertemporal pore; posterior otic and supraophthalmic pores absent, two pairs of nasal pores on snout ('ABCDFH' pattern). Incomplete neural arch formation over the caudal vertebrae in all but one species.

Description. Snout rounded, with subterminal mouth very slightly oblique to nearly horizontal. Eyes large, lateral and situated anteriorly at dorsal profile. Anterior nares tubular, near or at edge of snout, posterior nares open pits. Interorbital narrow. Body moderately elongate with head usually about 25% of SL. Opercular membrane broadly connected at base. Premaxilla protractile. Lower jaw included. No fleshy crest on nape. Tongue truncate or slightly emarginate in most, bilobed in some. Wide buccal membrane along upper jaw with broad band of papillae at attachment paralleling teeth and another band at margin. Pharyngeal plates with pin-like teeth. Knobby papillae in upper middle of throat between pharyngeal plates. Anterior sides of first ceratobranchial with 3 or 4 broad triangulate flexible rakers parallel to its axis. A large triangulate raker with membranous sheets attached located at angle of first arch. First epibranchial without rakers or large fleshy lobes (Pezold, 2004).

Vomer without teeth. Teeth in upper jaw 2 or 3 rows with outermost usually much larger, especially in males. Lower jaw also with several rows, frequently with very highly recurved teeth in innermost row and/or large recurved canine or two on each side near mental frenum.

Cephalic lateralis. Canal pores and sensory papillae are illustrated in Figure 1. Oculoscapular canal abbreviated, 'ABCDFH' pattern; two pairs of pores on snout, anteriormost pair anteromedial to tubular nares

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or medial, but between tubular and posterior nares, a pair of anterior interorbital pores and a single median posterior interorbital pore, supraophthalmic pore lacking, temporal portion of canal terminating above preopercle with anterior otic pore and terminal intertemporal pore, posterior otic pore absent. Preopercular canal present with two or three, usually three pores. Sensory papillae include five transverse rows on cheek, four beneath the eye, one anterior to eye reaching to corner of jaw; median longitudinal cheek row not reaching forward beyond 3rd transverse cheek row; diagonal row of papillae present on posterior opercle.

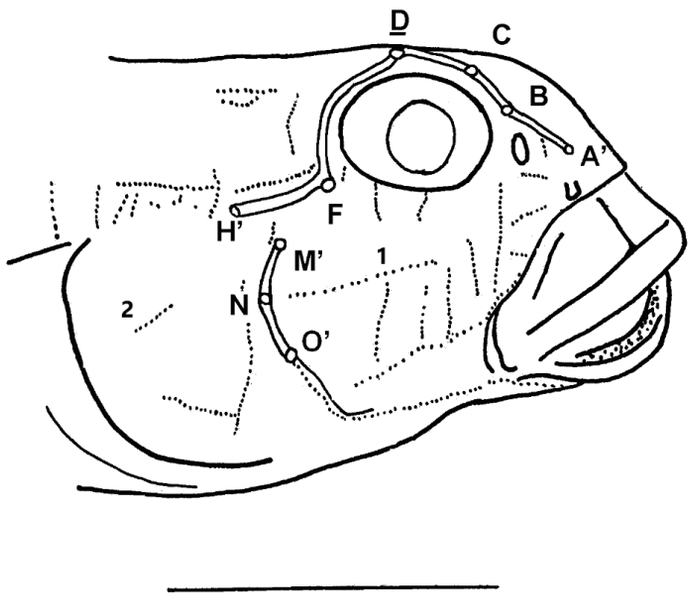

Figure 1. Oculoscapular canal with pores are labeled according to Akihito *et al.* (1984). Sensory papillae rows of the cheek and opercle - note five transverse rows on cheek, four below the eye and one anterior to eye running to corner of the jaw; median longitudinal cheek row labeled "1" and posterior opercular row labeled "2." Illustration from a specimen of *Ctenogobius lepturus.* Bar equals 5 mm.

Fins. D_1 VI flexible spines, third spine produced in many species. D_2 I,10-12, first element a flexible spine. Anal fin I,11-13 elements, first a flexible spine. Pectoral fins 15-19. Pelvic fins I-5. Interspinal membrane of pelvic fins with fimbriate margin. Innermost pelvic rays longest and joined by membrane. Caudal fin moderately elongate to very elongate and lanceolate, ranging from 1/3 SL in adult females of some species to more than 80% SL in males of one species. One more ray in the anal fin than in the second dorsal fin. Second dorsal fin origin slightly before anal fin origin.

Squamation. Ctenoid scales over most of body, cycloid (reduced ctenoid) scales present to varying degrees anterodorsally, extending from point along first dorsal fin base to upper pectoral fin base. Head usually naked in all species, but occasional individuals in some species with a few cycloid scales on upper opercle. Nape naked to fully covered with slightly embedded cycloid scales. Abdomen variably with naked midline to covered with slightly embedded cycloid scales. Prepelvic region generally naked but occasionally has scales, especially in *C. sagittula.*

Morphometry and sexual dimorphism. Males have a long pointed urogenital papilla, while females exhibit a short bulbous structure. Other aspects that differ between the sexes are discussed under species accounts, but for many species males have longer caudal and pectoral fins, larger jaws, elongate spines in the first dorsal fin

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and a more elongate caudal trunk region. Females of many species show proportionately larger heads, larger eyes and a larger precaudal region. In some species these trends are reversed for one or more characters.

Pigmentation. All species have five large midlateral blotches although these are faint in *C. stigmaticus* (Poey, 1860), *C. lepturus* and *C. thoropsis* (Pezold and Gilbert, 1987), possibly due to poor preservation in the last species. Most show some mottling on the head that frequently gives rise to three crossbars and two or three more across the nape. Underside generally light, dorsum with dark spots, bars and blotches over tan background.

Axial osteology. First dorsal fin pterygiophore formula 3(12210). Vertebrae: 10+16=26. Fourth neural spine simple or basally flared to form broad-based triangle, never spatulate. Neural arches incomplete over caudal vertebrae in all but one species. One or two epurals. Two anal fin pterygiophores before the first hemal spine.

Distribution. Twelve of the 15 species occur in the western Atlantic from Massachusetts to southern Brazil. Two species are found in the eastern Pacific from San Diego to northern Peru and one species is limited to the eastern Atlantic of West-Central Africa.

Included Species. Fourteen species previously referred to *Gobionellus* and one new species are assigned to *Ctenogobius: C. apogonus* (new species), *C. boleosoma* (Jordan and Gilbert, 1882), *C. claytonii* (Meek, 1902), *C. fasciatus* (Gill, 1858), *C. lepturus* (Pfaff, 1933), *C. manglicola* (Jordan and Starks in Jordan, 1895), *C. phenacus* (Pezold and Lasala, in Pezold and Gilbert, 1987), *C. pseudofasciatus* (Gilbert and Randall, in Gilbert and Kelso, 1971), *C. saepepallens* (Gilbert and Randall, 1968), *C. sagittula* (Günther, 1861), *C. shufeldti* (Jordan and Eigenmann, 1887), *C. smaragdus* (Valenciennes in Cuvier and Valenciennes, 1837), *C. stigmaticus* (Poey, 1860), *C. stigmaturus* (Goode and Bean, 1882), and *C. thoropsis* (Pezold and Gilbert, 1987).

3.2 Key to the species of *Ctenogobius*

1a. Second dorsal fin elements I,11; anal fin elements I,12; dark patch of pigment posterodorsal to opercle above pectoral fin base (shoulder patch) present or absent...4

b.Second dorsal fin elements and anal fin elements I,10 and I,11 or I,12 and I,13 elements, respectively; shoulder patch present...2

2a. Second dorsal fin elements I,10; anal fin elements I,11; scales in lateral series not more than about 45; pectoral fins reaching anus or anal fin origin...3

b. Second dorsal fin elements I,12; anal fin elements I,13; scales in lateral series 49-66, usually more than 55; pectoral fins very short, not reaching anus...***Ctenogobius sagittula***

3a. Head and sometimes trunk with scattered ocelli; lateral scales 31-45, usually near 40; nape commonly with scales to rear margin of opercle; third spine of first dorsal fin elongate; no well-developed V pattern on sides of trunk...***Ctenogobius smaragdus***

b.No ocelli on head or trunk; lateral scales 29-35 (mean 31); nape naked or with few scales, not scaled to rear margin of opercle; third spine of first dorsal fin not elongate; dorsal extensions of midlateral blotches forming V pattern on sides of trunk...***Ctenogobius boleosoma***

4a. Prominent dark pigment edging preopercular margin of cheek...5

b.Preopercular margin of cheek, if pigmented, not darker than other head pigmentation and not sharply defined...6

5a. Preopercular margin of cheek with narrow dark edging; nape with 10-12 scale rows, usually reaching above mid-opercle in specimens from Bermuda, to above preopercle elsewhere; females with series of dark

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comma-shaped marks crossing rays near base of anal fin; first dorsal fin spines not elongate in males...***Ctenogobius stigmaturus***

b. Preopercular margin of cheek with broad dark edging, widest and most intense at angle of preopercle; nape with few or no scales; comma-shaped marks not present on anal fins of females; third spine of first dorsal fin often greatly elongate in males...***Ctenogobius fasciatus***

6a. Eyes greatly reduced, not filling sockets...***Ctenogobius thoropsis***

b. Eyes normal, not reduced...7

7a. Cheek with three dark broad parallel bars; 7-10 unpigmented bars on sides of trunk in preserved specimens; tusk-like canine projecting laterally, sometimes nearly horizontally, from middle of lower jaw...***Ctenogobius stigmaticus***

b. Cheek lacking three dark parallel bars; no unpigmented bars on sides of trunk in preserved specimens; canine present midlaterally in lower jaw of some species, but not approaching a horizontal...8

8a. Broad dark stripe crossing lower cheek from just above corner of jaw to angle of the preopercle; males often with elongate third spine in first dorsal fin and large recurved canine midlaterally in lower jaw...***Ctenogobius pseudofasciatus***

b. Broad stripe not present as described above; males with or without elongate spine and large midlateral canine in lower jaw...9

9a. Cheek pigmentation dominated by distinct suborbital bar extending from lower rim of orbit to corner of jaw, in some populations of ***C. saepepallens*** reaching only 1/3 distance from orbit to jaw...10

b. Cheek not dominated by suborbital bar as described, instead a horizontal stripe across midcheek from upper end of preopercular lateralis canal to corner of jaw or a suborbital bar on snout extending from lower rim of orbit to midlateral upper jaw more prominent...11

10a. Scale pockets of midlateral trunk region darkly outlined forming lattice or rows of diamonds, especially pronounced anteriad; sides peppered with dark dots dorsally, paralleling faint midlateral blotches; cheek often with dark striations along sensory papillae rows; pelvic fins uniformly dusky in males; anal fin in females dusky; third spine of first dorsal fin moderately elongate in both sexes...***Ctenogobius lepturus***

b. Sides of trunk not as above, midlateral blotches frequently dash-like and separated by dots giving dot-dash effect; cheek lacking striations highlighting sensory papillae rows; pelvic fins of males dusky with dark margins; anal fin of females unpigmented or only pigmented on rear half; third spine of first dorsal fin elongate only in males ...***Ctenogobius saepepallens***

11a. Horizontal cheek bar connected to angular blotch at corner of jaw to form a prominent dark hatchet-shaped mark; males with large black spot at end of fifth spine of first dorsal fin and a dark margin on dusky pelvic disk...***Ctenogobius manglicola***

b. Cheek pigmentation not as above; first dorsal fin may have dark spots, but largest located along first spine; small, but not black, spot seen at tip of fifth spine in some individuals, especially females...12

12a. Caudal fin very elongate in both sexes (42-53% SL, mean 46%, in males; 39-50% SL, mean 45%, in females); dark well-defined shoulder patch present, most prominent marking of trunk, and V pattern formed by dorsal extensions of midlateral blotches in adults; jaws large (mean 14% SL), usually to posterior margin of orbit in both sexes...***Ctenogobius phenacus***

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b. Caudal fin moderately elongate (26-44% SL, mean 35% or 36% for males; 26-39% SL, mean 31% or 33% for females); shoulder patch may be present, but not darker than other markings, isolated dorsal extensions of midlateral blotches may be observed, but not forming V pattern; jaws may be large in adult males, but not reaching posterior margin of orbit in females (mean 10 or 11%)...13

13a. Pelvic fins of adult males dusky, females with bilateral streaks paralleling innermost rays; adult males usually with elongate third spine in first dorsal fin...14

b. Pelvic fins of adult males with bilateral streaks typical of females of other species described above, pelvic fins of females unpigmented; adult males without elongate first dorsal fin spines...***Ctenogobius shufeldti***

14a. Lightly pigmented, pallid, with the exception of spots along first dorsal fin spines in some individuals; males with teeth of outermost row in upper jaw greatly enlarged, large recurved canine midlaterally in lower jaw...***Ctenogobius claytonii***

b. Well-pigmented with prominent horizontal stripe on cheek and bar on snout from eye to midlateral jaw; faint shoulder patch usually present; males with teeth of outer row in upper jaw only slightly enlarged and small recurved canine midlaterally in lower jaw...***Ctenogobius apogonus*** **n. sp.**

3.3 *Ctenogobius apogonus*, new species, Brazilian Goby (Figure 2)

Figure 2. ***Ctenogobius apogonus,*** **MCP 54774 (former ANSP 121211), male, 40 mm SL, Brazil, Rio de Janeiro, Atafona, 10 July 1963 - 8 August 1963, J. Baskin, N.A. Menezes and I.A. Dias. Photo by Kyle Luckenbill.**

Diagnosis. D_2 I,11; A I,12. Midlateral series of five blotches typical of the genus plus smaller intermediate blotches, usually about 9 total. Third spine of first dorsal fin produced and pelvic fin dusky in males. Pelvic fin in females with dark bilateral streaks along inner ray and bases of outer rays, approaching one another posteriorly. Caudal fin with dark vertical bars on upper half and dusky lower half in males.

Description. Based on 38 specimens, 26.1-59.7 mm SL. General body form as given for genus; morphometrics given in Tables 2-4. Jaws reaching 1/3 to 1/2 distance to posterior margin of orbit in females; in males, ranges from 1/2 to beneath the posterior margin, increasing in proportion with age. Band of small teeth in upper jaw; outer edge with 4-6 caniniform teeth on each side, larger than any others in either jaw. Lower jaw with a band of teeth of about equal proportion; innermost teeth highly recurved; a small recurved canine on the outer edge midlaterally on each side in males, near origin of mental frenum. Teeth in males larger proportionately than in females. In addition to larger jaws, males have a longer caudal trunk region than females, while females have average greater cheek widths and have longer precaudal trunk regions (Tables 3-4).

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Table 2. Morphometric proportions for *Ctenogobius* reported as percentages of SL. Format given is mean, range (N). Males and females reported separately if significantly different with asterisk indicating sex with the larger mean size (*p < 0.05, **p<0.01, ***p<0.001).

	head length	head width	snout length	jaw length	orbit length
C. apogonus	25.2, 22.8-27.6 (40)	15.8, 12.1-19.8 (38)	7.3, 5.0-8.5 (38)	12.1, 10.1-15.2 (9) male ** 9.9, 8.5-12.4 (31) female	6.8, 5.6-8.7 (34)
C. boleosoma	25.5, 21.7-29.8 (220)	16.0, 12.8-23.9 (54)	7.0, 5.8-9.2 (53)	10.7, 8.6-13.2 (111) male *** 9.7, 7.3-11.3 (108) female	7.6, 5.3-10.2 (107) male 7.9, 5.6-10.1 (102) female*
C. claytonii	25.9, 23.1-27.6 (44)	16.5, 13.9-19.7 (44)	7.0, 5.3-8.8 (44)	10.9, 8.9-13.1 (13) male ** 10.1, 8.8-11.2 (31) female	7.5, 4.9-9.9 (44)
C. fasciatus	26.2, 23.0-35.1 (163)	16.3, 10.8-20.6 (80)	7.1, 5.7-10.9 (81)	10.4, 8.3-14.2 (79) male *** 9.8, 7.0-11.4 (81) female	7.9, 6.3-10.3 (80) male 8.2, 5.6-10.5 (82) female*
C. lepturus	24.8, 24.0-26.4 (11) male 25.7, 24.6-26.7 (19) female **	17.4, 14.5-19.8 (20)	7.1, 5.6-8.4 (21)	10.9, 9.8-11.6 (11) male *** 10.1, 9.4-10.8 (19) female	7.3, 5.8-8.5 (21)
C. manglicola	25.4, 23.0-28.8 (57) male 26.0, 23.7-29.0 (61) female **	15.7, 14.0-18.0 (40)	6.3, 5.0-7.7 (40)	10.7, 8.8-12.3 (57) male *** 10.1, 8.6-12 (61) female	8.2, 7.0-9.6 (57) male 8.4, 7.4-10.3 (60) female*
C. phenacus	26.5, 24.4-28.5 (12)	18.1, 15.2-21.0 (12)	7.5, 6.0-8.7 (12)	13.9, 12.8-15.7 (12)	7.5, 6.3-9.1 (11)
C. pseudofasciatus	25.9, 23.1-30.3 (42)	15.1, 12.8-20.1 (38)	6.9, 5.1-9.0 (38)	10.0, 8.2-11.9 (42)	8.5, 6.8-10.9 (42)
C. saepepallens	26.3, 22.6-31.3 (131)	15.2, 12.9-19.1 (68)	6.4, 5.3-8.4 (66)	10.2, 8.2-11.8 (129)	8.0, 6.4-10.0 (37)
C. sagittula	22.5, 19.9-26.2 (62) male 23.6, 21.3-26.0 (66) female***	14.0, 11.1-18.0 (116)	6.4, 4.9-7.3 (55) male 6.6, 5.1-8.4 (61) female*	8.9, 6.9-10.5 (129)	5.4, 3.7-7.1 (62) male 5.8, 3.8-7.2 (66) female**
C. shufeldti	27.1, 23.5-29.8 (87) male *** 26.2, 24.2-28.7 (140) female	18.1, 13.0-22.2 (67) male ** 17.1, 13.1-21.8 (75) female	8.0, 6.1-9.8 (67) male *** 7.4, 5.8-8.6 (74) female	13.7, 10.1-18.1 (87) male *** 10.7, 9.5-13 (143) female	7.0, 5.4-9.8 (85) male 7.2, 6.0-8.8 (134) female**
C. smaragdus	26.0, 22.3-28.6 (142)	17.5, 14.8-20.6 (42)	8.4, 7.1-11.8 (42)	11.5, 9.8-13.6 (73) male ** 11.1, 8.1-13.4 (68) female	6.9, 5.4-8.8 (58)
C. stigmaticus	23.1, 20.9-26.6 (47)	14.1, 12.2-16.9 (46)	5.8, 4.3-6.9 (46)	10.1, 7.8-11.5 (47)	7.4, 6.3-9.2 (47)
C. stigmaturus	26.8, 24.5-30.4 (98)	16.2, 14.6-17.9 (30)	7.7, 6.8-10.4 (30)	10.7, 9.2-12.1 (49) male *** 10.2, 8.6-12.8 (49) female	9.1, 8.4-10.4 (30)
C. thoropsis	25.0, 23.6-26.7 (5)	17.9, 15.4-20.3 (5)	8.3, 7.6-9.2 (5)	15.8, 15.0-17.4 (5)	6.7, 6.0-7.4 (5)

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Table 3. Morphometric proportions for *Ctenogobius* reported as percentages of SL. Format given is mean, range (N). Males and females reported separately if significantly different with asterisk indicating sex with the larger mean size (*p < 0.05, **p<0.01, ***p<0.001, ****p<0.0001).

	cheek depth (EJ)	cheek width (PJ)	interorbital width	nape length (ED1)	preanal body length
C. apogonus	9.6, 7.7-10.9 (38)	8.4, 7.2-9.3 (8) male 9.1, 7.6-10.7 (30) female*	2.0, 0.8-3.3 (38)	20.7, 19.3-23.0 (38)	50.2, 47.5-53.4 (8) male 52.8, 50.0-57.9 (30) female***
C. boleosoma	9.3, 8.1-10.7 (48)	7.9, 6.1-9.6 (24) male 8.4, 7.3-9.3 (24) female*	2.1, 1.4-2.8 (53)	20.8, 17.7-23.5 (24) male 21.9, 19.6-25.3 (24) female**	51.2, 45.9-57.2 (24) male 53.5, 50.3-58.6 (24) female***
C. claytonii	9.7, 7.0-12.2 (44)	9.2, 6.0-11.9 (44)	2.0, 1.3-3.5 (44)	20.2, 18.1-22.6 (13) male 21.2, 18.6-23.6 (31) female*	50.4, 46.8-57.8 (13) male 53.3, 49.3-58.1 (30) female***
C. fasciatus	9.1, 8.4-9.7 (8)	8.5, 7.0-10.6 (81)	2.3, 1.5-3.2 (40) male * 2.1, 1.3-3.0 (41) female	20.5, 18.3-26.4 (81)	51.1, 48.8-70.2 (81)
C. lepturus	10.6, 8.2-11.7 (21)	8.6, 7.4-9.9 (21)	1.4, 0.8-1.9 (21)	20.1, 19.0-21.9 (7) male 22.2, 19.5-31.9 (14) female*	53.5, 51.4-57.8 (5) male 57.3, 53.9-60.2 (14) female***
C. manglicola	9.0, 7.9-10.8 (40)	7.5, 5.3-10.5 (40)	1.9, 0.6-2.7 (40)	22.9, 18.4-25.3 (20) male 24.3, 21.5-27.7 (20) female**	53.5, 49.9-57.5 (20) male 55.6, 50.0-59.9 (20) female**
C. phenacus	10.0, 9.2-11.5 (11)	7.6, 6.3-9.0 (11)	3.0, 2.2-4.5 (12)	23.5, 21.7-25.6 (12)	53.3, 49.7-56.4 (12)
C. pseudofasciatus	9.7, 7.2-11.5 (34)	9.4, 6.8-11.7 (38)	2.0, 0.9-4.2 (38)	20.6, 18.3-25.3 (38)	49.8, 47.2-56.6 (38)
C. saepepallens	9.3, 8.0-10.7 (21) male 9.9, 7.6-12.5 (21) female*	8.7, 3.2-10.8 (66)	1.7, 1.2-2.3 (66)	23.2, 20.2-26.2 (66)	52.7, 49.7-57.3 (33) male 56.0, 51.3-60.1 (29) female****
C. sagittula	8.1, 6.4-9.3 (52) male 8.8, 6.4-11.0 (61) female****	7.4, 5.7-9.7 (55) male 7.8, 5.8-9.9 (61) female*	2.1, 1.1-3.2 (116)	21.2, 19.1-26.0 (55) male 22.4, 20.2-26.8 (61) female****	48.5, 43.0-53.6 (62) male 50.6, 45.5-54.6 (66) female****
C. shufeldti	10.2, 7.1-14.2 (81)	9.3, 6.9-12.1 (67) male 10.0, 7.1-13.0 (74) female***	2.8, 1.6-4.8 (68) male **** 2.4, 1.2-3.4 (74) female	20.6, 18.4-23.0 (67) male 21.5, 19.1-24.6 (74) female****	51.8, 48.5-59.6 (147)
C. smaragdus	10.2, 9.1-12.3 (42)	8.3, 7.1-9.8 (42)	2.8, 2.1-3.5 (42)	21.6, 19.3-24.7 (42)	51.9, 47.1-55.4 (41)
C. stigmaticus	9.4, 7.6-12.0 (46)	8.2, 6.9-11.7 (22) male * 7.7, 6.0-9.8 (24) female	2.0, 1.4-3.1 (32)	20.6, 18.9-26.3 (22) male 22.0, 18.8-24.2 (23) female**	50.8, 47.5-53.7 (21) male 52.2, 47.6-57.5 (25) female*
C. stigmaturus	9.9, 9.0-10.8 (10)	8.8, 6.9-10. 0 (30)	2.0, 1.2-3.0 (30)	22.6, 20.9-25.2 (30)	51.4, 48.0-53.9 (30)
C. thoropsis	10.8, 9.6-11.6 (5)	5.8, 5.1-7.2 (5)	4.4, 3.9-5.5 (5)	20.9, 18.6-21.8 (5)	52.0, 50.3-54.1 (5)

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Table 4. Morphometric proportions for *Ctenogobius* reported as percentages of SL. Format given is mean, range (N). Males and females reported separately if significantly different with asterisk indicating sex with the larger mean size (*p < 0.05, **p<0.01, ***p<0.001, ****p<0.0001).

	postanal length	body depth	caudal peduncle length	caudal peduncle depth
C. apogonus	54.4, 51.2-56.1 (8) male * 53.1, 50.4-56.5 (30) female	15.0, 12.3-17.3 (38)	12.7, 9.4-14.3 (38)	8.8, 7.8-10.0 (38)
C. boleosoma	54.4, 50.8-58.6 (24) male *** 51.9, 46.7-54.7 (24) female	16.9, 15.2-19.7 (24) male 17.5, 15.8-19.0 (24) female*	15.2, 13.3-17.8 (48)	10.4, 8.9-12.5 (48)
C. claytonii	55.4, 51.8-62.7 (13) male ** 52.8, 48.8-57.2 (30) female	15.5, 13.2-18.1 (44)	13.4, 10.1-16.2 (44)	9.3, 8.0-10.6 (44)
C. fasciatus	55.0, 49.9-74.6 (40) male ** 52.9, 48.4-58.8 (81) female	16.5, 12.8-22.6 (81	14.2, 11.6-19.2 (81)	9.8, 8.4-13.4 (81)
C. lepturus	54.9, 52.4-58.8 (5) male *** 50.5, 48.2-54.7 (14) female	16.4, 15.6-17.0 (7) male 17.4, 16.2-18.4 (14) female**	12.4, 10.1-14.0 (21)	9.2, 8.1-10.7 (21)
C. manglicola	52.8, 50.5-55.5 (20) male *** 50.4, 47.2-52.6 (20) female	15.8, 13.2-18.5 (40)	12.9, 11.0-15.8 (40)	10.1, 8.3-11.7 (40)
C. phenacus	50.2, 48.5-52.8 (12)	16.7, 15.3-18.6 (12)	13.4, 12.7-13.8 (6) male * 12.7, 12.1-13.4 (5) female	9.0, 8.1-10.0 (12)
C. pseudofasciatus	51.5, 47.7-58.8 (38)	16.2, 13.3-19.2 (38)	13.9, 12.4-17.7 (38)	9.9, 8.3-14.7 (38)
C. saepepallens	52.5, 49.0-55.7 (33) male **** 49.8, 46.1-53.0 (29) female	16.1, 12.5-19.0 (66)	13.1, 11.1-15.0 (66)	10.1, 9.0-15.6 (35) male ** 9.4, 7.7-10.9 (31) female
C. sagittula	56.9, 52.2-61.3 (62) male **** 55.3, 50.7-59.6 (66) female	12.9, 10.5-15.2 (55) male 13.8, 10.1-16.5 (61) female****	11.9, 9.7-15.5 (116)	8.0, 6.6-9.4 (55) male 8.5, 7.1-10.4 (61) female****
C. shufeldti	51.8, 47.3-56.4 (69) male ** 50.8, 46.2-56.3 (78) female	16.0, 12.9-19.0 (141)	13.4, 11.1-17.0 (141)	9.2, 7.5-11.0 (67) male ** 8.8, 7.1-10.3 (74) female
C. smaragdus	49.7, 46.7-54.9 (41)	16.3, 14.3-18.0 (42)	15.6, 14.2-18.7 (22) male * 15.0, 13.6-16.0 (20) female	10.2, 9.1-12.9 (42)
C. stigmaticus	54.8, 48.7-58.2 (21) male * 53.2, 47.5-56.8 (25) female	17.0, 14.5-20.0 (45)	13.4, 11.3-15.4 (44)	10.1, 8.5-11.4 (44)
C. stigmaturus	53.6, 48.1-56.8 (15) males ** 51.2, 46.8-56.8 (15) female	17.2, 15.3-19.0 (30)	14.6, 12.6-16.9 (30)	10.8, 10.2-12.0 (15) male * 10.2, 8.4-11.6 (5) female
C. thoropsis	48.9, 46.1-50.5 (5)	15.5, 13.9-17.3 (5)	12.0, 10.7-13.0 (5)	8.4, 7.5-10.1 (5)

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Third D_1 spine very elongate and filamentous in adult males, may equal D_2 in length (Figure 3). Pectoral fins extending to vertical through anus in females; to vertical through anus or, usually, anal fin origin in males. Pelvic fins not reaching anus in females; reaching anal fin origin in males. D_2 and anal fin appressed rays extending beyond procurrent caudal rays in males; usually not reaching caudal fin rays in females. Caudal fin longer in males than females. Fin measurements and ray counts given in Table 5.

Table 5. Fin measurements and element counts for *Ctenogobius* species. Counts reported as mode, range (N). The first element of second dorsal and anal fin counts is a flexible spine. Measurements as a proportion of SL given as mean, range (N). Males and females reported separately if significantly different with asterisk indicating sex with the larger mean size (*p < 0.05, **p<0.01, ***p<0.001).

	Left Pectoral Fin Rays	2nd Dorsal Fin Elements	Anal Fin Elements	Pectoral Fin Length	Pelvic Fin Length	Caudal Fin Length
C. apogonus	17, 15-18 (79)	12, 12-13 (40)	13, 12-14 (38)	21.7, 18.2-23.9 (40)	22.1, 17.8-26.7 (39)	36.2, 32.1-40.6 (8) male *** 31.0, 26.5-39.4 (30) female
C. boleosoma	17, 12-19 (436)	11, 10-12 (222)	12, 11-13 (224)	22.6, 17.9-26.3 (110) male *** 21.8, 18.8-24.6 (104) female	22.6, 18.3-34.0 (216)	37.6, 26.5-47.5 (109) male *** 31.8, 25.5-35.7 (107) female
C. claytonii	16, 15-18 (91)	12, 11-13 (47)	13, 12-14 (45)	23.0, 18.3-25.5 (44)	22.2, 17.6-27.6 (43)	33.4, 25.9-42.4 (40)
C. fasciatus	17, 14-19 (371)	12, 11-13 (187)	13, 12-14 (87)	25.8, 21.6-35.3 (77) male *** 24.0, 18.6-27.2 (81) female	23.4, 19.4-29.5 (79) male*** 22.4, 18.2-25.3 (83) female	38.9, 29.3-52.0 (76) male *** 32.8, 27.4-38.4 (82) female
C. lepturus	17, 16-18 (60)	12, 11-12 (30)	13, 12-14 (30)	21.0, 17.8-23.4 (30)	21.4, 17.1-25.0 (30)	36.2, 28.4-42.4 (11) male ** 32.4, 27.2-36.0 (19)
C. manglicola	16, 13-17 (**236**)	12, 11-13 (120)	13, 12-14 (120)	20.9, 18.0-23.6 (118)	22.7, 18.5-26.9 (118)	42.4, 31.7-53.5 (55) male *** 38.1, 32.1-44.4 (60) female
C. phenacus	18, 17-19 (32)	12, 11-12 (16)	13, 12-13 (16)	25.8, 23.9-27.7 (12)	23.1, 22.4-24.0 (5) male ** 20.8, 19.5-22.7 (6) female	45.4, 39.2-52.8 (12)

Table 5 (cont.). Fin measurements and element counts for *Ctenogobius* species. Counts reported as mode, range (N). The first element of second dorsal and anal fin counts is a flexible spine. Measurements as a proportion of SL given as mean, range (N). Males and females reported separately if significantly different with asterisk indicating sex with the larger mean size (*p < 0.05, **p<0.01, ***p<0.001).

