

A Review of the Indo-Pacific Gobiid Fish Genus *Ctenogobiops*, with Descriptions of Two New Species

John E. Randall¹, Kwang-Tsao Shao² and Jeng-Ping Chen^{3,*}

¹Bishop Museum, 1525 Bernice St., Honolulu, HI 96817-2704, USA

²Institute of Zoology, Academia Sinica, Nankang, Taipei, Taiwan 115, R.O.C.

³National Museum of Marine Biology and Aquarium, Checheng, Pingtung, Taiwan 944, R.O.C.

(Accepted May 9, 2003)

John E. Randall, Kwang-Tsao Shao and Jeng-Ping Chen (2003) A review of the Indo-Pacific gobiid fish genus *Ctenogobiops*, with descriptions of two new species. *Zoological Studies* 42(4): 506-515. The following 7 species of the Indo-Pacific shrimp-associated gobiid fish genus *Ctenogobiops* are recognized: *C. aurocingulus* (Herre), *C. feroculus* Lubbock and Polunin, *C. formosa* sp. nov., from southern Taiwan, *C. maculosus* (Fourmanoir) (*C. crocineus* Smith is a synonym), *C. pomastictus* Lubbock and Polunin, *C. tangaroai* Lubbock and Polunin, and *C. tongaensis* sp. nov. from Vava'u, Tonga. *Ctenogobiops formosa* is distinctive in having the 2nd or 3rd dorsal spines longest, much shorter than the head, 3 rows of dark spots on the body, the lower row midlateral with large oval spots, and 2 horizontal dark streaks on the cheek. In *C. tongaensis* the 2nd dorsal spine is the longest, being filamentous in the male and longer than the head, the caudal fin is clearly longer than the head, there are 4 rows of dark spots on body, and the round spots of midlateral 3rd row are largest. <http://www.sinica.edu.tw/zool/zoolstud/42.4/506.pdf>

Key words: Fish taxonomy, Indo-Pacific, Gobiidae, *Ctenogobiops*, New species.

The Indo-Pacific genus *Ctenogobiops* is one of 13 gobiid genera with species that live symbiotically with alpheid shrimp. It was created by Smith (1959) for his new species *crocineus* in his review of the gobies of the western Indian Ocean. He added, "*Aparrius atrocingulus* Herre, 1935 from Fiji probably falls here." He included *Cryptocentroides maculosus* Fourmanoir in Roux-Estève and Fourmanoir (1955) in his review, but left it in *Cryptocentroides*. Klausewitz (1960) placed *Ctenogobiops crocineus* in synonymy with *Ctenogobiops maculosus*.

Lubbock and Polunin (1977) described 3 new species of *Ctenogobiops*. They wrote that Klausewitz (1960) was incorrect in asserting that *C. crocineus* is a synonym of *C. maculosus*. They offered no evidence for this synonymy other than showing a drawing of the anterior end of a fish labeled *maculosus* with an arrow indicating the anterior position of the gill opening at the hind

margin of the preopercle. *Ctenogobiops maculosus*, however, has the gill opening extending forward to below the posterior edge of the eye, as it does in *crocineus*, so we follow Klausewitz in regarding *crocineus* as a synonym of *maculosus*.

Goren (1978) described *Ctenogobiops klausewitzi* from the Red Sea. Yoshino and Senou (1983) recorded 5 species of *Ctenogobiops* from the Ryukyu Is. and concluded that *C. klausewitzi* is not a species of *Ctenogobiops*. Randall (1995) referred it to a synonymy with *Amblygobius nocturnus* (Herre).

Having discovered a mutual interest in the genus *Ctenogobiops* (the 1st author found a new species from Tonga, and the 2nd and 3rd authors found one from Taiwan), we decided to review the genus together, provide a key to the species, and a diagnosis and color illustration of each species.

The 1st author photographed what appears to be an undescribed species of *Ctenogobiops* simi-

*To whom correspondence and reprint requests should be addressed. Tel: 886-8-8825001 ext. 8050. Fax: 886-8-8825066. E-mail: jpchen@nmmba.gov.tw

lar to *C. tangaroai* from Enewetak Atoll, Marshall Islands, but he failed to collect a specimen. This is illustrated in color to alert divers of the need to collect specimens.

MATERIALS AND METHODS

Specimens of the new species are deposited in the Museum of the Institute of Zoology, Taipei, Taiwan (ASIZP), the Bernice P. Bishop Museum, Honolulu, HI, USA (BPBM), and the National Museum of Marine Biology and Aquarium, Checheng, Pingtung, Taiwan (NMMBP). Measurements of the length of specimens are given as standard length (SL).

Methods of counts and measurements follow those of Hubbs and Lagler (1958). Clarification is needed for scale counts because gobies lack a lateral line. The scales in longitudinal series are counted from the upper end of the gill opening to the base of the caudal fin, while the transverse scale rows are counted from the anal-fin origin upward and backward to the 2nd dorsal fin.

The terminology of the cephalic sensory system follows that of Miller (1986) and Wongrat and Miller (1991) which are based on Sanzo (1911).

In the descriptions of the new species, data in parentheses refer to paratypes if different from the holotype. Proportional measurements in the text of the descriptions are rounded to the nearest 0.05.

Genus *Ctenogobius* Smith

Ctenogobius Smith, 1959: 191 (type species *C. crocineus*, by original designation = *C. maculosus* Fourmanoir, 1955).

