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Redescriptions and Synonymies of Species of the American–West African Genus *Gobionellus* (Teleostei, Gobiidae) with a Key to Species

FRANK PEZOLD

The genus *Gobionellus* and its six included species are diagnosed and redescribed. All species share a unique cephalic lateralis canal structure, which extends from the tip of the snout to above the rear margin of the operculum with an A'BCDFHKL' pore pattern; a vertical row of sensory papillae on the rear field of the operculum and transverse suborbital rows; and a blunt, distally flared fourth neural spine that is spatulate in five of the six species. Three species are found in the eastern Pacific Ocean. *Gobionellus daguae* is known only from the lower portions of rivers in Panama and Colombia. *Gobionellus liolepis* has been collected in tidepools and on beaches along the coast of Panama, in the Miraflores locks, and over mud habitats up to 20 m deep off El Salvador. The third eastern Pacific species, *Gobionellus microdon*, is widespread in estuaries and in some fresh waters from Mexico to Ecuador. *Gobionellus mystax* is a junior synonym of this species. Two species are recognized from the western Atlantic Ocean. *Gobionellus oceanicus* is found in estuaries and inshore coastal waters from New Jersey to southern Brazil. The other species, *Gobionellus stomatus*, is limited to Brazilian estuaries. *Gobionellus occidentalis* is the only member of the genus from western Africa, where it inhabits tropical estuaries and coastal waters. A key to the species is provided.

THE genus *Gobionellus* consists of six species native to the estuaries and coastal waters of the subtropical and tropical Atlantic and eastern Pacific Oceans. A phylogenetic analysis of osteological and cephalic lateralis characters has revealed two species groups in *Gobionellus*, as historically conceived (e.g, Ginsburg, 1932, 1953; Gilbert and Randall, 1979), which are more closely related to other gobionelline genera than to one another (Pezold, 2004). The genus as recognized here does not include 15 species that largely, but not strictly, correspond to the coarse-scaled species recognized by Gilbert and Randall (1979). Those species, reassigned to *Ctenogobius*, are *Ctenogobius boleosoma*, *Ctenogobius claytoni*, *Ctenogobius fasciatus*, *Ctenogobius lepturus*, *Ctenogobius manglicola*, *Ctenogobius phenacus*, *Ctenogobius pseudofasciatus*, *Ctenogobius saepepallens*, *Ctenogobius sagittula*, *Ctenogobius shufeldti*, *Ctenogobius smaragdus*, *Ctenogobius stigmaticus*, *Ctenogobius stigmaturus*, *Ctenogobius thoropsis*, and an undescribed species from Brazil. *Gobionellus atripinnis* and *Gobionellus comma* are included in the synonymies of *C. claytoni* and *C. saepepallens*, respectively. A full description of the genus *Ctenogobius* with a review of its species will be published separately. Another species originally described as a species of *Gobionellus*, *Oxyurichthys stigmalophius*, exhibits character states diagnostic of *Oxyurichthys* (Pezold, 1991).

Three species of *Gobionellus* are known from the eastern Pacific: *Gobionellus daguae*, *Gobionellus liolepis*, and *Gobionellus microdon*. Of these, the first two have limited distributions and appear infrequently in research collections. *Gobionellus microdon* is ubiquitous in mangrove habitats from the Sea of Cortez to Ecuador. Two species are recognized in the western Atlantic—the widespread *Gobionellus oceanicus* and the Brazilian endemic *Gobionellus stomatus*. *Gobionellus occidentalis* is the sole representative of the genus in the eastern Atlantic Ocean. All species of *Gobionellus* are associated with fine muds of estuaries or the continental shelf. Although common in marshes and mangroves, the inshore species seem more often associated with channels or pools that have some circulation. My own experiences with *G. microdon* and *G. oceanicus* suggest that they are not found in shallow mucky pools characterized by great extremes in temperature or dissolved oxygen levels.

There has been little study of the biology of these species, and, with one exception, their systematic status has not been examined for 50 years or more (Pezold and Grady, 1989). In this paper, I redescribe the component species of the genus, justify the synonymy of *Gobionellus mystax* Ginsburg with *G. microdon*, and summarize existing information on the biology of *Gobionellus* species. A key to the species is also provided.

MATERIALS AND METHODS

Meristic and morphometric data were collected as described by Pezold and Grady (1989).

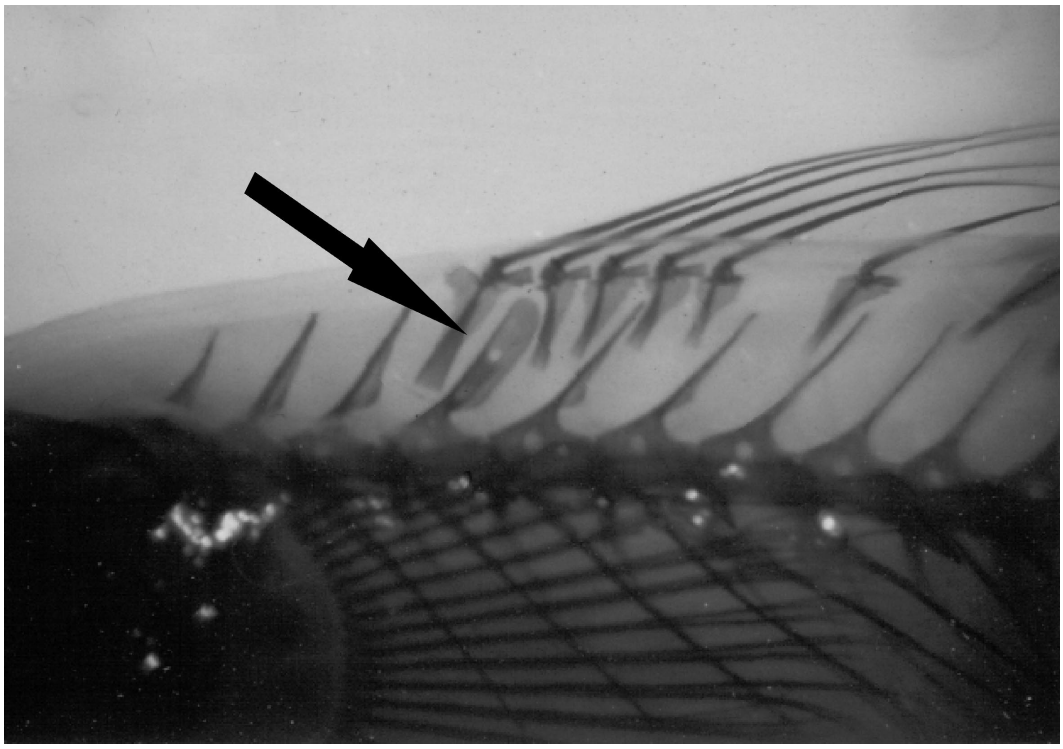

Fig. 1. Anterior vertebral column of a cleared-and-stained specimen of *Gobionellus microdon* illustrating the flared spatulate fourth neural spine (arrow).

Second dorsal and anal-fin ray counts are presented as number of total elements unless otherwise described. First dorsal pterygiophore patterns are represented as described by Birdsong et al. (1988). Abbreviations for median fins are given as D_1, first dorsal fin; D_2, second dorsal fin; A, anal fin. Oculoscapular canal pore labeling follows Akihito et al. (1984). Specimens of *G. oceanicus* examined in this study are given in Pezold and Grady (1989); for all other species, they are listed at the end of this paper. Museum abbreviations are as listed in Leviton et al. (1985).

Systematics

Gobionellus Girard, 1858

Gobionellus Girard, 1858:168 (type species: *Gobionellus oceanicus* [Pallas 1770] by subsequent designation, see Ginsburg, 1932).

Paroxyurichthys Bleeker, 1876:140 (type species: *Paroxyurichthys typus* Bleeker 1876 by monotypy, see Pezold, 1991).

Gobatus Ginsburg, 1932:45 (type species: *Gobionellus microdon* [Gilbert 1892] by original designation).

Gobatinus Ginsburg, 1953:25 (type species: *Gobionellus panamensis* [Meek and Hildebrand 1928] = *Gobionellus daguae* [Eigenmann 1918] by original designation).

Congruogobius Ginsburg, 1953:26 (type species: *Gobionellus liolepis* [Meek and Hildebrand 1928] by original designation).

Diagnosis.—A genus of relatively large-sized gobionelline gobies (96–215 mm SL reported maxima) having six spines in the first dorsal fin, 13 to 15 total elements in the second dorsal fin (one flexible spine and 12 to 14 rays), 13 to 15 total elements in the anal fin (one flexible spine and 12 to 14 rays), a body completely covered with scales, a 3–12210 first dorsal fin pterygiophore formula (Birdsong et al., 1988), a preopercular sensory canal usually with three pores, a complete oculoscapular canal extending from the snout to above the rear margin of the opercle, posterior opercular papillae row vertical or nearly so, connecting with subopercular papillae row, and transverse suborbital papillae. Characters unique to the genus include fourth neural spine broadly flared distally, blunt at top with constricted base (Fig. 1); an oculoscapular canal extending to opercular margin with an A'BCDFHKL' pore arrangement (Fig. 2).