	Left Pectoral Fin Rays	2nd Dorsal Fin Elements	Anal Fin Elements	Pectoral Fin Length	Pelvic Fin Length	Caudal Fin Length
C. saepepallens	16, 13-17 (264)	12, 11-13 (110)	13, 12-13 (111)	23.3, 19.2-26.9 (115)	24.3, 20.7-28.6 (107)	40.0, 30.1-52.1 (64) male *** 35.7, 29.6-41.9 (60) female

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	Left Pectoral Fin Rays	2nd Dorsal Fin Elements	Anal Fin Elements	Pectoral Fin Length	Pelvic Fin Length	Caudal Fin Length
C. sagittula	17, 15-18 (276)	13, 12-15 (138)	14, 13-15 (138)	16.7, 12.9-18.8 (62) male 17.3, 13.9-21.2 (66) female**	16.6, 12.6-21.6 (127)	44.9, 30.0-69.2 (61) male *** 37.4, 28.3-51.1 (66) female
C. shufeldti	17, 13-19 (545)	12, 11-13 (273)	13, 12-14 (273)	22.1, 18.5-25.7 (209)	20.8, 17.3-24.5 (208)	35.6, 28.4-43.6 (76) male *** 33.2, 27.5-39.0 (124) female
C. smaragdus	17, 15-18 (284)	11, 10-12 (143)	12, 11-12 (143)	22.8, 19.4-25.3 (139)	20.4, 17.8-24.7 (142)	55.5, 34.9-82.1 (68) male *** 46.4, 34.9-60.7 (67) female
C. stigmaticus	17, 15-18 (94)	12, 11-12 (47)	13, 12-13 (47)	23.4, 19.8-27.4 (22)	20.7, 17.2-25.2 (21)	50.9, 44.0-59.8 (12) male ** 43.8, 39.7-49.8 (7) female
C. stigmaturus	16, 9-18 (188)	12, 11-13 (98)	13, 11-14 (98)	22.9, 20.3-26.3 (97)	23.5, 20.3-26.9 (48) male ** 22.8, 21.0-26.0 (49) female	34.7, 29.3-39.9 (48) male *** 31.6, 27.9-37.2 (49) female
C. thoropsis	18, 17-19 (10)	12, 12-13 (5)	13, 13-14 (5)	28.2, 22.9-30.7 (5)	22.3, 20.7-23.3 (5)	67.5, 61.4-74.0 (5)
C. pseudofasciatus	17, 13-18 (88)	12, 11-12 (44)	13, 12-13 (45)	22.9, 20.2-28.2 (42)	24.5, 22.5-27.2 (12) male* 23.4, 19.1-26.2 (30) female	37.5, 30.6-50.4 (40)

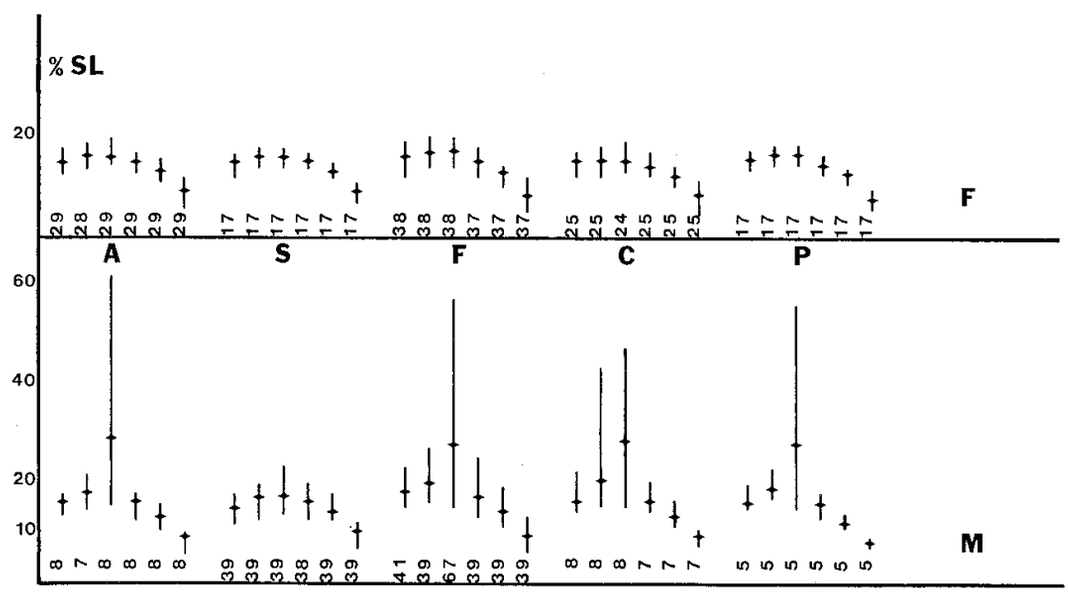

Figure 3. Graphical representation of first dorsal spine lengths in 5 species of "freshwater" *Ctenogobius*. Mean values were computed using arcsin-transformed data and reconverted to % SL. Females are represented in F and males in M. Numbers along the horizontal axis give sample size for each spine. A = *C. apogonus*, S = *C. shufeldti*, F = *C. fasciatus*, C = *C. claytonii*, P = *C. pseudofasciatus*.

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Ctenoid scales over posterior of body extending forward along dorsum to about the middle of the first dorsal fin, and along lateral midline to upper pectoral fin base, naked beneath axil of pectoral fin. Reduced ctenoid scales continue forward to diagonal from upper pectoral axil to D_1 origin, with few or no scales beyond. Belly with reduced ctenoid scales. Pectoral fin base, prepelvic region, cheek and opercle naked. Belly generally with naked midline or partly scaled; dermis over infracarinalis medius muscle without scales. Scale counts are given in Table 6.

Table 6. Scale counts for *Ctenogobius* species reported as mode, range (N).

	Lateral Scales	Predorsal Scales	Transverse Forward	Transverse Rear	Caudal Peduncle
C. apogonus	34, 31-41 (37)	0, 0-7 (38)	14, 12-17 (36)	12, 9-13 (35)	8, 6-9 (37)
C. boleosoma	31, 29-35 (191)	0, 0-10 (122)	13, 10-16 (85)	10, 8-13 (108)	7, 6-8 (51)
C. claytonii	31, 29-39 (39)	0, 0-5 (44)	15, 11-19 (40)	11, 10-16 (41)	7, 6-9 (38)
C. fasciatus	34, 29-37 (170)	2, 0-11 (187)	16, 11-19 (165)	12, 10-15 (173)	8, 6-9 (70)
C. lepturus	30, 29-35 (21)	0 (30)	13, 12-16 (17)	11, 10-14 (21)	7, 6-8 (16)
C. manglicola	30, 28-33 (89)	0 ± 0.2; 0-1 (39)	12, 10-15 (29)	9, 8-12 (30)	6, 6-8 (29)
C. phenacus	29, 29-34 (12)	2, 0-7 (14)	13, 12-15 (11)	9, 9-11 (12)	6, 6-7 (10)
C. pseudofasciatus	33, 29-36 (36)	1, 0-5 (32)	14, 13-19 (33)	12, 10-15 (33)	7, 6-9 (26)
C. saepepallens	31, 28-36 (80)	0 (50)	12, 10-16 (37)	11, 9-13 (37)	7, 6-8 (30)
C. sagittula	58, 49-66 (132)	26, 0-35 (131)	25, 15-33 (118)	17, 13-22 (128)	9, 7-11 (115)
C. shufeldti	33, 28-38 (261)	6, 0-14 (273)	15, 12-20 (196)	13, 11-16 (203)	8, 7-10 (65)
C. smaragdus	40, 31-45 (128)	11, 0-17 (58)	16, 13-20 (42)	14, 10-18 (54)	9, 7-10 (41)
C. stigmaticus	29, 28-33 (20)	3, 2-6 (25)	11, 11-14 (5)	9, 8-11 (8)	6, 6-7 (9)
C. stigmaturus	31, 28-35 (81)	12, 0-15 (93)	11, 10-14 (75)	11, 8-12 (79)	7, 6-8 (36)
C. thoropsis	31, 30-34 (4)	0, 0-10 (4)	12, 12-15 (4)	9, 9-11 (4)	7 (3)

Preopercular canal with three pores.

Pigmentation in preserved specimens. Faint dark streak on snout along rear of nares from eye to jaw; another streak from eye to midlateral region of jaw, much darker; small spot about mideye posterior to the dark snout streak, corresponding in position to suborbital bar seen in species such as *C. saepepallens*. Diagonal dark bar crossing cheek posterodorsally from upper corner of the jaw, not always reaching preopercle. Rear margin of cheek along preopercle with thin dusky edging, not as intense as *C. fasciatus* or *C. stigmaturus*. Opercle dusky, rear margin crisply defined. Snout, chin, both lips dusky. Top of head mottled, or with bands of variable completion in males. Two short dark bars in front of D_1 origin; in some a bar resembles the thin dark crescent seen in *C. boleosoma.*

Midlateral row of dark blotches on the trunk variable, from series of five blotches typical of the genus with interposed smaller blotches, to series of blotches of about equal proportion, usually about nine in total; posterodorsal arms frequently present on some blotches. Dark shoulder patch of variable development present. Upper pectoral fin base dusky with dark spot at corner of opercle and at base of rays; frequently another spot anterior to spot at base of rays, sometimes joined as a bar.

Pectoral fins either lightly dusky in females or with thin vertical bars; darker in males with five-six usually more discrete bars. Pelvic fins dusky in males; in females, dusky along base of outer 4 rays and midregion of innermost ray converging posteriorly, interradial membrane connecting fins sometimes with pigment posteriorly; interspinal membrane lightly pigmented at base. D1 with five or six diagonal bands, very dark at

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base behind fifth and sixth spines. D_2 with diagonal wavy bands of dark blotches. Anal fin dusky in males with some discrete dark spots; females with clear margin with dusky submarginal band and some spots. Caudal fin with clear upper and lower margin in females, distinctly barred in middle, bars being contained within a submarginal dusky border that is best defined below; in males lower half dusky, upper half with vertical bars of large spots, most distinct in largest male examined.

Color in life. Not observed.

Axial osteology. Fourth neural spine simple, not flared. Epural number variable, from two separate to two partly fused to a single fused element.

Etymology. From the Greek *απόγονος* (apógonos) for offspring or progeny. The species is named to recognize Nicole Pezold Hancock, Blaise Pezold and Michael Pezold for their support, patience and sometimes assistance throughout my career from its start in graduate school to finish.

Distribution. Known from Parnaiba, Piaui, in northern Brazil to the vicinity of Rio Grande, Rio Grande do Sol in southern Brazil.

Comments. This species is common in rivers and estuaries in Rio Grande do So1 (Roberto E. Reis, pers. comm.). Reis also reports its occurrence in salinities ranging from fresh to nearly marine in the vicinity of Tramandai Lagoon. In freshwater, he has taken this species with *Gobionellus oceanicus,* while in the lagoon it co-occurs with that species and *Ctenogobius boleosoma.* Three of the specimens examined were obtained in mangroves at Parnaiba by Tyson Roberts.

This species has been identified as *Ctenogobius shufeldti* in the past due to the similarity in their pigmentation patterns, squamation, fin ray counts and overall morphology. Several features distinguish these two species, however. These differences include: 1) males of *C. shufeldti* do not have elongate spines in the first dorsal fin (Figure 3, 2) the pelvic fins in *C. shufeldti* are clear in females and males have the bilateral streaks typical of females in a number of other *Ctenogobius* species; in *Ctenogobius apogonus* the pelvic fin is dusky in adult males, while females and juvenile males have the bilateral streaks, and 3) although *C. shufeldti* may have additional spots on the side of the trunk, these spots generally do not approach the five midlateral blotches in size (one exception in those specimens of *C. shufeldti* seen was from Avery Island, Louisiana, ANSP 70796). Another possible difference may be the pigmentation of the caudal fin. From the few male specimens of *Ctenogobius apogonus* available, there appears to be a tendency towards vertical bars of large spots on the upper half of the fin, instead of the diagonal clear streak and faint bars typical of most *Ctenogobius* species.

Principal components analyses were done on specimens of *C. apogonus* and *C. shufeldti* from both Atlantic and Gulf coast populations to determine if the two species might be distinguished by a combination of other features. Twenty meristic and morphometric variables were used in separate analyses of 62 males and 92 females. Females of the two species were not distinguished, but males of *Ctenogobius apogonus* and *C. shufeldti* showed some separation by the first two components (Figure 4). The first component was reflective of size with all morphometric variables highly correlated with standard length, while separation along the second component was obtained from differences in lateral scale row number, predorsal scale number, pelvic fin length and total pectoral fin ray number (Table 7). Males of *C. apogonus* had negative scores on the second component. Pelvic fin length and lateral scale number had negative coefficients on this component and males of *C. apogonus* have a higher mean value for both of these variables (Tables 5, 6). A second analysis performed on 73 males and 103 females (independently) using only the 17 morphometric variables (listed in Table 7) was unable to distinguish the two species. Interestingly, a plot of the scores for the first principal component for all 176 specimens against the natural logarithm of standard length (ln SL) shows two different scatters, not by species, but by sex (Figure 5). These results underscored the overall morphometric similarity of these two forms. None of the characters diagnostic of the new species were used in the analyses. These two species belong to a group of "freshwater"

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Ctenogobius species that are predominantly found in freshwater or oligohaline estuaries - *C. apogonus, C. claytonii, C. fasciatus, C. pseudofasciatus* and *C. shufeldti.* A similar result was obtained when the PC1 scores were plotted against the ln SL for all five of these "freshwater" *Ctenogobius* species (Figure 6). Divergence of the scatters was reflective of increased sexual dimorphism with growth; overall, there are greater shared differences of morphometry between sexes than between species.

Table 7. Principal component coefficients, eigenvalues and cumulative percentages of variation from analyses of *Ctenogobius apogonus* and *C. shufeldt*i males using 2 meristic and 18 morphometric variables.

	PC 1	PC 2	PC 3	PC 4
LS	0.063136	-.320597	0.893730	0.281896
P1 TOTAL	-.019011	0.832866	0.407435	-.328650
SL	0.244067	-.048019	0.014684	-.071858
PRED	0.153611	0.380688	-.135561	0.870501
JAWL	0.240954	-.034375	-.046473	-.074557
HW	0.237642	0.044622	-.032699	-.029584
HL	0.243596	-.009845	-.007909	-.016547
ORBIT	0.235952	0.029319	-.038356	-.017434
EYE to D1	0.241672	-.061874	-.002199	-.061586
IO	0.227110	0.097165	-.028131	0.080149
SNTL	0.240903	-.007985	-.015542	-.057693
POP to JAW	0.229459	0.103449	0.074102	0.005483
CPDL	0.235801	0.034290	-.017926	-.070608
AT to D2T	0.240416	0.012503	-.010587	-.019170
AO to D2O	0.241312	0.046609	-.021187	-.006016
P1L	0.241143	-.016238	-.004102	-.056076
P2L	0.238534	-.101982	0.036059	-.102547
CAUDL	0.239219	-.087662	-.040082	-.013485
PREA	0.244101	-.001346	-.012466	-.063086
POSTA	0.242445	-.079395	0.037408	-.076090
eigenvalues	16.05806	1.034054	0.81330	0.61325
cumulative	0.80290	0.86993	0.91059	0.94126

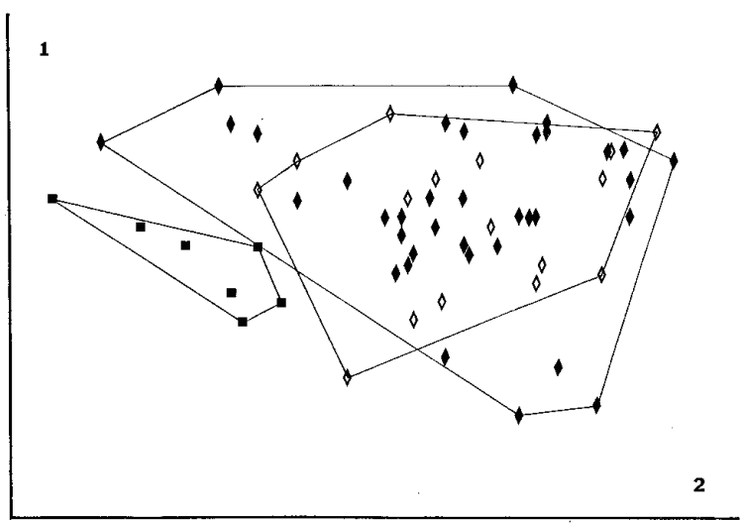

Figure 4. Principal components analysis of *Ctenogobius apogonus* males and *C. shufeldti* males from the SE US Atlantic coast and Gulf of Mexico using meristic and morphometric variables. Hollow diamonds = US Atlantic coast *C. shufeldti*; solid diamonds = Gulf of Mexico *C. shufeldti*; squares = *C. apogonus.*

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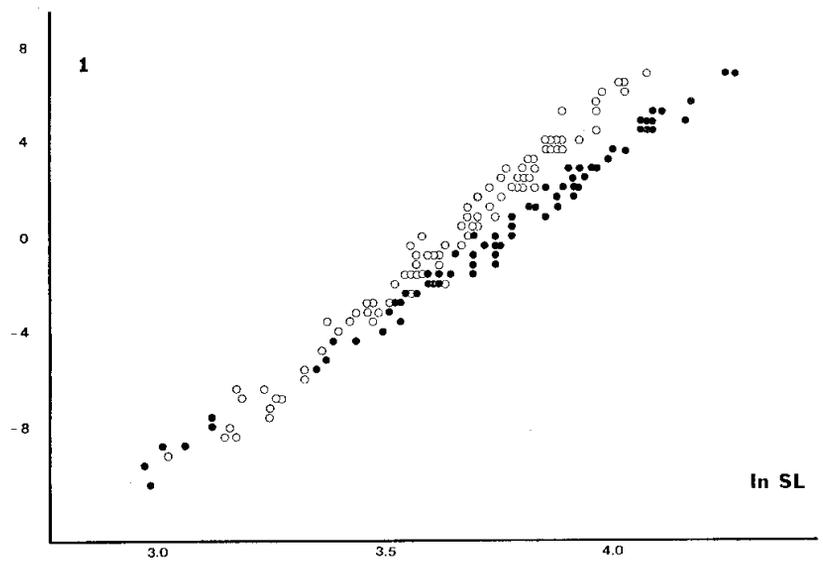

Figure 5. Regression of first principal component scores of *Ctenogobius apogonus* and *C. shufeldti* on the natural logarithm of standard length. Males = solid circles, females = hollow circles.

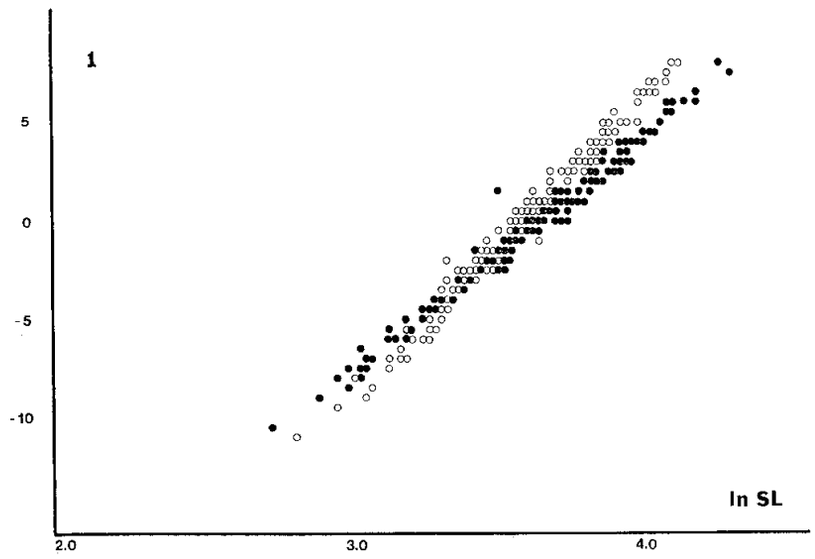

Figure 6. Regression of the first principal component scores of the 5 "freshwater" *Ctenogobius* species on the natural logarithm of standard length. Symbols as in Figure 5.

A recent review of three species of *Gobius* previously described from Brazil led to the placement of one, *Gobius silveiraemartinsi* Ihering 1893, in the synonymy of *Ctenogobius shufeldti* (Caires, 2019). The original description by Ihering is vague, incomplete, and obviously erroneous as the combination of characteristics

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described fits no existing gobioid fish from Brazil, or elsewhere perhaps. There is no type specimen or illustration.

Gobius silveiraemartinsi Ihering 1893 is regarded here as *incertae sedis.* Ihering (1893) comments that the description was based upon specimens long ago sent to Steindachner, thus it appears it was based upon notes and recollection. A rough translation follows:

> *Total length excluding caudal fin is 35 mm, body height 7 mm, eye diameter 2.5 mm, head length 10 mm, the head length goes 3 1/2 times into the body length, the body height goes 5 times into the body length. The ventral fins are fused, not attached. The caudal fin is pointed, it has 6 pale brown cross-bands. Body yellowish with brown spots, of which the middle ones are the largest. Two short brown stripes run from eye to mouth, and a third longer one over the cheeks. The two parts of the dorsal fin are separated by a short space. The anal fin is as long as the second dorsal fin. In the premaxilla there are two rows of small conical teeth in front, followed by a third smallest, also in the lower jaw. The upper edge of the mouth is only formed by the extensible premaxilla, the mandibles lie laterally behind it. The canines are missing. The gill slit is narrow. D 7-2/11, A. 2/11, P. 15, V 1/5.*

The conclusion that the name was a junior synonym of *C. shufeldti* resulted from a process of elimination of gobioid species known from southern Brazil based upon the lack of certain features being mentioned (e.g. basicaudal spots which would indicate *Evorthodus lyricus* or a shoulder patch indicating *C. boleosoma*) or disagreement of features counted or measured with values known for Brazilian species (e.g. the number of pectoral fin rays discounting species of Gobiosomatini [despite the noting of 7 spines in first dorsal fin] and difference in eye size proportionate to SL for *Awaous* and *Gobioides)*. The description of pigmentation below the eyes and on the cheeks were accepted as indicating that the species being described by Ihering was *C. shufeldti.* While this seems possible, in reality it is unknown what Ihering was describing or even if the notes and recollections were of one species or combined from more than the two specimens he mentions having shipped years ago. The number of pectoral rays is more easily miscounted from my experience than the number of first dorsal spines. We also do not know the locality or habitat in which the specimens were taken. Species taken from turbid estuarine waters are sometimes difficult to discern using pigmentation features, even *C. boleosoma* and *C. shufeldti* where they are taken syntopically. Discrimination of specimens of the latter two species from sympatric populations in Louisiana marshes actually relied upon relative intensity of pigment on the snouts and not the presence of a shoulder patch or a stripe on the cheek (Pezold and Cashner, 1983). Similar confusion could occur between *C. boleosoma* and *C. apogonus.* As first reviser of the genus, it seems more prudent to assign a holotype and a clear name to this species from Brazil.

Material Examined. **Holotype: MCP 54774** (former ANSP 121211), male, 40 mm SL, Brazil, Rio de Janeiro, Atafona, 10 July 1963 - 8 August 1963, J. Baskin, N.A. Menezes and I.A. Dias. **Paratypes:** PIAUI: **MCZ 46857 (2),** Mangrove near Parnaiba City, Piaui, Brasil, August 1968, T. R. Roberts. ESPIRITO SANTO: **FMNH 93256 (1),** Cachoeira, 17 April 1908, J. D. Haseman; **FMNH 93258 (10),** Cachoeira, Rio Parguassu?, 14 Apr 1908, J. D. Haseman; **FMNH 93268 (4),** Munez Freire or Cachoeira, Rio Itapemerim and creek one mile below town, 18 Jun 1908 J. D. Haseman; **FMNH 93278 (15),** Penedo, mouth of Rio Sao Francisco; in and along Rio Sao Francisco, both sides of river, 22 Mar 1908, J. D. Haseman; **FMNH 93280 (2)**, Munez Freire or Cachoeira, Rio Itapemerim and creek one mile below town, 18 Jun 1908, J. D. Haseman. RIO DE JANEIRO: **FMNH 86668 (5),** Campos, Rio Parahyba, 15 Jun 1908, J. D. Haseman; UF 19209 (2), Atafona, Rio de Janeiro, 19 March 1964, N. A. Menezes; **ANSP 121210 (2),** Rio de Janeiro, Atafona, 10 July 1963 - 8 August 1963, J. Baskin, N.A. Menezes and I.A. Dias. RIO GRANDE DO SUL: **MAPA 1498 (1),** Tramandai Lagoon, Tramandai, R.S. Brasil,9 December 1982, R. E. Reis, P. A. Buckup and L. R. Malabarba ; **MAPA 1501 (2),** Tramandai Lagoon, Tramandai, R.S. Brasil, 8 November 1982, R.E. Reis, L. R. Malabarba and P.A. Buckup; **MAPA 1718 (3),** Tramandai Lagoon, Tramandai, R.S. Brasil, 27 December 1982 R. E. Reis; **UF 34198 (2),**

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vicinity of Rio Grande, 2 September 1981, Belap; **UF 34199 (1),** vicinity of Rio Grande, 9 January 1981; **UF 34200 (4),** Lagoa dos Patos, Ilha dos Marinheiros, 28 December 1979, I. M. ; **UFRGS 0701 (1)**, Taim Swamp, Estacao Ecologica do Taim, Rio Grande, R.S., Brasil, 7/8 May 1981, R.E. Reis and J. R. Stehmann; **UFRGS 0946 (1)**, Custodias Lagoon, Tramandai, R.S. Brasil, 11 January 1980, Ana Beatriz; **UFRGS 0952 (1),** Custodias Lagoon, Tramandai, R.S. Brasil, 26 March 1980, A. B. Morais; **UFRGS 1023 (3),** Camarao river, Tramandai, R.S., Brasil, 11 January 1980, A. B. Morais.

Other Material: Rio Grande do Sul: MOFURG 80-34 (5), Porto Rei, Ilha Marinheiro, Rio Grande, R.S., Brasil, 29 November 1979; MOFURG 80-150 (2), Quiteria, Povo Novo, R.S., Brasil, 14 November 1980.

3.4 *Ctenogobius boleosoma,* Darter Goby (Figure 7)

Figure 7. *Ctenogobius boleosoma,* female, Ensenada Indio, Colon Province, Panama. Photo by J. Van Tassell.

Gobius boleosoma Jordan and Gilbert, 1882:295 (syntypes: USNM 30860; Pensacola, Florida).

Gobius encaeomus Jordan and Gilbert, 1883:611 (syntypes: USNM 29673; South Carolina).

Ctenogobius boleosoma Starks, 1913:68 (new combination).

Gobionellus encaeomus Meek and Hildebrand, 1928:884 (new combination).

Rhinogobius boleosoma Jordan, Evermann and Clark, 1930:439 (new combination).

Rhinogobius encaeomus Jordan, Evermann and Clark, 1930:439 (new combination).

Gobionellus boleosoma Ginsburg, 1932:24 (new combination).

Gobionellus munizi Vergara, 1978:1 (holotype: Instituto de Zoologia de la Academia de Ciencias de Cuba; Chirivico, Prov. Santiago de Cuba, Cuba).

Ctenogobius munizi Claro and Parenti, 2001:53 (new combination).

Diagnosis. D_2 I,10; A I,11. Anterodorsal and posterodorsal bars emanating from lateral blotches producing V pattern, occasionally also with antero- and posteroventral bars forming an X pattern; large dark patch of melanophores posterodorsal to opercular region on side of nape. No ocelli. Few or no scales on nape.

Description. Based on 225 specimens, 12.7-48.6 mm SL. General body form as given for genus; morphometrics given in Tables 2–4. Jaws larger in males than females, roughly 1/3-1/2 distance to posterior margin of orbit in females, 1/2-2/3 in males (Table 2). Highly recurved canine teeth in rear of lower jaw; no tusk-like teeth. Outer row includes about 3 large canines on each side of upper jaw. Eyes lateral, high on head, top forming part of dorsal profile, slightly larger in females than males (Table 2). Females have a greater body

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depth, greater cheek width, and longer nape and precaudal trunk region than males, while males show a longer caudal trunk region (Tables 3–4).

D_1 spines not greatly produced, 3rd or 4th spine of males reaching 2nd or 3rd element of second dorsal fin when appressed. Pectoral fins reaching to vertical through anal fin origin in males and a vertical through anus in females. Pelvic fins extending to urogenital papilla in males, not reaching anus in females. Appressed anal and D_2 fin rays extending beyond procurrent caudal fin rays in males; D_2 rays not reaching and anal fin rays reaching to procurrent caudal fin rays in females. Caudal fin longer in males than females. Fin measurements and ray counts given in Table 5.

Trunk with ctenoid scales from caudal fin base to pectoral fin base along midline, to rear of D_1 along dorsum; abdomen and anterior dorsum with cycloid scales. Usually no or few scales anterior to a diagonal from the pectoral fin base to the D_1 origin. Pectoral fin base, prepelvic region, cheek and opercle naked. Abdomen generally partly scaled, naked over infracarinalis medius muscle; juveniles with naked midline. Scale counts given in Table 6.

Preopercular canal generally with three pores; of 130 specimens examined, 11 had 2 pores on one side and 6 had 2 pores on each side.

Pigmentation in preserved specimens. Snout with several streaks, darkest running from eye to jaw halfway between anterior nares and angle of jaw; diagonal bar across cheek from mid-preopercle to angle of jaw; two ventrally directed bars from diagonal cheek bar to lower edge of cheek may appear of variable intensity and often incomplete, one in mid cheek region, the other near the preopercular margin. Opercle dusky. Large dark shoulder patch at upper angle of opercle on side of nape; thin intense crescent of subcutaneous pigment just before D_1 origin in mid nape region between shoulder patches (referred to as a V-shaped mark by Wyanski and Targett [2000]). Dark spot on upper and lower pectoral fin base. Five midlateral oblong blotches, last being basicaudal; anterodorsal and posterodorsal diagonal bars arising from three central blotches, forming a V pattern, frequently with short anteroventral and posteroventral diagonal bars to create an X pattern, but diagonal bars also often incomplete. D_1 diagonally barred, spines frequently with dark tips in males. D_2 diagonally barred with dark spot at tip of flexible spine in males. Anal fin dusky in males with occasional dark spots near base; dark submarginal bar on clear background in females. Pectoral fin lightly flecked or clear in females; slightly dusky with thin vertical bars of dark spots in males. Caudal fin in males with a clear streak near upper edge, but dark margin, slight vertical barring in middle, especially near base, and dusky at lower edge; mostly barred in females with clear lower margin, dusky submarginal region and slight dusky band on upper edge. Pelvic fins dusky in adult males; dusky medially with dark streak each side in females and juvenile males.

Color in life. Five dark midlateral oblong blotches with diagonal dorsal bars (as described above) on light tan to olive trunk, body color lighter cream color below midline; prominent large blueish black shoulder patch on nape above pectoral fin base; often 7 or more dark spots along dorsal midline from between dorsal fins to base of caudal procurrent fin rays, some from convergence of diagonal dorsal bars; head mottled with prominent stripe extending forward from orbit to mid-jaw; variably two somewhat longitudinal stripes on cheek, uppermost running from above corner of the jaws towards upper preopercle, sometimes forming a chain with three beads; lowermost cheek stripe parallel and near lower margin of cheek, sometimes only forming two distinct spots; when two cheek stripes broken into spots they sometimes appear to form posterovertical bars across cheek which though different may be confused with *C. stigmaticus.* Opercle dusky. Dorsal fins in males with reddish/orange hue especially towards margin of D2, rows of reddish brown spots, small dark spot at tip of first D1 and/or D2 spine prominent in some; anal fin in males dusky with reddish/orange tinge, females with clear margin, dusky submargin which may have light orange/red color; caudal fin in males bright orange red along upper quarter, vertical bars crossing rays or dark strips parallel to rays in middle half of fin; lower portion dusky but may have orange red highlights; caudal fin in females vertical bars and clear lower margin, upper fin

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may have clear submargin with light reddish tinge, but not as bright as males. Other fins as noted in preserved pigmentation. Additional notes on life colors of specimens from South Carolina and Texas are given by Jordan and Gilbert (1882; 1883).