Diagnosis: Dorsal rays VI + I, 10-12; anal rays I, 10-12; pectoral rays 18-20; pelvic rays I, 5, joined as a disk, a prominent frenum present; 45-58 scales in longitudinal series, progressively larger posteriorly, cycloid anteriorly, ctenoid dorsally on body below posterior 1/2 of 1st dorsal fin (ctenoid more anteriorly lower on body); no scales on head, chest, or nape (or only a few on side of nape anterior to upper end of gill opening); 1st gill opening partially closed by membrane anteriorly; lower-limb gill rakers 9 or 10; head and body compressed; body depth 4.2-5.5 in SL; gill opening extending forward to verticals between rear edge of orbit and posterior edge of preopercle; teeth in jaws in villiform bands, the outer row largest, with 2 pairs of incurved canines at front of lower jaw and 2 recurved canines on side of lower jaw; palate

edentate; tongue slightly bilobed; upper edge of eye extending slightly above dorsal profile of head; interorbital space very narrow, less than pupil diameter; sensory papillae on head not well developed, mostly in horizontal rows; caudal fin usually rounded, about equal to or longer than head; color in life whitish to transparent light gray with longitudinal rows of dark brown or yellow spots on body. Species small, none reported to exceed 64 mm SL.

Remarks: *Ctenogobiops* belongs to the largest assemblage of gobies, comprising 54 genera, termed the *Priolepis* group by Birdsong et al. (1988). These are characterized by a dorsal pterygiophore formula of 3-22110 and 10+16 vertebrae. Several species of shrimp of the genus *Alpheus* are known to associate symbiotically with species of *Ctenogobiops*. Unlike species of *Lotilia*, *Mahidolia*, *Stonogobiops*, and *Vanderhorstia* which hover above the shrimp as it emerges from the burrow, those of *Ctenogobiops* remain on the substratum, though they move as needed to accommodate the shrimp.

Key to the species of the genus *Ctenogobiops*

- 1a. Gill opening extending forward to a vertical at rear edge of orbit; pectoral fins with a long narrow white streak.....2
- 1b. Gill opening extending forward to a vertical at posterior edge of preopercle or halfway to rear edge of orbit; pectoral fins with a white spot or dash.....3
- 2a. First and 2nd dorsal spines forming along dusky filament, 1.5-2.0 in SL; a blackish-yellow spot at corner of mouth....
.....*tangaroai*
- 2b. First and 2nd dorsal spines not forming a long dusky filament, their length at most 4 times in SL; an oblique yellow line at corner of mouth.....*maculosus*
- 3a. Caudal fin long, its length 2.55-2.8 in SL.....4
- 3b. Caudal fin not long, its length 3.0-3.65 in SL.....5
- 4a. Caudal fin with 5th and 8th branched rays slightly prolonged as filaments; 1st dorsal spine longest, about equal to head length; abdomen and ventral part of body above anal fin with dusky-edged orange-yellow vertical lines; caudal fin with orange-red spots and streaks.....
.....*aurocingulus*
- 4b. Caudal fin without prolonged rays; 2nd dorsal spine longest, filamentous in male; ventral part of body without dusky-edged orange-yellow vertical lines; caudal fin without orange-red spots and streaks.....*tongaensis* sp. nov.
- 5a. Four rows of dark spots on body, with small yellow spots in between, lower row small, often as ocellated yellow spots.....*pomastictus*
- 5b. Three rows of dark spots on body, the lower row midlateral; no small yellow spots.....6
- 6a. First dorsal spine longest, often prolonged, 3.0-3.5 in SL; longitudinal scale series 50-58.....*feroculus*
- 6b. Second or 3rd dorsal spine longest, not prolonged, 4.25-5.8 in SL; longitudinal scale series 45-49.....
.....*formosa* sp. nov.

***Ctenogobiops aurocingulus* (Herre)**
(Fig. 1)

Aparrius aurocingulus Herre, 1935: 425 (type locality, Ovalau I., Fiji); Herre, 1936: 373, fig. 27.

Diagnosis: Dorsal rays VI + I,11; anal rays I,11; pectoral rays 18-20; longitudinal scale series 45-58; no scales on head, chest, or nape except for a few small embedded scales slightly anterior to upper end of gill opening; scales cycloid anteriorly on body, ctenoid dorsally on body posterior to last dorsal spine; gill opening reaching slightly anterior to a vertical at posterior margin of preopercle; body depth 4.7-5.5 in standard length; head length 3.1-3.45 in standard length; 1st dorsal spine longest, higher than 2nd dorsal fin, about equal to head length; caudal fin longer than head length, the 5th and 9th branched rays exerted as short filaments (when not spread, fin may be described as lanceolate); pelvic fins nearly or just reaching origin of anal fin; pale greenish gray with 4 longitudinal rows of dark brown spots on body; short vertical dusky-edged orange-yellow lines ventrally on body, sometimes associated with dark spots of lower row; oblique dark-edged orange and blue broken lines on cheek and operculum, 1 series beginning behind eye and curving upward onto nape; a white spot on pectoral fin, 1 at upper base of fin, and 1 dorsoposteriorly on caudal peduncle; a black or black-edged orange arc at base of 1st dorsal fin, and a black-edged orange line near base of 2nd dorsal fin; anal fin white with a gray margin and broad black submarginal band; caudal fin with orange streaks and spots.

Largest specimen, 64 mm SL.

Remarks: Known from the Ryukyu Is. and Taiwan to the Great Barrier Reef and New Caledonia, east to the Marshall, Caroline, and



Fig. 1. Underwater photograph of *Ctenogobiops aurocingulus*, NE Sulawesi, Indonesia.