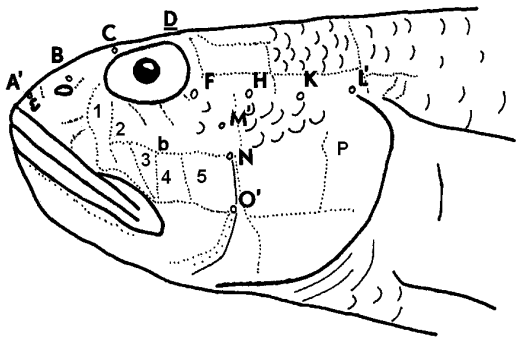

Fig. 2. Lateral view of the oculoscapular canal and sensory papillae rows of *Gobionellus occidentalis*. Canal pores are labeled according to Akihito et al. (1984). Labeled neuromast rows are posterior opercular row (p), horizontal midcheek row (b) and transverse suborbital cheek rows (1–5).

Description.—For all species, fin ray and scale counts are given in Table 1; morphometric data appear in Table 2. Snout broadly to sharply rounded, with terminal mouth; mouth horizontal to strongly oblique; tubular anterior nares near edge of snout, posterior nares open pits; large dorsolateral eyes; interorbital narrow to moderately broad; body elongate in most species; head moderate, usually less than 25% SL; premaxilla protractile; jaws large, extending from below mideye to posterior margin of orbit in most, but nearly reaching preopercle in males of two species; jaws equal or subequal; opercular membrane broadly connected; buccal membrane variably narrow or broad in upper jaw, narrow in lower jaw; postvomerine membrane curving posteriad along either side of roof of mouth from vomer; pharyngeal tooth plates with many fine pinlike teeth.

Anterior side of first ceratobranchial with seven to nine thin elongate rakers with flexible bases in all but *G. daguae*, which has three; epibranchial with six to seven rakers anterior to fleshy sheet in all but *G. daguae*, which has two rakers; fleshy sheet produced into a single thin fleshy lobe on posterior side of first arch, with or without smaller processes.

Vomer without teeth; teeth in both jaws fine and numerous; two species, *G. daguae* and *G. liolepis*, usually with a single row of teeth in upper jaw, upper jaw in remaining species and lower jaw in all species with two to three rows of small teeth; innermost tooth row of lower jaw highly recurved in some species; tongue emarginate to bilobed; no prominent midlateral canines in lower jaw; outer tooth row of upper jaw occasionally slightly larger than inner rows, but

TABLE 1. SCALE COUNTS AND FIN ELEMENT COUNTS FOR SPECIES OF *Gobionellus* REPORTED AS MODE, RANGE (*n*). The first element of second dorsal- and anal-fin counts is a flexible spine. * Lateral scale counts for *Gobionellus oceanicus* reported separately for Caribbean–South American samples (above) and Gulf of Mexico samples (below), U.S. east coast samples omitted.

	G. daguae	*G. liolepis*	*G. microdon*	*G. occidentalis*	*G. oceanicus*	*G. stomatus*
Lateral scales	31, 29–33 (17)	76, 70–81 (21)	65, 50–73 (63)	58, 54–66 (33)	65, 60–73 (24)* 82, 57–89 (65)	59, 54–66 (58)
Predorsal scales	2, 0–5 (17)	25, 23–29 (18)	25, 21–36 (60)	20, 0–23 (38)	27, 0–34 (131)	19, 13–27 (44)
Transverse forward rows	16, 13–18 (17)	25, 21–26 (19)	24, 20–31 (56)	19, 15–21 (27)	21, 17–29 (119)	19, 17–27 (42)
Transverse rearward rows	10, 8–11 (17)	20, 19–23 (21)	17, 14–22 (61)	15, 12–17 (29)	18, 14–23 (127)	15, 14–19 (42)
Caudal peduncle rows	7, 6–8 (15)	11, 10–12 (13)	9, 8–11 (62)	7, 7–9 (37)	9, 7–12 (124)	9, 7–10 (41)
Pectoral fin	18, 17–19 (17)	19, 18–20 (37)	19, 17–20 (146)	19, 17–20 (80)	19, 18–20 (137)	18, 16–19 (125)
Second dorsal fin	13, 12–14 (17)	15 (24)	13, 12–14 (75)	14, 13–14 (42)	14, 13–15 (137)	13, 12–14 (63)
Anal fin	13, 13–14 (17)	15 (24)	14, 13–14 (75)	15, 14–15 (42)	15, 14–15 (137)	14 (63)

TABLE 2. MORPHOMETRIC PROPORTIONS FOR *Gobionellus* REPORTED AS PERCENTAGES OF SL. Format given is mean, range (*n*). SL of males and females reported separately for each species, and for other characters if significantly different with notation beside sex with larger values (* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$).

	G. daguae	*G. liolepis*	*G. microdon*	*G. occidentalis*	*G. oceanicus*	*G. stomatus*
Standard length	77.1, 67.8–95.7 (6) males	47.4, 22.0–72.8 (2) males	72.6, 18.0–156.2 (42) males	106.8, 39.3–132.8 (21) males***	103.3, 35.9–153.8 (63) males*	74.0, 27.9–86.5 (28) males
	71.7, 56.9–84.1 (11) females	52.9, 15.6–81.2 (22) females	58.4, 27.0–119.0 (33) females	68.2, 21.6–101.1 (19) females	93.3, 39.3–149.2 (68) females	71.0, 42.4–86.4 (35) females
Head length	24.1, 22.4–25.8 (17)	20.7, 19.1–23.2	23.3, 20.8–26.2 (31) males	17.8, 16.5–21.5 (20) males	19.4, 16.7–23.9 (63) males	21.7, 20.0–24.6 (63)
			24.1, 22.2–27.3 (24) females*	20.2, 18.2–23.8 (15) females***	20.2, 17.3–23.9 (68) females*	
Head width	14.4, 11.4–16.6 (17)	10.6, 9.6–11.8 (23)	12.1, 10.2–14.1 (53)	8.9, 8.1–9.9 (20) males	10.4, 7.5–13.2 (131)	12.1, 10.2–13.6 (41)
				9.8, 8.1–11.5 (15) females***		
Snout length	8.8, 7.4–9.4 (17)	4.6, 3.9–5.4 (23)	6.6, 5.5–7.6 (31) males*	4.9, 4.3–5.6 (20) males	5.6, 4.1–6.8 (131)	6.1, 5.3–7.0 (41)
			6.3, 5.4–7.1 (22) females	5.2, 4.3–6.3 (15) females**		
Jaw length	9.8, 9.2–10.8 (17)	9.2, 8.0–10.6 (23)	13.2, 10.6–16.5 (31) males***	9.2, 8.2–10.7 (35)	8.9, 7.5–10.5 (131)	15.2, 14.0–16.7 (28) males***
			10.8, 9.7–11.6 (24) females			12.6, 11.0–13.7 (35) females
Orbit length	6.0, 5.1–6.9 (6) males	4.7, 3.7–6.7 (23)	5.5, 4.2–7.8 (31) males	4.2, 3.4–6.4 (20) males	3.9, 3.0–5.3 (63) males	5.9, 4.6–6.8 (41)
	6.6, 5.9–7.5 (11) females*		6.2, 4.5–7.7 (24) females**	5.0, 3.9–7.4 (15) females**	4.2, 3.1–5.4 (68) females**	
Interorbital width	3.2, 2.7–3.8 (17)	2.3, 1.7–3.6 (15)	3.3, 2.1–4.6 (52)	2.2, 1.5–2.7 (35)	2.0, 0.8–2.8 (131)	2.6, 2.0–3.6 (41)
Body depth	17.2, 16.0–18.0 (6) males	15.2, 13.2–17.0 (23)	16.4, 13.6–18.8 (31) males	13.4, 11.5–16.3 (20) males	13.8, 10.4–15.9 (63) males	14.7, 13.6–16.0 (21) males
	18.9, 17.6–20.5 (11) females***		18.2, 15.8–22.0 (22) females***	15.2, 13.6–18.1 (15) females***	14.6, 10.7–17.1 (68) females***	15.9, 13.5–17.7 (20) females***
Caudal-peduncle length	15.3, 14.1–16.1 (6) males*	8.1, 6.2–11.3 (23)	11.5, 10.4–14.2 (53)	9.7, 7.1–13.7 (35)	9.6, 7.2–10.9 (131)	10.7, 8.2–11.9 (41)
	14.2, 11.9–15.5 (11) females					
Caudal-peduncle depth	10.4, 9.0–11.1 (17)	9.7, 8.5–10.9 (23)	9.1, 6.9–10.4 (31) males	8.9, 7.4–9.5 (20) males	8.8, 7.1–10.6 (63) males	9.0, 7.5–10.1 (41)
			9.5, 8.5–11.1 (22) females*	9.6, 8.8–10.4 (12) females**	9.1, 7.1–10.7 (68) females*	

TABLE 2. CONTINUED.