Specimens observed from the Bahamas are more silvery in body color, ranging from individuals showing a silvery background with the basic dark pigment patterns and red-orange highlights described above to those having an opalescent body with the dark pigment greatly reduced to a prominent shoulder patch and a thin dark stripe along the lateral midline. In the latter cases, pigmentation on the cheeks may be limited to small scattered reddish brown spots.

Axial osteology. Vertebrae: 10 + 16 = 26. Neural arches of caudal vertebrae incomplete. Fourth neural spine simple, not flared. 2 epurals.

Distribution. This species is known from southern New Jersey and Bermuda to southern Brazil. It has also been reported from Massachusetts (Hoff, 1976), but that specimen has not been examined. It is rarely taken above North Carolina along the Atlantic coast.

Comments. Gilbert and Randall (1979) placed *Gobionellus munizi* in the synonymy of *C. boleosoma.* This nominal species is reported as having 12 second dorsal fin and 13 anal fin elements and 22 to 26 lateral scales (Vergara, 1978), which would distinguish it from any known species of *Ctenogobius.* Despite the diagnosis given for this species, Gilbert and Randall (1979)'s decision is tentatively followed here. From the description and accompanying figures, it is obvious that this form shares the distinctive pigmentation pattern of *C. boleosoma.* As pointed out by Gilbert and Randall, the irregular placement of anterior scale rows results in some variability in counts - even by the same person. However, the counts of lateral scales given for *G. munizi* are very low. Of the counts made for 191 specimens of *C. boleosoma* in this study, the lowest number recorded was 29 (Table 6). Gilbert and Randall (1979) also noted that the highly branched last ray in the second dorsal and anal fins may be mistakenly counted as two, resulting in higher median fin element counts. A major reason for which I concur with their decision is the high degree of similarity in the pigmentation of *Gobionellus munizi* with *C. boleosoma.* Although *C. phenacus, C. sagittula, C. stigmaticus, C. smaragdus* and *C. manglicola* regularly display a shoulder patch similar to that found in *C. boleosoma,* they also differ from that species in other pigmentary characters. Only in *C. phenacus* is a V pattern developed on the trunk that approaches that found in *C. boleosoma,* but it differs from *C. boleosoma* in having clear pelvic and anal fins. Pigmentation of the pelvic and anal fins described for *G. munizi* is as generally found in *C. boleosoma.*

Geographic variation in the wide-ranging *Ctenogobius boleosoma* was studied using principal component analyses. Analyses were performed separately on 51 males and 50 females selected from across the species' range. Specimens were assigned to the following regions: U.S. Atlantic coast, Gulf of Mexico, insular Caribbean, continental Caribbean, and Brazil. Using 10 variables - standard length, lateral scale row number, predorsal scale number, jaw length, head length, orbit length, pectoral fin length, pelvic fin length, caudal fin length and total pectoral fin ray number - no separation of forms coincident with geographic region was accomplished. Regression of the first principal component, reflective of size, on the natural logarithm of standard length also failed to separate specimens on the basis of region or sex. Subsequently, 102 males and 98 females were independently treated using only the 7 morphometric variables listed above. Again, no separation resulted.

This species was described from a large series of specimens. Ongoing research in another lab suggests that the lack of morphological variation observed here may not be consistent with genetic variation. To stabilize the name, a male specimen, 38mm SL, is designated the lectotype, USNM 30860, with the other 39 specimens becoming paralectotypes, USNM 265103. Specimens from the same collection deposited in other museums are also designated as lectotypes. One specimen of *Microgobius thalassinus* was removed from MNHN 1887-0484 and assigned to MNHN 1990-0648.

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Material Examined. NEW JERSEY: ANSP 130090 (1) Brigantine, Absecon Inlet, cove on south end of Brigantine, 24 October 1973, R. P. Smith and D.L.T. DELAWARE: ANSP 73745 (1), Lewes-Rehoboth Canal (Broadkill River) about 1 1/4 mile NW of Canary Creek, 6 October 1953, T. Dolan IV and J. H. Wallace-ANSP Dept. Limnology. BERMUDA: MCZ 32987(1), Hungry Bay, near Hamilton, February 1903, T. Barbour. NORTH CAROLINA: USNM 123291 (1), Carteret Co., Pivers Island, Beaufort, 10 July 1914, S. F. Hildebrand; USNM 123295 (1), Carteret Co., Pivers Island, Beaufort, 1 July 1932, S. F. Hildebrand USNM 123301 (2), Gabriel's Marsh, Newport River (Beaufort), Hildebrand and Cable; USNM 123298 (6), Mullet Pond, Beaufort, 29 January 1930, S. F. Hildebrand; USNM 123299 (1), Mullet Pond, Beaufort, 25 July 1914, S. F. Hildebrand. SOUTH CAROLINA: ANSP 142663 (24), Fort Johnson, pool in spoil area Southeast of GMBL, 7 June 1971, W.D. Anderson, HWF, WWH, JFM, and TDB; ANSP 142664 (1), Fort Johnson, pool in spoil area Southeast of GMBL, 7 June 1971, W.D. Anderson, HWF, WWH, JFM, and TDB; USNM 265067 (3), Shore near mouth of Edisto River, Charleston, 11 Oct 1935; USNM 365956 (4), James Island, shallow water ponds in salt marsh, Charleston, 22 Apr 1935, D. M. Cohen; **USNM 29673 (3), syntypes, *Gobius encaeomus,*** Charleston Co., Charleston, C. H. Gilbert. GEORGIA: ANSP 71066 (1), Northwest end of Sapelo Island, 21 November 1941, G. A. B. Orr, and C. B. Peterson. FLORIDA: AMNH 52339 (1), Monroe Co., grassy flats off S side of Boot (Marathon) Key, 10 January 1977, Dingerkus et al.; USNM 89876 (3), Monroe Co., Key West, pond at Wagon Bridge to Stock Island, 7 August 1919, Hildebrand and Cable; USNM 89877 (4), Monroe Co., Key West, Boca Chica, 16 May 1919, Hildebrand and Stevenson; UF 63575 (UF/FSU 13575) (115), Franklin Co., Alligator Peninsula, tidal pond behind FSU Marine Lab, 19 March 1966, R. Yerger et al.; ANSP 96801 (1), Marquesas Keys, 18 March 1954, D. M. Barringer; ANSP 113042(1), Monroe Co., E side of Key West near junction of U.S. Hwy. A1A and Flager Avenue, 4 May 1968, N. R. Foster; USNM 123305 (4), Gulf Co., Money Bayou, between Cape San Blas and Indian Lagoon, 21 June 1932, I. Ginsburg; USNM 265068 (1), Sarasota County, Sarasota, 100 yards south of Cape Haze Marine Lab, 24 Aug 1966, R. F. Cressey; USNM 123303 (3), Gulf Co., Cape San Blas in pond near point, 20 June 1932, I. Ginsburg; USNM 265070 (30), Pensacola Bay, muddy bight east side of Bruce's Dock, 23 February 1932, Bingham. Ocean Coll.; **USNM 30860, lectotype, *Gobius boleosoma,*** Escambia County, Laguna Grande, Pensacola, March 1982, D. S. Jordan, and S. Stearns; **USNM 265103 (39), paralectotypes, *Gobius boleosoma,*** same collection as lectotype; **MNHN 1887-0484 (1), paralectotype,** same collection as lectotype; **CAS-SU 1675 (33), paralectotypes,** same collection as lectotype. ALABAMA: AMNH 35737 (3), Mobile Co., Bay (boat channel) at Point Aux Pins, Bayou La Batre, 12 October 1975, Stiles et al.; AMNH 35730 (12) Mobile Co., Dauphin Island, Mobile Bay along NE shore near Dauphin Island Sea Lab, 11 October 1975, G. Dingerkus et al.; AMNH 53021 (1), Mobile Co., Dauphin Island, Mississippi Sound side airport marsh, 21 July 1982, Holk et al.; USNM 127465 (1), Mobile Co., Sand Island, 2 Sep 1930, I. Ginsburg. MISSISSIPPI: USNM 265008 (1), Jackson County, Ocean Springs, south of Ocean Springs Research Lab, 1 Jun 1960, J. Watson and J. P. Morrison. LOUISIANA: USNM 123314 (8) Jefferson Par., Grand Isle, ponds at east end, 25 July 1930, I. Ginsburg; USNM 123319 (1), Jefferson Par., Grand Isle, Ft. Livingston, 19 July 1930, I. Ginsburg. TEXAS: ANSP 115760 (1), Texas/Louisiana, Orange Co./Cameron Parish, Sabine River just above Sabine Island, ca. 1.5 mi S of mouth of Cow Bayou, 28 July - 8 August 1969, J. J. Loos, et al., ANSP Dept. Limnology; ANSP 73643(2), Orange Co., Sabine River about 2 miles above Sabine Lake, 23 August 1952, ANSP Dept. Limnology; ANSP 115719(1), Texas/Louisiana: Orange Co/Calcasieu Parish, Sabine River, off SW end of Cutoff Island, ca 100 yds above the Intracoastal Waterway, 8 July - 8 August 1969, J. J. Loos, et al. - ANSP Dept. Limnology ; ANSP 99216 (2), Texas and Louisiana: Orange Co/Cameron Par: Sabine River, just above Sabine Island, ca 1.5 mi S of mouth of Cow Bayou, 7 August - 17 August 1962: ANSP Dept. Limnology; ANSP 73849(3), Orange Co., Sabine River about 2 miles above Sabine Lake, 19 April 1953, T. Dolan, IV - ANSP Dept. Limnology; USNM 118549 (1), Galveston Bay, 1935, Baughman; USNM 123339 (1), Swan Lake, Galveston, 5-15 November 1891, B. W. Evermann; USNM 7391

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(2), Aransas Co., St. Joseph's Island, Wurdemann. MEXICO: GCRL 2879(18), Vera cruz, Boca del Rio, 5 June 1968, C. E. Dawson and Romay; USNM 192269 (1), Quintana Roo, Ascension Bay, shore in front of Allen Point Light, 13 Apr 1960, F. C. Daiber. BELIZE: USNM 265001(1), South of Stann Creek, 17 May 1977, M. L. Jones. BAHAMAS: ANSP 98654 (1), Great Bahama Bank, Andros, tidal creek on S shore of southern Bight, near E end, Sta. 393., 24° 12' 35" N: 77° 37' 0', 11 July 1957, J. E. Böhlke, C.C.G. and G.W. Chaplin, H.R. and R.B. Roberts, and A. Kemp; ANSP 98777 (1), Great Exuma, Grassy Bay SW of Simons Point, 24 April 1959, C. C. G. Chaplin et al.; AMNH 21412 (2), Great Inagua, Alfred Sound, Sheep Cay, 30 June 1964, C. L. Smith et al.; AMNH 23339 (3), San Salvador, E end of French Bay, mangroves, 13 November 1964, C. L. Smith et al.; AMNH 28812 (26), S shore Grand Bahama, halfway between Bell Channel and Gold Rock, 21 September 1966, C. L. Smith et al.; AMNH 23468 (11), San Salvador, sand flat, Pigeon Creek, 19 November 1964, C. L. Smith et al. CUBA: USNM 265011 (1), Guantanamo Bay, 1 - 14 Feb 1937, R/V Atlantis; USNM 265072 (3), Havana Harbor, beach near boatyard, 1 Feb 1932; USNM 178955 (1), Isle of Pines, Cayo dos Indios, 8 March 1936. JAMAICA: USNM 265071 (1), St. Ann's, Jamaica, British West Indies, drainage ditch, 22 Feb 1937. DOMINICAN REPUBLIC: USNM 265069 (1), Samana Province, 5.4 kilometers east Las Terrenas, seined from small stream flowing into ocean about 50 meters from beach, 8 Jan 1976, J. F. Jacobs and R. I. Crombie. PUERTO RICO: UMMZ 172793 (16), old mouth of Bayomon River at San Juan Bay, 24 July 1955, D. S. Erdman and C. L. Smith; AMNH 28375 (1), Guanajibo, from mouth of Rio Estero, 18 July 1968, D. S. Erdman; ANSP 144506 (1), Lake Joyuda, mangrove shore with mud bottom, 28 December 1964, F. Pagan and M. Perez; ANSP 144488 (3), Lake Joyuda; mud bottom near mangroves, 23 October 1963, J. E. Randall, et al.; USNM 86910 (1); USNM 55695 (1), Mouth of Rio San Juan, March 1904, Eigenmann; USNM 114657 (1), Rio Anasco Beach, pool near mouth, 22 Aug 1956, D. S Erdman and Zalduando. ST. KITTS and NEVIS: USNM 133064 (3), Nevis, "Hot Baths" fresh stream south of Charlestown, near sea, 23 Feb 1946, D. S. Erdman. GUADELOUPE: ANSP 144487 (2), S of Pt. Lambis, West coast of Grande Terre; mangrove area off Canal de la Belle Plaine, 1 July 1976, J. E. Randall, et al.; USNM 170241 (5), Between Monroux Island and Rat Islands, Pointe-a-Pitre, Grande Terre, 30 - 31 March 1956, F. Chace and D. Nicholson, Smithsonian Institution-Bredin Caribbean Expedition. MARTINIQUE: ANSP 113089 (5), Harbor W of Point Caracoli (NE end of Martinique), beach along N end of bay, 14° 47' " N, 60° 53' " W, 7 July 1965, J.C. Tyler and W.N. Eschmeyer. TRINIDAD and TOBAGO: AMNH 11761 (3), Trinidad, 1931, D. Parsons. PANAMA: GCRL 4669 (66), Colon Prov., Boca Del Rio, Boca Del Rio Piedras, 28 Jun 1970, C. E. Dawson; GCRL 12227 (1), Colon Prov., Maria Chiquita, 6 November 1973, C.E. Dawson and Jones; ANSP 146903 (1), Colon Prov., River mouth at Buenaventura; first turn W of Portobelo; st. 67, 11 March 1981: D. and P. Fromm; USNM 148716 (1), Canal Zone, Thalassia beds, Fort Randolph, Galeta Point, 31 Oct - 1 Dec 1948, V. Walters; USNM 123344 (2), Colon, Brackish Creek, 23 Feb 1935, Venable; USNM 265000 (1), beyond Maria Chiquita, on dead coral and mud, 17 Jul 1969, L. G. Abele; USNM 205204 (1), Ft. San Lorenzo, mouth of freshwater stream, 20 Nov 1948, V. Walters; USNM 226379 (1), Fort Randolf, Turtle Grass Bed, 17 May 1979, D. L. Kramer; USNM 123348 (2), Gatun Locks, Lowest Chamber, 24 Feb 1935, S. F. Hildebrand; USNM 81825 (1), Colon, ditch at Slaughter House, 13 Jun 1911, S. E. Meek and S. F. Hildebrand; USNM 123346 (1), Fort Randolph, Canal Zone (north central Panama), 4 Mar 1937, S. F. Hildebrand. COLOMBIA: GCRL 4787 (24), Magdalena, Santa Marta, 11 June 1970, C. E. Dawson; USNM 38655 (3), Sabanilla, 16 - 22 Mar 1884, RV Albatross. CURAÇAO: ANSP 144507 (4), Inner Piscadera Bay, 19 November 1962, J. E. Randall and C. R. Robins. VENEZUELA: GCRL 15513 (9), Margarita, 28 March 1976; MCNG 660 (7), Laguna at Playa Supi, Peninsula de Paraguana, Falcon State, 18 April, 1978, D. Taphorn; USNM 123273 (1), Gulf of Venezuela, Port Macolla, 19 Apr 1925, P. P. Blackburn, USS Niagara. BRAZIL: MAPA 1502(6 [of 35]), Tramandai Lagoon, Tramandai, Rio Grande do Sul, 8 December 1981, R. E. Reis, L. R. Malabarba and P. A. Buckup; AMNH 3836 (13), Natal, Rio Grande do Norte, 1911, E. C. Starks; ANSP 121172 (3), Grussai, Rio de Janeiro; brackish water lagoon, 1963, J. Baskin, et al; ANSP 121173 (1), Manguinbros, Rio de Janeiro. 1963, J. Baskin, et al.; ANSP 121182 (2), Rio de Janeiro, Ilha da Pecanha (Pecanha Is.); Atafona, 10 July - 8 August 1963, J. Baskin, N.A. Menezes and I.A. Dias; AMNH 20746(1) Rio

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de Janeiro, Atafona, pontal, 19 March 1964, N. A. Menezes; AMNH 20705(1), Rio de Janeiro, Atafona, Island of Pecahna, 19 Mar 1964, N. A. Menezes.

3.5 *Ctenogobius claytonii*, Mexican Goby (Figure 8)

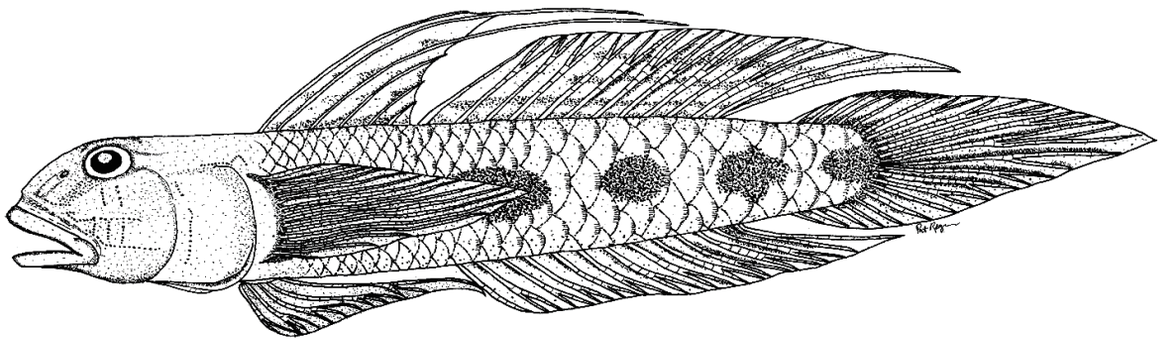

Figure 8. ***Ctenogobius claytonii,*** **UF 101623, male, 50.5 mm SL, Rio Boca de Ovejas, Vera Cruz State, Mexico. Drawing by Pat Regan.**

Gobius claytonii Meek, 1902:121, pl. 31 (holotype: FMNH 3740; Rio San Francisco, Vera Cruz, Mexico).

Rhinogobius shufeldti Jordan and Dickerson (in part), 1908:21 (new combination).

Rhinogobius claytonii Jordan, Evermann and Clark, 1930:439 (new combination).

Gobionellus claytonii Ginsburg (in part), 1932:15 (new combination).

Gobionellus atripinnis Gilbert and Randall, 1979:38 (holotype: UMMZ 167639; Brownsville, Texas).

Diagnosis. D_2 I,11; A I,12. Second and third D_1 spines long and filamentous in males. Pelvic fin dusky in males, with parallel streaks in females. Strong, recurved canine in midlateral lower jaw of males. Ventral midline and nape usually naked or with only a few scales.

Description. Based on 48 specimens, 15.2-55.5 mm SL. Body form as described for genus; morphometrics given in Tables 2–4. Jaw extending beneath anterior 1/3 of eye in females; to 1/2-2/3 of eye in males. Outer row of upper jaw teeth in males much enlarged, only slightly so in females, with 4-6 teeth on each side of symphysis in both sexes. Innermost row of lower jaw teeth highly recurved; one or two large recurved canines midlaterally in outer row in males, near origin of mental frenum. Females have a longer nape and preanal body length; males have longer postanal body lengths.

Second and third D_1 spines usually greatly produced in adult males, with the third spine to nearly half of standard length (Figure 3). Pectoral fins extending slightly beyond vertical through anal fin origin in males, to vertical at anus in females. Pelvic fin also going beyond anal fin origin in males; in females not reaching anus. Posteriormost second dorsal and anal fin rays reaching past procurrent caudal rays in males when appressed, just to procurrent rays in females. Caudal fin roughly 1/3 SL in both sexes (Table 5).

Trunk with ctenoid scales posteriorly extending to pectoral fin base midlaterally; cycloid scales forward from middle of first dorsal fin along fin base and in abdominal region. No scales beneath axil of pectoral fin. Few or no scales forward of a diagonal line from upper pectoral fin base to D1 origin. Cheek, opercle, pectora

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fin base and prepelvic region naked. Ventral midline of abdomen generally naked, occasionally partly scaled in females; naked over infracarinalis medius muscle in all specimens at hand. Scale counts given in Table 6.

Preopercular canal generally with three pores.

Pigmentation in preserved specimens. Snout with streak from eye to midlateral jaw; cheek dusky with poorly defined markings. Opercle faintly edged. Top of head uniformly pigmented to vaguely mottled.

Trunk with five midlateral blotches, sometimes with intermediate spots - the latter not being as well-defined as those in *Ctenogobius apogonus.* Pectoral fins dusty to clear. Pelvic fins evenly pigmented throughout in males; with bilateral streaks in females. Dorsal fins with diagonal waves of blotches. Dark elongate spot at top of first dorsal spine and another dark spot at top of spine in second dorsal fin in some males. Females sometimes with slightly darker pigment towards tips of spines, including D_2 spine. Anal fin in males dusky with sharp dots at the base in some; females with more diffuse blotches at base and a submarginal band. Caudal fin in males with a dusky region over lower half which is divided by a clear horizontal strip; upper half faintly barred; dark elongate spot at upper edge near base. Females with lower margin dusky, and remainder of fin with vertical bars.

Color in life. This species is generally lightly pigmented and specimens from larger streams may be nearly completely blanched in appearance. Specimens also seem to fade substantially in preservative.

Axial osteology. Fourth neural spine simple, not flared. Two epurals.

Distribution. This species is presently known from the Rio Grande in the vicinity of Brownsville, in streams and estuaries in the state of Vera Cruz, from Tampico south to the Rio Coatzacoalcos, and from lagoons in the Usumacinta/Grijalva basin in the state of Tabasco (Macossay-Cortez et al., 2011).

Comments. This species has been confused with *Ctenogobius fasciatus,* a Caribbean species (Ginsburg, 1932; Robins and Lachner, 1966). Gilbert and Randall in Gilbert and Kelso (1971) first recognized these two forms as valid species on the basis of the dark preopercular margin and greater squamation of the belly in *C. fasciatus.* Interestingly, Ginsburg (1932) had distinguished his Panamanian representatives of *Gobionellus claytonii* (actually *C. fasciatus*) from his Mexican series *(C. claytonii)* using the same characters, but felt the distinction insignificant. As Gilbert and Kelso (1971) pointed out, however, these differences are accompanied by a significant difference in geographic range; they cannot be merely regarded as representing population variation. Castro-Aguirre (1978) regarded *C. claytonii* as a synonym of *C. shufeldti.* These two species differ in pelvic fin pigmentation, the elongation of the third D_1 spine in adult males (Figure 3) and *C. shufeldti* has proportionately smaller teeth. *Ctenogobius shufeldti* also shows greater squamation on the belly and usually more predorsal scales. The latter character is variable, however. The pelvic fin is clear in female *C. shufeldti,* but with bilateral streaks in *C. claytonii* females. Males of *C. shufeldti* have the bilateral streaks typical of females and juveniles in a number of *Ctenogobius* species. The retention of the juvenile pattern in male *C. shufeldti* is unique to that species. *Ctenogobius claytonii* males have the more common uniformly pigmented pelvic; considering the propensity for these specimens to fade, however, it is sometimes necessary to inspect the pelvic fin with a microscope.

Gilbert and Randall (1979) described *Gobionellus atripinnis* from the western Gulf of Mexico. This species was distinguished from *Ctenogobius claytonii* by 1) the presence of black blotches at the tip of the first spine in the spinous dorsal and at the tip of the spine of the soft dorsal in males, 2) having small, distinct black interradial spots on the membrane at the base of the anal fin in males, 3) having small, distinct spots between the three

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posteriormost midlateral blotches in adult females, 4) most individuals possessing 16 pectoral fin rays instead of 17, 5) a relatively shorter (though elongate) third dorsal spine in males and 6) a probably smaller potential maximum size. Addressing the last proposed distinction first, these species are too close in size and proportion and represented by too few specimens to cogently offer difference in achievable length as evidence for specific validity. Regarding the possible differences in length of the third dorsal spine, a plot of arcsin transformations of this spine as a proportion of standard length against the natural logarithm of the standard length (Figure 9) for all eight male specimens of these two morphs in which the spine was not broken does not suggest much more than increased spine length with increased growth. The data are admittedly meager - a point favoring a more conservative interpretation. As for the position of the holotype, it is definitely out of line not only with specimens regarded as *C. claytonii* by Gilbert and Randall (1979), but with *G. atripinnis* specimens as well.

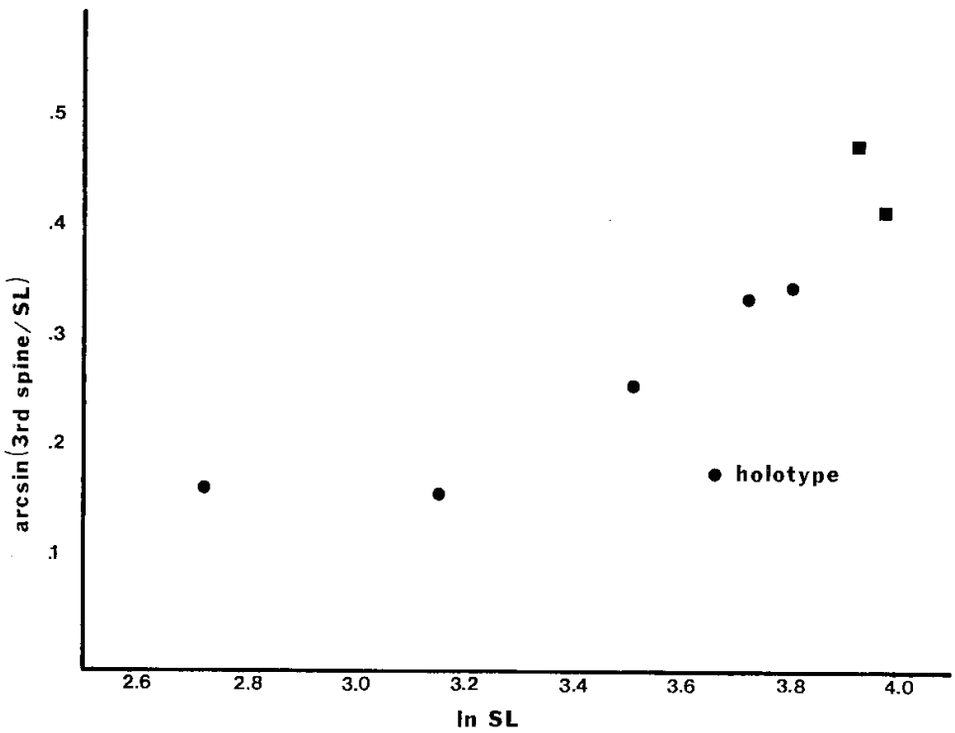

Figure 9. Arcsin transformed length of the 3rd dorsal spine as a proportion of the natural logarithm of standard length. Circles = *Ctenogobius atripinnis,* Squares = *Ctenogobius claytonii.*

More substantial evidence was offered in the pigmentation patterns of the medial fins and the pectoral ray numbers. Dark spots are variably seen at the tip of the first dorsal fin spine and at the tip of the spine of the soft dorsal fin in *C. shufeldti* and *C. boleosoma.* It is much more variable in *C. shufeldti* than in *C. boleosoma,* perhaps reflecting some level of population differentiation. *Ctenogobius lepturus* has dark pigment at the tips of most spines in both sexes. *Ctenogobius apogonus* males often show a slightly darker spot at the tip of the first dorsal spine. The discrete interradial spots on the membrane of the anal fin in males may also be seen in some specimens of *C. shufeldti,* and more generally in *C. boleosoma, C. apogonus* and *C. lepturus. Ctenogobius stigmaturus* males also show discrete pinpoint-like dots on the anal fin, but these are often more associated with the rays than the interradial membranes. The significance of the small spots between the midlateral blotches, it

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is not clear (Gilbert and Randall, 1979). Spots between the blotches appear to be variably developed in this species; in fact, the reference in the description of *G. atripinnis* is to one female paratype. Although not mentioned in the original description of *C. claytonii* (Meek, 1902), interposed spots are visible in the drawing of the holotype. Such spots are also found in C. fasciatus, but are best developed in *C. apogonus*. Inspection of the largest female of *Gobionellus atripinnis* (in UMMZ 181796) revealed a few odd spots still standing out on a faded specimen. They did not appear to be associated in any regular pattern with the midlateral blotches.

Gilbert and Randall (1979) also presented evidence for an average of 16 pectoral fin rays in *G. atripinnis* and 17 in *C. claytonii,* but noted there was overlap. In short, the pigmentation patterns are presented as diagnostic in conjunction with a number of pectoral rays that incompletely separate the two forms. As similar variation for the same pigmentary features and for pectoral ray counts (spanning the same range) have been observed in closely related species, *Gobionellus atripinnis* is regarded as a junior synonym of *Ctenogobius claytonii.*

Most specimens of *Gobionellus atripinnis* have been taken in relatively large river systems for that region - the Coatzacoalcos, Papaloapam and Panuco-Tamesi drainages, while those previously identified as *C. claytonii* have been predominantly from smaller coastal streams and lagoons. As noted by Ginsburg (1932), specimens from the Rio Papaloapam are very bleached compared to specimens from other localities. It is possible that pigmentary variation reflects genetic differentiation among populations, but it may also be due to ecophenotypic variation.

Material Examined. TEXAS: **UMMZ 167639, holotype, *Gobionellus atripinnis,*** Cameron Co., Stream 7.7 mi E of Brownsville on Rte. 4; Rio Grande drainage, 9 April 1952, C. L. Smith and H. E. Winn. TAMAULIPAS: SU 68864 (3) market at Tampico, January 1899, J. O. Snyder and D.S. Jordan. VERA CRUZ: **FMNH 3740, holotype, *Gobius claytonii,*** Rio San Francisco, La Antigua, 10 May 1901, S. E. Meek and F. E. Lutz; FMNH 3741 (1), same collection as holotype; FMNH 16900 (7), same collection as holotype; FMNH 4572 (1), San Francisco, 10 Mar 1903, S. E. Meek; FMNH 16907 (4), San Francisco, 10 Mar 1903, S. E. Meek; UF 101623(1), Rio Boca de Ovejas, 17.4 mi SE of Vega de Alatorre, 2 May 1965, F. Thompson; UMMZ 184472 (2), Rio Rancho Nuevo in lagoon at mouth, ca. 10 mi N of Vega de Alatorre (N of Veracruz), 27 January 1959, R. R. Miller, R. J. Schultz et al.; UMMZ 184456 (1), Rio Raudal, 5.3 mi S of Nautla on coastal road, (at San Rafael los Flores), 26 January 1959, R. R. Miller and R. J. Schultz; UMMZ 184609 (1), Laguna de Pajaritos at E end (entrance) and on playa at S shore, across from Coatzacoalcos; Rio Coatzacoalcos, 9 Febraury 1959, R. R. Miller and R. J. Schultz; TNHC 11277 (1), Rio Papaloapan, 8 km N Tlalcotalpan on Mexico 175, 15 August 1981, F. Pezold and R. J. Edwards; TNHC 11287 (6), Rio Papaloapan, 8 km N Tlalcotalpan on Mexico 175, 15 August 1981, F. Pezold and R. J. Edwards; **UMMZ 181796 (7; one cleared and stained), paratypes, *G. atripinnis,*** 5 mi S of Tampico, in brackish-water lagoon, 4 January 1956, Clifton and Kuhn; **UMMZ 187725 (4), paratypes, *G. atripinnis,*** Rio Chiquito, arm of Rio Coatzacoalcos, 0.25-0.5 mi below Tenochtitlan, 40 airline km SW of Minatitlan, 28 January 1968, R.R. Miller, M. B. Lackey, F. Davalos and O. Castro; UMMZ 187703 (7), West bank Rio Chiquito, 0.25 to 0.5 mi below Tenochtitlan; Rio Coatzacoalcos dr, 19 May 1968, J. A. And M. B. Lackey; UMMZ 97727 (3), Rio Papaloapan, 2 miles W of San Cristobal, 21 May 1930, Creaser, Gordon and Ostos; **UMMZ 187763**(1), **paratype, *G. atripinnis,*** small arroyo about 0.5 mi N of Tenochtitlan, adjacent to W bank of Rio Chiquito; Rio Chiquito - Rio Coatzacoalcos dr., 1 February 1968, R. R. Miller and M. B. Lackey.