Samoa Is. The only Indian Ocean record is a specimen collected by the 1st author in Sri Lanka. Occurs on sand-rubble bottoms from tidepool depths (the type specimens were collected from "a pool on a reef") to at least 15 m; symbiotic with snapping shrimp of the genus *Alpheus*.

Materials examined: Sri Lanka: Trincomalee, BPBM 18836, 4: 52-64 mm. Taiwan: Tan-Tze-Wan, ASIZP 56126, 45.6mm. Nan-Wan, ASIZP 60589, 18.1mm. Ching-Wa-Shih, BPBM 23366, 44 mm. Indonesia: Flores, BPBM 34143, 25 mm. Papua New Guinea: Port Moresby, BPBM 38831, 38 mm. Solomon Islands: Guadalcanal, BPBM 38732, 2: 37-39 mm.

***Ctenogobiops feroculus* Lubbock and Polunin**
(Fig. 2)

Ctenogobiops feroculus Lubbock and Polunin, 1977: 509, pl. 3, figs. 5, 8 (type locality, New Caledonia); Polunin and Lubbock, 1977: 70, figs. 4, 5.

Diagnosis: Dorsal rays VI + I,11-12; anal rays I,11; pectoral rays 19-20; longitudinal scale series 52-58; scales ctenoid dorsally on body to below 6th dorsal spine, cycloid anteriorly; gill opening extending forward to posterior margin of preopercle; body depth 4.7-5.5 in standard length; head length 3.1-3.45 in standard length; 1st dorsal spine longest, sometimes prolonged, 3.0-3.5 in standard length; caudal fin rounded, about equal to head length; pelvic fins nearly or just reaching anal-fin origin; whitish with 3 longitudinal rows of dark orangish brown spots, those of 2nd row mostly as double spots and often forming a triangle with a spot of upper row; lower row of spots midlateral and consisting of 6 or 7 spots, the 1st 4 or 5 horizontally elongate; a dark blotch behind eye, a more elongate one below on cheek, sometimes



Fig. 2. Underwater photograph of *Ctenogobiops feroculus*, Alphonse lagoon, Seychelles.

with a blue and/or yellow line just below; often a short dark line behind corner of mouth; 2 dark brown spots on opercle; a white spot in middle of pectoral fin near base, sometimes elongate; basal 1/3 of anal fin white, the outer 2/3 blackish; median part of pelvic disc blackish.

Largest specimen examined, 48 mm SL, but other fish of this species photographed underwater were estimated to be as large as 55 mm SL.

Remarks: Lubbock and Polunin (1977) described paratypes from Mahé, in the Seychelles, and Port Sudan, Red Sea. *Ctenogobiops feroculus* is the most wide-ranging species of the genus, occurring from the Red Sea to islands of Micronesia and the Society Is., and in the western Pacific from the Ryukyu Is., to the Great Barrier Reef and New Caledonia. Generally found in protected areas of fine sand and rubble, often in less than 4 m; symbiotic with snapping shrimp, including *Alpheus djeddensis* and *A. rapax*. Sometimes seen in pairs.

Materials examined: Maldives: North Malé Atoll, BPBM 34403, 31 mm. Marshall Islands: Enewetak Atoll, BPBM 12191, 2: 37-48 mm; BPBM 28774, 39 mm; BPBM 31230, 28 mm;

BPBM 31221, 5: 29-47 mm. Society Islands: Moorea, BPBM 11275, 43 mm.

***Ctenogobiops formosa* sp. nov.**

(Table 1; Figs. 3-5)

Holotype: ASIZP 61575, ♂, 45.7 mm SL, southern Taiwan, Pingtung County, Nanwan, sand bottom, 10-12 m, rotenone, J.-P. Chen, 6 Nov. 1998.

Paratypes: NMMBP 2404, ♀, 40.7 mm SL, taken with holotype; ASIZP 61576, ♀, 35.7 mm, same collecting data as for holotype, the burrow less than 1 m from that of holotype and its female pair; BPBM 38479, ♂, 35.8 mm, Nanwan, outside intake bay of Third Nuclear Power Plant, 12 m, rotenone, J.-P. Chen, 7 Nov. 1997.

Diagnosis: Gill opening extending forward to below hind margin of preopercle; caudal fin about equal to head length, 3.2-3.6 in SL; 2nd or 3rd dorsal spine longest, 4.25-5.8 in SL; caudal fin equal to or shorter than head; longitudinal scale series 45-49; 3 longitudinal rows of dark spots on body, the lower row largest and midlateral; a dark brown streak behind corner of mouth and a shorter paral-

Table 1. Proportional measurements of type specimens of *Ctenogobiops formosa* expressed as percentages of the standard length

	Holotype		Paratypes	
	ASIZP061575	NMMBP3317	ASIZP061576	BPBM38479
Sex	male	female	female	male
Standard length (mm)	45.7	40.7	35.7	35.8
Body depth	20.8	23.8	19.9	19.4
Head length	29.8	30.8	31.7	33.4
Snout length	6.5	6.3	6.4	6.1
Orbital diameter	7.0	7.0	8.2	9.0
Interorbital width	2.4	2.0	1.9	1.9
Upper-jaw length	11.6	11.1	11.4	11.3
Caudal-peduncle depth	12.8	12.9	12.7	12.6
Predorsal length	35.3	35.0	34.7	35.9
Preanal length	60.0	59.5	49.3	49.1
Prepelvic length	28.4	29.6	58.8	28.7
Base of dorsal fins	48.2	49.3	48.7	47.1
First dorsal spine	17.1	18.2	18.4	15.2
Second dorsal spine	19.5	24.3	24.3	17.2
Third dorsal spine	20.4	23.6	23.0	16.8
Fourth dorsal spine	15.8	17.5	broken	broken
Longest dorsal ray	23.0	19.7	18.7	15.5
Anal-fin base	23.4	23.0	24.1	23.2
Longest anal ray	19.0	18.4	17.1	16.8
Caudal-fin length	30.3	30.2	31.4	27.5
Pectoral-fin length	26.4	27.1	26.8	26.9
Pelvic-fin length	20.2	22.0	20.8	21.0

lel one above it.