	G. daguae	*G. liolepis*	*G. microdon*	*G. occidentalis*	*G. oceanicus*	*G. stomatus*
Pectoral-fin length	21.3, 18.7–22.6 (17)	17.4, 15.2–20.3 (23)	20.2, 16.8–27.3 (53)	17.4, 15.4–20.0 (20) males 19.2, 15.2–23.2 (15) females*	17.4, 11.2–21.6 (130)	19.9, 16.7–22.4 (63)
Pelvic-fin length	19.5, 18.2–21.1 (17)	17.4, 14.5–20.2 (23)	20.1, 15.2–25.9 (55)	17.2, 15.8–19.2 (20) males 18.6, 17.0–21.9 (15) females**	16.2, 8.4–19.9 (62) males 17.1, 11.9–21.2 (68) females*	21.0, 18.5–24.0 (28) males*** 19.2, 16.9–21.6 (35) females
Caudal-fin length	45.3, 41.0–52.2 (6) males** 40.3, 37.8–41.9 (8) females	36.9, 31.7–43.6 (20)	49.7, 31.1–62.6 (30) males*** 40.5, 32.0–47.0 (23) females	49.5, 40.7–59.4 (20) males*** 42.3, 37.0–48.6 (15) females	43.8, 28.9–60.1 (63) males*** 40.6, 32.7–47.7 (63) females	50.3, 43.6–56.8 (26) males*** 44.4, 39.4–48.9 (35) females

never with large canines; no fleshy crest on nape.

Six spines in first dorsal fin; second dorsal fin with one flexible spine and 12–14 rays; anal fin with flexible spine and 12–14 rays; one more ray in anal fin than second dorsal fin in four species, equal numbers in two species; first three dorsal fin spines moderately elongate in some species, reaching to 11th second dorsal fin element in some male *G. microdon*; dorsal fins broadly joined by membrane in *G. liolepis*, but not confluent with caudal fin, first dorsal fin weakly attached or abutting second dorsal base in others; pectoral fin rays 16–20, usually 18 or 19; pelvic fins I-5; broad interspinal membrane with an even margin, slightly fimbriate toward spine in some; innermost rays of pelvic fin longest and joined by membrane; caudal fin lanceolate, to about 60% SL in males of most species; second dorsal fin origin slightly before anal fin origin.

First dorsal fin pterygiophore formula 3–12210; vertebrae 10 + 16 = 26 (one of three specimens of *G. liolepis* 10 + 15 = 25); fourth neural spine broadly rounded distally and flared (spatulate), with constricted base, in most species (Fig. 1), broad with blunt tip and narrow base, but not spatulate, in *G. daguae* (Pezold, 2004); neural arches completely formed over caudal vertebrae in all but *G. stomatus*; two epurals in all but *G. liolepis*, which varies from one to two; two anal pterygiophores before the first hemal spine.

Four of six species with fine ctenoid scales on posterior trunk; nape, head, abdomen, prepelvic region and caudal fin base with cycloid scales (if present) in all species; *G. liolepis* and *G. stomatus* with all cycloid scales; all species but *G. daguae* with fully scaled nape or scaled except for naked median; cheek and opercle naked in *G. stomatus*, *G. microdon*, and *G. daguae*, scaled in *G. oceanicus*, *G. occidentalis*, and *G. liolepis*; abdomen naked in *G. daguae*, fully scaled or nearly so in all others.

Cephalic lateralis system.—Preopercular canal present with three pores, occasionally two pores in one species (Figs. 2–3); oculoscapular canal complete from near tip of snout to rear opercular margin with two pairs of snout pores (A and B), one pair above rear end of posterior nares and other pair anteromedial to tubular nares; one pair anterior interorbital pores (C); a single median posterior interorbital pore (D); supraotic (E) and posterior otic (G) pores absent; anterior otic (F), intertemporal (H), anterior temporal (K) and posterior temporal (L) pores present. Cephalic sensory papillae (free

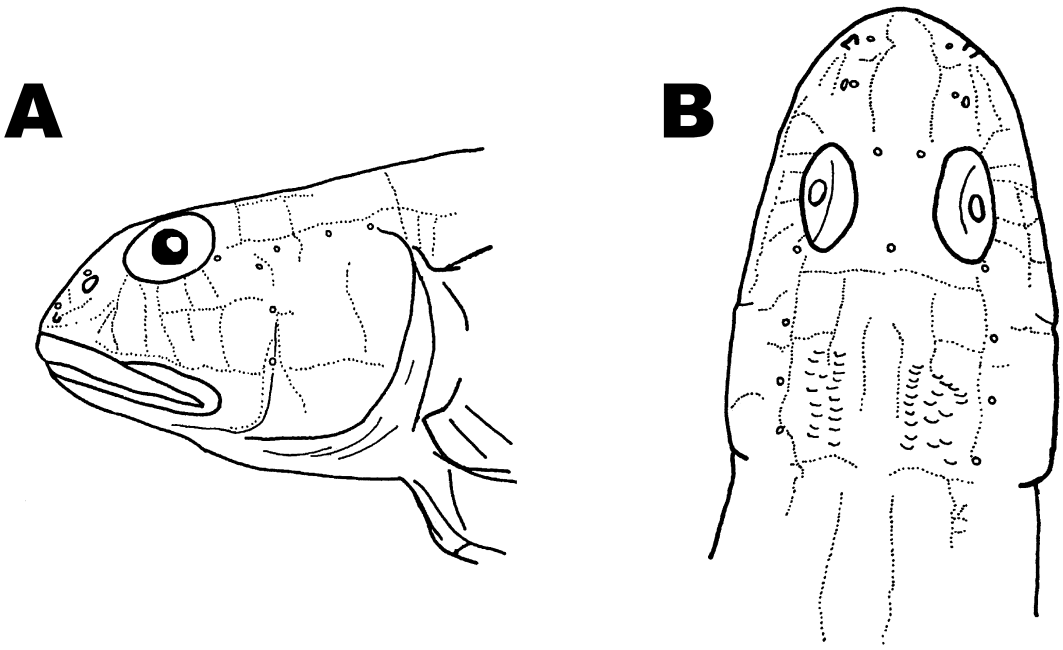

Fig. 3. Cephalic sensory papillae rows and lateralis canal pores of *Gobionellus microdon.* (A) lateral view (B) dorsal view.

neuromasts) conservative for the genus, except that horizontal midcheek row "b" does not extend forward beyond the third transverse suborbital row in *G. microdon* and not forward beyond the third or fourth transverse suborbital row in *G. stomatus* (Fig. 3). The "b" row meets the second transverse row in the other species.

Sexual dimorphism.—Males of all species have a long pointed urogenital papilla, which is short and bulbous in females. Sexual dimorphism differs from species to species and is treated under each account, but where differences occur, males have larger jaws and longer caudal fins, whereas females may have larger heads, larger orbits, and may be more robust.

Key to the Species

Geographic distribution follows species name. EP = eastern Pacific Ocean, WA = western Atlantic Ocean and EA = eastern Atlantic Ocean.

1a. Scales over trunk region from second dorsal-fin and anal-fin origins to caudal fin base cycloid 2
1b. Scales over trunk region finely ctenoid 3
2a. Total elements of second dorsal and anal fins equal in number, 15 in each fin; dorsal fins broadly confluent; no midlateral blotches, may have blotches on dorsum but not extending below midline of trunk ..... *Gobionellus liolepis* (EP; El Salvador to Panama)
2b. One more element in anal fin than second dorsal fin (usually 14 and 13, respectively); first dorsal-fin base extends to second dorsal fin, but not broadly connected; sides of trunk with vertically elongate midlateral blotches extending above and below midline ..... *Gobionellus stomatus* (WA; Brazil, Fortaleza to Rio de Janeiro)
3a. Total elements in soft dorsal and anal fins equal, 13 in each; scales large, 28–35 in lateral series; nape naked or with few scales in adults ..... *Gobionellus daguae* (EP: Panama and Colombia)
3b. One more element in anal fin than in soft dorsal fin; scales moderate to small, 50–90+ in lateral series; nape covered with many small scales in adults 4
4a. Usually 13 total elements in second dorsal fin, 14 in anal fin; prominent vertically elongate midlateral blotches extending above and below midline; jaw extremely elongate in males, reaching beyond rear margin of orbit, to preopercle in large males (10.6–16.5% SL) ..... *Gobionellus microdon* (EP; Sonora, Mexico to Guayaquil, Ecuador)
4b. Usually 14 elements in second dorsal fin, 15 in anal fin; if blotches present, restricted to dorsum; jaw extending to posterior margin of orbit, but never to preopercle (7.5–10.7% SL) 5
5a. Most prominent pigmentation a well-defined dark triangulate patch on opercle and a basicaudal spot, anterolateral blotch described below may be faintly visible; lateral scales 54–66 ..... *Gobionellus occidentalis* (EA; Senegal to Pointe Noire, Congo)