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3.6 *Ctenogobius fasciatus,* Burnside Goby (Figure 10)

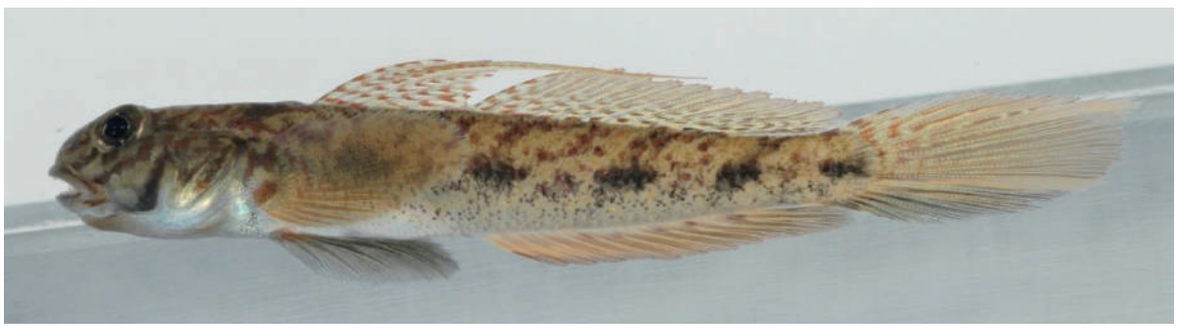

Figure 10. *Ctenogobius fasciatus,* male from Rio Guanche, Colon Province, Panama. Photo by J. Van Tassell.

Ctenogobius fasciatus Gill, 1858:376 (syntypes: USNM 7549; Trinidad). Robins and Lachner, 1966 (USNM 7549 designated lectotype, USNM 198110 designated paralectotype).

Gobius fasciatus Günther, 1861:34 (new combination).

Gobionellus claytonii Ginsburg, 1932:15 (in part).

Gobionellus fasciatus Pfaff (in part), 1933 (new combination).

Diagnosis. D_2 I,11; A I,12. Intense wide dark margin along preopercle, widest at the angle. Third spine of D_1 greatly elongate in males. Strong, recurved canine in midlateral lower jaw in males. Zero or few scales on nape. Fourth neural spine simple, not flared. Two epurals.

Description. Based on 190 specimens, 12.0-62.1 mm SL. General body form as described for the genus; morphometric details given in Tables 2–4. Jaws reaching beneath anterior 1/3 to 1/2 of eye in both sexes. Teeth in upper jaw with about 5 greatly enlarged teeth on either side of symphysis in outermost row. Outer row of lower jaw including one or two slightly larger recurved canines on each side near origin of mental frenum in males, but not as large as largest teeth of upper jaw. Females have a large orbit length, males have longer postanal body lengths, larger jaws, and interorbital regions. Females have larger orbit diameters than males.

Third spine of spinous dorsal greatly elongate (Figure 3) in males, 57% of standard length in one large specimen. Pectoral fins reaching beyond vertical through anal fin origin in large males; extending to vertical through anus in females. Pelvic fins reaching to anal fin origin or urogenital papilla in males; not reaching anus in females. Second dorsal and anal fin rays reaching beyond procurrent caudal fin rays in males; to procurrent rays in females. Caudal fin longer in males than females, approaching 40% SL in males, about 1/3 SL in females. Fin measurements, and ray counts given in Table 5.

Ctenoid scales over most of the body from the caudal fin to the pectoral fin; naked beneath the pectoral axil. Cycloid scales along dorsum forward from near D_1 origin, sometimes with a row or so extending back along base of D1 to near its terminus. Usually few or no scales before a diagonal line running from upper pectoral fin base to D_1 origin. Prepelvic region, pectoral fin base, cheek and opercle naked. Cycloid scales along abdomen; abdominal midline naked to partially scaled, naked over infracarinalis medius.

Preopercular canal with three pores.

Pigmentation in preserved specimens. Dark streak present on snout from eye to midlateral jaw. Cheek with diagonal dark bar from near upper preopercle to corner of jaw. Snout dusky. Preopercular margin of cheek with dark outline most intense and broad at the angle. A few diffuse bars sometimes evident on head, with two or

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three slightly more distinct on nape before first dorsal fin. Trunk with five midlateral oblong blotches, the last being basicaudal; diffuse blotches sometimes evident between them, reducing contrast of the primary blotches, but not as distinct as those seen in *Ctenogobius apogonus.* Posterodorsal arms from posterior blotches present in some. Pectoral fins generally dusky, occasionally with some very faint thin vertical bars of pigment over upper 2/3. Pelvic fins dusky in males; with bilateral streaks in females. Both dorsal fins with diagonal bars, with bars frequently more distinct in soft dorsal fin; membrane between branches of last ray with darker pigment in some; tips of first couple of spines with a dark spot in some males. Anal fin dusky in males; females have a dusky submargin and large dark but diffuse spots on the interradial membranes near the base. Caudal fin generally dusky in males with a hint of bars on upper half, especially towards the caudal base, often darkest along ventral margin and towards tip, with dusky ventral portion offset form rest of fin by clear horizontal strip. Females with bars over most of caudal fin, dusky submargin and clear margin below, frequently darker distally.

Color in life. Body color is olivaceous with the dark markings described above, but in males there are red or reddish brown highlights associated with spotting on the head and dorsum, a red spot on the lower pectoral fin base and rows of reddish brown spots in the dorsal fins. Pectoral fins in males with reddish or orangish yellow hue.The anal fin in males is reddish yellow with a dark margin and reddish dark interradial spots along the fin base. The caudal fin is dark ventrally with a light orangish yellow longitudinal band extending from the caudal fin base to its posterior margin just below the body midline; medial portion of the fin is dusky and topped by an orangish to yellowish upper third that has a reddish spots towards the fin base. Immature males show vertical barring on upper half of caudal fin as observed in females.

Axial osteology. Vertebrae: 10 + 16 = 26, 10 + 15 = 25 in one. Fourth neural spine simple, not flared. Two epurals.

Distribution. Primarily Caribbean; east-central Florida to Greater and Lesser Antilles, Costa Rica to Panama and Venezuela. Apparently most common in the southern Caribbean, Costa Rica to Barbados.

Comments. From Gill's description (1858) of this species, there is little doubt that he was referring to a member of this group of gobies, but beyond that little is offered. The shape of the caudal fin and its pigmentation suggest a female specimen was described, but the anal, pectoral and pelvic fins as described would belong to a male specimen. The type being lost, Robins and Lachner (1966) designated a lectotype for *Gobionellus fasciatus* drawn from a collection collected by Gill in Trinidad and identified as *G. claytonii* by Ginsburg. Their concept of *G. fasciatus* was a group including the goby described in this account and at least the species recognized in this work as *C. claytonii; G. claytonii* was considered a junior synonym. The lectotype and paralectotype were examined and proved to be the present species as herein defined. The paralectotype is a male, while the lectotype is female, perhaps explaining the mixture of sexual pigmentation patterns in the original description. Both specimens have the characteristic pigmentation of the rear cheek margin. Specimens from Panama referred to *Gobionellus claytonii* by Ginsburg (1932) included this species (USNM 81819, USNM 81874, USNM 81875) and one specimen of *C. pseudofasciatus* (USNM 81824, designated a paratype by Gilbert and Randall, 1979). Meek and Hildebrand (1928) reported this species, as well as *C. pseudofasciatus* (FMNH 32178, USNM 123264, USNM 205202 and USNM 105109, the latter three also designated paratypes by Gilbert and Randall, 1979), as *Gobionellus stigmaticus.* Specimens of *C. shufeldti* reported from Venezuela may be this species or the less commonly collected *C. pseudofasciatus.*

Material Examined. TRINIDAD: ***USNM 7549***, lectotype, ***Ctenogobius fasciatus,*** T. Gill; **USNM 198110 (1), paralectotype, *C. fasciatus,***T. Gill; AMNH 26394 (2), St. George, blanchisseuse, in stream under paria main road between 67.75 and 68 mileposts, 23 April 1967, A. Vinegar and C. Collins. BARBADOS: ROM 36366 (91), St. Andrews Co., Green Pond, Morgan Lewis Beach, 15 November 1974, M. Telford; ROM 36216 (88), St. Lucy Co., NE Coast, Tide Pool in River, River Bay, 23 August 1974, Emery and Emery; ROM 24325 (2), St. Andrew Co., Long Pond, 1 June 1961, G. Power; ROM 36363 (1), St. Andrew Co., Long Pond, 19

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November 1974, M. Telford. DOMINICA: USNM 199703 (1), North Mouth of Batali River, 25 March 1964, A. Hart and H. Hobbs; USNM 199704 (2), Mouth Blenheim River, Which Is a Wide Spot Connected To Sea By a Narrow Stream, North Coast, 7 November 1964, V. Springer and R. Reckeweg; USNM 199705 (1), General Area South of Scotts Head26 October 1964, V. Springer and local commercial fishermen. DOMINICAN REPUBLIC: UF 30402 (1), Samana Co., Spring run, El Valle, 30 January 1977, F. Thompson and L. Franz. HAITI: UMMZ 167222 (7), Etang Saumatre, 20 February 1933, R. M. Bond. VENEZUELA: UMMZ 147507 (31), Saline Lagoon, El Cable at Carupano, 30 March 1939, F. F. Bond; UMMZ 147536 (1), Rio Macarapana, 5 km SE of Carupano, 30 March 1939, F. F. Bond; USNM 194104 (1), Dto. Federal, Rio Aricagua, 1 August 1958, P. Bottome and W. Wallis. PANAMA: USNM 81874 (1), Canal Zone, Mindi Cut, 28 January 1911, S. Meek and S. Hildebrand; USNM 81875 (4), Canal Zone, Mindi creek, 14 January 1911, S. Meek and S. Hildebrand; USNM 81876 (2), Rio Cascajal, Porto Bello, 17 March 1912, S. Meek and S. Hildebrand; USNM 81819 (3), Rio Cascajal, Porto Bello, 17 March 1912, S. Meek and S. Hildebrand; USNM 148715 (1), Canal Zone, San Lorenzo, mouth of freshwater stream, 20 November 1948, V. Walters; CAS-SU 18574 (10), Rio Sugandi, Mosquito Point, San Blas, July 1950, W. T. Miller; FMNH 32186 (3), Rio Cascajal, Porto Bello, 17 March 1912, Meek and Hildebrand; FMNH 32184 (1), Canal Zone, Mindi Cut, 28 January 1911, Meek and Hildebrand; GCRL 7846 (15), Colon Prov., Maria Chiquita, 11 November 1971, C. E. Dawson; GCRL 12773 (5), Colon Prov., Devil's Beach, 6 March 1974, C. E. Dawson et al.; GCRL 10282 (2), Colon Prov., Maria Chiquita, 14 November 1972, C. E. Dawson et al.; GCRL 10266 (2), Colon Pro.v, Devil's Beach, 16 November 1972, C. E. Dawson et al.; GCRL 12777 (9), Colon Prov., Colon, 17 April 1974, C. E. Dawson et al.; GCRL 3280 (1), Colon Prov., Devil's Beach, 25 July 1968, C. E. Dawson et al.; UF 35956 (1), Gatun Lake spillway, 12 April 1965, Brockmann and Frederick; ANSP 122357(1), Bocas del Toro Prov., Rio Sixaola and creek into it near Finca California pumping station, 2 September 1962, H. G. Loftin and M. Canipe; ANSP 122358 (1), Colon Prov., Rio Lagarto, coastal stream at Lagarto (Palma Nueva), W. of Canal Zone, 25 August 1962, H. G. Loftin and E. L. Tyson. COSTA RICA: TU 24861 (2) Limon Prov, Rio Moin at Moin, 18 February 1960, R. D. Suttkus and S. Jimenez-C.; TU 24877 (28), Limon Prov., Rio Portete about 2km E of Moin, 18 February 1960, R. D. Suttkus and S. Jimenez-C.; UMMZ 180655 (3), Limon Prov., Tortuguero Lagoon, 0.5 miles from inlet, in small creek, 3 September 1958, L. Ogren; UF 11139 (10), Limon Prov., Tortuguero Lagoon, backwater bay ca 200 yds below point where river flows into lagoon across from Tortuguero Village, 18 August 1963, C. Gilbert et al.; UF 11176 (5), Limon Prov., Rio Palacio ca 2 mi above mouth ca 5 mi NNW of Tortuguero, 23 August 1963, C. Gilbert and D. P. Kelso; UF 10268 (6), Limon Prov., Tortuguero, 15 July 1962, D. Kelso, and R. L. Hirth; UF 67695 (UF/FSU 17695) (3), Limon Prov., 1 mi up Benjamin Creek from Tortuguero River, 17 August 1969, G. Holmes and C. Carr; UF 67624 (UF/FSU 17624) (4), Limon Prov., 0.62 mi S of mouth of Tortuguera River, W bank, 13 August 1969, G. Holmes; UF 67727 (UF/FSU 17727) (1), Limon Prov., Mouth of Tortuguero River, 18 August 1969, G. Holmes; UF 67670 (UF/FSU 17670) (1), Limon Prov., 3.5 mi S of mouth of Tortuguera River, W bank, 16 August 1969, G. Holmes; UF 67645 (UF/FSU 17645) (4), Limon Prov., 3.62 mi S of mouth of Tortuguero River, W bank, 13 August 1969, G. Holmes. HONDURAS: UMMZ 199685 (1), Trib. to Caribbean at mouth, 5 km W of Trujillo, 16 May 1975, R.R. Miller et al. FLORIDA: HBOM 107:07544 (2), Brevard Co., Sebastian Creek (N fork), below spillway on Fellsmere Canal, 25 August 1980, R. G. Gilmore; UF 193085 (1), Brevard Co., North Fork of Sebastian Creek, 19 April 1983, R. G. Gilmore and Ross.

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3.7 *Ctenogobius lepturus*, Snakeskin Goby (Figure 11)

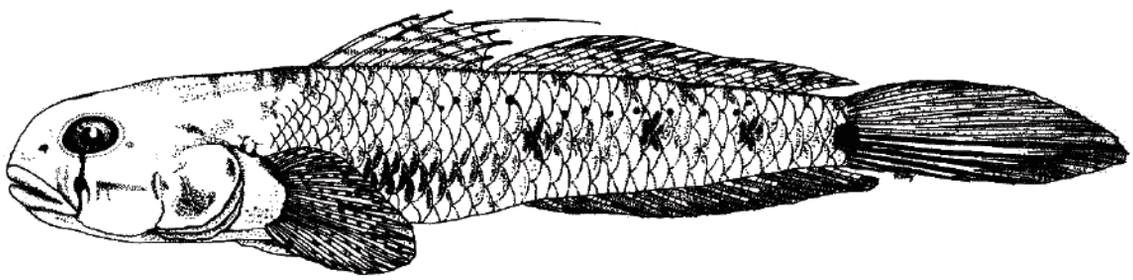

Figure 11. *Ctenogobius lepturus*, MNHN 1967-416, Pointe-Noire, Congo. Drawing by R. Sky.

Gobionellus lepturus Pfaff, 1933:303, Figure 11 (holotype: ZMUC P 781333; Lagos, Nigeria).

Gobius lepturus Fowler, 1936 (new combination).

Ctenogobius lepturus Miller, l98l (new combination).

Diagnosis. D_2 I,11; A I,12. Dark suborbital bar from eye to corner of the jaw. Scale pockets in midlateral region darkly outlined, producing reticulate pattern. Irregular row of spots, sometimes very dark, above and paralleling midlateral blotch series. Transverse and longitudinal papillae rows on cheek highlighted with pigment. Spines with dark tips in both sexes. Pelvic fin of females from very dark, broad bilateral strips, uniting posteriorly to mostly dusky with thin light margin. Third dorsal spine elongate in both sexes. Second dorsal fin of males with dark black spots on interradial membranes between tips of rays. Fourth neural spine with broad base. One or two epurals.

Description. Based on 30 specimens, 21.4-44.3 mm SL. General body form as described for genus; morphometric data given in Tables 2–4. Jaw reaching to vertical through midpoint of eye in both sexes. Teeth in upper jaw largest in outer row, with about 3 or 4 recurved teeth on either side of premaxillary symphysis; inner teeth small, forming a narrow band. Outer row of lower jaw teeth in males markedly large, but not as large as outer row of upper jaw; includes one or two tusk-like recurved canines on either side in both sexes, at about the origin of the mental frenum, stronger in males. Tusk-like teeth not exposed when mouth is closed. Males with large, recurved tooth on either side of dentary symphysis in innermost row. Head length, nape length, preanal body length, and body depth at anal fin origin greater in females than males, jaws and postanal body length greater in males than females (Tables 2–4).

Third dorsal spine moderately elongate in both sexes, appressed spine may reach to second or third element of second dorsal fin in females, to as far as sixth or eighth element in males. Pectoral fins reaching vertical through anus in males; often slightly shorter in females, not reaching vertical. Pelvic fins extending to anus in males; short of anus in females. Appressed posterior rays of second dorsal and anal fins reaching beyond procurrent caudal rays in both sexes. Caudal fin longer in males than females. Fin measurements and ray counts are given in Table 5.

Ctenoid scales over most of body, from caudal fin base to pectoral region midlaterally. Cycloid scales anterodorsally forward from fifth spine of first dorsal fin and on abdomen. Few or no scales anterior to diagonal from D_1 origin to upper pectoral fin base. Head, pectoral fin base, chest and nape naked. Abdomen partially scaled, naked over infracarinalis medius, most specimens with naked midline extending to anus. The holotype,

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ZMUC P781333, from Nigeria, examined by Carter Gilbert, also has a naked midline. Scale counts are given in Table 6.

Preopercular canal variably with 2 or 3 pores; 8 of 27 specimens with 2 pores, but only 2 specimens with 2 pores on each side.

Pigmentation in preserved specimens. Thin dark suborbital bar extending from lower margin of eye to behind corner of jaw; several irregular dark lines on cheek, highlighting median longitudinal cheek row of sensory papillae and several transverse rows. Another vertical bar near preopercle but not along edge. Opercle and subopercle dark (no dark triangle formed) with diffuse pattern varying from blotches to streaks. About two crossbars on top of head and three on nape before D_1 origin, sometimes broken into blotches for mottled appearance. Five midlateral blotches present of variable intensity. Many scale pockets in midlateral region darkly outlined, giving reticulate or lattice-like appearance, especially towards pectoral region. Irregular row of spots, sometimes very dark and pepper-like, above and paralleling midlateral blotch series.

First dorsal fin with about five diagonal bars, tips of spines usually with very black spots. D_2 with diagonal bars, often wavy and ill-defined, sometimes approaching fish-net appearance; spine of second dorsal fin with dark tip common in females, but not in the males at hand. Interradial membrane with dark elongate spots between tips of rays in males; general pattern darker in males, especially towards base and between tenth and eleventh soft rays. Anal fin dark in males with sharply defined black spots on interradial membranes near base; dusky in females, variably with basal spots (noticed primarily in smaller females). Pectoral fins with wavy vertical bars of pepper-sized spots in both sexes, spots very black in males. Pelvic fins generally dusky medially in females, with broad light margin at least towards branch tips of outermost three rays, sometimes connecting membrane between innermost fins unpigmented towards base of fin; completely dusky in males. Caudal fin in males dusky overall with black lines along rays medially; clear diagonal strip inside margin on upper third; lower third with dark strip at tips of rays with lighter strip immediately behind; black spots on upper edge apparent in some specimens. Females similar, generally dusky, but not as dark as males, with diagonal light strip inside margin above and below; very faint and diffuse barring in upper half of some; black spots on upper edge interradially to first branched ray; tip of caudal dark

Color in life. Not observed.

Axial osteology. Fourth neural spine broadly expanded basally. Epurals variably one or two (two in eight of 10 specimens examined).

Distribution. Endemic to West Africa from Senegal to the Cunene River estuary of Angola and Namibia, also recorded from São Tomé Island (Harrison et al., 2007; Schliewen, 2011; Reiner and Wirtz, 2016; Skelton, 2019).

Comments. The holotype was examined by Carter Gilbert, who provided its description. The holotype, a 40mm SL female, has mutilated pectoral fins; Gilbert's best estimate of the number of rays was 15. Of the 30 specimens examined here, only three had counts of 16 rays (two had 16 in both fins), while most had 17 rays in each fin. According to Gilbert, the holotype has I,11 second dorsal fin elements, I,12 anal fin elements, and 30 scales in a lateral series. It also has a dentition pattern as described for the 30 specimens examined here and agrees in the extent of squamation. Other counts and measures taken that may be compared were: transverse scale rows 14; caudal fin length 33.3% SL; head length 27.6% SL; snout length 5.5% SL; interorbital width 1.5% SL; orbit diameter 7.0% SL; caudal peduncle length 8.5% SL; and pelvic fin length 24.9% SL. These measurements are within the range of those taken from the Ghana and Congo specimens, except head length and caudal peduncle length which are slightly higher and lower, respectively. Most importantly, his description of the female holotype's pigmentation pattern generally agrees with that compiled here. He noted that the five midlateral blotches typical of *Ctenogobius* are absent in the holotype; considering that in some specimens they

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are only faintly present, the blotches may have faded since preservation. The medial membrane connecting the innermost rays of the pelvic fins is reported as entirely clear. Even the smallest females (to 21mm SL) from Ghana and Congo show melanophores posteriorly between the innermost rays. Their lack in the 40mm SL holotype may be genuine since the pattern in adult females progresses from the disconnected bilateral streaks typical of many *Ctenogobius* females, or it may simply be due to fading.

Pfaff's (1933) own description of the holotype differs from Gilbert's for some features. Pfaff counted 12 transverse rows between the anal fin origin and second dorsal fin base and 35 lateral scales. He also reported five faint midlateral blotches and a dusky pelvic fin. Scale counts in gobies can vary due to the irregular pattern of rows along the anterior portion of the trunk, even when taken by the same individual on a single fish. The presence of the midlateral blotches in Pfaff's description and figure (1933) supports the supposition of fading in the holotype. This is apparently also true for the pelvic fin pigmentation.

Miller (1981) first recognized this species as belonging to the genus *Ctenogobius.* Although his reasons are unstated, in the key to goby genera of the east central Atlantic he distinguishes *Ctenogobius* from *Gobionellus* on the basis of scale size, numbers of rays in the second dorsal and anal fins, and on differences in the forward extension of the median longitudinal cheek row of sensory papillae. The only species of *Gobionellus* in the eastern Atlantic region is *G. occidentalis.*

Material Examined. GHANA: USNM 264991 (2), Kakum River Mouth, 7 March 1960, G. Bane. CONGO: MNHN 1967-416 (28), Pointe-Noire, June 1964, Stauch.

3.8 *Ctenogobius manglicola,* Mangrove Goby (Figure 12)

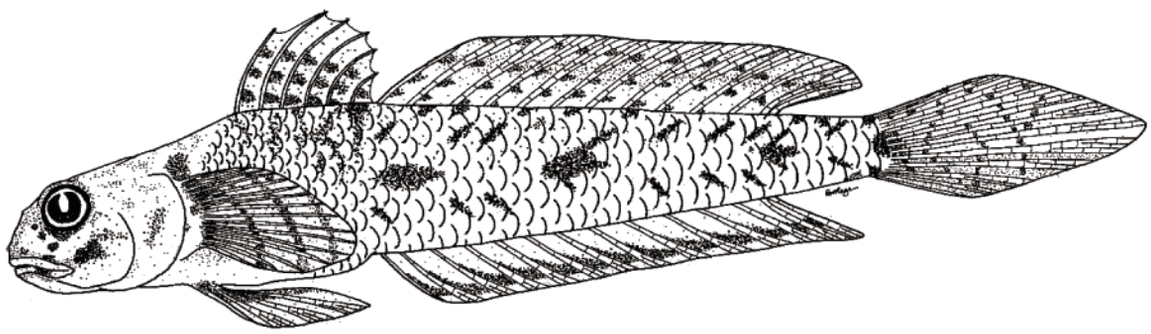

Figure 12. *Ctenogobius manglicola*, AMNH 73935, bay at Pedro Gonzalez Island, Islas Perlas, Gulf of Panama, Panama. Drawing by Pat Regan.

Gobius manglicola Jordan and Starks, in Jordan, 1895:495 (holotype: SU 3095; Mazatlan, Mexico).

Gobionellus manglicola Meek and Hildebrand,1928:883 (new combination).

Rhinogobius manglicola Jordan, Evermann and Clark, 1930:439 (new combination).

Diagnosis. D_2 I,11; A I,12; horizontal bar on cheek combining with angular blotch above corner of jaw to form a hatchet or axe-shaped marking; shoulder patch on nape at upper angle of opercle; males with dark spot around end of fifth dorsal spine and a dark margin around pelvic disc, including the interspinal membrane, occasionally incomplete near termini of innermost rays.

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Description. Based on 120 specimens, 11.7-24.8 mm SL. General morphology as described for the genus; morphometrics given in Tables 2–4. Jaw extending 1/3 to 1/2 distance to posterior margin of orbit in both sexes. Upper jaw with an inner band of fine teeth and an outer row of 3 to 4 large canines on each side. Teeth in lower jaw forming a band, with a tusk-like canine on outer edge each side of the lower jaw near origin of mental frenum; one to a few pronounced canines on inner edge of band each side of the dentary symphysis. Females with greater head length, orbit diameter, nape and preanal body lengths than males; males with larger jaws and postanal body lengths than females (Tables 2–4).

Third and fourth dorsal spines only slightly produced in males, extending to second or third element of the second dorsal fin when appressed. Pectoral fins not reaching vertical through anus in either sex. Pelvic fins extending to anus in males; just short of anus in females. Appressed anal and second dorsal fin rays reaching beyond procurrent caudal rays. Caudal fin about a third to half of SL, longer in males than females. Fin measurements and ray counts given in Table 5.

Trunk with ctenoid scales extending anteriorly along dorsum to about fifth dorsal spine, to near pectoral fin base along midline; abdomen and anterior dorsum with cycloid scales. Few to no scales forward of diagonal from pectoral fin base to D_1 origin. Pectoral fin base, prepelvic region, cheek and opercle naked. Abdomen usually partially scaled or with naked midline; infracarinalis medius muscle generally naked. Scale counts given in Table 6.

Preopercular canal generally with 3 pores; of 112 specimens examined, 4 individuals had 2 pores on one side and 4 had 2 pores on each side. One specimen lacked the anterior extension of the snout canal on one side and the accompanying anterior canal pore.

Pigmentation in preserved specimens. Snout with a pair of streaks from eye to jaw, one below posterior nares running through anterior nares, the other midway between corner of jaw and tip of snout. A dark patch at upper corner of jaw connected to horizontal stripe along median longitudinal cheek papillae row forming a hatchet- or axe-shaped mark. Lower lip and chin dusky. Top of head sometimes mottled. Nape with several bars of variable distinction. Opercle dusky. Small patch at upper angle of opercle on trunk, less intense than hatchet mark. Five midlateral oblong blotches, often much longer than deep, approaching dash pattern of *C. saepepallens;* anteriormost blotch often indistinct and blending with other smaller blotches, posteriormost basicaudal. A prominent small dark spot above and below basicaudal blotch on caudal peduncle. Small dark flecks scattered on sides. Subcutaneous row of dark spots sometimes apparent at base of anal fin. Pectoral fins usually faintly flecked or indistinctly barred in females; with 3-4 thin, vertical bars in males. Pectoral fin base with dark blotch dorsally on both sides of fin. Pelvic fins with dark margin, including interspinal membrane in males, sometimes incomplete over termini of innermost rays; in females two dark streaks along interradial membrane connecting the two fins, converging or approaching one another posteriorly, with pigment continuing forward over base of interspinal membrane, to give the appearance of a dark "scarf" thrown over the joined pelvic fins. D_1 with several series of light blotches forming diagonal bars in females; two distinct horizontal stripes in males with uppermost, at mid-fin height, forming dark spot posteriorly spanning both sides of fifth spine where it terminates. D_2 with blotches forming diagonal bars in both sexes, lightly dusted with pigment towards tips of rays. Anal fin dusky in males; clear with submarginal band in females. Caudal fin dusky over lower third, medially with faint vertical bars, more pronounced towards base, and upper third with a clear diagonal streak beneath a dusty margin; females with more pronounced barring medially, dusky lower and upper margins, upper margin often with an elongate blotch.

Color in life. Observed from photos of two male specimens. Body color olivaceous with white abdomen, dark pigments as described above. Orange red margin on first dorsal fin stopping at black spot; submarginal red band present on second dorsal fin. Caudal fin with submarginal red band above and below dusky mid-fin. Light yellow tinge to side of abdomen and lower pectoral fin base may be present.

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Axial osteology. Fourth neural spine broadly flared at base, triangular in form. One epural.

Distribution. Gulf of California to northern Peru.

Comments. Independent analyses of 9 meristic and morphometric variables on 47 males and 40 females did not distinguish northern and southern populations. The characters included were: lateral scale rows, standard length, jaw length, head length, orbit length, pectoral length, pelvic length, caudal length and total number of pectoral rays. Another set of analyses using only the seven morphometric variables was performed on 55 males and 60 females spanning the geographic range of this species. Again, there was no distinction of populations, nor was separation evident when the first principal component score was regressed on ln SL, either by sex or population.

Material Examined. MEXICO: **SU 3095, holotype**, ***Gobius manglicola***, Sinaloa, estuary at Mazatlan, 24 December 1894, D. S. Jordan et al.; GCRL 4421 (23), Chiapas, Barra Cauhuacan, 25 May 1969, C. E. Dawson and J. Carranza; GCRL 2771 (9), Baja California Sur, Ensenada de Anape, 10 August 1967, C. E. Dawson; GCRL 2658 (35), Sinaloa, Teacapan, 4 August 1967, C. E. Dawson; ANSP 152821 (1), Baja California, lagoon (with no open connection at time of seining) inshore from Bahia San Carlos, 13 April 1952, J. Böhlke et al. GUATEMALA: GCRL 5849 (57), Esquintla, Canal Chiquimulilla, 19 May 1970, C. E. Dawson. EL SALVADOR: GCRL 5030 (17), La Paz, Est de Jalte Estero Jaltepeque, 3 July 1968, C. E. Dawson. COSTA RICA: GCRL 3529 (180), Puntarenas, Estero Chacarita, 13 July 1968, C. E. Dawson. PANAMA: AMNH 73935 (60), bay at Pedro Gonzalez Island, Islas Perlas, Gulf of Panama, 16 January 1978, C.L. Smith, R. Deneau and J. Nielsen; USNM 123251 (2), Canal Zone, Balboa dry dock, 18 March 1937, S. Hildebrand; USNM 81826 (2), tidepools Panama, 21 March 1912, S. Meek and S. Hildebrand; USNM 101374 (1), tidepools Panama, 21 March 1912, S. Meek and S. Hildebrand; USNM 119328 (2), Venado Beach, 10 July 1915; USNM 123250 (6), Panama Prov., Gulf of Panama, Near Panama City, San Francisco Beach tide pools, 13 February 1937, S. Hildebrand; USNM 123248 (15), Canal Zone: Miraflores Locks (East Side-Upper), 28 April 1937, S. Hildebrand; USNM 123247 (28), Canal Zone, Lower Chamber (Panama Canal) Miraflores Lock, 26 March 1937, S. Hildebrand; USNM 265063(3). COLOMBIA: GCRL 5142 (15), Valle del Cauca, Valle Buena Ventura, 20 June 1970, C. E. Dawson. PERU: GCRL 22308 (20), Tumbes, tidepool along edge of mangrove, 23 February 1974, C. E. Dawson et al.