Description: Dorsal rays VI + I, 11; anal rays I, 11; pectoral rays 19; pelvic rays I, 5, united as a disk, with a well-developed frenum; branched caudal rays 12; longitudinal scale series 46 (45-49); transverse scale rows 12 (12-13); no scales on head, nape, nor chest; scales progressively larger posteriorly; scales cycloid anteriorly on body, becoming ctenoid posterior to base of 3rd or 4th dorsal spines; no scales on fins except basally on caudal fin; lower-limb gill rakers 9.

Body slender, depth 4.8 (4.2-5.15) in SL, and compressed, width about 1/2 body depth; head length 3.35 (3.0-3.25) in SL; snout length 4.6 (4.9-5.5) in head length; orbit diameter 4.25 (3.7-4.4) in head length; interorbital space narrow, the least width 12.4 (15.4-17.6) in head length; caudal-peduncle depth 7.8 (7.75-7.95) in SL; predorsal length 2.85 (2.8-2.9) in SL; preanal length 1.65 (1.7) in SL; prepelvic length 3.0 (2.8-2.9) in SL.

Mouth strongly oblique, with lower jaw slightly projecting, the maxilla reaching below center of eye; upper-jaw length 2.55 (2.7-3.05) in head length. Dentition typical of the genus. Gill membranes narrowly attached to isthmus. Gill opening extending forward to below posterior margin of preopercle. Sensory canals and papillae of head as shown in figure 4.

First dorsal fin narrowly separated from 2nd dorsal fin; no spines of 1st dorsal fin prolonged; 2nd or 3rd dorsal spine longest, 4.9 (4.25-5.8) in SL; origin of 2nd dorsal fin slightly anterior to a vertical through anus; 3rd or 4th dorsal soft ray longest, 4.35 (5.1-6.45) in SL; longest anal soft ray 5.25 (5.45-6.1) in SL; caudal fin rounded in female, slightly truncate medially in male, equal to or short-

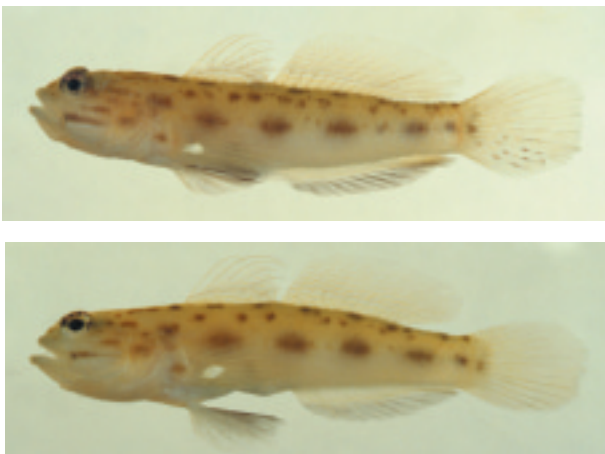


Fig. 3. Upper: Holotype of *Ctenogobiops formosa*, ♂, ASIZP 61575, 45.7 mm, Nanwan, Taiwan. Lower: Paratype of *C. formosa*, ♀, NMMPB 3317, 40.7 mm, Nanwan, Taiwan.

er than head length, 3.3 (3.3-3.65) in SL; pectoral fins reaching above base of 2nd to 3rd anal soft rays, fin length 3.8 (3.7-3.75) in SL; pelvic fins reaching origin of anal fin, 4.95 (4.55-4.85) in SL.

Color in life: Whitish with 3 longitudinal series of dark brown spots, the 3rd series largest and midlateral, consisting of 4 oval spots and 3 small spots posteriorly, the last on caudal-fin base; uppermost series of spots from nape along dorsal body contour consisting of 10-12 small spots, and the 2nd series of 8-10 small spots a short distance below, the largest the 1st behind upper margin of operculum; a diagonal series of small, light blue spots from behind eye to predorsal area; cheek with 2 narrow dark brown stripes, one posterior to corner of mouth, progressively narrower posteriorly, and a shorter parallel one above; base of pectoral fins with a dark brown spot; dorsal fins trans-