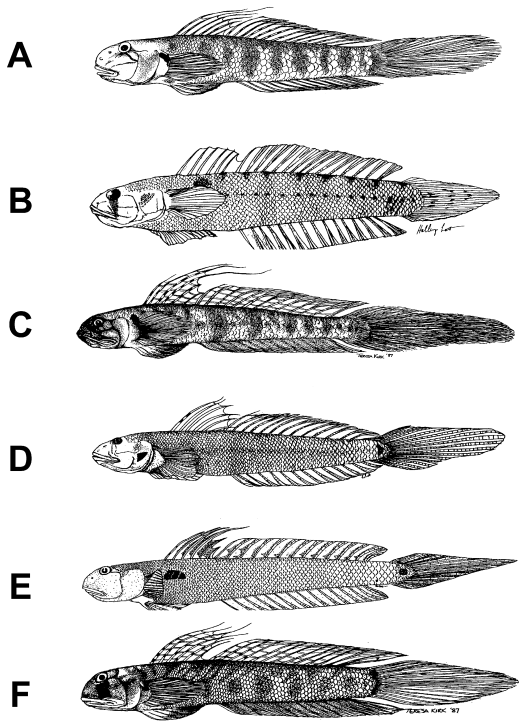

Fig. 4. (A) *Gobionellus daguae* (Eigenmann, 1918), USNM 257680, male, 96.6 mm SL, Rio Mira at Cabo Manglares, Colombia. (B) *Gobionellus liolepis* (Meek and Hildebrand 1928), FMNH 8480, female, 66 mm SL, Balboa, Canal Zone, Panama. Figure is reversed. (C) *Gobionellus microdon* (Gilbert, 1892), UMMZ 179934, male, 126 mm SL, Colima, Mexico. (D) *Gobionellus occidentalis* (Boulenger, 1909), MNHN 1967–904, male, 132.3 mm SL, Togo. (E) *Gobionellus oceanicus* (Pallas, 1770). NLU 3201, male, 128 mm SL, Pilottown, Louisiana. (F) *Gobionellus stomatus* Starks, 1913. AMNH 3847, male, 82.0 mm SL, Natal, Brazil.

5b. Most prominent pigmentation an anterolaeral blotch on trunk beneath posterior portion of pectoral fin above midline; some, especially juveniles, with a row of small midlateral dots and/or blotches on dorsum, and a basicaudal spot; lateral scales about 60–70+ in Caribbean and South American populations, mid-70s to low 90s in Gulf of Mexico, with both forms and apparent intermediates occurring along eastern seaboard of United States — *Gobionellus oceanicus* (WA; southern New Jersey to southern Brazil)

Gobionellus daguae (Eigenmann, 1918)
Choco Goby
Figure 4A

Gobius daguae Eigenmann, 1918:685 (holotype: FMNH 58479, *ex*-CM 7481, male 88.8 mm SL, Rio Dagua, Colombia)

Euctenogobius panamensis Meek and Hildebrand, 1928:874 (holotype: USNM 81839, female, 67.4 mm SL, Rio Culebra, Panama)

Diagnosis.—Distinguished from other species of *Gobionellus* by a combination of: a bluntly rounded snout and horizontal, subterminal mouth; a large conspicuous blotch on upper pectoral-fin base; second dorsal fin and anal fin each with 13 elements; first and second dorsal fins not broadly joined; large scales, with 28–35 in lateral series; a nape naked or with a few rows of scales before the first dorsal fin; a single complete row of teeth in the upper jaw in most specimens; and the first gill arch with three triangular gill rakers on the ceratobranchial, one at the angle and two lobular rakers on the epibranchial.

Description.—Based on 18 specimens, 56.9–95.7 mm SL. Snout bluntly rounded; mouth horizontal, dorsoanterior tip of upper jaw lying ventral to a line through lower edge of orbit; maxilla not extending posterior of anterior margin of pupil; teeth fine, upper jaw usually with single row of about 50 blunt conical teeth (two large males, including holotype, with two rows), lower jaw with 2–3 rows of teeth; nares spaced equidistant from each other, anterior margin of orbit and tip of snout; first gill arch with three triangular rakers on ceratobranchial, one near angle of arch and two lobular rakers on epibranchial. Males have significantly longer caudal peduncles, females with larger orbits and greater body depth (Table 2).

First four spines of D_1 elongate, appressed third spine reaches fourth D_2 element; membrane of D_1 terminating at origin of D_2 near base of first spine. Pectoral fins extending posteriorly to line through anus. Pelvic fins not reaching anus. Appressed D_2 and anal fin rays reaching procurrent caudal fin rays, longer in males than females. Caudal fin elongate, longer in males than females (Table 2).

Large, finely ctenoid scales over most of body; cycloid scales in dorsal-most one or two rows along base of D_1 anterior to second spine and on scaled portion of abdomen; head, prepectoral base and chest naked; nape naked or with a few rows of scales; abdomen naked along midline, may have a few scale rows anterior to anus; abdomen over infracarinalis medius muscle always scaleless.

Pigmentation in alcohol.—(From USNM 257680, 67.3–95.7 mm SL.) Side of head with lightly contrasted hollow triangle formed over upper part of cheek by horizontal stripe from middle

preopercle pore to midlateral upper jaw; streak on snout from eye to midlateral jaw, and diagonal stripe from middle lower edge of orbit intersecting cheek bar near its posterior end; top of head, dorsum, opercle and subopercle mottled; upper pectoral fin base with large dark blotch; four wide vertically elongate diffuse blotches on midlateral trunk alternating with narrow barlike blotches; diffuse basicaudal spot; first dorsal fin dusky, sometimes with ill-defined bars; second dorsal fin dusky, with wavy bands of small interradial spots; anal fin dusky with light margin; pectoral fin membranes unpigmented, the rays outlined by tiny melanophores; pelvic fins unpigmented in females, but dusky in largest males, with a thin dark margin; caudal fin in females with large medial region faintly barred, dusky along upper margin and over lower third; caudal fin in largest males dusky with thin dark margin along upper edge.

Distribution and habitat.—Eastern Pacific Ocean, where known only from the lower reaches of Rio Culebra and Rio Mamoni of the Rio Bayano basin in Panama, and the mouths of Rio Dagua and Rio Mira, Colombia. The eight type specimens collected by Meek and Hildebrand (1928) in the Rio Bayano basin were found in ''brackish muddy water.'' Specimens from the mouth of the Rio Mira at Cabo Manglares south of Tumaco, Colombia were taken in reeds at a sandy mud beach.

Comments.—This species differs from other species of *Gobionellus* in its overall body form. Of all gobioid genera I have observed, *G. daguae* superficially most resembles species of *Stenogobius* with its blunt snout, horizontal mouth, and stocky trunk. Like *Stenogobius* it also has an equal number of elements in the second dorsal and anal fins, though there are 13 elements in each fin compared to 11 or 12 in *Stenogobius* (Pezold, 1991; Watson, 1991). It differs from *Stenogobius* both in the structure of the oculoscapular canal and in lacking papillate processes on the shoulder girdle. *Gobionellus daguae* also lacks a defining synapomorphy of *Stenogobius*, the position of the anterior nares medial to the lateralis canals on the snout (Pezold, 1991).

The single row of teeth in the upper jaw caused Meek and Hildebrand (1928) to place this species in *Euctenogobius* (as *E. panamensis*). Eigenmann (1918) allocated it to the *Gobius* subgenus *Ctenogobius*, indicating it was allied to *Gobius* (= *Ctenogobius*) *boleosoma*, presumably because of its large scales, position of the mouth and blunt snout. The gill rakers of the first ceratobranchial are also like those found in *Ctenogobius*. Ginsburg (1953) reassigned *Euctenogobius panamensis* to *Gobionellus* and placed it in its own subgenus, *Gobatinus*, because it held a mixture of the characters by which he had delimited other subgenera—a cephalic lateralis canal typical of the subgenus *Gobionellus*, large scales such as those found in his subgenus *Gobica* (Ginsburg, 1932; type species *Gobionellus* [= *Ctenogobius*] *boleosoma*), and a body form intermediate between that observed in those two subgenera. *Gobionellus panamensis* was first recognized as a junior synonym of *G. daguae* by Gilbert and Randall (1979). In that same work, they divided *Gobionellus* into two major groups, coarse-scaled and fine-scaled forms. *Gobionellus daguae* was included, along with most species recognized in this paper as *Ctenogobius*, in the coarse-scaled group. Although it is true that *G. daguae* exhibits a mixture of character states typical of *Gobionellus* and *Ctenogobius*, it could also be viewed as intermediate between *Gobionellus* and *Oligolepis* or *Stenogobius*. The assignment of this species to *Gobionellus* is based on derived character states shared with other members of the genus as delimited here—the distal flaring of the fourth neural spine (though not spatulate), the oculoscapular canal, and the opercular sensory papillae topography (Pezold, 2004).

Gobionellus liolepis
(Meek and Hildebrand, 1928)
Okapi Goby
Figure 4B

Euctenogobius liolepis Meek and Hildebrand, 1928:875 (holotype: USNM 81836, female, 81.2 mm SL, Balboa, Panama).