3.9 *Ctenogobius phenacus,* Impostor Goby (Figure 13)

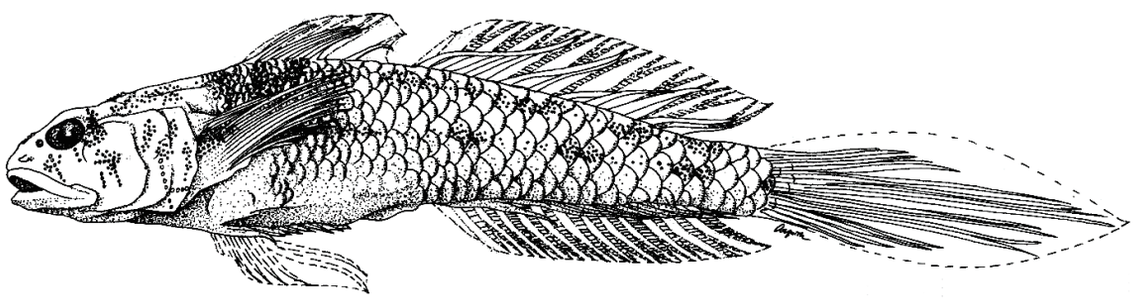

Figure 13. *Ctenogobius phenacus,* MBUCV 14128, paratype, female, 29 mm SL, Punta Moron W de Puerto Cabello, Estado Carabobo, Venezuela. Drawing by A. Asquith.

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Gobionellus phenacus Pezold and Lasala, 1987 in Pezold and Gilbert, 1987:172 (holotype: UF 34132, Cayenne River estuary near mouth, French Guiana).

Diagnosis. D_2 12; A 13. Shoulder patch present. In adults, diagonal anterodorsal and posterodorsal bars extending from midlateral blotches to form V pattern. Eyes not reduced. No ocelli on body and head. Jaws and caudal fin elongate in both sexes. Fourth neural spine flared basally. One or two epurals.

Description. Based on 12 specimens, 16.0-32.2 mm SL. General body form as described for genus; morphometrics given in Tables 2–4. Jaws reaching posteriorly from 1/2 diameter of eye to rear margin of the orbit (13-16% SL in males, 13-14% SL in females). Teeth in outermost row of upper jaw much larger, caniniform, and fewer than those in inner row with 2-3 on either side. Lower jaw with 2-3 large partially recurved canines on each side in outer row in males; females generally with fine band, a single tusk-like tooth each side of lower jaw in largest females (USNM 226248). Several heavy teeth in innermost row on either side of dentary symphysis. Caudal peduncle length is significantly greater in males. Measurements of caudal peduncle length were rounded off when originally reported by Pezold and Gilbert (1987) masking the differences shown here.

No produced spines in first dorsal fin. Pectoral fins in both sexes reaching beyond anal fin origin. Pelvic fins short, not reaching anus, but significantly longer in males. Appressed posterior rays of D_2 and anal fins extending to procurrent caudal fin rays or barely beyond. Caudal fin elongate in both sexes. Fin measurements and ray counts given in Table 5.

Cycloid scales anterior to line from about terminus of D_2 to midline of trunk at pectoral fin base. Ctenoid scales over remainder of trunk to caudal fin base. Cycloid scales also present on abdomen. Pectoral fin base, chest and head naked; nape generally with a few incomplete rows of cycloid scales just before D_1 origin, not usually scaled to posterior opercular margin. Abdomen generally partly scaled, naked over infracarinalis medius muscle. Scale counts given in Table 6.

Preopercular canal variably with two or three pores; 3/3 in 8 of 16 specimens, 3/2 in 2 specimens, 2/2 in 4 specimens. One juvenile with 2/0 and another with no preopercular pores.

Pigmentation in preserved specimens. Head with a prominent cheek bar along median longitudinal cheek row of sensory papillae, from upper preopercular canal to above corner of the jaw. Dark streak on snout from eye to midlateral upper jaw, with spot on upper lip. Opercle with dusky patch. Top of head with several bars. Trunk with dark shoulder patch at upper angle of the opercle. Five midlateral blotches present, frequently (in adults) with V pattern formed by anterodorsal and posterodorsal bars. First dorsal fin with two diagonal bands in both sexes. Second dorsal fin with submarginal dusky band, sometimes bases of rays are pigmented on shaft. Pectoral fins lightly dotted in both sexes. Pelvic fins generally clear; one female with a small area lightly sprinkled with melanophores bilaterally along a portion of the fourth pelvic ray. Anal fin mostly clear. Caudal fin lightly speckled along rays; hint of indistinct thin bars in females.

Color in life. Observed from photo of one male specimen in aquarium. Body color light blue gray due to aquarium light, accentuating blue black color of shoulder patch and dark markings on cheek and trunk. First and second dorsal fins with reddish orange margin, several bands of dark spots, two lowermost bands in second dorsal fin comprised of large interradial spots, uppermost are vertically elongate spots along rays. Caudal fin with reddish orange margin on upper and lower edges.

Axial osteology. Fourth neural spine flared basally. One or two epurals.

Distribution. The species was described from Venezuela (near Puerto Cabello), Surinam (the mouth of the Corantijn River) and French Guiana (from the mouths of the Cayenne and Mahury Rivers). Since then it has

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been recorded from the Suriname River in Surinam (Mol et al., 2012) and the Kourou River in French Guiana (Le Bail et al., 2012). Guimaraes et al. (2017) reported the capture of a specimen of *Ctenogobius boleosoma* in the Canal Raposa estuary, Ilha de Sao Luis, Maranhao, northeastern Brazil. From the photograph, it may be this species. They report 11 second dorsal fin and 13 anal fin elements. In the photograph 12 second dorsal elements are visible. The specimen also has large jaws and coloration similar to that observed in *C. phenacus.*

Comments. This is a shallow water estuarine species easily confused with several others in the region. It differs from *Ctenogobius thoropsis* most prominently in having fully developed eyes, basal flaring of the fourth neural spine and a shorter caudal fin (Table 5). From *C. smaragdus, C. pseudofasciatus* and *C. fasciatus* it is easily distinguished by pigmentation pattern. Females also have a much longer caudal fin than females of *C. fasciatus. Ctenogobius smaragdus* and *C. boleosoma* have 11 D_2 elements and 12 anal fin elements. Both sexes of *C. phenacus* have longer caudal fins than *Ctenogobius apogonus* and females of the former species have larger jaws (Tables 2 and 5) than those of the latter species.

Material Examined. FRENCH GUIANA: **UF 34132, holotype, *Gobionellus phenacus,*** Cayenne River estuary near mouth, 23-Jul-1967, Greenwood, Pritchard and Fourmanoir; **USNM 244153 (3), paratypes, *G. phenacus,*** Mahury River Below Le Degrad Des Cannes. (new dock) near Cayenne, 4 May 1975, B. Collette; **USNM 264990 (7), paratypes, *G. phenacus,*** Mahury River Below Le Degrad Des Cannes. (new dock) near Cayenne, 4 May 1975, B. Collette. SURINAM: **USNM 226247 (2), paratypes, *G. phenacus,*** Nickerie District, Mouth of the Corantijn River, close to the airport, 14 May 1980, H. Madarie; **USNM 226248 (1), paratype, *G. phenacus,*** Nickerie District, Corantijn River, 14 May 1980, H. Madarie. VENEZUELA: **MBUCV-V 14128 (2), paratypes, *G. phenacus,*** Estado Carabobo, Punta Moron, W de Puerto Cabello, 24 June 1982, Lasala.

3.10 *Ctenogobius pseudofasciatus,* Slashcheek Goby (Figure 14)

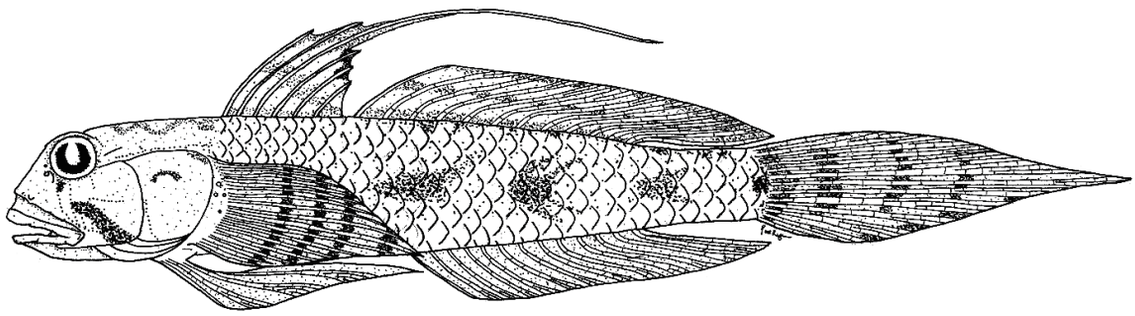

Figure 14. *Ctenogobius pseudofasciatus,* UF 17696, male, 35.2 mm SL, 1 mi up Benjamin Creek from Tortuguero River, Limon Province, Costa Rica. Drawing by Pat Regan.

Gobionellus pseudofasciatus Gilbert and Randall, in Gilbert and Kelso, 1971:44 (holotype: UF 13516; Tortuguero, Costa Rica).

Diagnosis. D_2 12; A 13; Broad strip of dark pigment from just above corner of jaw to lower preopercular angle, faintly pigmented in arc towards lower edge of eye. Male with produced third dorsal spine and large recurved canine midlaterally in lower jaw. Fourth neural spine simple, not flared. Two epurals.

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Description. Based on 45 specimens, 16.4-54.4 mm SL. General body form as described for genus; morphometrics given in Tables 2–4. Jaws extending to vertical delineating anterior 1/3 of eye in females, 2/3 diameter of eye in males. Outer teeth of upper jaw prominent, larger in males than in females, four to six each side of symphysis. Large recurved canine, projecting slightly laterally, equal in length to prominent teeth of upper jaw, found midlaterally in lower jaw above origin of mental frenum in males; generally not exposed when mouth is closed as in *C. stigmaticus;* slightly smaller in females.

Third dorsal spine elongate in adult males, to 56% of standard length in one specimen. Pectoral fins reaching to vertical through anal fin origin in males, through base of urogenital papilla in females. Pelvic fins to anal fin origin in males, to urogenital papilla base in females. Appressed posteriormost rays of second dorsal and anal fins extending past origin of procurrent caudal rays in males, to origin of procurrent rays in females. Caudal fin elongate. Fin measurements and ray counts given in Table 5.

Ctenoid scales over most of body, from caudal fin to pectoral region along midline of trunk. Dorsum with cycloid scales from about fifth dorsal spine forward. No or few scales anterior to a diagonal from the upper pectoral fin base to the D_1 origin. No scales on trunk beneath pectoral axil. Prepelvic region, pectoral fin base, cheek and opercle naked. Abdomen with cycloid scales, partially scaled or with naked midline. No scales over infracarinalis medius muscle. Scale counts given in Table 6.

Preopercular canal with three pores.

Pigmentation in preserved specimens. Broad stripe of intense dark pigment on lower cheek extending from above corner of jaw posteroventrally to lower angle of preopercle. Nearly horizontal faint to dark stripe present on midcheek. Snout dusky, with prominent dark streak from eye to midlateral upper jaw. Another vertical streak extending from mideye to anterior end of the lowermost dark stripe; streak varies from faintly pigmented to dark. Opercle dusky. Indistinct crossbars present on top of head. Trunk with 5 prominent midlateral blotches; posterior blotches may have dorsocaudal extensions. Sides with marks of equal intensity above and below blotches, suggesting rows of irregular spots.

Pectoral fins dusky, with about four vertical bars of varying distinction. Pelvic fins dusky in males, with parallel streaks in females. Dorsal fins in both sexes with about 3 long rows of discrete blotches in soft dorsal; margins generally dusky. Anal fin dusky in males, with scattered pinpoint dots; females with clear margin, dusky submargin, darker posteriorly. Caudal fin with vertical bars on upper 2/3 in females, with dark streak below and a clear margin; male as in female but with a dusky streak above bars also and no clear lower margin.

Color in life. Hastings (1978) provided a detailed description of life colors of Florida specimens. Photos examined of two female specimens, although faded, largely agree with his description of color highlights of a red-orange margin on first dorsal fin, and red-orange membranes on the second dorsal and anal fins.

Axial osteology. Fourth neural spine simple, not flared. Two epurals.

Distribution. This species has a continental Caribbean distribution where it is known from Surinam (Mol et al., 2012) and Trinidad to Belize, and a possibly disjunct population in east central Florida (Gilmore and Hastings, 1983; Hastings, 1978).

Comments. As noted earlier, Meek and Hildebrand (1928) identified this species, along with *C. fasciatus,* as *Gobionellus stigmaticus.* This confusion possibly resulted from the observation of the recurved midlateral canine in the lower jaw found in males of *C. fasciatus* and in both sexes of *C. pseudofasciatus.* Tusk-like midlateral canines are diagnostic of *C. stigmaticus.* Male *C. pseudofasciatus* have particularly strong posterolaterally directed canines in this position that approach the *C. stigmaticus* condition. Ginsburg (1932) included specimens of this species in his treatment of *Gobionellus (=Ctenogobius) claytonii.* Reports of *C. claytonii* or *C. shufeldti* from the Caribbean basin have most likely been of this species or the more commonly

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collected and widespread *C. fasciatus.* The listing of the Slashcheek Goby by Gilmore and Hastings (1983) from the Bahamas, Greater Antilles and Lesser Antilles is an error; the general range is correctly depicted in Fig. 2D in the same work. Specimens are not generally found in as great numbers as *C. fasciatus.* The collection of large series in Florida, however, suggests that they can be locally abundant and that their numbers in museums may reflect a sampling artifact.

Karyotypes were obtained for five specimens of *C. pseudofasciatus* taken in Brevard County, Florida. Sixty-one mitotic cells from three males and 44 cells from 2 females were examined for chromosome type and number. Forty-one percent of the male somatic cells observed had 46 acrocentric chromosomes and a single, large metacentric chromosome; 98% had a single, large metacentric chromosome (Figure 15). Fifty-seven per cent of the female cells showed 48 acrocentric metaphase chromosomes (Figure 15). The karyotypes for males and females of this species have the same number and form of chromosomes seen in *Ctenogobius shufeldti* in which sex determination is by an $X_1X_1X_2X_2$:X_1X_2Y multiple sex chromosome system (Pezold, 1984b). Voucher specimens are deposited in the Texas Natural History Collection (TNHC 73969).

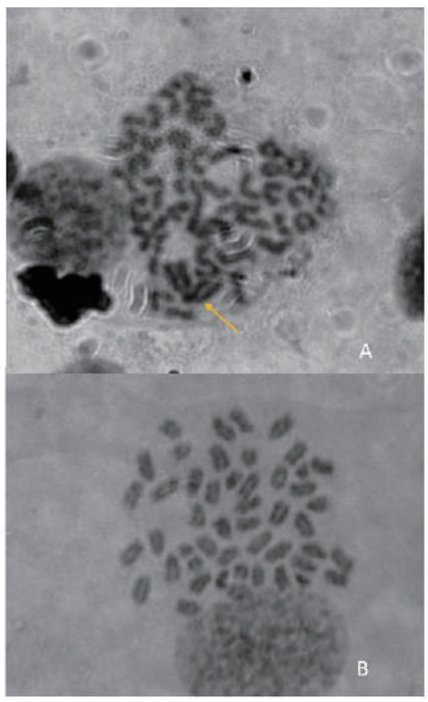

Figure 15. Karyotypes for *Ctenogobius pseudofasciatus:* A) male, arrow indicates single large metacentric chromosome; B) female.

Material Examined. TRINIDAD: **UF 2225 (1), paratype, *Gobionellus pseudofasciatus,*** VENEZUELA: UMMZ 147535 (1), Falcon Prov., Coastal lagoons, 15 km N of Maracaibo, 6 April 1938, F. F. Bond. PANAMA: FMNH 32178 (1), Canal Zone, creek at Mindi, 14 January 1911, S. Meek and S. Hildebrand; **USNM 81824(1), paratype, *G. pseudofasciatus,*** Canal Zone, Mindi Creek, 14 January 1911, S. Meek and S. Hildebrand; **USNM 105109 (1), paratype,** Canal Zone, creek at Mindi, 28 January 1911, S. Meek and S. Hildebrand; ***G. pseudofasciatus;*** **USNM 123264 (1), paratype,** Canal Zone, Mindi Cut, 28 January 1911, S. Meek and S. Hildebrand; ***G. pseudofasciatus;*** **USNM 205202 (1), paratype, *G. pseudofasciatus,*** Canal Zone, Mindi Creek, 14 January 1911, S. Meek and S. Hildebrand. COSTA RICA: **USNM 201589 (1), paratype, *G. pseudofasciatus,*** Limon Prov., Tortuguero Lagoon, West side, just below point across from Tortuguero Village, 25 August 1963, C. R. Gilbert and R. Kaufman; **ANSP 109179(1), paratype, *G. pseudofasciatus,*** Limon Prov., Creek off Rio

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Agua Fria, ca 8 mi from Tortuguero village, 25 August 1964, D. P. Kelso; **UF 67696 (UF/FSU 17696) (1), paratype, *G. pseudofasciatus,*** Limon Prov., 1 mi up Benjamin Creek from Tortuguero River, 17 August 1969, G. Holmes and C. Carr; **UF 13517 (1), paratype, *G. pseudofasciatus,*** Limon Prov., W side of Tortuguero Lagoon in sidewater pool just below point across from village of Tortuguero, 25 August 1963, C. R. Gilbert and R. Kaufman; **UF 13518(1), paratype, *G. pseudofasciatus,*** Limon Prov., Tortuguero Lagoon, backwater bay ca 200 yds below point where river flows into lagoon across from Tortuguero Village, 18 August 1963, C. R. Gilbert et al.; **UF 13519(1), paratype, *G. pseudofasciatus,*** Limon Prov., Rio Palacio ca 2 mi above mouth ca 5 mi NNW of Tortuguero, 23 August 1963, C. R. Gilbert and D. P. Kelso; **UF 13520(1), paratype, *G. pseudofasciatus,*** Limon Prov., Creek off Rio Agua Fria, 8 mi from Tortuguero Village, 25 August 1964, D. Kelso. HONDURAS: UMMZ 199544 (1), Distributary of Rio Patuca in channel leading to town of Brus Laguna, at SE end of Brus Laguna, 8 May 1975, D. W. Greenfield and R. K. Johnson. BELIZE: FMNH 82076 (1), Toledo, Temash River, ca. 2.5mi. down river from Crique Sarco in side tributary, 14 April 1976, D. W. And T. A. Greenfield; FMNH 86680 (1), Sibun River 1/2 mile upstream from Freetown, 30 December 1970, D. W. Greenfield and G. D. Deckert. FLORIDA: TNHC 10859 (1), Palm Beach Co., W Prong of SW Fork of Loxahatchee River, Jupiter 1.7 mi. W Hwy A1a on W Center St., 23 May 1981, F. Pezold and D. Mosier; TNHC 73969 (10) Brevard Co., North Fork Sebastian Creek from confluence of N Prong to dam, 22 May 1981, F. Pezold, D. Mosier, R. G. Gilmore and party; UF 100057 (13), Brevard Co., North Prong of Sebastian Creek below spillway, 16 March 1978, P. Hastings and G. Kukzychi; HBOM 107:05086 (4), Sebastian Creek, N Fork, 3.2 km W of railroad bridge, below floodgate S-157, 8 June 1979, P. A. Hastings et al.; HBOM 107:05102 (7), Brevard Co., Sebastian Creek, N Fork, below spillway, 13 March 1979, R.G. Gilmore et al.; HBOM 107:07358 (11), Fellsmere Canal, shoreline below spillway, 6 May 1983, D. Cooke et al.; HBOM 107:07363 (5), Sebastian Creek, N fork, across from fence site at break in vegetation, 6 May 1983, D. Cooke et al.; HBOM 107:07543 (3), Sebastian Creek, N fork, below spillway on Fellsmere Canal (culvert & fence sites), 25 August 1980, R. G. Gilmore.

3.11 *Ctenogobius saepepallens,* Dash Goby (Figure 16)

Figure 16. *Ctenogobius saepepallens,* male, Spaanse Water, Curacao. Photo by J. Van Tassell.

Gobionellus saepepallens Gilbert and Randall, 1968:2, Fig. 1 (holotype: ANSP 109180; Green Turtle Cay, Bahamas).

Gobionellus comma Gilbert and Randall, 1979:34, Fig. 2 (holotype: ANSP 109181; Isla Cubagua, Venezuela).

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Diagnosis. D_2 I,11; A I,12. Dark patch of pigment often distinctly triangular on opercle. Second and third dorsal spines elongate in both sexes. Suborbital bar variable from thin and short, extending 1/3 distance to jaw, to long and broad reaching below corner of jaw. Midlateral blotches frequently narrow and elongate. Pelvic fins in males dusky with dark margin; in females centrally dusky with light margin to completely dusky. Nape without scales. Preopercular canal most often with two pores. Fourth neural spine flared basally. One or two epurals.

Description. Based on 143 specimens, 11.8-35.9 mm SL. General morphology as described for the genus; morphometric data given in Tables 2–4. Jaw extending to about midway beneath eye in both sexes. Upper jaw with 2 or 3 large slightly recurved canines on either side of premaxillary symphysis in outermost tooth row. Lower jaw with strongly recurved canine in outer row midlaterally on each side above mental frenum origin; canine not projecting laterally. Teeth proportionately larger in males. Males of this species exhibit a longer caudal trunk region and greater depth of caudal peduncle between the anal fin terminus and D_2 terminus. Females have a greater span of cheek from the eye to the corner of the jaw and a proportionately greater precaudal region of the body (Tables 2–4).

Third dorsal spine elongate; in males may equal second dorsal fin in length. Pelvic and pectoral fins vary in proportion among populations. Pectoral fins ranging from not reaching vertical through anus to reaching line through anal fin origin in males; generally short of vertical through anus or just reaching it in females. Pelvic fins generally short of anus or just to anus in females; in males most often to anus or anal fin origin. Appressed posterior rays of D_2 and anal fins extending beyond procurrent caudal fin rays. Caudal fin significantly longer in males than females. Fin measurements and ray counts given in Table 5.

Ctenoid scales posteriorly on trunk, extending forward along dorsum to about fifth spine and midlaterally to beneath pectoral fin, naked beneath pectoral axil. Abdomen with cycloid scales. Cycloid scales along dorsum from fifth spine forward. Nape, head, pectoral fin base and chest naked. Ventral midline of abdomen naked to partially scaled, most often with infracarinalis medius naked or nearly naked and remainder scaled. Scale counts given in Table 6.

Preopercular canal variable in number of pores; of 83 specimens examined 67% had two pores an each side, 19% two pores on one side and 13% three pores in both canals. Pore number, except in smallest juveniles, was not correlated with extent of canal development; specimens with two pores most often simply lacked the middle pore. The middle pore was reduced in many individuals that had three pores per side.

Pigmentation in preserved specimens. Suborbital bar of variable length and width extending from eye towards corner of the jaw; generally, Bahamas and Belize populations with reduced bar, but more extensive in Puerto Rico, Panama, North Carolina, Cubagua and Brazil. Intrapopulation variability also apparent. Opercle dark, often with distinct triangular patch.

Trunk with the 5 midlateral blotches typical of the genus; frequently with additional spots between them. Midlateral blotches frequently compressed and elongate forming series of dashes or dots (if midlateral spots present) and dashes. No shoulder patch.

Females with four or five wavy diagonal bands in both dorsal fins; male similar but darker. Male holotype of *Gobionellus comma* with distinct black spot at tip of 4th-6th dorsal spines; males from NC with smaller black tips; males from Panama with dark brown pigment at 4th-6th spines; but dark black spine tips not present in

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male from Bahia or male paratype of *G. comma.* Anal fin dusky in males; in females clear over anterior half, posterior end with scattered melanophores to clear in Bahamian specimens, but dusky with dark dots on membrane at base scattered singly between rays in Panamanian specimens. Pectoral fins in both sexes lightly sprinkled with melanophores; less so and sometimes clear in Bahamian specimens, especially females. Pelvic fins dusky in males with slightly darker broad margins; in Bahamian specimens may be light centrally; females with bilateral streaks joining posteriorly across median membrane; in some Panamanian and Puerto Rican specimens some weaker pigment present in median membrane along length of streaks, making fin centrally dusky with broad light margin, to occasionally completely dusky. Caudal fin in both sexes with clear diagonal submarginal streak on upper edge, dark lower margin and dusky medial region with faint barred pattern frequently evident; specimen from Brazil and those from Cubagua previously assigned to *Gobionellus comma* with dark lower margin offset by clear submarginal streak. Barred pattern in Cubagua specimens more prominent on caudal fin. North Carolina specimens with dark submargin and dark margin below.

Color in life. Life colors of a female specimen from Culebra Island, Puerto Rico are given in Gilbert and Randall (1968):

> *Body pale bluish-gray, faintly mottled on upper half with reddish-brown; dusky markings along side of body faintly edged with pale blue; center of each lateral marking with a blackish horizontal line, and a fainter dusky segment between each of the dusky spots (except last two); a blackish spot in iris above pupil; rest of iris yellowish, the pupil dark blue-green; upper half of caudal fin with irregular, vertical rows of brownish spots, the upper margin dusky with a broad, pale yellow, submarginal band; dorsal fins pale, with four nearly horizontal rows of small dark brown blotches, most occurring on fin rays.*

Gilbert and Randall (1979) gave a color description from the freshly preserved male holotype of *Gobionellus comma* from Cubagua Island, Margarita Islands, Venezuela:

> *Color of body translucent yellowish; edges of scales brown; head faintly reddish with a black bar running ventrally from eye and a large black spot on opercle; dorsal fins with broad yellow margins and rows of small black marks; caudal with yellow submarginal band (margins dusky), centrally with vertical rows of small black marks; anal and pelvic fins dusky.*

Photos of live or freshly caught specimens were examined for this species across much of its range including Florida, Panama, Venezuela, Curacao, Virgin Islands, and Bonaire. Many are available for viewing at the website for the Shorefishes of the Greater Caribbean hosted by the Smithsonian Tropical Research Institute (https://biogeodb.stri.si.edu/caribbean/en/pages).

A photograph of a male specimen showing the same caudal and suborbital pigmentation as the holotype of *Gobionellus comma,* was taken from Punta de Araya, Venezuela, less than 20 miles from the type locality. A photo of a less developed but maturing male from the same locality shows a thinner suborbital bar and a lighter anal fin. Other specimens from Curacao and Venezuela exhibit a darker lower caudal fin and variably developed suborbital pigmentation. A photo of an individual in situ taken off Mexico Beach, Florida (Fishbase, Carol Cox) has a bluish body tint described by Gilbert and Randall (1971). Most photos of this species from dark substrates show more of a yellowish or tannish translucent body tint as described for *Gobionellus comma* (Gilbert and Randall, 1979) and may or may not have discrete dash-like marks on the sides, some having the dash-like mark surrounded by a less dark, diffuse spot. Photos of individuals from lighter or more coralline

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habitats tend to have white body color and discrete dashes along the side of the trunk, not embedded in a more rounded diffuse spot. Most specimens have a dark spot above and below the pupil aligned with the suborbital bar. Photos of individuals from Florida to Bonaire appear to have a yellow margin at least on the first dorsal fin and show the submarginal yellow band on the caudal fin as well as some light margin on the lower caudal fin. The anal fin may also be lighter in color. From the photos it is not clear if the light colored lower caudal fin and anal fins observed are due to a clear portion of the fins with yellow color or an overlay of iridescent pigment on a dusky fin. There may also be a yellow tint to the pectoral fins. In addition, the dorsal fins and caudal fins generally have reddish highlights and a reddish hue to the head.

Axial osteology. Fourth neural spine flared basally. One or two epurals.

Distribution. Known from North Carolina to Santa Catarina, Brazil (Barneche et al., 2009), in the eastern Gulf of Mexico as far north as the vicinity of Mexico Beach and throughout the Caribbean, at depths ranging from 0 to at least 44m. Specimens from North Carolina are from 33-37m and the specimen from Trinidad was taken at 32m. Five paratypes (not seen in this study) were taken at about 44m off the Florida coast.

Comments. The inclusion of specimens from outside of the range of material seen by Gilbert and Randall (1968), has necessitated the emendation of their original diagnosis, and has also led to the synonymization of *Gobionellus comma,* which they described in 1979. Gilbert and Randall (1979) postulated that their specimens of *G. comma* were most closely related to *Ctenogobius manglicola* (with *C. saepepallens* its closest relative in the western Atlantic) because of the: pigmentation of the first dorsal fin in males (both species having the fifth spine with a dark spot at its tip); triangular dark patch on the opercle; lack of a shoulder patch; five elongate midlateral blotches; and naked nape and body size. As they noted, *C. saepepallens* shares the triangular opercle patch and small maximal body size. But *Ctenogobius saepepallens* also lacks the shoulder patch, has a naked nape and has the elongate midlateral blotches. The type specimens of *Gobionellus comma* have a suborbital bar on the cheek and the holotype has an elongate third dorsal fin spine, both characters observed in *C. saepepallens,* but not *C. manglicola.*

Considerable variation was noted in this study for the expression of a suborbital bar in *C. saepepallens.* In the original description (Gilbert and Randall, 1968, p. 4), a "thin, black, suborbital bar" is noted for this species as "curving slightly posteriorly and extending to posterior end of upper jaw". The figure accompanying the description, however, shows a female paratype from Puerto Rico that has an abbreviated suborbital bar, perhaps reaching half the distance from the eye to the angle of the jaw. In their later key to coarse-scaled *Gobionellus* species (= *Ctenogobius* in part), Gilbert and Randall (1979) described *C. saepepallens* as having a "thin suborbital bar, curving slightly posteriorly, extending from lower margin of orbit about halfway to lower margin of cheek (distance varying somewhat with individual)". In actuality, all of these statements are true, especially that in parentheses. The bar is not always thin either, even when the specimens described as *Gobionellus comma* are excluded. A qualitative index of suborbital bar length was constructed to allow graphical depiction of the range of variation encountered for this pigmentation (Figure 17). In general, individuals from the Bahamas, Grand Caymans, and Belize had low values (less extensive suborbital bars). Specimens from North Carolina, Panama, Brazil and Puerto Rico had higher values, similar to *G. comma* specimens. This variation is important as a wide dark suborbital bar (from which the fish gets its name) is one of the diagnostic characters of *Gobionellus comma* (Gilbert and Randall, 1979).

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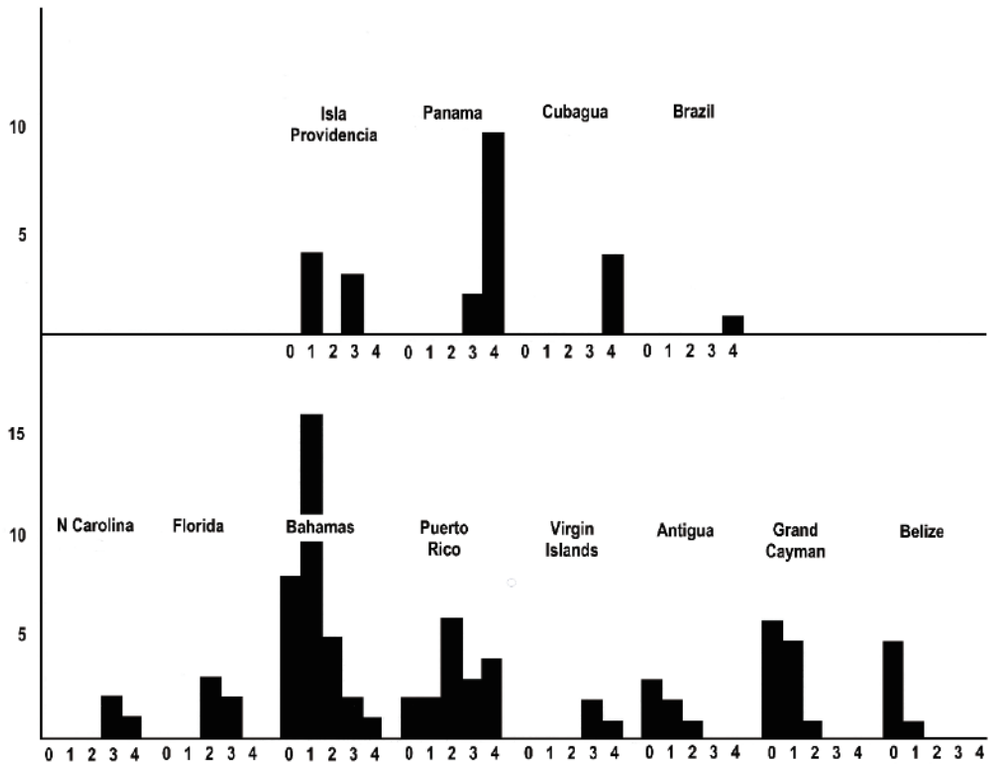

Figure 17. Distribution of qualitative index scores of suborbital bar length for C. saepepallens population samples. The length of the bar was graded into five categories: 0 - bar reaches < or = 1/3 distance to LLC; 1 - bar reaches > 1/3 but < 2/3 to LLC; 2 - bar reaches 2/3 or more but does not reach LLC; 3 - bar reaches LLC; 4 - bar reaches beyond LLC. LLC = Least longitudinal cheek row of sensory papillae (row running from corner of jaw rearward to preopercle).