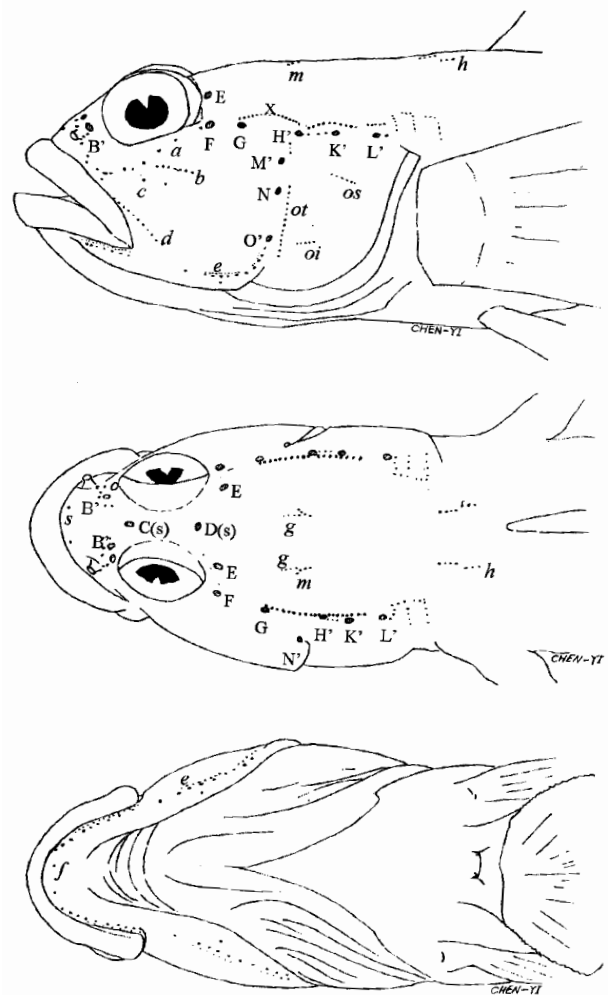


Fig. 4. Cephalic sensory system of the holotype of *Ctenogobiops formosa* (Y-I Chen).

parent with a faint narrow brown stripe near base; anal fin hyaline on basal 1/2, brown on distal 1/2; caudal fin of female transparent, of male transparent with a scattering of very small dark spots on lower 1/3 of fin; pectoral fins with a prominent slightly oval white spot near base; pelvic fins dusky brown medially, transparent laterally.

Color in preservative yellowish, dark spots still prominent; small light blue spots faintly brown in female, but not visible in male.

Etymology: This species is named *formosa* from the earlier Western name for Taiwan.

Remarks: *Ctenogobiops formosa* is known only from southern Taiwan. It was collected at depths of less than 1 to 12 m. As can be seen in figure 5, it lives in association with alpheid shrimp (the shrimp in the photograph appears to be *Alpheus rapax*).

Ctenogobiops feroculus appears to be the closest relative, as may be seen from the similarity in color pattern. It differs from *C. formosa* in having the 1st dorsal spine longest, often prolonged, at 3.2-3.5 in SL, compared to the 2nd or 3rd dorsal spines of *formosa* being longest, at 4.25-5.8 in SL. Two differences in color pattern are noteworthy: the presence of a long dark brown streak behind the corner of the mouth of *formosa* with a short line on the cheek above not seen in *feroculus*. Also the arc of small light blue spots from behind the eye onto the nape is distinct to *formosa*.

***Ctenogobiops maculosus* Fourmanoir** (Fig. 6)

Cryptocentroides maculosus Fourmanoir, in Roux-Estève and Fourmanoir, 1955: 201 (type locality, Red Sea).

Ctenogobiops crocineus Smith, 1959: 191, pl. 11 K (type locality, Mahé, Seychelles).

Diagnosis: Dorsal rays VI + I, 11-12; anal rays I, 11; pectoral rays 18-19; longitudinal scale series 52-56; scales ctenoid dorsally on body to below 3rd or 4th dorsal spines, cycloid anteriorly; no scales on head, chest, or nape except for a few small scales just before upper end of gill opening; gill opening extending forward to a vertical at posterior edge of eye; body depth 4.5-5.2 in standard length; head length 3.0-3.3 in standard length; 2nd dorsal spine usually longest, 4.0-4.6 in standard length; caudal fin rounded or medially truncate, equal to or a little longer than head; pelvic fins just reaching anal-fin origin; translucent pale gray with 4 longitudinal rows of orangish brown spots (sometimes dark brown with enclosed small orange

spots); 3rd row of spots largest, some slightly elongate, with smaller spots in between; often with scattered pale blue dots and white flecks; 2 oblique rows of orange or orangish brown dashes on cheek and opercle, and one behind eye continuing as an arc to origin of dorsal fin, some dashes with an adjacent blue line; a narrow white streak in pectoral fin nearly full length of fin.

Largest specimen recorded the holotype 55 mm.

Remarks: This species is known from the Red Sea, Comoro Is., Seychelles, Maldives, Great Barrier Reef, and the Ryukyu Is. More localities should be expected. Polunin and Lubbock (1977) reported it as occurring with alpheid shrimp in sand and rubble at the edge of coral reefs in water less than 8 m deep.

Material examined: Red Sea: Gulf of Aqaba, BPBM 13424, 33 mm. Sudan, Towartit Reef, BPBM 27441, 46 mm. Maldives: South Malé Atoll, BPBM 32953, 40 mm. North Malé Atoll, BPBM 33059, 46 mm.

***Ctenogobiops pomastictus* Lubbock and Polunin** (Fig. 7)

Ctenogobiops pomastictus Lubbock and Polunin, 1977: 505, pl. 1, figs. 4, 7 (type locality, Lizard Is., Great Barrier Reef).