Diagnosis.—Distinguished from other species of *Gobionellus* by the combination of a terminal, oblique mouth; no large blotch on pectoral-fin base; trunk with large blotch anterodorsally beneath pectoral fin and a series of small midlateral spots, but no series of large midlateral blotches with vertical extensions; D_2 and A each with 15 elements; broadly confluent dorsal fins; small cycloid scales completely covering trunk and nape, with 70 or more in a lateral series; one complete row of teeth in the upper jaw of most specimens, but two or three appearing in larger individuals; and first gill arch with eight thin rakers on ceratobranchial, six on epibranchial.

Description.—Based on 37 specimens, 15.6–143.0 mm SL. Mouth terminal, oblique, at about 45° angle to longitudinal body axis; tip of lower jaw equal to lower margin of orbit; maxilla reaching

nearly to vertical from posterior margin of orbit; one to three rows of teeth in upper jaw with two or three complete rows present in large specimens recently collected off El Salvador, in holotype only a few additional teeth present behind outer teeth at symphysis; two to three complete rows in lower jaw; teeth in both jaws very fine, numerous; anterior nares at margin of snout, posterior nares just before eyes; distance between anterior and posterior nares greater than distance between posterior nares and eye; anterior surface of first gill arch with eight thin rakers on ceratobranchial, six rakers on epibranchial before flaplike tissue; snout sharply rounded; body relatively deep and compressed.

Dorsal fins without elongate spines; pectoral and pelvic fins short, not reaching vertical through anus; interspinal membrane of pelvic fins with even margin; appressed dorsal and anal fins reaching procurrent caudal fin rays; caudal fin not as elongate as other species (Table 2). Cycloid scales over entire body; nape and top of head fully scaled to near oculoscapular canal behind eyes; about seven diagonal scale rows on opercle extending from anterodorsal corner to midopercular region (0–11 rows observed for 21 specimens); cheek with 0–11 scales, covering entire cheek in large specimens; prepectoral region usually partially scaled; prepelvic region with 0–16 rows of scales, fully scaled in larger specimens; abdomen fully scaled in adults.

Pigmentation in alcohol.—As most specimens from 1928 are faded, the following description was compiled from a few of those individuals plus material recently collected off the coast of El Salvador (see below). Differences between those collections are noted where they occur.

Background color tawny. Suborbital bar from lower margin of eye to corner of jaw, broader at eye than at jaw, faded in specimens from El Salvador; a dark triangular patch on the opercle, dusky snout, and thin dark margin along edge of snout above upper jaw present in specimens from El Salvador; trunk with large blotch anterodorsally, not apparent in specimens from El Salvador; faint vertical bars on dorsum, not apparent in most specimens from El Salvador; midlateral row of numerous small dots, not apparent in specimens from El Salvador; specimens from El Salvador have scales with light centers and dark margins on the head and upper half of the trunk, and generally show a light crescent at the base of the pectoral fin rays with a dark posterior margin; pectoral fins and pelvic fins unpigmented; D_1 dusky, D_2 with diagonal bars or dusky; caudal fin dusky or with vertical rows of spots (spots in most specimens from El Salvador); Panama specimens with anal fin pigmented, perhaps with submarginal band, specimens from El Salvador with little or no pigment in anal fin, a suggestion of dark margin over midportion of anal fin in one specimen.

Distribution and habitat.—Eastern Pacific Ocean from El Salvador to Panama, and possibly Ecuador (Allen and Robertson, 1994). Specimens from Panama were captured along a sandy beach at Balboa (Meek and Hildebrand, 1928), at Venado Beach, in tidepools at San Francisco Beach and one specimen was taken from the Miraflores Locks. C. R. Robins reports one individual taken at 35 m by the RV PILSBURY. This species was collected in March 2001 off El Salvador in the Gulf of Fonseca and off Las Tunas at depths of 13–20 m by the shrimp trawler AMANECER and the URRACA over mud bottoms. The largest individuals captured off El Salvador measured 143 mm SL.

Comments.—Ginsburg (1953) placed this species of *Gobionellus* in its own subgenus, *Congruogobius*, because of its cycloid scales and united dorsal fins. He viewed it as intermediate to *Gobionellus* and *Gobioides* (which has cycloid scales and united dorsal fins), but closer to *Gobionellus*. Within *Gobionellus*, Ginsburg considered *G. liolepis* to be most closely related to members of the nominate subgenus (containing *G. oceanicus* and two nominal species regarded as synonyms in this work—see comments under *G. oceanicus*) because of its lateralis canal system, lateral scale counts, body shape, and fin ray numbers.

The relationship of *G. liolepis* to its congeners is muddled, but pigmentary features suggest that it is closest to *G. oceanicus* and *G. occidentalis*. All three species have a distinctive anterolateral blotch on the trunk beneath the pectoral fins (most prominent in *G. oceanicus* but faintly seen in the other two species) and a midlateral row of dots best observed in juveniles. *Gobionellus microdon* specimens also exhibit a midlateral row of dots. Cycloid scales are also observed in *G. stomatus*. *Gobionellus daguae* shows a single complete row of teeth in most specimens and has an equal number of elements in the second dorsal and anal fins, but body form, first gill arch structure, pigmentation, and fin-ray counts differ between the two species.

Gobionellus microdon (Gilbert, 1892)
Palmtail Goby
Figure 4C

Gobius microdon Gilbert, 1892:554 (cotypes: USNM 48256, female, 38.3 mm SL, and

USNM 46535, female, 40.4 mm SL, San Juan Lagoon, Mexico).

Gobionellus mystax Ginsburg, 1953:23 (holotype: USNM 130859, male, 141.7 mm SL, Laguna de Mexcaltitan, Nayarit, Mexico).

Diagnosis.—Distinguished from other species of *Gobionellus* by a combination of a terminal, slightly oblique mouth; upper pectoral fin base dusky, but not dark; a large dark patch above the pectoral fin base on trunk just beneath nape, most prominent in males and large females; 13 second dorsal fin elements and 14 anal fin elements; first and second dorsal fins not broadly connected; small ctenoid scales on the body posteriorly, with cycloid scales limited to anteriormost portion of trunk, with 50–73 in a lateral series; nape with many small scales; first gill arch with eight thin rakers on ceratobranchial and seven on epibranchial; third transverse suborbital row of free neuromasts on cheek extending dorsally above horizontal midcheek row ''b'', usually to orbit; horizontal midcheek row ''b'' not extending forward beyond third transverse suborbital row (Fig. 3).

Description.—Based on 187 specimens, 18.0–156.2 mm SL. Mouth terminal, slightly oblique; maxilla reaching to rear of pupil or posterior margin of orbit in females, from just beyond posterior orbit margin to preopercle in males; jaws equal in females, subequal in males; both jaws with fine teeth; 2–3 rows in upper jaw, outermost teeth slightly larger; band of teeth in lower jaw, innermost row slightly recurved and slightly larger, in males equal in size to outer row of upper jaw teeth; upper buccal membrane broad; postvomerine membrane not as deeply fimbriate as in other species; tongue bilobed; about eight triangulate, thin, flexible rakers on anterior surface of ceratobranchial of first gill arch and seven anterior to fleshy sheet on the epibranchial; eleven thin rectangulate rakers on posterior side of ceratobranchial; snout broadly rounded, longer in males; tubular nares near edge of snout. Females with larger orbits and heads and deeper-bodied (Table 2).

First three D_1 spines elongate in males, reaching eleventh or twelfth second dorsal element in some, usually about 33% SL (to 45% SL in one male 103.6 mm SL), shorter in females, generally to about 25% SL; D_1 membrane extending to base of D_2 but not broadly connected; slight ridges of membrane running posteriorly from base of D_1 on either side of D_2 origin in some specimens; pectoral and pelvic fins not reaching vertical through anus, though nearly so in some males; interspinal membrane of pelvic fins with even edge, may be slightly fimbriate near spines; appressed second dorsal fin and anal fin posteriormost rays extending beyond procurrent rays of caudal fin. Caudal fin extremely lanceolate in adult males, moderately so in females (Table 2).

Posterior portion of trunk covered with finely ctenoid scales to D_2 and anal fin origins, dorsally and ventrally, respectively, and to vertical from posterior portion of first dorsal fin along midline; cycloid scales forward of these points and on caudal fin base, nape, top of head and on prepelvic region (when present); cheek, opercle and pectoral-fin base naked; prepelvic region usually naked but occasionally with a few rows of embedded scales; trunk naked beneath pectoral fin axil.

Pigmentation in alcohol.—Head dusky, with poorly contrasted suborbital bar from lower margin of orbit to jaw; opercle dark, frequently with oblique slash across upper portion; trunk with about six vertically elongate, moderately wide midlateral blotches; basicaudal spot present, but not prominent; alternating smaller blotches along dorsum above midlateral blotches sometimes visible; row of small dots along midline between blotches, usually about two between each blotch, most prominent in juveniles; dark patch above and behind upper edge of pectoral fin base, but position not the same as that found in species of *Ctenogobius*; dorsal fins with thin, wavy bands; pectoral fins dusky in both sexes; pelvic fins in females with unpigmented center, broad dark submarginal ring (formed by bilateral strips of melanophores) and light margin, completely dark in males; anal fin generally light in females, but dark in female specimens from Guatemala, dark in males; lower half of caudal fin dusky with vertical bars over upper portion in both sexes.