The other diagnostic character given that would distinguish *Gobionellus comma* from *Ctenogobius saepepallens* is the presence of a large well-defined black spot at the tips of the fourth through sixth dorsal fin spines in males. This character is illustrated in the photograph of the holotype (Gilbert and Randall, 1979). The only male paratype (LACM 20634, 18.5mm) was examined and found to have brown spots at the tips of the fourth and fifth spines - but not the distinctive black spotting of the holotype. Similar pigmentation has also been seen in Panamanian specimens of *C. saepepallens* (MCZ 58718).

Although not included in the original diagnosis, another distinctive pigmentation feature of nominal *G. comma s*pecimens is found in the caudal fin. *Ctenogobius saepepallens* from Panama through North Carolina have a dusky upper margin, a clear submarginal diagonal band, a dusky mid-region that in preservative may retain a faint barred pattern and a dusky lower third. *Gobionellus comma* males have a clear submarginal band in the lower portion of the fin (Fig. 2, Gilbert and Randall, 1979); females have the typical *C. saepepallens* pattern but have greater preservation of the median vertical bars. Although distinctive, identical caudal fin patterns are found in a male specimen from Bahia, Brazil (GCRL 10917, 24mm) and a female specimen from off the coast of Trinidad (MCZ 58720, damaged trunk region), respectively. The Brazilian male has neither dark black nor dark brown pigmentation on the tips of the 4th, 5th or 6th dorsal fin spines. The female from Trinidad also lacks dark spine tips. Considering the amount of variation of pigmentation patterns found in the population samples examined, the lack of coincidence in this variability among those characters, as well as

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pigment variation that may result from differences in ontogenetic stage, sex, and habitat association, recognition of *G. comma* as a distinct species is questionable.

Material Examined. BRAZIL: GCRL 10917 (1), Bahia, Isla Itaparica, 27 April 1973, C. E. Dawson et al. TRINIDAD: MCZ 58720 (1), Station 44, off South coast of Trinidad, 16fms, RV Chain 035. VENEZUELA: **ANSP 109181, holotype, *Gobionellus comma,*** Margarita Islands, Caribbean Sea off point near NW end of Isla Cubagua, 25 January 1965, J. E. Randall; **LACM 20634 (1), paratype, *G. comma,*** Nueva Esparta, Tubores Co., Isla Cubagua, 10°47'55" N, 64°13'53" W, 15 April 1939, R/V Velero III; **LACM 20635 (1), paratype, *G. comma,*** Nueva Esparta, Tubores Co., Isla Cubagua, 10°49'25" N, -64.2666667, 15 April 1939, R/V Velero III; **UF 12793 (1), paratype, *G. comma,*** Isla Cubagua, 10.8329640, -64.1668540, 21 February 1965, F. Cervigon. PANAMA: MCZ 47646 (1), Caribbean Sea, Galeta Island, Ira Rubinoff; GCRL 4668 (1), Colon, Maria Chiquita, 27 June 1970, C. E. Dawson; MCZ 58718 (14), Caribbean Sea, Large tidepool at San Lorenzo, Fort Sherman, near Colon, G. W. Mead et al. COLOMBIA (ISLA DE PROVIDENCIA): UF 24450 (1), W side of Catalina Island at entrance to 'Bat Cave', 20 August 1970, C. R. Gilbert, W. Clerke and A. Schieber; UF 19103 (6), Midway along W side of Santa Catalina Island off 'Bat Cave', 26 August 1969, C. R. Gilbert et al.; UF 25851 (1), NE of NE end of island ca 0.5 mi N of Crab Key & ca 1.5 mi offshore, 10 August 1969, C. R. Gilbert et al. BELIZE: FMNH 86618 (1), Glovers Reef, Long Cay, channel between Long and Little Cay, 27 July 1971, D. W. Greenfield and J. Thomerson; FMNH 77684 (5), Glover's Reef-Long Cay-lagoon, W-72-6, 4 July 1972, C. W. Wayman; FMNH 77681 (5), Glover's Reef-Long Cay-lagoon, W-72-1, 23 June 1972, C. W. Wayman; FMNH 77685 (1), Glover's Reef-Long Cay-lagoon, W-72-8, 10 July 1972, C. W. Wayman; FMNH 77687 (3), Glover's Reef-Long Cay-lagoon, W-72-11, 14 July 1972, C. W. Wayman; FMNH 77682 (5), Glover's Reef-Long Cay-lagoon, W-72-2, 23 June 1972, C. W. Wayman; FMNH 77686 (3), Glover's Reef-Long Cay-lagoon, W-72-9, 10 July 1972, C. W. Wayman; FMNH 77683 (5), Glover's Reef-Long Cay-lagoon. W-72-5, 2 July 1972, C. W. Wayman. MEXICO (COZUMEL): UF 209458 (2), ca 2 mi SW of San Miguel, in lagoon, 12 July 1961, W. Starck. CAYMAN ISLANDS: **UF 13521 (25), paratypes, *Gobionellus saepepallens,*** Grand Cayman, Paradise Rocks ca 300-400 yds offshore from N side of Georgetown (Station 5), 22 October 1964, C. Gilbert and J. Tyler; **UF 13523 (2), paratypes, *G. saepepallens,*** Grand Cayman, Paradise Rocks ca 0.75 mi from shore at N side of Georgetown (Station 21), 29 October 1964, C. Gilbert and J. Tyler; **UF 13522 (5), paratypes, *G. saepepallens,*** Grand Cayman, Paradise Rocks ca 400 yds offshore from N side of Georgetown (Station 6), 23 October 1964, C. Gilbert and J. Tyler; **ANSP 109177(3), paratypes, *G. saepepallens,*** Grand Cayman Island, W side of island, Paradise Rocks, ca. 3/4 mi from shore, N side of Georgetown, 29 October 1964, C. R. Gilbert and J. C. Tyler; **ANSP 109178 (20), paratypes, *G. saepepallens,*** Grand Cayman Island, Paradise Rocks, ca. 300-400 yds offshore from N side of Georgetown, Sta. 5, 22 October 1964, C. R. Gilbert and J. C. Tyler. PUERTO RICO: **UPR 2412 (4), paratypes, *G. saepepallens,*** Culebra Island, Firewood Bay, 10 ft., 12 November 1964, J. E. Randall; UF 23017 (12), Mayaguez, La Parguera, back reef area 14 mi N of W end of Laurel Reef, 10 September 1976, D. Weiler; USNM 114656 (1), La Parquera, 10 December, 1954, H. Wasmke. VIRGIN ISLANDS: **UPR 1766 (1), paratype, *G. saepepallens,*** St. John, Reef Bay, 70 ft., 15 August 1962, J. E. Randall; GCRL 1999 (2), St. Thomas, behind Red bay, 18°20.12' N, 64°50.97' W, 12 November 1966, C. E. Dawson; **UF 13524 (1), paratype, *G. saepepallens,*** St. John, Salt Pond Bay, 30 March 1965, J. and H. Randall. ANTIGUA: CAS-SU 37270 (1), English Harbor, 28 June 1918, W. K. Fisher; **UF 12759 (1), paratype, *G. saepepallens,*** E side of island, in Marygalante Bay, just E of point separating Great Deep Bay, 27 April 1964, C. R. Gilbert, B. Endicott and E. Wing; **UF 11304 (7), paratypes, *G. saepepallens,*** E coast of Antigua 200 ft off Green Island. 25 April 1964, C. Gilbert, J. Randall and B. Endicott. DOMINICA: **USNM 199706 (1), paratype, *G. saepepallens,*** Anse Bouleau, First Point North of Gueule Lion Point (West Coast), To 20 Ft From Shore, 3 November 1963, V. Springer, R. Reckeweg and R. Blatcher. BAHAMAS: ANSP 147349 (5), Grand Bahama Bank, Rose Island; sandy beach on N shore, 25 August 1972, J. E. Böhlke family; **UMMZ 186507 (2), paratypes, *G. saepepallens***, Little Bahama Bank, Green Turtle Cay, E of Little Abaco Island, ca 1/2 mi S of

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New Plymouth, SW end of island (Gilliam Bay), 14 January 1961, C. C. G. Chaplin et al.; **ANSP 100519 (38), paratypes, *G. saepepallens,*** Little Bahama Bank, Green Turtle Cay, E of Little Abaco Island, ca 1/2 mi S of New Plymouth, SW end of island (Gilliam Bay),14 January 1961, C. C. G. Chaplin et al.; **ANSP 109180, holotype, *G. saepepallens,*** Little Bahama Bank, Green Turtle Cay, E of Little Abaco Island ca 1/2 mi S of New Plymouth, SW end of island (Gilliam Bay), 14 January 1961, C. C. G. Chaplin et al.; **ANSP 86135 (1), paratype, *G. saepepallens,*** Grand Bahama Bank, Andros, W side of the southern of the two Long Bay Cays, 12 July 1957, J. E. Böhlke et al.; **AMNH 25792 (2) paratypes, *G. saepepallens,*** Little Bahama Bank, Green Turtle Cay, E of Little Abaco Island ca 1/2 mi S of New Plymouth, SW end of island (Gilliam Bay), 14 January 1961, C. C. G. Chaplin et al.; AMNH 24936 (59), Hawks Nest Creek, Cat Island, 9 April 1965, C. L. Smith et al.; **FMNH 73908 (2), paratypes, *G. saepepallens,*** Green Turtle Cay, E. of Little Abaco (Little Bahamas Bank), 14 January 1961, C. C. Chaplin, B. and S. Barringer; **USNM 201590 (2), paratypes, *G. saepepallens,*** Green Turtle Cay, E. of Little Abaco (Little Bahamas Bank), 1/2 Ft. To Shore, 14 January 1961, C. Chaplin and B. Barringer. FLORIDA: ANSP 84784 (1), American Shoal, 16 April 1940, F. R. Schwengel; UF 7050 (1), Florida Keys, around end of Big Pine Key, Spanish Harbor Key bridge on Big Pine, 7 June 1956, D. Caldwell, C. Briggs and J. Dickinson; USNM 167676 (2), Gulf of Mexico, Biscayne Bay, boat slip west side Soldier Key. NORTH CAROLINA: UWM uncat. lot 1 (1), Eastward Cruise, E8-77, Sta. 225, 35 35.9'N, 75 14.2' W, 37m depth, 27 October 1977; UWM uncat. lot 2 (1), Eastward Cruise, E8-77, Sta. 87 SBT, 35 37.5' N, 75 13.0' W, 35m depth, 21 October 1977; UWM uncat. lot 3 (1), Eastward Cruise, E8-77, Sta. 52, 35 30.1' N, 75 13.2' W, 33m depth, 20 October 1977; UWM uncat. lot 5 (2), Eastward Cruise, E8-77, Sta. 76, 35 40.' N, 75 13.9' W, 21 October 1977.

3.13 *Ctenogobius sagittula,* Longtail Goby (Figure 18)

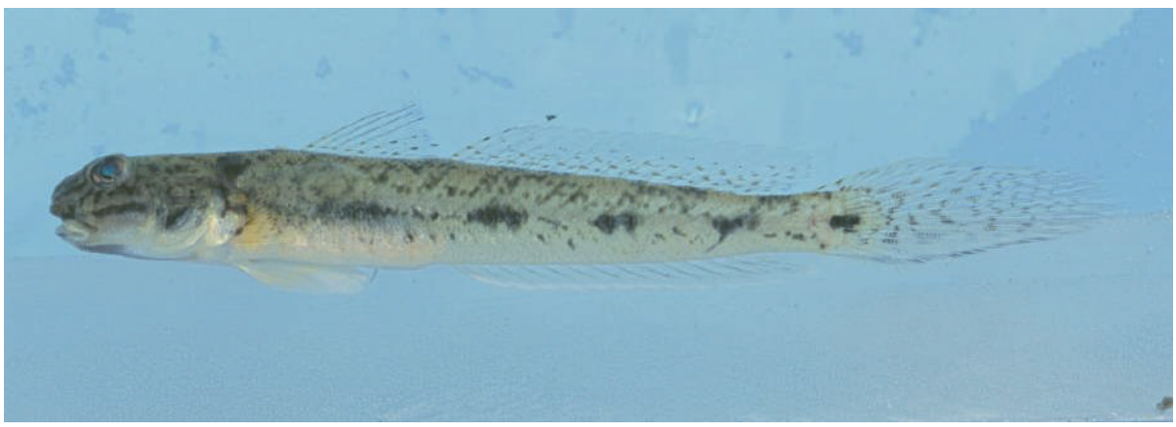

Figure 18. *Ctenogobius sagittula,* male, Panama Canal, Panama. Photo by J. Van Tassell.

Euctenogobius sagittula Günther, 1861:372 (west coast of Central America; holotype BMNH 1861-8-13-26).

Gobius sagittula Jordan and Gilbert, 1882 (new combination).

Gobius longicaudus Jenkins and Evermann, 1889:146 (Guaymas, Mexico; syntypes USNM 39636).

Gobionellus sagittula Gilbert and Starks, 1904 (new combination).

Gobionellus longicaudus Ginsburg, 1953 (new combination).

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Diagnosis. D_2 I,12; A I,13. Lateral scale rows 49-66, usually 55-60. Greatly elongate body, with small head and small paired fins not reaching anus in either sex. Shoulder patch present. Large dark spot midlaterally on upper jaw on both sides. Caudal fin elongate, greatly produced in males.

Description. Based on 135 specimens, 18.9-137.5 mm SL. General morphology as described for the genus; morphometric data given in Tables 2–4. Jaws extending to vertical line from anterior 1/3 to 1/2 of eye in both sexes. Outermost tooth row of upper jaw consisting of many large conical teeth extending along entire jaw, but no greatly enlarged canines as found in smaller species of this genus. A few highly recurved strong canines either side of dentary symphysis in innermost tooth row of lower jaw. Eyes lateral, high on head, top forming part of dorsal profile, small for the genus, slightly larger in females than males. Snout, head length, cheek depth and width, nape, body depth, preanal body length and caudal peduncle depth larger in females; postanal body longer in males (Tables 2–4).

D_1 spines falling short of or just reaching D_2 origin in most specimens examined; some variability with a number of Colombian males and a few from Central American collections having slightly elongate spines reaching to the base of the third element of D_2. Pectoral fins and pelvic fins short in both sexes, but pectoral fins longer in females than males. Appressed posteriormost rays of D_2 and anal fins just reaching or short of procurrent caudal rays. Caudal fin longer in males than females. Fin measurements and ray counts given in Table 5.

Ctenoid scales posteriorly on trunk. Cycloid scales in narrow band 1-2 scales wide along base of dorsal fins anteriorly from about third D2 element, broadening to include all scales above and forward of a perimeter roughly from D2 origin to anterior edge of first midlateral blotch and upper base of the pectoral fin. Cycloid scales on pectoral fin base, abdomen, nape and, when scales present, on opercle. Trunk beneath pectoral axil variably scaled or partially scaled. Nape generally scaled to about mid-opercle in southern populations, to preopercle in north. Pectoral fin base usually partially scaled. Prepelvic region generally naked, but may have up to 18 rows of scales. Cheek naked; opercle usually naked, but occasionally with a few scales along anterodorsal margin. Abdomen generally fully scaled, including infracarinalis medius, but may be partially scaled or with naked midline, particularly in juveniles. Scale counts given in Table 6.

Preopercular canal generally with three pores.

Pigmentation in preserved specimens. Upper jaw with dark spot midlaterally on each side. Horizontal bar on cheek below median longitudinal row of papillae, extending from above corner of the jaw to preopercle. Patch behind eye following posteriormost suborbital papillae row then turning caudad to continue towards upper terminus of preopercular lateralis canal; sometimes discontinuous and forming blotches. Opercle dusky. Shoulder patch present. Five midlateral blotches present on trunk with last two or three frequently having thin posterodorsal arms, last two often with anteroventral arms. Occasionally one of blotches may have thin anterodorsal arm. Small spots scattered variably across sides. Second dorsal fin with diagonal rows of blotches in females; blotched pattern to more diffuse pattern of wavy bands in males with broad dusky margin. First dorsal fin with one or two horizontal to slightly diagonal, basal bands; spines dusky with perhaps a few scattered blotches distally, remainder of fin being clear. Anal fin dusky with clear margin in males; clear with very light sprinkle of melanophores between branches of posterior rays in females. Pectoral fins dusky in females, sometimes with indistinct blotches forming vague bars; vertical bars more pronounced in males. Pelvic disk clear in females; in males occasionally clear, most commonly dusky centrally with clear margin. Caudal fin with numerous vertical bars in females, with dusky submargin and light margin ventrally; males with dark ventral margin bordered by clear submargin, median rays dusky distally; males frequently with clear submarginal streak evident dorsally.

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Color in life. From Fig. 18, photograph of a male specimen. Body and head light olive green, golden yellow highlights on trunk beneath pectoral fin near base, abdomen white. Lower pectoral fin base yellowish white. Pelvic fins with yellow along rays. Anal fin margin and submarginal band in lower caudal fin white to clear. Dark markings as described for preserved specimens.

Axial osteology. Fourth neural spine flared basally. Two epurals.

Distribution. The eastern Pacific Ocean, from San Diego Bay, California to Guayaquil, Ecuador.

Comments. This species is unique in the genus for several reasons: its large adult size; the number of lateral scale rows on the trunk; reverse sexual dimorphism for proportionate length of the pectoral fins and first dorsal fin spines; and the frequent occurrence of four gill rakers on the lower ceratobranchial, and one at the angle, giving a total of five rakers on the first arch (occasionally there are two at the angle of the arch, given a total of six elements). Although the greater number of scale rows led Gilbert and Randall (1979) to exclude it from their "coarse-scaled" group, this species shares the diagnostic features of *Ctenogobius* with the "coarse-scaled" species (excluding *Gobionellus daguae*) (Pezold, 2004).

Females of this species are generally more robust than males (reflected in the anal fin origin to D_2 origin [body depth] and anal fin terminus to D_2 terminus [caudal peduncle depth] measures), and have a larger head, including a larger orbit, a broader cheek region (preopercle to jaw and eye to jaw measures - not reflective of differences in jaw size) and a larger snout. Females also have a greater preanal distance and eye to first dorsal distance - both of which may or may not simply reflect the difference in head size. In contrast to other *Ctenogobius* species, females have longer pectoral fins and longer spines in the first dorsal fin than males (spines 1, 3 and 5; for 43 males and 49 or 50 females, $p < 0.05$). The data for spine lengths, however, do not include specimens from one large Colombian collection (USNM 257678) in which the males have slightly longer spines than females, reaching to the third element (second soft ray) of the second dorsal fin when appressed. Variation in spine length requires additional analysis. Examination of males from Central America (including Panama), Mexican populations and other Colombian collections showed that although Mexican samples had the shortest spines, males from Central American and other Colombian collections also had shorter spines than those of the larger Colombian lot. Males of this species have a longer caudal trunk than females and a more elongate caudal fin.

At the time of Ginsburg's revision of this genus (1932), *Gobius longicaudus* was regarded as a junior synonym of *Ctenogobius sagittula;* a view traceable to Jordan and Eigenmann (1887). In 1953, however, Ginsburg designated *Gobionellus longicaudus* as the type species of a new subgenus, because he was uncertain to which species the name *Gobionellus sagittula* actually belonged (*Gobionellus microdon* being a possible candidate in his view) and because he noted some divergence in the number of pectoral fin rays and lateral scale rows in northern and southern populations of *C. sagittula.* He was also uncertain as to whether or not these populations should be recognized as subspecies or species as some intergradation was observed.

Specimens from five different coastal regions were compared for numbers of pectoral fin rays and counts of lateral, transverse rearward, transverse forward and predorsal scale rows (Table 8). One region roughly corresponds to the Cortez Province while the others span the Panamic Province (Robertson and Cramer, 2009). No particular geographic pattern was observed for pectoral fin ray variation, but northern populations from the Cortez Province and the Mexican portion of the Panamic Province averaged greater numbers of scale rows than southern populations.

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Table 8. Mean scale row number (lateral, transverse rearward, transverse forward, predorsal) and total pectoral fin ray number for *Ctenogobius sagittula* specimens by region. STD = standard deviation.

		Mean	(n)	STD	Range
Lateral	Colombia	53.4	(20)	2.7	50-59
	Panama	54.6	(23)	2.4	49-59
	Costa Rica/El Salvador	55.2	(16)	2.2	51-59
	Michoacan-Mazatlan	58.9	(41)	1.7	56-63
	North of Mazatlan	59.3	(24)	2.5	55-66
Transverse Rearward	Colombia	15.5	(19)	1.8	13-19
	Panama	15.7	(21)	1.4	14-19
	Costa Rica/El Salvador	15.3	(15)	1.2	13-17
	Michoacan-Mazatlan	18.1	(41)	1.3	15-21
	North of Mazatlan	17.4	(24)	1.4	16-22
Transverse Forward	Colombia	19.9	(13)	3.5	15-26
	Panama	20.2	(21)	2.0	16-24
	Costa Rica/El Salvador	21.2	(13)	2.1	17-25
	Michoacan-Mazatlan	24.6	(41)	2.6	18-33
	North of Mazatlan	24.3	(24)	2.6	19-29
Predorsal	Colombia	20.7	(21)	6.4	3-29
	Panama	23.8	(21)	3.1	20-32
	Costa Rica/El Salvador	21.3	(15)	2.9	17-27
	Michoacan-Mazatlan	25.0	(42)	8.1	0-35
	North of Mazatlan	26.4	(24)	2.5	22-32
Pectoral Fin Rays	Colombia	33.6	(22)	1.0	31-36
	Panama	32.7	(23)	1.0	31-34
	Costa Rica/El Salvador	32.3	(18)	1.0	30-34
	Michoacan-Mazatlan	33.9	(41)	0.8	32-36
	North of Mazatlan	33.6	(24)	1.4	32-36

Principal component analyses were conducted for 53 males and 60 females (separately treated due to morphometric sexual dimorphism) using 22 meristic and morphometric variables to further test the possibility of distinctive northern and southern populations. Specimens were treated as three geographic groups - Mexico above Mazatlan (Cortez Province), Mexican portion of the Panamic Province, and the southern Panamic Province (Ecuador to El Salvador were lumped due to small sample sizes). The analyses did not completely separate northern and southern populations of either sex (Figs. 19, 20). The separation on axis 2 was primarily due to meristic variables in both sexes (Tables 9, 10) with all scale numbers used contributing more than pectoral fin ray numbers in females, and all but predorsal scale counts having higher coefficients than pectoral fin ray counts in males. *Gobius longicaudus* syntypes fell within the cluster for the other specimens from the Cortez Province. The first component had high morphometric variable coefficients, all of which were highly correlated with standard length reflecting differences due to specimen size. Plots of principal components 1 and 3 gave no separation by region; component 3 was most heavily influenced by pectoral fin number. Using gross morphological features alone, the evidence favors the recognition of a single polytypic species.

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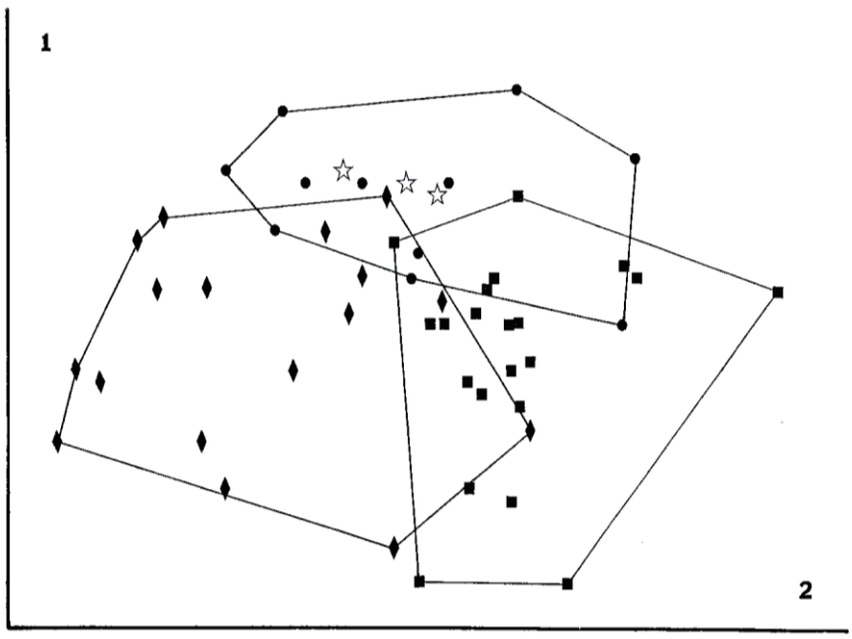

Figure 19. Principal components analysis of *C. sagittula* males using meristic and morphometric variables. Components 1 and 2 plotted. Diamonds = populations from El Salvador south, Squares = Michoacan through Mazatlan, Mexico, Dots = Mexico above Mazatlan, Stars = *Gobionellus longicaudus* syntypes.

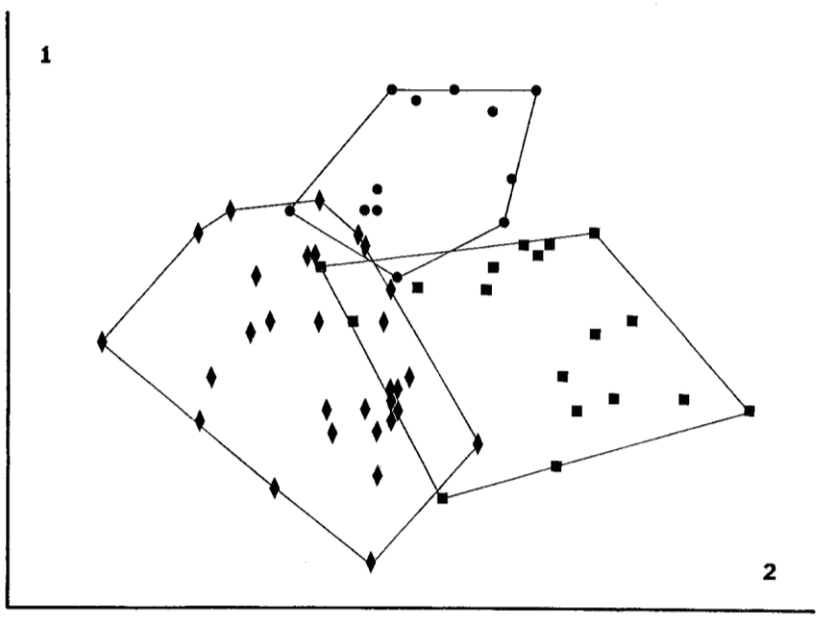

Figure 20. Principal components analysis of *C. sagittula* females using meristic and morphometric variables. Components 1 and 2 plotted. Key as in Figure 18.

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Table 9. Principal component coefficients, eigenvalues and cumulative percentages of variation from analyses of *Ctenogobius sagittula* and *Gobius longicaudus* males using meristic and morphometric variables.

	PC 1	PC 2	PC 3
SL	0.243112	-.015517	0.014778
LS	0.077055	0.496959	0.085289
TR	0.072266	0.519595	-.209125
TF	0.064668	0.493525	-.393742
PRED	0.123641	0.267338	-.179949
JAWL	0.240675	-.053613	0.001491
HW	0.235831	-.009714	0.060992
HL	0.242137	-.047938	0.017913
ORBIT	0.235477	-.087133	-.036194
EYE to D1	0.240603	-.056240	-.005606
IO	0.220373	-.129731	0.015553
SNTL	0.239624	-.025662	0.010526
POP to JAW	0.237637	0.012843	0.081537
CPDL	0.240033	-.025961	0.025131
AT to D2T	0.240378	-.055959	-.032736
AO to D2O	0.240530	-.015727	0.012160
P1L	0.240209	-.018559	-.035920
P2L	0.239334	-.014891	0.067673
CAUDL	0.237498	-.021133	-.005311
PREA	0.242576	-.029917	0.011917
POSTA	0.242495	-.029917	0.011917
P1 TOTAL	0.004132	0.357850	0.860681
eigenvalues	16.84006	2.62630	0.83401
cumulative	0.76546	0.88483	0.92274

Table 10. Principal component coefficients, eigenvalues and cumulative percentages of variation from analyses of *Ctenogobius sagittula* females using meristic and morphometric variables.