Diagnosis: Dorsal rays VI + I, 11-12 (usually 11); anal rays I, 11-12 (usually 11); pectoral rays 18-20; longitudinal scale series 50-55; no scales on head, nape, chest, nor pectoral-fin base; scales cycloid anteriorly on body, ctenoid dorsally on body posterior to 3rd or 4th dorsal spines; gill opening extending forward to nor slightly before posterior margin of preopercle; body depth 4.5-5.0 in standard length; head length 3.1-3.4 in standard length; 2nd dorsal spine longest (but 3rd nearly as long), 3.3-5.1 in standard length; caudal fin rounded, about equal to head length; pelvic fins nearly or just reaching origin of anal fin; pale gray with 4 longitudinal rows of dark brown spots on body, 6 or 7 in the 3rd row largest, the 1st 4 or 5 horizontally elongate; a small ocellated yellow spot between each pair of brown spots of 3rd row, and scattered small yellow or brown spots elsewhere on body; small brown spots in lower row usually with yellow centers; 3 brown spots behind eye, the 1st preceded by blue and yellow dashes which continue as an arc onto nape; 3 small blue and yellow spots in a row behind lower edge of eye, the 3rd obscured by brown; 3 brown spots in a row on cheek, and a row of 3 or 4 brown spots or dashes behind corner

of mouth; sometimes a white spot in upper part of caudal fin near base, or a series of small whitish blotches dorsally on posterior part of body; an oblique white spot, sometimes spindle-shaped, in lower 1/3 of pectoral fin near base; anal fin white basally, gray distally, with a dark band in between; pelvic disc dusky, especially medially.

Largest specimen, 57 mm.

Remarks: Known in the Indian Ocean from the Andaman Sea and Rowley Shoals off north-western Australia; in the western Pacific from the Ryukyu Is. to the Great Barrier Reef and New Caledonia, east to Palau, the Mariana Is. and the Marshall Is., occurs on silty sand and rubble substrata near lagoon coral reefs, generally in less than 6 m; lives symbiotically with *Alpheus djeddensis*, *A. djiboutensis*, and *A. ochrostriatus*.

Materials examined: Palau: BPBM 9472, 46 mm. Marshall Islands: Enewetak Atoll, BPBM 28780, 53 mm; BPBM 28985, 2: 23-37 mm.

***Ctenogobiops tangaroai* Lubbock and Polunin (Fig. 8)**

Ctenogobiops tangaroai Lubbock and Polunin, 1977: 511, pl. 3, figs. 6, 9 (type locality, Tutuila, American Samoa).

Diagnosis: Dorsal rays VI + I, 10-11 (usually 11); anal rays I, 10-11 (usually 11); pectoral rays 18-20; longitudinal scale series 47-51; no scales on head, chest, nor nape except for a few oblique rows of small scales anterior to upper end of gill opening; scales cycloid anteriorly on body, ctenoid dorsally on body posterior to 4th or 5th dorsal fin; gill opening extending forward to a vertical at posterior margin of eye; body depth 4.3-5.2 in standard length; head length 2.95-3.15 in standard length; 1st and 2nd dorsal spines greatly prolonged as a broad filament, the 2nd longer, generally more than 1/2 standard length; caudal fin rounded except middle 5 or 6 rays of equal length (so fin margin straight in central part), fin length about equal to head length; pelvic fins nearly or just reaching anal-fin origin; body translucent light gray with a midlateral row of 5 orange-yellow spots nearly as large as pupil; other smaller orange-yellow spots, white spots, and a scattering of pale blue dots on body; head with 2 oblique dark-edged yellow lines behind eye, the upper continuing as a series of dashes to origin of 1st dorsal fin; small dark-edged orange-yellow spots on cheek and opercle, the darkest (may be mainly black) behind corner of mouth; membrane between 1st and 2nd dorsal spines blackish; a long narrow white streak

on lower 1/3 of pectoral fins (white spot or short dash in other species of the genus).

Largest specimen reported, 51.4 mm SL (Yoshino and Senou 1983).

Remarks: Ranges in the western Pacific from the Ryukyu Is. to the Great Barrier Reef, east to Palau, Guam, Tonga, Fiji, and the Samoa Is. usually found in sand-rubble pockets on seaward reefs in from 4-40 m, generally in more than 15 m; symbiotic with the snapping shrimp *Alpheus ochrostriatus*. Named for the Polynesian god of the sea.

As mentioned in the "Introduction", the 1st author photographed a species of *Ctenogobiops* in the lagoon of Enewetak Atoll (Fig. 9) that is clearly related to *C. tangaroai*. It differs in having a shorter white anterior part of the 1st dorsal fin and a different color pattern of small yellow and pale blue spots and white flecks on the head and body. Specimens are needed for the description of this species.

Materials examined: American Samoa: Tutuila, BPBM 17472, 42 mm; BPBM 17478, 36.5 mm; BPBM 17503, 2: 35-38 mm. Tonga: Vava'u, BPBM 38116, 38 mm. Marshall Islands: Enewetak

Table 2. Proportional measurements of type specimens of *Ctenogobiops tongaensis* expressed as percentages of the standard length

	Holotype	Paratype
	BPBM	ASIZP
	38297	61734
Sex	male	female
Standard length (mm)	39.3	33.0
Body depth	22.6	22.8
Head length	32.8	33.8
Snout length	7.7	7.6
Orbit diameter	8.1	9.6
Interorbital width	1.8	1.7
Upper-jaw length	12.9	13.0
Caudal-peduncle depth	12.2	12.6
Predorsal length	37.6	36.6
Preanal length	57.5	57.8
Prepelvic length	35.4	35.2
Base of dorsal fins	47.4	46.3
First dorsal spine	21.6	19.4
Second dorsal spine	39.5	28.8
Third dorsal spine	25.0	18.8
Fourth dorsal spine	18.1	16.8
Longest dorsal ray	22.9	19.1
Anal-fin base	23.3	23.6
Longest anal ray	22.9	20.5
Caudal-fin length	35.5	37.8
Pectoral-fin length	34.4	34.2
Pelvic-fin length	27.6	27.5

Atoll, BPBM 17761, 34 mm; BPBM 26387, 34 mm.
Taiwan: Tan-Tze-Wan, ASIZP 56127, 43.2mm.
Ryukyu Islands: Okinawa, BPBM 22300, 49 mm.