Distribution and habitat.—Eastern Pacific Ocean from Sonora, Mexico to Guayaquil, Ecuador. Brackish lagoons and streams (Meek and Hildebrand, 1928), mangrove creeks (Allen and Robertson, 1994), and fresh waters—above tidal influence in the Rio Grande at Miraflores in Panama (Gilbert and Starks, 1904).

Comments.—The type specimens of *G. microdon* consist of two small female cotypes, USNM 48256 and USNM 46535. The larger of these two specimens, USNM 46535 (40.4 mm SL), is in better condition and is here designated the lectotype; USNM 48256 (38.3 mm SL) is a paralectotype.

Gobionellus mystax was described by Ginsburg

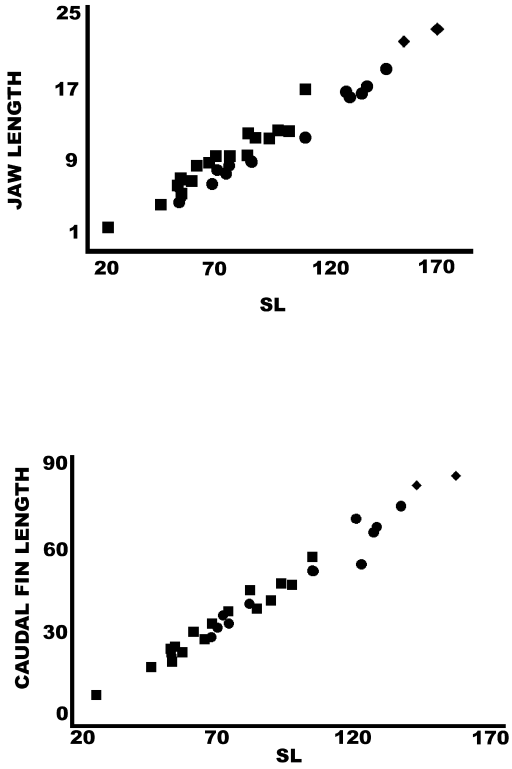

Fig. 5. Regression of jaw length (above) and caudal fin length (below) on standard length of male specimens of *Gobionellus microdon*. Diamonds = syntypes of *Gobionellus mystax*, dots = Guatemalan and Costa Rican specimens, squares = Mexican specimens.

(1953) as differing greatly from *G. microdon* in the size of the maxilla and length of the caudal fin. Ginsburg's observations were based on six specimens. The largest male he had was a specimen from Panama 117 mm SL. Despite his awareness of sexual variation for both of these characters, he felt the differences observed were too great to occur within a single species. With a greater number of specimens available, it is apparent that there is simply a striking elongation of the jaw coincident with growth in males. It may be seen in Figure 5 that the types of *G. mystax* are in line with the regressions of jaw and caudal fin sizes for other male *G. microdon*. Male specimens of *G. stomatus* also show an increase in jaw size with length (Table 2).

Variation in the number of scale rows on the trunk in this species approaches that seen in *G. oceanicus* (Table 1). Samples of individuals from four localities are compared in Table 3. Although the sample sizes are small, there is no indication of significant geographic variation in squamation as seen for *G. oceanicus*. Individuals

Table 3. Lateral Scale Row Number for *Gobionellus microdon* by Geographic Region.

	Mean (*n*)	STD	Range
Costa Rica	63.5 (13)	2.9	60–69
Guatemala	68.0 (11)	3.3	64–73
Guerrero/Oaxaca	65.6 (15)	3.4	60–73
Michoacan/Mazatlan	63.1 (23)	2.7	58–68

from Guatemala do show a slightly higher mean number than samples from farther north or south. Male specimens from this area also have proportionately longer jaws (Fig. 5), a trait they also appear to share with males from Costa Rica as well. The significance of this variation cannot be adequately assessed without examining additional material.

Diploid chromosome number of 56 with a karyotype composed of four metacentric, six submetacentric and 46 acrocentric chromosomes (Uribe-Alcocer and Díaz-Jaimes, 1996). The same diploid number was observed in one specimen of *G. oceanicus* from southeastern Florida (unpubl. data).

Gobionellus occidentalis (Boulenger, 1909)
Delta Goby
Figure 4D

Gobius occidentalis Boulenger, 1909:431 (holotype: BMNH 1909.10.29.109, female, 82.6 mm SL, Gunnal River, Portuguese Guinea).

Diagnosis.—Distinguished from other species of *Gobionellus* by the combination of a terminal, oblique mouth; most prominent pigmentation a well-defined dark triangular patch on opercle and a basicaudal spot; no large blotch on pectoral fin base; trunk with large blotch anterodorsally beneath pectoral fin; 14 second dorsal fin elements, 15 anal fin elements; dorsal fins separate; small ctenoid scales covering trunk and nape in adults, with 54 to 66 scales in a lateral series, usually about 60; several rows of teeth in upper jaw; and first gill arch with seven to nine thin rakers on ceratobranchial, and five or six on epibranchial.

Description.—Based on 40 specimens, 21.6–132.8 mm SL. Jaws equal and terminal; mouth oblique, tip of upper jaw reaching to or slightly above line through lower rim of orbit; fleshy fold overhanging upper jaw from upper end of maxilla to midlateral part of premaxilla near origin of mental frenum; maxilla extending to point between mideye and posterior margin of

orbit; several rows of fine teeth in each jaw; teeth of outermost row usually slightly larger in each jaw; upper jaw with 50–60 small teeth in outer row, larger and more caniniform toward symphysis, followed by narrow band; lower jaw with broader band of teeth, innermost and outermost of band slightly larger, innermost teeth slightly recurved; upper buccal membrane moderate with even edge and one to a few low ridges of papillae near teeth; lower buccal membrane narrow; deep fimbriate membrane hanging in semicircle from roof of mouth behind vomer; seven to nine triangulate flexible rakers on lower limb of first gill arch, one or none at angle, five or six on epibranchial anterior to a wide fleshy sheet; several folds on rear side of sheet, generally with a large fleshy process hanging from the fold just behind gill rakers; rear side of lower gill arch with about 8 broad, thin rectangular gill rakers; snout sharply rounded; anterior nares at edge of snout. Females more robust than males, with larger heads, and greater body depth at the origins and termini of the second dorsal and anal fins (Table 2).

D_1 spines only slightly elongate, third spine reaching to third element of second dorsal fin; pectoral and pelvic fins not reaching vertical through anus, both longer in females; interspinal membrane of pelvic fins with even margin; appressed D_2 and A rays reaching beyond procurrent rays of caudal fin; caudal fin lanceolate, longer in males than females (Table 2).

Trunk with cycloid scales in narrow row along D_2 base, and on dorsum, sides and abdomen anterior to diagonal lines from D_2 origin and anal fin origin to tip of pectoral fin; head and caudal fin base with cycloid scales; most of midlateral and caudal trunk with finely ctenoid scales; trunk beneath pectoral axil naked; abdomen fully scaled; nape and top of head scaled to above preopercles; cheek with one or a few scattered scales; opercle with several rows of scales; prepelvic region with about seven rows of scales; prepectoral fin base naked.

Pigmentation in alcohol.—Pigment largely diffuse on the head and trunk in preserved specimens with exception of a dark triangular patch on the operculum (at least part of which results from pigment on the pharyngeal surface) and a basicaudal spot; anterolateral trunk blotch as seen in *G. oceanicus* often visible, but faint; other faint lateral trunk blotches may also be visible, as well as a midlateral row of spots also typical of *G. oceanicus*; dorsal fins dusky in both sexes, usually with a few dark spots along the shaft of the first spine; anal fin dusky with light margin in males, dusky at base only in females, with broad unpigmented region distally; caudal fin dusky; pectoral fins dusky in males, lighter in females; pelvic fins dusky with narrow light margin in males, with bilateral dark longitudinal streaks or centrally dusky in females.

Distribution and habitat.—Eastern Atlantic Ocean from Senegal to at least Pointe Noire, Congo, possibly to northern Angola. This species is known from estuaries and coastal waters of tropical West Africa (Miller, 1990).

Comments.—Boulenger (1909) described this species as having a single row of teeth in the upper jaw. A single row of teeth has historically been viewed as diagnostic of the genus *Oxyurichthys*, and for that reason Boulenger put this species in the subgenus *Oxyurichthys*. Fowler (1936) later referred to it as *Oxyurichthys occidentalis*. Examination of the holotype shows Boulenger to be in error. Behind the more prominent (but still small) outer row of teeth are two rows of very fine teeth forming a narrow band. Boulenger (1909) also reported the holotype to have seven spines in the first dorsal fin, but there are only six. *Oxyurichthys occidentalis* Boulenger was recognized as a species of *Gobionellus* by Miller (1981), presumably because of similarities of the free neuromast patterns.

Gobionellus oceanicus (Pallas, 1770)
Highfin Goby
Figure 4E

Gobius cauda longissima, acuminata Gronovius, 1763:82, pl. 4, Figure 4 (Nonbinomial name; locality unknown).