	PC 1	PC 2	PC 3
SL	0.245294	-.031612	-.005077
LS	0.096495	0.483932	-.172479
TR	0.076350	0.532927	-.064419
TF	0.084707	0.541293	-.015129
PRED	0.095069	0.310767	-.173592
JAWL	0.240683	-.084976	0.035624
HW	0.237728	-.068878	0.050873
HL	0.244560	-.062644	0.006219
ORBIT	0.230153	-.131181	-.090616
EYE to D1	0.241120	-.069529	-.020303
IO	0.212748	-.008957	-.083694
SNTL	0.238498	-.085942	0.026042
POP to JAW	0.235980	0.000171	0.050716
CPDL	0.238422	-.022344	-.044163
AT to D2T	0.241109	-.057486	-.035596
AO to D2O	0.241322	0.005697	0.000084
P1L	0.241825	0.013819	0.017591
P2L	0.240539	0.023736	0.029260
CAUDL	0.235128	-.054833	0.128092
PREA	0.244360	-.048813	0.004567
POSTA	0.245176	-.019109	-.013250
P1 TOTAL	0.024983	0.188366	0.944432
eigenvalues	16.42636	2.38271	0.99319
cumulative	0.74665	0.85496	0.90010

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Material Examined. CALIFORNIA: CAS-SU 9893 (4), San Diego Bay, E. C. Starks; CAS 12944 (1), San Diego, E. C. Starks and Morris. MEXICO: ANSP 152820 (5), Baja California, lagoon (with no open connection at time of seining) inshore from Bahia San Carlos, 13 April 1952; AMNH 5558 (6), Baja California, Bahia Agua Verde, 2 April 1911; CAS 51045 (4), Sinaloa, lagoon ca. 1.5 mi. N of Camaron Beach, 1 February 1951, K. Norris et al.; LACM 1025 (35), Nayarit, Rio Santiago, La Boca del Asadero, approx. 2 mi. from mouth, 31 January 1958, Rosenblatt et al.; LACM 34081-2 (5), Baja California, ca. 5 miles south of San Felipe, 21 September 1970, L. Lester; FMNH 57530 (3), Guaymas; MCZ 27881 (1), Gulf of California, Laguna Algodones; green muddy bottom, USFC Steamer Albatross; CAS-SU 169 (8), Sonora, Yaqui River, 31 March 1889, U.S. Fish Commission; UMMZ 178590 (2), Sinaloa, Topolobampo, ca. 15 mi S of Los Mochis, 10 April 1957, R.R. Miller et al.; UMMZ 184865 (27), Nayarit, Laguna de Puerto del Rio, between Tecuala and Novillero; leads N to sea, S to Rio Acaponeta, 20 March 1959, R. R. Miller and R. J Schultz; UMMZ 172256 (15), Nayarit, Slough at N end of Laguna de Mexcaltitan, ca 3 km N of Mexcaltitan, elev ca 100 ft, 28 March 1955, R. R. Miller and J. T. Greenback; USNM 300440 (2), Baja California, Conception Bay, 19 March 1889, Linsburg; **USNM 39636 (3), syntypes, *Gobius longicaudus,*** Sonora, Gulf of California, Guaymas, July 1887, O. Jenkins and B. Evermann; USNM 59456 (7), Gulf of California, Concepcion Bay, Mouth of Rio Muleje, 19 March 1889; USNM 46655 (1), Sonora, San Juan Lagoon, Rio Ahome, Off Lower California, 2 April 1889; USNM 123265 (6), Baja California: Concepcion Bay, Mouth of Rio Muleje, 19 March 1889; USNM 214515 (1), Gulf of California, Choya Estero, Mexico, sand & mud, 10 May 1969; USNM 30936 (7), near San Jose, 16 May 1882, L. Belding; USNM 43740 (3), Guaymas, 27 February 1891, P. Jouy; USNM 265002 (1), Baja California Sur, Magdalena Bay, Howland's Lagoon, 30 July 1966, R. Bolin et al. EL SALVADOR: FMNH 12018 (2), Triunfo, 10 February 1924, S. F. Hildebrand and F. J. Foster; FMNH 93706 (2), Rio Chaquantique, Jiquilisco Bay, 11 February 1976, M. Miller; GCRL 16554 (4), Jiquilisco Bay, 24 March 1976, M. Miller; GCRL 16562 (1), Jiquilisco Bay; El Potrero, 10 March 1976, M. Miller; USNM 87200 (3), Triunfo, 10 February 1924, S. Hildebrand and F. Foster; USNM 220642 (2), El Potrero, Jiquilisco Bay, 10 June 1976, P. Phillips et al. COSTA RICA: CAS-SU 69120 (1), Golfito (on Golfo Dulce), 5 March 1938, Templeton Crocker Expedition; FMNH 86669 (3), Puntarenas, Estero near shipyard of Cona, 21 September 1952, D. S. Erdman; FMNH 91226 (1), Gulf of Nicoya, mouth of Rio San Pedro-(Canjel), 27 October 1952; LACM 2700, (1) Puntarenas, Rio Tarcolitos at mouth, 9 July 1961, W. Bussing; LACM 2889 (2), Puntarenas, Rio Tarcolitos at mouth, 29 December 1962, W. Bussing and A. Obando; TCWC uncat. (1), Osa Peninsula, Rio Claro estuary, 8 July 1983, K. Winemiller. PANAMA: ANSP 151059 (1), Chiriqui, Rio Estero at IAH; 13.9 km E of intersection of IAH and Chiriqui-Gualaca road, 29 January 1983, D. Fromm and D. Weber; FMNH 8469 (3), Canal Zone, Corozal, 20 April 1911, Meek and Hildbrand; MCZ 46472 (2), Punta Paitilla, I. Rubinoff; MCZ 46482 (1), San Carlos beach; dune pool, I. Rubinoff; UF 16208 (10), Panama Canal Zone, Miraflores Locks, at spillway, 11 May 1967, R. Birdsong and T. Fraser; UMMZ 180724 (2), By bridge over Rio Abajo, Panama Vieja, 2 August 1940, N. Scrimshaw and T. Sanders; USNM 81961 (2), Chame Point, 26 July 1913, R. Tweedlie; USNM 79013 (3), Corozal, Canal Zone, 18 August 1911, S. Meek and S. Hildebrand; USNM 123260 (1), Venado Beach, 26 February 1937, S. Hildebrand; USNM 123258 (2), Canal Zone: Balboa, dry dock, 18 March 1937, S. Hildebrand; USNM 265005 (1), Panama Prov., Venado Beach, along Sandbar to Isla Venado, 4 April 1973, C. E. Dawson et al.; USNM 123259 (1), Canal Zone, Lower Chamber (Panama Canal) Miraflores Lock, 26 March 1937, S. Hildebrand; USNM 81821 (1), Chame Point, 14 February 1912, S. Meek and S. Hildebrand; USNM 81818 (1), Balboa Bay, Canal Zone, 5 May 1911, S. Meek and S. Hildebrand; USNM 81820 (3), Corozal, Canal Zone, 20 April 1911, S. Meek and S. Hildebrand. CENTRAL AMERICA: **BMNH 1861-8-13-26, holotype, *Euctenogobius sagittula,*** Captain Dow. COLOMBIA: CAS 51041 (2), Cauca, mouth of Rio Dagua, C. H. Eigenmann; CAS-SU 64211 (2), Valle del Cauca, Buenaventura, 24 March 1959, K. H. Luling; FMNH 58481 (2), Mouth of Rio Dagua, March 1912, C. H. Eigenmann; FMNH 86693 (10), Pizarro, Chaco, Pacific side. field

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numbers-1919, 2225, 1722, 1626, 2205, 2147, 1584, 1779, 1895, 2071, September 1945; USNM 257662 (7), Rocky point just toward Buenaventura from Bocana and mangrove area in bay, 8 October 1969, L. Knapp; USNM 257678 (235), Choco, Boca Baudo at Pizarro. Site A: stream and Site B: mangrove, 7 November 1970, L. Knapp and W. Taylor; USNM 265085 (1), Bocana Micay near Punta Coco, small muddy tidal bay or just north of Punta Coco- stream and tributary in mangroves 3-4 ft deep, 24 October 1970, L. Knapp; USNM 257667 (3), Brackish stream on beach near Pizarro, 11 November 1970, L. Knapp and W. Taylor; USNM 257679 (243), Mouth of Rio Mira at Cabo Manglares south of Tumaco, Colombia. Site A: young mangroves-water about 2 ft. Site B: reeds with sandy, and beach; Site C: stream about 10' deep and 25' wide, 27 October 1970, L. Knapp and E. Artunduaga. ECUADOR: CAS-SU 9291 (4), Guayaquil, P. O. Simons; USNM 88785 (2), Guayaquil, Salada, mangrove swamp, 1 October 1926, W. Schmitt.

3.14 *Ctenogobius shufeldti,* Freshwater Goby (Figure 21)

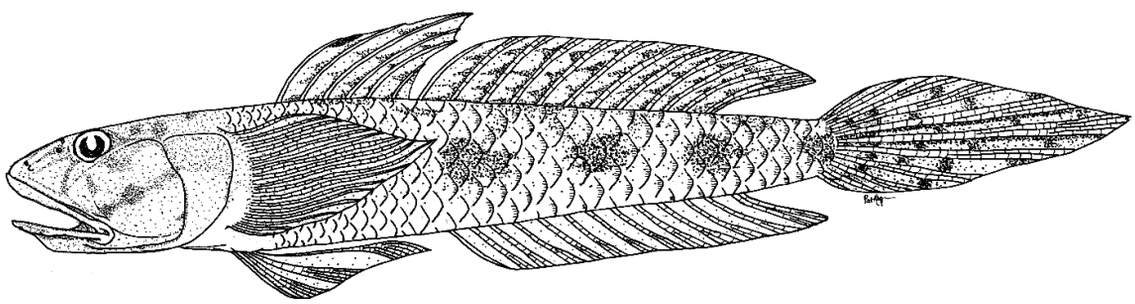

Figure 21. ***Ctenogobius shufeldti,*** **NLU 47575, 57 mm SL, male, Mississippi, Jackson Co., Ocean Springs. Drawing by Pat Regan.**

Gobius shufeldti Jordan and Eigenmann, 1887:495 (syntypes: USNM 35202; New Orleans, Louisiana).

Rhinogobius shufeldti Jordan, Evermann and Clark, 1930:439 (new combination).

Gobionellus shufeldti Ginsburg, 1932 (new combination).

Diagnosis. D_1 I,11; A I,12. Pelvic fin in males with membrane connecting innermost rays of disk clear, but with faint bilateral streaks running from bases of outer rays along distal branches of innermost ray on either side; pelvic fin in females clear. Dark shoulder patch, usually lacking, if present, very faint. Third spine of first dorsal fin not produced in adult males. Fourth neural spine simple, not flared. Two epurals.

Description. Based on 279 specimens, 14.9–73.0 mm SL. General morphology as described for the genus; morphometric data given in Tables 2–4. Jaws extending rearward to a point 1/3 to 1/2 of the eye diameter in females; in males from 1/3 or 1/2 eye diameter in juveniles to posterior margin of orbit in adults. Fine teeth in band in both jaws, larger towards outer edge; 6 or more small canines each side of symphysis in outer row of upper jaw largest, most distinct in males. Small recurved canine near origin of mental frenum each side of lower jaw in large males. Outer teeth of upper jaw reach larger size in males of Atlantic populations, but still smaller than those of other freshwater-inhabiting species of this genus.

Third spine of first dorsal fin not produced in males. Pectoral fins variably falling short of or reaching vertical through anus in females; reaching to vertical at least through anus, usually through anal fin origin in

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males. Pelvic fins in females not reaching anus; usually reaching anus in males. Appressed posterior rays of D_2 and anal fins reaching to or slightly beyond procurrent caudal fin rays in females and beyond procurrent caudal fin rays in males. Caudal fin longer in males than females. Fin measurements and ray counts given in Table 5.

Ctenoid scales from caudal fin base to beneath pectoral fin rays on trunk, naked beneath pectoral axil; first few rows of scales in lateral series may be cycloid. Cycloid scales along dorsum, several rows either side of D_1, from fifth spine forward. Nape usually with several rows of cycloid scales. Pectoral fin base, cheek and opercle naked. Prepelvic region normally scaleless, but seven incomplete rows found in one female. Abdomen partially covered with cycloid scales in adults; infracarinalis medius usually naked, but occasionally partially scaled. Scale counts given in Table 6.

Preopercular canal with three pores.

Pigmentation in preserved specimens. Several dark brown or black streaks from eye to jaw on snout, none more intense than the other in Gulf populations, middle streak slightly darker in Atlantic seaboard populations; posteriormost streak more diffuse, especially towards jaw. Dark stripe crossing cheek from above corner of jaw to 3/4 distance to upper preopercle. Upper opercular region, top of head and nape mottled; top of head and nape with vague crossbars. Opercle dusky. Upper pectoral fin base pigmented, no distinct spots; pigment may extend to bottom of pectoral fin base along edge of fin. Five midlateral blotches, last basicaudal; last two on trunk may have posterodorsal arms. Dorsum with irregular small blotches of pigment, less intense than midlateral blotches. Usually no shoulder patch, faint if present. Dorsal fins with wavy diagonal bands in both sexes; tips of spines 1-5 may have dark splotch in males, only fourth or fifth may be so colored in females. Pectoral fins clear or with fine pinpoint spots on rays in females; males may have faint vertical bars over upper 1/2; generally light in both sexes. Pelvic fins clear in females; with bilateral streaks in males. Anal fin broadly dusky in males, sometimes with discrete interradial spots, sometimes with clear margin; females with clear margin and light dusky submarginal band that broadens posteriorly. Caudal fin in males dusky over lower 1/3, vertical bars medially and lightly dusky over upper 1/4; females with distinct clear margin around fin, a narrow dark submargin, with light variably defined vertical bars filling the main body of the fin.

Color in life. Head and body tan to light olive green. Abdomen white, dark brown pigment as described in preserved specimens.

Axial osteology. Fourth neural spine simple, not flared. Two epurals.

Distribution. Atlantic coast of the United States from New Jersey to Indian River, Florida and along the Gulf of Mexico from the Florida panhandle (Apalachicola Bay region) to east Texas (Galveston Bay). On the east coast of the US it is uncommon north of North Carolina, but two records have been reported from New Jersey, the northernmost in the Hackensack River (Schmidt and Bragin, 2021).

Comments. Males of this species are characterized by larger heads, larger jaws, greater caudal peduncle depth, longer caudal fins, and a greater postanal distance, while females have larger orbits, cheek width and a longer nape (Tables 2–5). There is almost a significant difference shown for preanal distance ($p = 0.07$), which could possibly reflect the significantly larger eye to D_1 measure in females despite a significantly smaller head size. Although the dorsal spines of male *C. shufeldti* are not elongate like those found in other members of the freshwater inhabiting complex, the third and fourth spines are significantly longer in males than in females (Fig. 3). Wyanski and Targett (2000) described juvenile features and pigment and made observations on a transformation larva.

Specimens historically identified as *Ctenogobius shufeldti* outside of the range given above belong to *C. fasciatus, C. pseudofasciatus, C. claytonii* or *C. apogonus* (see comments under these species). One specimen of *C. shufeldti* has been seen recorded from outside of this range. It was a 63mm SL male (TCWC 0919.10)

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reportedly taken at Fish Pass, Mustang Island in Nueces Co., Texas. The veracity of this record is questioned for two reasons: 1) the specimen is reported from atypical habitat and 2) there were two separate tags in the jar, one claiming four specimens in the lot, and another claiming five. The jar actually held six specimens when I examined it; five specimens were *C. boleosoma.* This is the only specimen I have seen of *C. shufeldti* reported to have been taken behind a barrier island in what was undoubtedly a fairly high salinity. It is suspected that the specimen of *C. shufeldti* was mistakenly added to the collection of *C. boleosoma,* a species common at that locality and for which the habitat is typical. These species have often been confused in collections and the literature and can occur syntopically in oligohaline estuaries (Pezold and Cashner, 1983; Wyanski and Targett, 2000).

At least three of the freshwater gobies, *Ctenogobius fasciatus, C. pseudofasciatus* and *C. shufeldti,* are known to overlap in range in Florida, and two have undetermined boundaries in the western Gulf of Mexico, *C. claytonii* and *C. shufeldti.* Although Jordan and Eigenmann (1887) based their description of *Gobius shufeldti* on 23 syntypes, only 12 were found in the lot at USNM. To stabilize the name the largest specimen in the series, a 61mm SL male, is here designated as the lectotype and retains the collection number USNM 35202. The remaining 11 specimens (9 females, 2 males, 42.9-56.3mm SL) are designated paralectotypes and are assigned to USNM 265188. Another specimen from the same collection located at the Museum of Comparative Zoology at Harvard, MCZ 35917, is also a paralectotype.

Material Examined. NORTH CAROLINA: UMMZ 126274 (6), Outlet of freshwater pond, Carolina Beach, 4 mi SE of Wilmington, 21 April 1930, L. Giovannoli; USNM 123238 (2), Beaufort, Newport River, above Narrows, 21 April 1931, S. Hildebrand and J. Gutsell; USNM 123240 (2), North Carolina: Beaufort: Newport River above "Narrows", 3 April 1931, S. Hildebrand. SOUTH CAROLINA: USNM 59074 (8), Georgetown, 16 January 1891, Kendale and United States Bureau of Fisheries; USNM 123237 (1), Fripp's Camp, Edisto River, 29 April 1938, S. Pearson; USNM 123244 (1), Edisto R., Across Form Will Town, 24 May 1938, S. Pearson; ANSP 149878 (3), Dewees Inlet and Tidal Creek, 27 May 1965, W. Gaud et al.; UMMZ 155196 (3), Jasper Co., Savannah Migratory Water Fowl Refuge, C. M. Tarzwell. GEORGIA: GCRL 16980 (2), Liberty Co., Riceboro Creek, Crossroads at headwater, ca. 0.8km W of US 17, 31 July 1980, C. E. Dawson; UF 25089 (1), Glynn Co., Altamaha River Park, 3 November 1958, V. Springer; UMMZ 155219 (7), Chatham Co., Savannah (Pond S27), 12 June 1945, C. M. Tarzwell; USNM 298633 (30), Glynn Co., Altamaha River at Altamaha River Park about 10 miles North Brunswick, 8 July 1953, F. Berry et al.; USNM 346221 (16), Glynn Co., Altamaha River at Altamaha River Park about 10 miles north of Brunswick, 11 March 1955, F. Berry et al.; USNM 131223 (1), St. Simons Island, Dunbar Creek Headwaters; ditched, 4' wide 6"-10" deep; slight current, 26 February 1945, R. and B. Johnson. FLORIDA (ATLANTIC COAST): UF 100061 (5), Brevard Co., Sebastian Creek, north prong below spillway, 14 February 1979, P. Hastings and R. G. Gilmore; UF 100062 (2), Indian River Co., North Relief Canal at US 1, 13 March 1979, R. G. Gilmore et al.; TNHC 10834 (1), Brevard Co., North Fork Sebastian Creek from confluence of N Prong to the dam, 22 May 1981, F. Pezold, D. Mosier, R. G. Gilmore and party; UF 57585 (UF/FSU 7585) (4), Duval Co., ditch on Jacksonville University campusflowing into St. John's River, 28 March 1961, R. Holliman et al.; UF 7741 (8), Duval Co., Stream W of Fulton, 7 June 1949, W. McLane; UF 7742 (1), Putnam Co., E shore of St. Johns River, at Palatka, 20 July 1948, W. McLane and R. Strawn; UF 7743 (1), Clay Co., stream SW shore of Doctor's Lake, 23 April 1949, W. McLane; UF 7744 (3), Duval Co., St. Johns River at Little Marsh Island, near Mayport, 16 April 1949, W. McLane; UF 7745 (4) Putnam Co., 3 mi N of Orange Mills on FL 14, 16 April 1949, W. McLane; UF 7746 (1), St. Johns Co., stagnant flatwoods stream 5 mi N of Spuds on Fl 47, 16 April 1949, W. McLane; UF 7747 (14), Clay Co., Doctors Lake near Orange Park, 12 December 1948, W. McLane; UF 7748 (11), Putnam Co., St Johns River at Palatka, 30 July 1948, W. McLane and R. Strawn; UF 7749 (3), Duval Co., San Carlos Creek near New Berlin, 28 June 1949, W. McLane and G. Nelson; UF 7750 (2), Duval Co., San Carlos Creek near New Berlin, 1 August 1949, W. McLane and G. Nelson; FLORIDA (GULF COAST): UF 54381 (UF/FSU

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4381) (1), Escambia Co., Escambia River near E end of Escambia River bridge on Rte 90, 21 April 1958, J. Barkuloo; UF 55334 (UF/FSU 5334) (7), Okaloosa Co., Mill Creek in Niceville from Rte 20 to mouth in Boggy Bayou, 9 September 1959, R. Yerger et al.; TU 103016 (2), Escambia Co., Elevenmile Creek W of Saufley field, 5 mi W of Pensacola, 19 July 1977, Suttkus, Smalley and Sorensen; TU 120046 (1), Escambia Co., Elevenmile Creek at outfall at Hwy. C-186, 0.5 mi. E of C-297A, 6 January 1981, R.D. Suttkus and S.O. Rohmann; TU120073 (1), Escambia Co., Elevenmile Creek 0.5 mi. W of Saufley Field, 6 January 1981, R.D. Suttkus and S.O. Rohmann; UMMZ 163443 (3), Gulf Co., Roadside ditch, W end of St. Vincent's Sound, US 98, 8 April 1941, C. L. and L. C. Hubbs and B. Walker; ANSP 72835 (2), Santa Rosa/Escambia Co., Escambia River, Escambia River Survey #1, sta. 15A, 28 October 1952, H.E. Winn and R.R. Rosanio; ANSP 72981 (1), Santa Rosa/Escambia Co., Backwater pond on Escambia River, 31 March 1953, C. L. Smith and R. Allen; ANSP 73030 (13), Sta.Rosa/Escambia Co., Escambia River, 29 March 1953, C. L. Smith and R. Allen; ANSP 73069 (1), Santa Rosa/Escambia Co., Escambia River at junction with White River, 4 mi. E of Gonzalez, 29 March 1953, C. L. Smith and R. Allen. ALABAMA: UMMZ 163590 (28), Baldwin Co., Bayou Minette, at Old Spanish Fort on US Hwy 31; Trib. Mobile Bay drainage, 12 April 1941, C. L. and L. C. Hubbs and B. Walker. MISSISSIPPI: ANSP 55812-15 (4), three miles N of Biloxi, 20 April 1932, M. J. Allen; GCRL 2066 (1), Mississippi Sound, Belle Fontaine beach, 5 April 1967, C. E. Dawson; GCRL 2067 (1), Jackson Co., Mississippi Sound, Magnolia State Park, 23 April 1966, Gamble; GCRL 2777 (1), Jackson Co., Pascagoula River, 30°28.88' N, 88°36.55' W, fisheries trawl, 6 May 1968, C. E. Dawson; GCRL 2778 (1), Jackson Co., Pascagoula River, trawl north of mouth of Robinson Bayou, 30°29.53' N, 88°33.87' W, 9 April 1968; GCRL 2779 (3), Jackson Co., Pascagoula River, just north of mouth of Robinson Bayou, 30°29.53' N, 88°33.87' W, 14 March 1968; TU 122420 (2), Hancock Co., East Pearl River along E bank about 1.5 mi. SSE of Hwy. I-10 bridge (T9S R16W Sec. 6 SW1/4), 3 May 1980, D. C. Heins and Findley; TU 122465 (5), Hancock Co., East Pearl River along E bank about 3.1 mi. SSE of Hwy. I-10 bridge (T9S R16W Sec. 17), 4 May 1980, D. C. Heins and Findley; TU 122501 (8), Hancock Co., East Pearl River along E bank about 2.6 mi. SSE of Hwy. I-10 (T9S R16E Sec. 17 NW 1/4), 10 July 1980, C. Heins and Findley; UMMZ 155431 (2), Harrison Co., Gulf of Mexico, 3 mi W of Gulfport, 3 April 1948, R. M. and M. K. Bailey; UMMZ 163654 (4), Harrison Co., Roadside pools & ditches near mouth of Wolf River, 14 April 1941, C. L. and L. C. Hubbs and B. Walker. LOUISIANA: **USNM 35202 (1), lectotype, *Gobius shufeldti,*** Orleans Par., New Orleans, R. W. Shufeldt; **USNM 265188 (11), paralectotypes, *Gobius shufeldti,*** Orleans Par., New Orleans, R. W. Shufeldt; MCZ 35917 (1), paralectotype, ***Gobius shufeldti***, Orleans Par., New Orleans, R. W. Shufeldt; USNM 123239 (1), Orleans Parish, Rigolets, 15 March 1934; USNM 123241 (1), Jefferson Par., Bayou St. Denis, G. Gunter; USNM 123349 (1), St. Tammany Par., Bayou Lacombe, September 1933, Mayley; ANSP 70796 (1), Iberia Par., Avery Island, W. Stone; FMNH 51061 (2), St. Tammany Par., Lugger Island, West Pearl River, 15 July 1923, Weed and P. Viosca; TU 163910 (47), Plaquemines Par., Dennis Pass, 2.1 mi. NE of Port Eads, 11 May 1971, W. W. Forman et al. (Freeport McMoran Inc.); TU 266 (18), St. Charles Par., Bonnet Carre Spillway ponds 20 mi. W of New Orleans, 14 April 1951, S.T. Tucker and Wherritt; UF 33927 (3), Cameron Par., Rockefeller Wildlife Refuge, drainage canal, 31 March 1978, E. Beane et al.; UMMZ 155326 (9), Lake Pontchartrain at Mouth of Tchefuncte River, 2 mi S of Madisonville, 1 April 1948, R. M. and M. K. Bailey; UMMZ 155292 (18), Plaquemines Par., near mouth of distributary of Mississippi River, prob. Bienvenue Pass, 12 mi ESE of Venice, 29 March 1948, R. M. Bailey, C. L. Hubbs, and W. Follett; UNOVC 656 (708) Plaquemines Par., Dennis Pass 2.25 km above mouth, 4.4 km NNE Port Eads lighthouse, 21 May 1978, F. Pezold et al.; UNOVC 763 (15), Plaquemines Par., Dennis Pass 0.7 km above Freeport Sulphur Co. water tower, 7.9 km NNW Port Eads lighthouse, 24 June 1978, F. Pezold et al.; UNOVC 769 (33), Plaquemines Par., Dennis Pass at mouth, 3.4 km NE Port Eads lighthouse, 24 June 1978, F. Pezold et al.; UNOVC 787 (223) Plaquemines Par., Wright Pass 0.4 km above east mouth, 5.8 km NE Port Eads lighthouse, 25 June 1978, F. Pezold et al.; UNO 1224 (25), Plaquemines Par., Dennis Pass 0.7 km above Freeport Sulphur Co. water tower, 7.9 km NNW Port Eads lighthouse, 29 July 1978, F. Pezold et al.; UNOVC 1232 (3) Plaquemines Par., Wright Pass, 0.25 mi above E mouth, flats on west side, 2 December

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1978, F. Pezold et al. USNM 265081 (1), Grand Isle, 8 July 1930, I. Ginsburg; UNOVC 1770 (22), St. Mary Par., Atchafalaya Bay just E of Poverty Bayou outlet, 10 April 1976. LOUISIANA-TEXAS (Sabine Lake): ANSP 99078 (7), Orange Co./Calcasieu Par., Sabine River, just above US Hwy 90 bridge (NE extreme of Orange City Limits), 7 August 1962, ANSP Dept. Limnology; ANSP 115695 (2), Orange Co./Calcasieu Par., Sabine River, just above US Hwy 90 bridge (NE extreme of Orange City Limits) 28 July 1969, J. J. Loos, et al. TEXAS: TCWC 1619.02 (1), Chambers Co., Trinity River Drainage, Round Lake Bayou (ID Survey), 9 June 1977, J. Van Connor; USNM 123245 (1), Galveston Co., Dickinson Bayou at Dickinson, Bureau of Fishes Reserve.

3.15 *Ctenogobius smaragdus,* Emerald Goby (Figure 22)

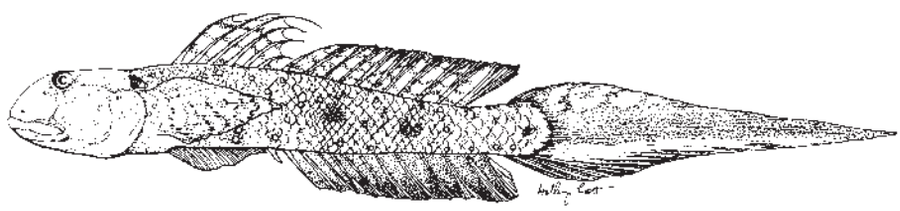

Figure 22. ***Ctenogobius smaragdus,*** **UF 19336, 66 mm SL, male, Florida, St. Johns Co., Matanzas River (W bank), just W of Crescent Beach, on St Hwy 206. Drawing by Holley Lott.**

Gobius smaragdus Valenciennes, in Cuvier and Valenciennes, 1837:120 (holotype: MNHN 1257; Cuba).

Smaragdus valenciennesi Poey, 1860:280 (syntypes: MCZ 13120; Cuba).

Gobionellus smaragdus Poey, 1868a:167 (new combination).

Diagnosis. D_2 I,10; A I,11. Head and body with numerous small greenish white ocellated spots. Bluish black shoulder patch present. Upper jaw with 2 large canines in outer row laterally on each side. D_1 third spine elongate in both sexes. Caudal fin elongate, to about 80% of SL in males and about 60% in females. About 40 scales in lateral series; predorsal with about 11 scale rows. Fourth neural spine flared basally. Two epurals.

Description. Based on 143 specimens, 19.1–80.5 mm SL. General morphology as described for the genus; morphometric data given in Tables 2–4. Jaws reaching posteriorly 1/3 to 1/2 diameter of eye in females; from 1/2 diameter to posterior margin in males. Numerous larger teeth in outermost row of upper jaw (about 25 in holotype) progressively increasing in size laterally, to two large canines on each side, immediately behind the two large canines are a couple of small recurved canines pointed in a medial direction; inner rows much smaller; teeth proportionately much larger in males than females. Lower jaw outer row only slightly larger in males except for three large teeth either side of symphysis in innermost row, these sometimes stronger than any others in either jaw. Dentition closer to that of *C. sagittula* than other *Ctenogobius* species; in females teeth of lower jaw about equal in size except for the large inner set at the symphysis. Males have a longer caudal peduncle than females.

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D_1 spines moderately produced in both sexes, longer in males. Pectoral fins reaching vertical through anal fin origin in both sexes. Pelvic fins reaching anus in males, not quite to anus in females. Appressed D_2 and anal fin rays extending beyond procurrent caudal fin rays in males, reaching to procurrent rays in females. Caudal fin longer in males than females. Fin measurements and ray counts given in Table 5.

Ctenoid scales over most of body, with cycloid scales along anterior dorsum craniad to line running from D_1 terminus to forward edge of first midlateral blotch. Region beneath pectoral axil partly scaled, with anteriormost being cycloid type. Cycloid scales on abdomen. Nape with cycloid scales to about rear margin of the opercle. Cheek and opercle naked. Pectoral fin base generally with patch of cycloid scales. Chest variably naked or scaled, for 46 specimens there was an average of five scale rows before the pelvic fins, but zero modally. Abdomen usually completely scaled or near complete. Scale counts given in Table 6.

Preopercular canal generally with three pores; middle pore missing on one side in 14 of 117 specimens examined.

Pigmentation in preserved specimens. Head, and frequently trunk, with scattered ocelli formed by light spots encircled with darker pigment. Dark cheek bar arching from upper corner of jaw to middle preopercular pore. Dark streak crossing from lower edge of eye to midlateral upper jaw, where it forms a dark spot on the upper lip as seen in *Ctenogobius sagittula* and *C. boleosoma.* Another short dark arc directed posteriorly from lower edge of orbit towards, but not reaching, uppermost preopercular pore; usually a spot in the vicinity of the pore. Another streak directed from lower eye to corner of jaw, not as intense as others, and frequently disjointed to form spots. Opercle with dark patch. Top of head with several bars, frequently disconnected to form series of spots. Nape with two or three bars before D_1 origin. Dark patch on shoulder. Five midlateral blotches, with many irregular dark spots and blotches above, below and between.

Dorsal fins with wavy diagonal bars in both sexes; may have dark spot just below tip of first D_1 spine both sexes and dark tips on other spines. Anal fin uniformly dark in males; dusky basally in females with slightly darker submarginal band and clear margin. Pectoral fins with distinct dark bars over dusky background in males, over clear background in females. Pelvic fin dark in males; variable in females from broad bilateral bands with clear median strip, to centrally dark with broad clear margin (i.e. median strip is pigmented). Caudal fin with many irregular bars and clear lower margin with dusky submargin in females; in males, dusky or dark medially, clear submarginal streak along upper edge and near lower edge, with lower margin intense black, with a few bars near base.

Color in life. Head and anterior trunk blue grey grading to tan posteriorly on trunk. Scattered ocelli formed by greenish white spots (yellowish white from original description, [Poey, 1860]) surrounded by black rings on cheek, operculum and trunk, more concentrated on anterior half of body, sometimes not extending full length of the trunk. A bright blue blotch occurs on top of the black shoulder patch. Caudal fin in males with reddish yellow submarginal stripe near upper and lower margins. Ventral edge of caudal fin dark black.

Axial osteology. Fourth neural spine flared basally. Two epurals.

Distribution. This species has been recorded from: North Carolina (Ross and Rohde, 2004) to Charlotte Co. in southwestern Florida in the United States, most common from the Indian River estuary south; Cuba; Virgin Islands; Belize; Venezuela; and Brazil, where specimens have been reported as far south as the Patos Lagoon in Rio Grande do Sul (Dias de Mattos Burns et al., 2010).

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Comments. There has been little confusion historically regarding the identity of this species, most probably because of the unique presence of ocelli on the head and trunk. Although types of *Smaragdus valenciennesi* were not seen, Poey, who was the source of the USNM collections from Cuba examined in this study and who also provided the holotype of *Gobius smaragdus* described by Valenciennes, later placed the name S. *valenciennesi* in synonymy as it was an unnecessary replacement name (Poey, 1868).

Most commonly associated with mangroves in Florida and Brazil, some of the gaps in this species' distribution probably reflect a sampling artifact. Considering the localities from which it is known, little support can be found for recognizing an antitropical distribution (Gilbert and Randall, 1979). Its absence in the northern and western Gulf of Mexico is apparently real.