***Ctenogobiops tongaensis* sp. nov.**

(Table 2; Fig. 10)

Holotype: BPBM 38297, ♂, 39.3 mm, Tonga, Vava'u, Neiafu, inner harbor, off dock of Paradise International Hotel, silty sand and rubble, 1 m,

spear, J.E. Randall, 19 Mar. 1983.

Paratype: ASIZP 61734, ♀, 33.0 mm, same collecting data as for holotype.

Diagnosis: Gill opening extending forward to a vertical about halfway between posterior edge of preopercle and hind margin of orbit; caudal fin longer than head length, 2.65-2.8 in SL; 2nd dorsal spine 2.95 in SL in male and 2.65 in SL in female; caudal fin longer than head; longitudinal scale series 50-51; 3 longitudinal rows of dark spots on

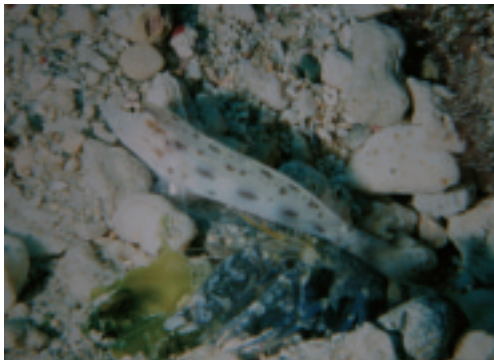


Fig. 5. Underwater photograph of *Ctenogobiops formosa*, Nanwan, Taiwan.



Fig. 6. Underwater photograph of *Ctenogobiops maculosus*, Alphonse lagoon, Seychelles.



Fig. 7. Underwater photograph of *Ctenogobiops pomastictus*, Palau.



Fig. 8. Underwater photograph of *Ctenogobiops tangaroai*, Milne Bay, Papua New Guinea.

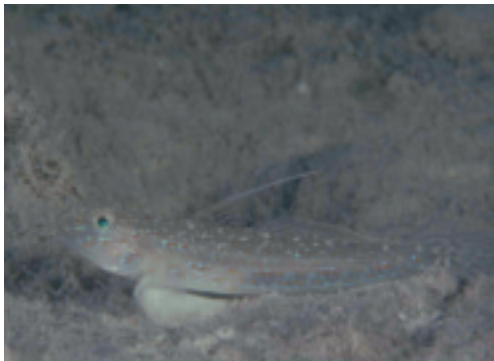


Fig. 9. Underwater photograph of *Ctenogobiops* sp., Enewetak Atoll, Marshall Islands.



Fig. 10. Holotype of *Ctenogobiops tongaensis*, BPBM 38297, 39.3 mm, Vava'u, Tonga.

body.

Description: Dorsal rays VI + I, 11; anal rays I, 11; pectoral rays 18; pelvic rays I, 5, united as a disk, with a well-developed frenum; branched caudal rays 12; longitudinal scale series 51 (50); transverse scale rows 13; no scales on head, nape, nor chest; scales progressively larger posteriorly; scales cycloid anteriorly on body, becoming ctenoid dorsally on body posterior to base of 4th dorsal spine; no scales on fins except basally on caudal fin; lower-limb gill rakers 10 (9).

Body slender, depth 4.45 (4.4) in SL, and compressed, the width about 1/2 body depth; head length 3.05 (2.95) in SL; snout length 4.25 (4.45) in head; orbit diameter 4.05 (3.5) in head; interorbital space narrow, the least width 18.2 (19.8) in head length; caudal-peduncle depth 8.2 (7.95) in SL; predorsal length 2.65 (2.75) in SL; preanal length 1.75 in SL; prepelvic length 2.8 (2.85) in SL.

Mouth strongly oblique, with lower jaw projecting, maxilla reaching below center of eye; upper-jaw length 2.55 (2.6) in head. Dentition typical of the genus. Gill membranes narrowly attached to isthmus. Gill opening extending forwards to below about middle of preopercle. Sensory canals and papillae of head essentially the same as in figure 4 of *C. formosa*.

First dorsal fin narrowly separated from 2nd dorsal fin; 2nd dorsal spine longest, prolonged as a filament in the male holotype and moderately long in female paratype, 2.55 (3.5) in SL; origin of 2nd dorsal fin in line with a vertical through anus; penultimate dorsal soft ray longest in male, 5th to 9th longest in female, subequal, 4.35 (5.25) in SL; penultimate anal soft ray longest in both sexes, 4.35 (4.9) in SL; caudal fin rounded, longer than head length, 2.8 (2.65) in SL; pectoral fins reaching above base of 4th anal soft ray, fin length 2.9 in SL; pelvic fins reaching base of 2nd anal soft ray, 3.6 in SL.