Gobius oceanicus Pallas, 1770:4 (first binomial name, based on Gronow's description; neotype herein designated—USNM 81879, male, 130 mm SL, Mindi River, Mindi, Canal Zone, Panama, Meek and Hildebrand, 16 January 1911).

Gobius lanceolatus Bloch, 1783:8, pl. 38, Figures 1, 6 (Martinique).

Gobius bacalaus Valenciennes, 1837:119 (syntypes: MNHN A.1260, 2 females, 149.2 and 118.0 mm SL, Brazil; A.1262, female, 86.4 mm SL, Surinam; A.1360, 2 specimens, male, 89.8 mm SL and other in poor condition missing the head, Brazil).

Gobionellus hastatus Girard, 1858:168 (St. Joseph's Island, Texas; see also Girard, 1859:25, pl. 12, figs. 7–8).

Paroxyurichthys typus Bleeker, 1876:141 (holotype RMNH 4679, 85.5 mm SL, Ambon Island, Mollucas Is., Indonesia; see Pezold, 1991).

Gobius bayamonensis Evermann and Marsh, 1899:

355 (holotype: USNM 49365, male, 147 mm SL, San Juan Market, Puerto Rico).

Gobionellus gracillimus Ginsburg, 1953:24 (holotype: USNM 123227, male, 165 mm SL, Apalachicola Bay, Florida).

Diagnosis.—Distinguished from other species of *Gobionellus* by the combination of: a terminal, oblique mouth; most prominent pigmentation a large blotch on trunk located anterodorsally beneath pectoral fin; a triangular patch present on opercle; a blotch present on pectoral-fin base; 14 second dorsal-fin elements, 15 anal fin elements; dorsal fins separate; small ctenoid scales covering trunk and nape in adults, with 57 to 89 scales in a lateral series; several rows of teeth in upper jaw; and first gill arch with eight thin rakers on ceratobranchial, one at the angle, and six or seven on epibranchial.

Description.—Based on 332 specimens, 15.1–193.0 mm SL (morphometric data obtained from 131 specimens, 35.9–153.8 mm SL, Table 2). Maximum size to 215 mm SL (Dawson, 1969). Mouth terminal, slightly oblique to oblique; jaws equal; maxilla reaching to vertical through mideye in both sexes; tongue emarginate to bilobed; eight triangulate flexible gillrakers on anterior side of lower limb of first gill arch, one at angle and six or seven on upper arch on anterior side of fleshy sheet; fleshy sheet along upper arch with several thin ridges and one or two thin fleshy lobes visible from posterior side; teeth in both jaws fine and forming bands; outermost teeth of upper jaw largest, 40–60 along edge; innermost teeth of lower jaw recurved; buccal membrane thin in lower jaw, moderate in upper jaw with low papillae near base, margins of both even, not fimbriate; thin membrane from roof of mouth behind vomer, arcing rearward with fimbriate margin; tubular nares near edge of snout. Females more robust with greater body depth and a greater head size (Table 2).

First dorsal-fin spines slightly to moderately elongate in both sexes, reaching as far as sixth element of D_2 in some (about 40% SL; for discussion, see Ginsburg, 1932); pectoral fin not reaching vertical through anus; pelvic fins not reaching anus, pelvic fins longer in females than males (Table 2); pelvic interspinal membrane margin even, not fimbriate; appressed rays of second dorsal fin and anal fin reaching beyond procurrent caudal fin rays; caudal fin longer in males than females (Table 2).

Fine ctenoid scales over posterior trunk to beneath tip of appressed pectoral fin midlaterally and to about D_2 and anal fin origins along dorsum and ventrum, respectively, cycloid scales anterior to this demarcation; scales on head, on trunk adjacent to D_2 and at base of caudal fin also cycloid; trunk naked beneath pectoral axil; pectoral fin base naked; several rows of scales at anterior upper corner of opercle and variable number of scattered scales usually present on cheek; prepelvic region usually with several rows of scales.

The species as recognized here is extremely variable in the number of scales in a lateral series. Populations of a northern form from the Gulf of Mexico and Atlantic coast of the United States have smaller scales with up to 91 in a lateral series, whereas specimens from the Caribbean basin have larger scales with as few as 56 in a lateral series. Gulf of Mexico specimens generally have 78–82 scales, whereas those from the Caribbean most commonly have 60–66 scales in a series. Populations from the eastern coast of South America show an increase in scale number from that seen in the Caribbean with scales numbering 65–73. Both the Caribbean and northern forms and intergrades are found along the eastern US coast (Pezold and Grady, 1989). Preopercular canal generally with three pores; of 130 specimens, 11 had two pores on one side and six had two pores on each side.

Pigmentation in alcohol.—Head without distinctive markings, but opercle with dark patch in some specimens; trunk with prominent anterolateral blotch, often ocellated, above horizontal midlateral septum beneath tips of upper pectoral-fin rays; basicaudal spot prominent; remainder of trunk pigmentation variably exhibited—often a midlateral series of dots, most often in juveniles, and/or vertical trunk blotches on dorsum extending ventrally to the horizontal septum, midlateral dots run together to form a line in some; upper pectoral-fin base with dark blotch; juveniles and young adults may show several saddles on dorsum; dorsal fins dusky with interradial bars of pigment paralleling rays; first spine of D_1 with two to four spots on shaft; second dorsal fin often with wavy bar basally and dusky distally over anterior portion, interradial bars parallel to rays posteriad; anal fin light to dusky with clear margin, occasionally light anteriad and lightly pigmented distally; pectoral fins lightly pigmented; pelvic fins in females either with wide parallel, bilateral dark stripes, broadly united posteriad over innermost rays, or centrally dusky with broad light margin; pelvic fins usually dark with thin clear margin in males; caudal fin dusky in both sexes.

Distribution and habitat.—Virginia to southern Brazil, occasionally taken as far north as Great Bay estuary, New Jersey. This euryhaline species inhabits estuarine bays, tidal streams, brackish marshes and muddy inshore and offshore bottoms. Dawson (1969) found them most often in trawls in Mississippi Sound April to August but also noted their presence in oligohaline estuaries and at other times of the year. In the Gulf of Mexico off Port Aransas, Texas, they are known from muddy bottoms at 40+ m (Hoese and Moore, 1977). The species was also noted as common along the length of the muddy coast of French Guiana, and especially common along the lower Cayenne River (Puyo, 1949), where they were often collected at low tide by fishers. According to Puyo, highfin gobies favor those littoral sections of the Cayenne River near the mouths of tributary creeks. When the tide is out and the flats and beaches along the river's edge are exposed, the gobies remain in water-filled burrows they have excavated in the mud. Apparently some of the gobies taken by fishers in this manner were females coiled around egg masses. The species has pelagic oceanic larvae (Hildebrand and Cable, 1938). The development of transforming larvae and juveniles has been described by Wyanski and Targett (2000).

Comments.—The types of both *G. oceanicus* and *G. hastatus* are lost. Ginsburg (1932) pointed out that, although the type locality of *G. oceanicus* was unknown, Bloch (1783) placed *G. oceanicus* in synonymy with *G. lanceolatus* (incorrectly cited by Ginsburg as 1784), thereby restricting the name to the Caribbean form. Following Ginsburg, I am designating as the neotype of *G. oceanicus*: USNM 81879, male, 130 mm SL Mindi River, Mindi, Canal Zone, Panama; Meek and Hildebrand, 16 January 1911.

Ginsburg (1932) first recognized the variability in form and pigmentation of this species. He recognized the northern form, *Gobionellus hastatus* and the southern form, *G. oceanicus* as distinct species. The only character that could be used to consistently separate the two species was the number of lateral scales on the trunk. He placed *G. bacalaus*, *G. bayamonensis*, and *G. lanceolatus* in synonymy with *G. oceanicus* noting that they were distinguished from the latter species by features that varied with age, sex, preservation, or by features that simply varied among individuals. *Gobionellus hastatus* was described by Ginsburg as having 76–89 scale rows in a lateral series; 60–76 were noted for *G. oceanicus*. Ginsburg recognized a third species in 1953, *Gobionellus gracillimus*, distinguished from the other two species by a longer caudal fin, more slender body, longer first dorsal fin spines and a greater number of lateral scale rows. He observed that 58 specimens of the smaller scaled forms at his disposal from the United States fell into bimodal groups for theses characters. The two different groups were also noted to intergrade for all these characters and individual specimens could not always be assigned to one group or another. Ginsburg also observed that the diagnostic characters, except for scale counts, varied with size and sex. The range of scale counts for *G. gracillimus* was given as 83–99. Hoese and Moore (1977) reported different populations from south Texas with lateral scale counts ranging from 61–91 in inshore samples and an offshore population with deciduous scales numbering less than 65 in a lateral series.