Material Examined. FLORIDA (east coast): HBOM 107:02560 (4), St. Lucie Co., Indian River, Ft. Pierce, Jim Island flats, 24 April 1972, R. G. Gilmore and G.R. Kulczycki; HBOM 107:02606 (5), St. Lucie Co., Indian River, Ft. Pierce, Jim Island flats, 27 November 1974, R. S. Jones et al.; HBOM 107:04842 (5), St. Lucie Co., Indian River, Ft. Pierce, Jim Island flats, 19 March 1974, R. G. Gilmore and G.R. Kulczycki; TNHC 10860 (16), Palm Beach Co., W Prong of SW Fork of Loxahatchee River, Jupiter, 1.7 mi. W Hwy A1A on W Center St., 23 May 1981, F. Pezold and D. Mosier; TNHC 10884 (1), St. Lucie Co., Tidal Pool 5 mi. S Ft. Pierce Inlet 11.3 mi. N Hwy 707a on Hwy A1a E side, 23 May 1981, F. Pezold and D. Mosier; UF 4807 (1), Martin Co., Sewalls Point near St. Lucie Inlet, 27 February 1955, D. Caldwell and T. Hellier; UF 7756 (3), St. Johns Co., Matanzas River at Crescent Beach, 24 August 1949, W. McLane et al.; UF 11602 (14), Martin Co., Jupiter Island, drainage ditch 3 mi N of Jupiter Inlet, 15 April 1964, R. and C. Christensen; UF 19336 (1), St. Johns Co., Matanzas River (W bank), just W of Crescent Beach, on St Hwy 206, 18 July 1972, E. Kane et al.; UF 28776 (1), St. Lucie Co., Indian River, Jim Island flats, near Fort Pierce, 23 March 1972, HBFL personnel; UF 28778 (1), St. Lucie Co., Indian River, Jim Island flats, near Fort Pierce, 19 April 1972, HBFL personnel; UMMZ 189754 (10), Dade Co., Biscayne Bay at Radio Relay Station, Virginia Key, 21 September 1959, C. R. Robins and R. M. Bailey. FLORIDA (west coast): ANSP 71056 (10), Marco Bay at new bridge, 24 January 1938, J. C. Galloway; ANSP 71067 (1), Marco tide ditch, 20 January 1938, J. C. Galloway; CAS 51043 (7), Marco; LACM 1448 (6), Collier Co., Tidepool off ST.29, 1 mi. S. of Everglades City, 10 March 1961, D. Paulson and W. Bussing; UF 74720(UF/FSU 24720) (7), Collier Co., Marco Island, Johnson Bay, grassflats adjacent to mangroves, November 1974, F. Brockmann and J. Kinch; UF 3433 (5), Lee County, Bonita Beach, Estero Bay, near south end, 15 February 1954, L. Giovannoli; UF 9231 (1), Charlotte Co., Tide pool directly in front of Cape Haze Marine Lab, Placida, 4 March 1960, D. Rosen and O. Farver. CUBA: **MNHN 1257, holotype, *Gobius smaragdus,*** F. Poey; USNM 4769 (2), F. Poey; USNM 37461 (1), F. Poey; USNM 264987 (4), Guantanamo Bay, 1-14 February 1937, R/V Atlantis. VIRGIN ISLANDS: USNM 78150 (1), St. Thomas, 4 July 1915, C. R. Shoemaker. BELIZE: FMNH 86666 (1), Stann Creek, South water 'Range', on Twin Cay, a mangrove cay ca. 2mi W of Carrie Bow Cay, 8 March 1980, R. K. Johnson et al.; FMNH 86677 (1), Manatee Bar, at entrance to S Lagoon, pools back from beach, 3 August 1972, D. W. and T. A. Greenfield. VENEZUELA: GCRL 15514 (2), Margarita, 28 March 1976. BRAZIL: CAS-SU 52379 (1), Espirito Santo Vitoria, Praia Sta. Helena, 14 November 1944; GCRL 9621 (46), Bahia State, Isla Itaparica, 13°7.00' S, 38°47.00' W, 24 August 1972, C. E. Dawson et al.; MCZ 4624 (1), Rio de Janeiro and environs, L. Agassiz et al.; MCZ 13077 (1), Para State, Ponta Curuca, Thayer Expedition to Brazil, L. Agassiz; CAS-SU 52386 (1), Ports of Maranhao and Bahia; UF 19211 (20), Bahia State, Itaparica Island, Cacha Pregos, Salvador, 25 August 1972, N. Menezes et al.

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3.16 *Ctenogobius stigmaticus,* Marked Goby (Figure 23)

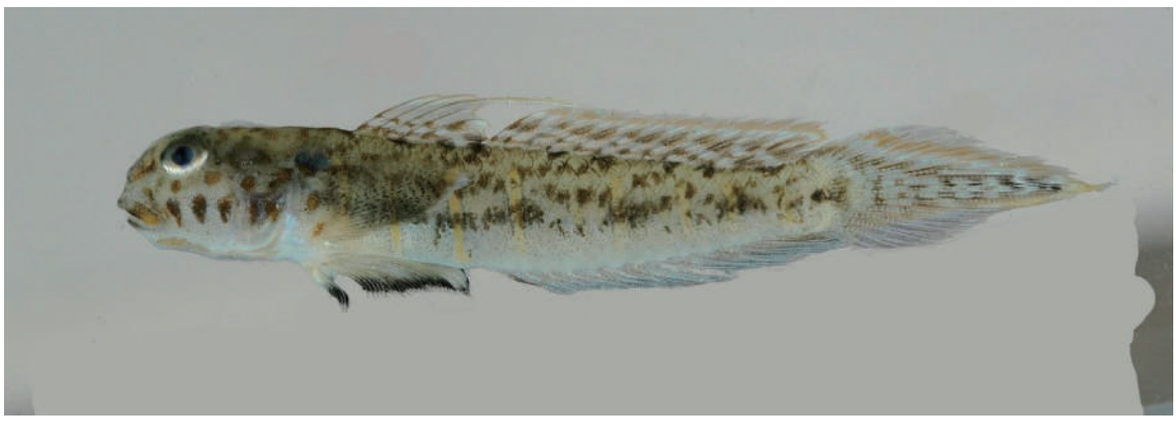

Figure 23. ***Ctenogobius stigmaticus,*** **Florida, Jim Island, N of Fort Pierce Inlet along mangroves. Photo by J. Van Tassell.**

Smaragdus stigmaticus Poey, 1861: 281 (holotype: MCZ 13104; Cuba).

Gobionellus stigmaticus Poey, 1868b: 394 (new combination).

Gobius stigmaticus Jordan, 1886 (new combination).

Diagnosis. D_2 I,11; A I,12. Cheek with 3 or 4 dark, broad vertical bars. Trunk with vertical yellow bars, appearing as unpigmented strips in preserved specimens. Strong recurved tusklike canine each side of lower jaw, projecting laterally from mouth. Males with dark margin on pelvic fins. Fourth neural spine simple, not flared basally. Two epurals.

Description. Based on 47 specimens, 16.9-54.6 mm SL. General morphology as described for the genus; morphometric data given in Tables 2–4. Three or four large canines in outermost row of upper jaw on each side. Innermost row of lower jaw composed of large recurved canines, largest on either side of symphysis. A large laterally-projecting large canine on each side of lower jaw in both sexes, frequently almost horizontal; usually the largest tooth of jaw. Females have a larger nape and preanal body length; males have broader cheeks, and a greater postanal body length (Tables 2–4).

Third D_1 spine often elongate in adult males. Pectoral fins in both sexes extending to vertical through urogenital papilla base or anal fin origin. Pelvic fins not reaching anus in females; reaching anus in some males. Appressed posterior rays of D_2 and anal fins just reaching procurrent rays of caudal fin or slightly past in females, beyond procurrent rays in males. Caudal fin longer in males than females Fin measurements and ray counts given in Table 5.

Ctenoid scales on trunk from caudal fin base to a line running from D_1 terminus to the upper pectoral fin base, replaced by cycloid scales anteriad. Nape with several rows of scales before diagonal between D_1 origin and upper pectoral fin base. Cycloid scales over most of abdomen. Head, prepectoral region and chest naked. Scale counts given in Table 6.

Preopercular canal generally with three pores, 5 of 42 specimens examined lacking middle pore on one side.

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Pigmentation in preserved specimens. Cheek with three broad vertical bars running from about height of median longitudinal cheek row to least longitudinal cheek row (in one female from Florida they form 3 large spots in midcheek). Opercle dusky. Side of nape with dark shoulder patch. Five midlateral blotches faint and disrupted or not defined. Sides diffusely pigmented except for 7-10 unpigmented vertical bands. Dorsal fins with diagonal bars in both sexes. Anal fin dusky; with clear margin in females. Pectorals with scattered pepper-like dots in both sexes. Pelvic fin in males clear or lightly dusted with melanophores centrally, with very dark margin; females with bilateral streaks from bases of outer rays posteriorly through branches of innermost rays (5th). Caudal fin with bars medially (those near tip frequently darker), dusky lower portion with clear margin and clear strip just beneath upper margin, in females; caudal fin in males similar except barring more faint to nonexistent but dusky medially instead (with dark tip) and no clear margin beneath dusky lower region.

Color in life. Head and trunk light tan with dark markings as described for preserved specimens, abdomen white. Three dark short bars or vertically elongated spots on cheek and one on opercle. Head and pectoral fin base with scattered red spots, some associated with the dark markings on the cheek and opercle; reddish brown spots dorsally on trunk and dorsal fins. Metallic blue sheen on dark shoulder patch on nape above pectoral fin base. Seven to nine vertical reddish yellow vertical bars along side of trunk. Dorsal fins with reddish margin, caudal fin with submarginal reddish band dorsally and ventrally, broad dark margin along lower edge of caudal fin, irregular vertical bars of dark spots medially. Anal fin dusky with some reddish color along base. Pectoral fins as described in preserved specimens but with opalescent margins. Pelvic fins patterned as in preserved specimens with pearly membrane.

Axial osteology. Fourth neural spine simple, not flared basally. Two epurals.

Distribution. North Carolina to southernmost Brazil. Specimens examined in this study are from both coasts of Florida (including the Keys), Mississippi and Texas in the United States, Cuba, Honduras, Antigua, Guadalupe, and the vicinity of Rio de Janeiro, Brazil. Ross and Rohde (2004) and Perschberger and Schwartz (2014) verify records from North Carolina; the latter publication includes a photograph clearly identifying one if not two individuals as this species (the photo of a specimen of *C. boleosoma* used for comparison however, is *Evorthodus lyricus*). *Ctenogobius stigmaticus* has also been collected in Belize (Carter Gilbert, pers. comm.), Panama, Venezuela (James Van Tassell, photos) and Dias de Mattos Burns et al. (2010) recorded it from Patos Lagoon, Rio Grande do Sul, Brazil.

Comments. Males of this species have a longer caudal fin, a longer caudal trunk (postanal length measure) and a greater cheek width as measured from the corner of the jaw to the preopercle. Females had a larger preanal body length measure and a larger distance between the eye and D_1 origin, which is a measure of the expanse of the occipital region and nape.

Specimens from Texas were collected over mud and grasses in a salinity of 40 ppt in the Lower Laguna Madre (Pezold and Edwards, 1983). I have also collected one specimen in the Matanzas River estuary of Florida on a muddy bottom in a salinity of 26 ppt. Cooley (1978) reported this species as common in the vicinity of Pensacola, particularly during the summer and fall, but the specimens collected could not be located. Considering the scarcity of this species in most collections, this is unusual and the record is regarded as doubtful.

When Ginsburg revised *Gobionellus* in 1932, the type of this species was lost. Howell-Rivero (1938), in his catalogue of Poey specimens at the Museum of Comparative Zoology, stated that MCZ 13104 was the type. Karsten Hartel (pers. comm.) has pointed out that some of Howell-Rivero's type assignments were incorrect. He also noted that whereas the specimen designated as type by Poey (1861) was described as being 60 mm total length, that recognized by Howell-Rivero measures 49 mm total length, with the caudal fin in good condition. My own measurements of the specimen (50 mm) are in line with Hartel's measurement. Howell-Rivero indicates that his conclusions on type assignments were based upon receipts and records in the MCZ library. Howell-Rivero's assignment is followed here.

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Material Examined. FLORIDA: TNHC 10703 (1), St. Johns Co., Matanzas River, lagoon, off W side of State Hwy A1A, 500 mi. N Marineland, 19 May 1981, F. Pezold and D. Mosier; UF 30509 (1), Bay Co., N shore of St. Andrew Bay ca 1 mi below Hathaway bridge, March 1968, C. Swift et al.; UF 213450 (1), Miami-Dade co., Sands Key (S of Ragged Keys, N of Elliot Key) at inland saltwater bay near NW end of island, 15 October 1963, R. Bayer and class. MISSISSIPPI: GCRL 13824 (3), Mississippi Sound, Stn. 951, 7 May 1975. TEXAS: TCWC uncat. (4), Cameron Co., Mexiquita Flats, 1.6 km SE of Port Isabel Post Office off FM 100 on Long Island, 23 July 1977, A. M. Landry & students. CUBA: **MCZ 13104 (1), holotype, *Smaragdus stigmaticus,*** Caribbean Sea, off Cuba, F. Poey; MCZ 13122 (3), Caribbean Sea, off Cuba, F. Poey; MCZ 13123 (2), Caribbean Sea, off Cuba, F. Poey; CAS-SU 1936 (6), Havana, D. S. Jordan. ANTIGUA: USNM 170308 (1), English Harbor, 4 April 1956, Smithsonian Institution-Bredin Caribbean Expedition.GUADELOUPE: ANSP 144494 (1), S of Pt. Lambis, West coast of Grande Terre; mangrove area off Canal de la Belle Plaine, 1 July 1976, J. E. Randall et al. HONDURAS: FMNH 86678 (1), Brus Lagoon, 10 May 1975, M/V Sabrina. BRAZIL: UF 19212 (1), Rio de Janeiro, 27 July 1966; UF 19903 (1), Rio de Janeiro, Angra dos Reis, May 1965; MCZ 4622 (22), Rio de Janeiro and environs, Thayer Expedition to Brazil, L. Agassiz; UMMZ 201445 (2), Rio de Janeiro, L. Agassiz.

3.17 *Ctenogobius stigmaturus,* Spottail Goby (Figure 24)

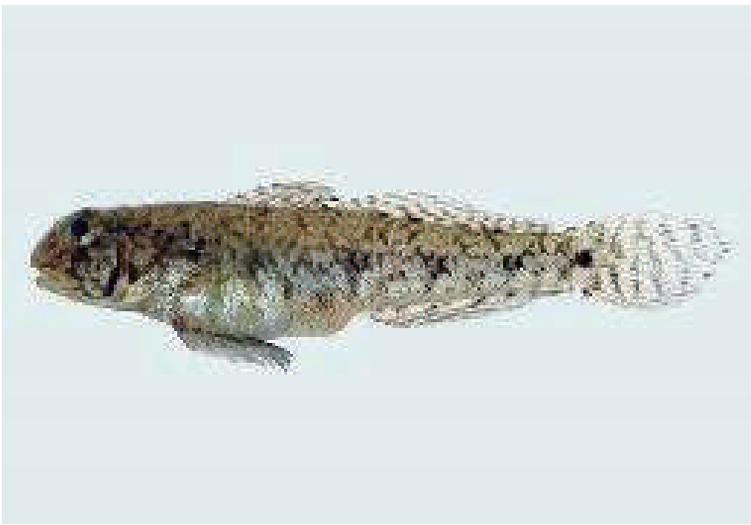

Figure 24. *Ctenogobius stigmaturus,* Venezuela, Estado Aragua, Laguna de Yapascua. Photo by J. Van Tassell.

Gobius stigmaturus Goode and Bean, 1882:418 (southern United States).

Rhinogobius stigmaturus Jordan, Evermann and Clark, 1930:439 (new combination).

Gobionellus stigmaturus Ginsburg, 1932 (new combination).

Diagnosis. D_2 I,11; A I,12. Nape usually with 10 to 12 scales before D_1 origin. Cheek with thin dark edging along preopercular margin. Two preopercular canal pores. Anal fin in females with thick diagonal dark blotches at base. D_1 third spine not produced in either sex. Neural arches complete over caudal vertebrae. Fourth neural spine simple, not flared basally. One or two epurals.

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Description. Based on 98 specimens, 15.5-38.5 mm SL. General morphology as described for the genus; morphometric data given in Tables 2–4. Jaws extending posteriorly to 1/2 diameter of the eye. Upper jaw with 2 to 3 rows of teeth. Two or three large canines on either side of symphysis in outermost row of upper jaw, largest of all teeth in jaw. Lower jaw in males with 2 large recurved canines at origin of mental frenum; females with smaller teeth at this location, and all teeth reduced by comparison to males. Males have longer jaws, greater postanal body lengths and caudal peduncle depths than females (Tables 2 & 4).

D_1 spines not elongate in either sex. Pectoral fins in both sexes reaching as far back as vertical line through anus. Pelvic fins reaching to anal fin origin in males, reaching anus in females. Appressed D_2 rays not reaching procurrent caudal fin rays, and appressed anal fin rays barely reaching that far in females; in males appressed rays of both fins extending beyond procurrent rays. Caudal fin and pelvic fin longer in males than females. Fin measurements and ray counts given in Table 5.

Ctenoid scales over most of trunk, cycloid scales on dorsum anterior to a diagonal from about fifth dorsal spine to the upper pectoral fin base; cycloid scales on abdomen, and on chest and pectoral fin base when scales present. Abdomen generally scaled or nearly completely scaled in most specimens; Bermuda specimens usually partially scaled. Pectoral fin base, chest, opercle and cheek usually naked, but a few scales occasionally observed, more often on pectoral fin base (about 25% of specimens, ranging from one scale to a patch of scales) and opercle (20% of specimens examined, 1–3 rows at upper craniad corner). Nape generally scaled to point above mid-opercle or rear margin of preopercle, with Bermuda specimens showing the least forward extent. Greatest nape squamation variation seen in Bermuda samples, with scale rows ranging from zero to 11; a single specimen from a population outside of Bermuda (Florida) had only one row of scales anterior to the first dorsal fin. Outside of Bermuda, the range is usually 9–15 predorsal scales; specimens from southern Florida generally had counts of 4–7. Scale counts are given in Table 6.

Preopercular canal with two pores in 97 of 98 specimens examined; one specimen lacked the preopercular canal on the left side.

Pigmentation in preserved specimens. Head dusky, with narrow dark band at preopercular margin of cheek. Streak from snout to midlateral upper jaw, ending in dark spot on upper lip. In some Florida specimens, cheek with thin lines of dark pigment following transverse papillae rows; in most specimens from all areas broad dark bar from eye to corner of jaw (but not highly contrasted when thin streaks are present). Opercle with dark spot on lower portion. Row of dark dots above upper edge of opercle. Chin and throat dusky. Small dark bar before D_1 origin on nape. No shoulder patch as in *C. boleosoma.* Five dark midlateral blotches, with many smaller spots between that are not quite as dark, sometimes in irregular rows at upper and lower edges of midlateral blotches; last spot in series a dense black spot at mid-base of caudal fin. Midlateral blotches frequently with anteroventral extensions; blotches dash-like in some specimens.

First dorsal fin with diagonal wavy bars, dusky in larger individuals; spines frequently with dark tips. Second dorsal with diagonal bars and dusky margin. Anal fin dusky in adult males with disjunct thin strips of dark pigment at base of some membranes; in females and juvenile males strong dark diagonal bar pattern evident with bars at 45 degree angle to base, running anteroventrad to posterodorsad, fin with broad dusky margin in females. Pectoral fins dusky with faint broad bars in females; in males much less distinct. Pelvic disk centrally dusky with clear margins to fully dusky in males; in females centrally dark with clear margin. Caudal fin with vertical bars medially and dusky margin in both sexes, with dense dark spot mid-base. Bermudan specimens at hand differ in having a much lighter background; dots on trunk between midlateral blotches less intensely pigmented; and a distinctly contrasted suborbital bar (much of the other cheek pigment is not expressed).

Color in life. Head and body tan or olive green, becoming lighter ventrally on trunk, abdomen white. Specimens taken over light substrates have silvery white heads and bodies. Some photos suggest males may

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have reddish-yellowish margins of dorsal fins and dorsal edge of caudal fin. Dark pigmentation as noted in preserved specimens above.

Axial osteology. Neural arches complete over caudal vertebrae. Fourth neural spine simple, not flared basally. One or two epurals.

Distribution. This species is known from Bermuda, southern Florida from Brevard though Monroe Counties, Bahamas, Cuba, Puerto Rico, Virgin Islands, Belize, Panama, Curacao and Venezuela. There are records in the literature for Pensacola and Cedar Keys in the northeastern Gulf of Mexico (Cooley, 1978; Kilby, 1955), but no specimens from these locations were found.

Comments. Males of this species have slightly (but significantly) larger jaws, longer caudal trunk regions, deeper caudal peduncles and longer pelvic and caudal fins than females (Tables 2–5). The holotype for this species is apparently lost (Ginsburg, 1932), being last noted by Jordan and Eigenmann (1887). Ginsburg associated the species described in this account with the description of the holotype provided by Jordan and Eigenmann (1887) because of agreement in pigmentation pattern and squamation. Although Goode and Bean (1882) do not state where specifically in the southern United States the holotype came from, most of the early collections atr USNM were from Key West and Jordan and Eigenmann (1887) list the holotype from Florida. USNM 89883, a specimen from Key West illustrated by Ginsburg (1932, Figure 1) is selected as a neotype.

Material Examined. BERMUDA: ANSP 148421 (1), Castle Harbour, patch reef, 20 July 1981, W. F. Smith-Vaniz et al.; ANSP 148422 (4), Castle Harbour, patch reef, 30 July 1981, W. F. Smith-Vaniz et al.; ANSP 148423 (1), Castle Harbour, 'grass beds, 17 July 1981, W. F. Smith-Vaniz and K. Heck; ANSP 148424 (14), Castle Harbour: patch reef, 18 July 1981, W. F. Smith-Vaniz et al.; GCRL 19604 (6), St. Georges, stn. 1329, 24 September 1982; GCRL 19605 (2), St. Georges, stn. 1329, 24 September 1982; USNM 178903 (2), the Reach, 18 October 1931, W. Beebe; USNM 178904 (2), Nonesuch Island, 20 September 1930, W. Beebe. FLORIDA: ANSP 96784 (1), Key Largo, shoal banks on ocean side of N end, ca.10 mi N of highway viaduct, 3 April 1958, D. M. Barringer et al.; HBOM 107:01750 (4), Brevard Co., Indian River, Sebastian Inlet, N shore - island, 19 February 1976, R. G. Gilmore et al.; HBOM 107:02564 (60), Martin Co., Indian River, Seminole Shores, 26 February 1975, R. G. Gilmore et al.; HBOM 107:04005 (6), St. Lucie Co., Indian River, Ft. Pierce, off N peninsula of Link Port Channel, 19 November 1976, G.R. Kulczycki et al.; UF 63247 (UF/FSU 13247) (1), Martin Co., E side of Intracoastal Waterway, ca 2.5 mi N of Jupiter Inlet, just N of Palm Beach-Martin County line, 30 December 1960, R. Christensen et al.; UF 59152 (UF/FSU 9152) (5), Miami-Dade Co., SW point of Key Biscayne in Miami, 1 August 1959, D. and P. Paulson; UF 63245 (UF/FSU 13245) (2), Martin Co., W side of Intracoastal Waterway, 2.5 mi N of Jupiter Inlet, 27 November 1959, R. Christensen; UF 63255 (UF/FSU13255) (3), Palm Beach Co., Jupiter Inlet, DuBois Bight, 26 April 1959, C. Curry et al.; UF 61467 (UF/FSU 11467) (1), Martin Co., N side of Intracoastal Waterway 2.5 mi N of Jupiter Inlet, 6 July 1960, R. and N. Christensen; UF 7081 (43), Florida Keys, Beach flats on Atlantic side Spanish Harbor Keys, 7 June 1956, D. Caldwell, C. Briggs and J. Dickinson; **UF 37133 (59)**, Palm Beach Co., East side of Intracoastal Waterway 0.25 mi N Jupiter Inlet S end of Indian River lagoon, 16 April 1983, G. Burgess et al.; LACM 1446 (6), Dade Co., NW tip of Virginia Key, 17 February 1961, D. Paulson & W. Bussing; UMMZ 189866 (10), Biscayne Bay at Mashta Island, SW tip of Key Biscayne, 24 September 1959, Robins et al.; USNM 35004 (1), Monroe Co., Key West, December 1883, D. S. Jordan; USNM 57330 (31), Monroe Co., Summerland Keys, 6 December 1906, B. A. Bean; USNM 57365 (4), Monroe Co., Ramrod Key, Newfound Harbor, 7 December 1906, B. A. Bean; USNM 57431 (2), Monroe Co., Broad Creek, 24 November 1906, B. A. Bean, R/V Orion; USNM 57450 (8), Monroe Co., Newfound Harbor, 7 December 1906, B. A. Bean and J. A. Pine, R/V Orion; USNM 65327 (1), Broad Creek, 21 December 1908, B. A. Bean and J. A. Pine, R/V Orion; USNM 73097 (3), Money Key Lake (sic), 1/2 Mile North of Eastern End of Bahia Honda Key, station 7401, 7 January 1903, R/V Fish Hawk;

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USNM 89868 (1), Monroe Co., Key West, 11 December 1922, United States Bureau of Fisheries; USNM 89869 (2), Monroe Co., Key West, 7 November 1922, United States Bureau of Fisheries; USNM 89870 (1), Monroe Co., Key West, 21 November 1922, United States Bureau of Fisheries; USNM 89871 (1), Monroe Co., Key West, 2 November 1922, United States Bureau of Fisheries; USNM 89872 (2), Monroe Co., Key West, 8 February 1919, United States Bureau of Fisheries; USNM 89873 (1), Monroe Co., Key West, 17 March 1923, United States Bureau of Fisheries; **USNM 89883 (1), neotype**, male, 30 mm SL, Monroe Co., Key West, 8 February 1919, United States Bureau of Fisheries; USNM 89884 (1), Monroe Co., Key West, 6 December 1922, United States Bureau of Fisheries; USNM 264985 (1), Dade Co., Biscayne Bay, boat slip west side Soldier Key, 26 August 1954, J. E. Randall. CUBA: USNM 82512 (2), Ensenada de Santa Rosa, 18 May 1914, J. B. Henderson and P. Bartsch. BELIZE: AMNH 24615 (5), Water Cay, on landward side, 12 miles south-east of Belize, D. E. Rosen et al. PANAMA: AMNH 73937 (16), Laguna de Chiriqui, small patch reef off southeast side Zapatilla Cay, 5 January 1978, C. L. Smith et al.

3.18 *Ctenogobius thoropsis,* Sperm Goby (Figure 25)

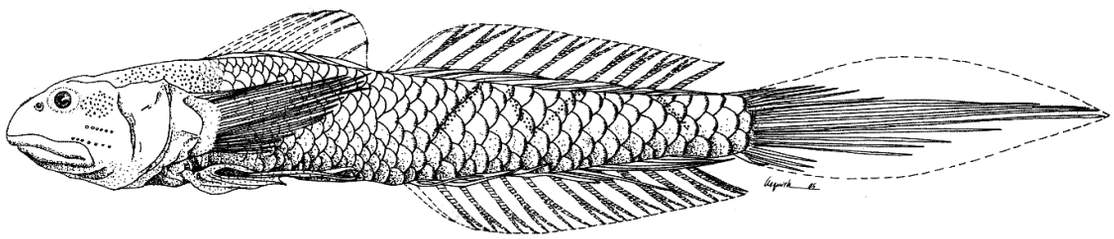

Figure 25. *Ctenogobius thoropsis,* FMNH 90554, holotype, male, 37 mm SL, Surinam, N of Surinam River 1.5 mi offshore at 10 fathoms. Drawing by A. Asquith.

Gobionellus thoropsis Pezold and Gilbert, 1987: 170, Fig. 1. (holotype: FMNH 90554; Surinam, north of Surinam River, 1.5 miles offshore).

Diagnosis. D_2 I,11; A I,12. Eyes small, not filling sockets. Large jaw in both sexes, extending to the rear margin of the orbit. Very long lanceolate caudal fin in both sexes. Pectoral fins elongate in both sexes with 17-19 rays, modally 18. Fourth neural spine simple, not flared. Two epurals.

Description. Based on 5 specimens, 24.8-43.6 mm SL. Large jaw in both sexes extending to the rear margin of the orbit. Eyes greatly reduced, about half normal size for the genus, not filling sockets (3.5, 2.8-4.1% SL). Head very broad, depressed (0 = 17.9% SL). Upper jaw teeth in weak inner row and an outer row of 3-5 large, highly recurved canines on each side, running between the anterior nares. Two rows of canines in lower jaw; inner row slightly recurved and smaller than the outer row. Two large recurved canines an each side of lower jaw of males, one in female, just posterior to the tubular nares; proportionately larger in males. Large strongly recurved canine on either side of the dentary symphysis inside of the innermost tooth row. Other aspects of body morphology as described for the genus (Tables 2–4).

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Third and fourth first dorsal spines moderately long, reaching to fourth D_2 element in 44mm male from Brazil; in all others fourth and fifth D_1 spines not reaching beyond second element of D_2; third spine not reaching beyond D_2 origin. Pectoral fins in both sexes reaching beyond vertical through anal fin origin. Pelvic fins reaching or falling just short of anus. Appressed posterior rays of D_2 and anal fins reaching beyond procurrent caudal rays. Caudal fin extremely long in both sexes, lanceolate (middle rays much longer than marginal rays). Fin measurements and ray counts given in Table 5.

Ctenoid scales over most of trunk, from caudal fin base to line from D_2 origin to midline and then forward along midline; scales anterodorsal to this line cycloid. Abdomen 3/4 to completely covered with cycloid scales. Nape naked in two specimens; remaining three with 3-10 predorsal scales (fewer on dorsal midline). Pectoral fin base, chest and head naked in all specimens. Scale counts given in Table 6.

Preopercular canal with three pores.

Pigmentation in preserved specimens. Patterns are not well developed in the specimens at hand. All individuals are pallid but there is a large faint patch of melanophores above the upper angle of the operculum (shoulder patch). Holotype has a trace of a diagonal bar pattern (as in *C. boleosoma*) on its sides and a light general sprinkling of melanophores on head, dorsal trunk and upper pectoral fin base. Fins unpigmented in all specimens.

Color in life. Not observed.

Axial osteology. Fourth neural spine simple, not flared. Two epurals.

Distribution. Currently known from the coast of Surinam near the mouth of the Surinam River and the coast of Brazil, in and near the mouth of the Rio Amazonas.

Comments. Specimens were captured at depths ranging from 20-40m. This is the only species of *Ctenogobius* with reduced eyes similar to the condition found in *Gobioides*, which suggests it is fossorial. Males of this species have pectoral fins, caudal fins and jaws of greater length relative to other species in the genus. While the latter two characters are frequently sexually dimorphic in *Ctenogobius* species (being larger in males than females), the single known female specimen does not significantly differ from males in these features (Tables 2 & 5).

Material Examined. SURINAM: **FMNH 90555 (1), holotype, *Gobionellus thoropsis,*** N. of Surinam River, 15 miles offshore, 3 May 1957, M/V Coquette; **FMNH 94890 (2), paratypes, *Gobionellus thoropsis,*** N. of Surinam River, 15 miles offshore, 3 May 1957, M/V Coquette. BRAZIL: **USNM 214066 (1), paratype, *Gobionellus thoropsis,*** Para, Foz Do Rio Amazona, stn. 157, 13 June 1971, Geomar; **USNM 264992 (1), paratype, *Gobionellus thoropsis,*** Northeastern Brazil, off State of Amapa, continental shelf, stns. 17672, 17673, 9 May 1975, Expedition French Guiana and Northeastern Coast of Brazil, April 22 - June 3, 1975, B. B. Collette et al.

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