Color of holotype when fresh: Pale gray, shading to whitish ventrally on head and abdomen, with 4 longitudinal rows of somewhat rounded blackish spots on body, the largest in midlateral row consisting of 7 spots that progressively decrease in size posteriorly, the last on base of caudal fin; 1st row of spots, more as indistinct blotches, along dorsal contour of body; 2nd row as 8 discrete spots, most smaller than pupil, the 1st at upper end of gill opening; lower row of 5 spots, all smaller than pupil; a few small dark blotches scattered on body between major spots; a row of 3 dark brown spots on cheek, the 3rd in middle of opercle with 2 indistinct spots above; a blue and

yellow line below first 2 spots on cheek; an irregular pale bluish band from behind eye along upper edge of operculum; a series of 7 yellow and blue dashes forming an arc from behind eye to origin of dorsal fin, the last 2 obscured by dark pigment; snout and lips bluish gray; iris dusky yellow with dark brown spots dorsoanteriorly; 1st dorsal fin with bluish brown spines, membranes at base with alternating lines of pale blue and brownish yellow; 2nd dorsal fin pale blue at base with 2 irregular brownish yellow lines; membranes of rest of fin with alternating oblique blue and black-edged yellowish lines; basal 1/2 of anal fin bluish white, outer 1/2 black, shading distally to dusky purple, the 2 zones separated by a blue line; caudal fin with bluish brown rays and 3 small spots in a vertical row at base, the lower spot faint; pectoral fins translucent gray with a spindle-shaped white spot longer than pupil near base on lower 1/3 of fin; pelvic fins dusky with light blue rays.

Color of holotype in alcohol: Light brown with darker brown spots as described above; median and pectoral fins largely transparent, only base of caudal fin and outer 1/2 of pelvic fins with a trace of dark pigment as small dots; pelvic fins dusky.

Etymology: Named *tongaensis* for the type locality.

Remarks: The 2 type specimens were noted to live in burrows in association with an alpheid shrimp. The bottom was silty sand and rubble, at a depth of only 1 m. In view of all the fish collecting in Tonga (Randall et al., in press), it is surprising that more specimens have not been obtained.

This species is most closely related to *Ctenogobius pomastictus*, sharing with it the 4 rows of dark spots on the body, a similar color pattern of the head, and the elongate 2nd dorsal spine. It differs in having rounded dark spots of the 3rd row on the body, in contrast to being horizontally oblong in *pomastictus*, a caudal fin that is clearly longer than the head (about equal to the head in *pomastictus*), the gill opening extending forward to below the middle of the preopercle (only slightly anterior to the hind edge of the preopercle in *pomastictus*), and in having 18 pectoral rays (a strongly modal 19 for *pomastictus*).

Acknowledgments: We thank Ching-Yi Chen for her drawing of figure 4.

REFERENCES

Birdsong RS, EO Murdy, FL Pezold. 1988. A study of the verte-

- bral column and median fin osteology in gobiid fishes with comments on gobioid relationships. *Bull. Mar. Sci.* **42**: 174-214.
- Goren M. 1978. A new gobiid genus and seven new species from Sinai coasts (Pisces: Gobiidae). *Senck. Biol.* **59**: 191-203.
- Herre AW. 1935. New fishes obtained by the Crane Pacific Expedition. *Field Mus. Nat. Hist. Zool.* **18**: 383-438.
- Herre AW. 1936. Fishes of the Crane Pacific Expedition. *Field Mus. Nat. Hist. Zool. Ser.* **21**: 1-472.
- Hubbs CL, KF Lagler. 1958. Fishes of the Great Lakes region. *Bull. Cranbrook Inst. Sci.* **2**: 1-213.
- Klausewitz W. 1960. Fische aus dem Roten Meer. IV. Einige systematisch und ökologisch bemerkenswerte Meergrundeln (Pisces, Gobiidae). *Senck. Biol.* **41**: 149-162.
- Lubbock R, NVC Polunin. 1977. Notes on the Indo-West Pacific genus *Ctenogobiops* (Teleostei: Gobiidae), with descriptions of three new species. *Rev. Suisse Zool.* **84**: 505-514.
- Miller PJ. 1986. Gobiidae. In PJP Whitehead, ML Bauchot, JC Hureau, J Nielsen, E Tortonese, eds. *Fishes of north-eastern Atlantic and the Mediterranean*, Vol. 3. Paris: UNESCO, pp. 1019-1085.
- Polunin NVC, R Lubbock. 1977. Prawn-associated gobies (Teleostei: Gobiidae) from the Seychelles, western Indian Ocean: systematics and ecology. *J. Zool. Lond.* **183**: 63-101.
- Randall JE. 1995. *Coastal fishes of Oman*. Honolulu: Univ. of Hawaii Press, xiii + 439 pp.
- Randall JE, DG Smith, JT Williams, M Kulbicki, GM Tham, P Labross, M Kronen, E Clua. In press. Checklist of the shore and epipelagic fishes of Tonga. *Atoll Res. Bull.* (in press)
- Roux-Estève R, P Fourmanoir. 1955. Poissons capturés par la mission de la "Calypso" en Mer Rouge. *Ann. Inst. Océanogr. Monaco (N.S.)* **30**: 195-203.
- Sanzo L. 1911. Distribuzione delle papille cutanee (organi ciati-formi) e suo valore sistematico nei gobi. *Mitt. Zool. Stat. Neapel* **20**: 249-328.
- Smith JLB. 1959. Gobioid fishes of the families Gobiidae, Periophthalmidae, Trypauchenidae, Taenioididae, and Kraemeriidae of the western Indian Ocean. *Ichth. Bull. Rhodes Univ.* **13**: 185-225.
- Wongrat P, PJ Miller. 1991. The innervation of head neuromast rows in eleotridine gobies (Teleostei: Gobioidae). *J. Zool. Lond.* **225**: 27-42.
- Yoshino T, H Senou. 1983. A review of the gobiid fishes of the genus *Ctenogobiops* from Japan. *Galaxea* **2**: 1-13.