Pezold and Grady (1989) placed *G. hastatus* and *G. gracillimus* in the synonymy of *G. oceanicus* following morphological analyses of specimens from the entire range of this complex and allozyme electrophoresis of specimens from the Gulf of Mexico and southeastern Florida. Although their study also discerned two recognizable forms based upon scale-type with correlated geographic distributions (assignable to *G. hastatus* and *G. oceanicus*), they found evidence of intergradation for that character along the eastern coast of the United States and no evidence from allozyme electrophoresis to support genetic separation. Hoese and Moore (1977) suggested distinct inshore and offshore populations of the species with the latter conforming to the southern form. They also noted that the inshore form had a range of scale counts, which, although averaging higher, included the counts observed for the offshore form. Pezold and Grady (1989) also found no morphological support for the recognition of the second northern form, *G. gracillimus*. Dawson (1969) and Hoese and Moore (1977) were of the same opinion based upon their observations of large series of individuals from the Gulf of Mexico.

Gobionellus stomatus Starks, 1913
Muckraker
Figure 4F

Gobionellus stomatus Starks, 1913:67, pl. 10 (holotype: SU 22219, male, 86.2 mm SL, Natal, Brazil).

Diagnosis.—Distinguished from other species of *Gobionellus* by a combination of a terminal, oblique mouth; most prominent pigmentation five large blotches on sides of trunk, last four of which are vertically elongate, dark blotch on upper half of pectoral-fin base, and broad subor-

bital patch crossing cheek from eye to middle of upper jaw; 13 second dorsal fin elements, 14 anal fin elements; dorsal fins not broadly connected; body covered with small cycloid scales, 54–66 in lateral series; nape with scales along naked midline; maxilla extending beyond posterior margin of orbit in males, to posterior margin in females; first gill arch with seven thin rakers on ceratobranchial, one at angle, and six on epibranchial; horizontal midcheek row ''b'' not extending forward beyond 3rd or 4th transverse suborbital row (Fig. 3).

Description.—Based on 64 specimens, 27.9–86.5 mm SL. Mouth terminal, oblique; maxilla reaching nearly to angle of preopercle in males, to posterior margin of orbit in females, lower jaw equal or subequal to upper jaw; fleshy fold over middle of maxilla; seven flexible gill rakers on lower first gill arch, one at angle, six on epibranchial; upper gill arch with about four fleshy, nearly longitudinal, folds or flaps on underside, with several fleshy processes; lower jaw with a broad band of fine teeth, innermost row with slightly enlarged highly recurved canines, may be slightly larger in males than in females; upper jaw with about 40 slightly enlarged conical teeth in outer row and a thin band of fine teeth along inner edge; upper buccal membrane broad with even edge and low thick papillae, not in well-defined rows; fimbriate membrane suspended from roof of mouth just behind vomer arcing rearward along each side; snout bluntly rounded; tubular anterior nares near edge of snout, distance to edge of snout smaller than distance between anterior and posterior nares. Females with greater body depth (Table 2).

D_1 spines little or moderately elongate, usually reaching second D_2 element in both sexes but may reach to fourth or fifth element in either sex, membrane posterior to sixth dorsal spine large and joined to D_2 at base, but not broadly connected; pectoral fins short, not reaching vertical through anus; pelvic fins not reaching anus in either sex, but longer in males, pelvic interspinal membrane weakly fimbriate; appressed rays of second dorsal fin and anal fin extending well beyond procurrent caudal fin rays in both sexes; caudal fin longer in males than females (Table 2). Trunk covered with cycloid scales, median muscular ridge of nape naked, but scaled on each side forward to above middle of opercle, naked beneath pectoral axil; pectoral fin base and head naked, prepelvic region generally scaleless, but some embedded rows of scales seen in one individual; abdomen completely scaled or nearly so.

Pigmentation in alcohol.—Broad dark suborbital patch from eye to middle of upper jaw; snout tip dusky; side of snout with dark streak from eye to jaw, joined with anterior upper corner of suborbital patch; spot on cheek near upper end of preopercular lateralis canal, sometimes forming a streak crossing cheek to suborbital patch; eye with a dark spot on upper margin; sharply defined thin crossbar behind eyes running between preopercles; three less defined broad bars crossing nape and occipital region; pectoral base with dark blotch on upper half; five large blotches on midlateral trunk, last four vertically elongate; basicaudal spot; smaller spots alternating with blotches in midlateral row, about equal to basicaudal spot; first dorsal fin usually with five dark wavy horizontal bands; second dorsal fin with wavy diagonal bars and dusky margin on anterior portion and dark streaks paralleling rays posteriorly; caudal fin dusky in males with some vertical rows of spots on upper portion, mostly dusky in females; pectoral fins dusky but lighter than pelvic fins which are also dusky in both sexes; anal fin dusky.

Distribution and habitat.—Known only from Brazil, from Fortaleza, Ceara to Rio De Janeiro. This species is an inhabitant of estuaries and has been taken over fine sediments near mangroves. Starks (1913) commented that it was not found in rocky tidal pools.

Comments.—This species shows a mixture of character states seen in *Oxyurichthys*, *Gobionellus*, *Ctenogobius* (as restricted in this work), *Oligolepis*, and *Evorthodus*. As in the last three genera, the neural arches over the caudal vertebrae are incompletely formed. Some of the head pigmentation resembles that found in some *Oxyurichthys* species—the dark spot on the eye and the dark bar on the nape behind the eyes. It also has the number of second dorsal-fin rays and anal-fin rays typical of *Oxyurichthys*. However, it possesses character states considered to be derived for *Gobionellus*. Other characteristics shared with particular *Gobionellus* species include cycloid scales (also found in *G. liolepis*); and elongate jaws in males, anal- and second dorsal-fin ray counts, and a pigmentation pattern on the trunk as observed in *G. microdon*. Ginsburg (1932) placed this species in the subgenus *Gobatus* with *G. microdo*n and *Ctenogobius sagittula*.

Materials Examined

Gobionellus daguae.—Colombia: FMNH 58479 (1), holotype, *Gobius daguae*; CAS 46150 (2),

paratypes, *G. daguae*; USNM 257680 (9). Panama: USNM 81839 (1), holotype, *Euctenogobius panamensis*; USNM 81838 (2), paratypes, *E. panamensis*; USNM 293538 (1); FMNH 8482 (1), paratype, *E. panamensis*; FMNH 8484 (1), paratype, *E. panamensis*.

Gobionellus liolepis.—El Salvador: USNM 367352 (5); USNM 367353(5); USNM 367354(1); USNM 368106(1); USNM 369507(1). Panama: USNM 81836 (1), holotype, *Euctenogobius liolepis*; USNM 81837 (7), paratypes; USNM 93175 (3); USNM 123254 (1); USNM 123255 (4); USNM 123256 (1); FMNH 8474–8480 (7), paratypes.

Gobionellus microdon.—Sonora, Mexico: USNM 46535 (1), lectotype, *Gobius microdon*; USNM 48256 (1), paralectotype. Sinaloa, Mexico: LACM 9901–1(1); UMMZ 171972 (1). Nayarit, Mexico: USNM (1), paratype, *Gobionellus mystax*: USNM 130859 (1), holotype, *G. mystax*: UMMZ 171998 (1); UMMZ 178310 (1); UMMZ 184864(3). Colima, Mexico: UMMZ 179934(16). Guerrero, Mexico: UMMZ 66265(1); UMMZ 178514(6); UMMZ 184817(3); UMMZ 202940(4). Oaxaca, Mexico: UTMSI (University of Texas Marine Science Institute) 1314(1). Guatemala: UMMZ 194137(76). El Salvador: USNM 220644(1). Nicaragua: TCWC 2491.1(1). Costa Rica: ANSP 140685(1); LACM 7038 (11); LACM 30115–3(1); NLU 62439 (30); UF 19622(6). Panama: ANSP 151035(2); FMNH 8471(5); USNM 81827(6); USNM 121902(1). Ecuador: GCRL 23045(4); MNHN 2002–1009 (1).

Gobionellus occidentalis.—Senegal: MRAC 79-29-P-95 (1); MRAC 79-34-P-82(1). Portuguese Guinea: BMNH 1909.10.29.109(1), holotype, *Gobius occidentalis*. Ivory Coast: MRAC 74-14-P-6880(1); MRAC 74-14-P-6882(1). Ghana: CAS-SU 63029(1). Togo: MNHN 1967–904(18). Dahomey: MRAC 179555(1). Nigeria: BMNH 1959.8.18.81(1); RMNH 25047(5); ZMA 115.587(1); ZMA 115.596(1). Cameroon: CAS-SU 40435(1); CAS-SU 40436(1). Gabon: MNHN 24123–124(2). Congo: MNHN 1967–417(3).

Gobionellus stomatus.—Brazil: Ceara: CAS-SU 52393(11). Rio Grande Do Norte: CAS-SU 22219(1), holotype; CAS-SU 22212(33), paratypes; AMNH 3847(10), paratypes; TCWC 2395.6(1). Sergipe: GCRL 13879(1). Bahia: GCRL 9643(1); GCRL 9645(3). Rio de Janeiro: ANSP 121167(1); ANSP 121181(1). Unknown: CAS-SU 52385(1).

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MUSEUM OF NATURAL HISTORY, UNIVERSITY OF LOUISIANA AT MONROE, MONROE, LOUISIANA 71209–0504. E-mail: pezold@ulm.edu. Submitted: 10 Oct. 2002. Accepted: 19 Jan. 2004. Section editor: D. G. Buth.