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A New Species of the Genus *Priolepis* (Perciformes: Gobiidae) from Tosa Bay, Japan

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Abstract *Priolepis winterbottomi* sp. nov is described on the basis of 4 specimens from Tosa Bay, Japan, in the western North Pacific. Within the genus *Priolepis*, the new species is classified in the "*P. profunda*" grade (1 of 3 subgroups of the Indo-Pacific *Priolepis*) because it has well developed transverse-papillae rows on cheek and predorsal scales. It clearly differs from other 8 species of this grade by the following combination of characters: 9 dorsal-fin soft rays, 8 anal-fin soft rays, 18–19 pectoral-fin rays, 28–29 lateral line scales, 14–15 predorsal scales, numbers of anterior and posterior transverse interorbital papillae (4 and 12, respectively), wide interorbital width (47–52% of eye diameter), all pectoral-fin rays branched, vertical bars on head and body, pinkish body, dorsal fins without distinct pattern, red vertical fins, and deep-dwelling habitat (collected at the depths of ca. 40–95 m).

Key words : Gobiidae, *Priolepis*, new species, Tosa Bay, Japan

Gobies of the genus *Priolepis* are widely distributed around rocky and coral reefs of tropical to temperate waters in the Indo-Pacific and Atlantic Oceans (Senou *et al*., 2004). The genus comprises about 34 species, all of which are small in size (up to about 50 mm standard length [SL]) and diagnosed as lacking cephalic sensory canals and associated pores, lacking transverse row of cheek sensory-papillae between the posterodorsal eye and the upper longitudinal row, having a gill opening extending anteroventrally to below the vertical limb of the preopercle or just anterior to this, having vertical bars, usually with darkened borders, on the head and body, having 0–20 predorsal scales, and possessing denticles or odontoids on the medial surface of the outer gill rakers of first gill arch (Winterbottom and Burridge, 1989, 1992; Senou *et al*., 2004). Further, species of *Priolepis* in the Indo-Pacific have been conveniently divided into three groups by the states of sensory papillae on cheeks and predorsal scales, i.e., "*P. profunda*" grade (8 species, having well-developed sensory-papillae rows on cheek and predorsal scales), "*P. semidoliata*" clade (11 species, having reduced sensory-papillae rows on cheek and no predorsal scales), and "*P. cincta*" grade (15 species, having reduced sensory-papillae rows on cheek and predorsal scales) (Winterbotton and Burridge, 1992, 1993a, 1993b; Goren and Baranes, 1995). Among them, 10 species are known from Japan (Akihito *et al*., 2002; Senou *et al*., 2004).

During researches on fish fauna of Kochi Prefecture, Japan, 4 small gobies were collected from central Tosa Bay at depths between about 40 and 95 m by bottom trawls in early June of 1993, 1994, and 2003. These specimens possess the diagnostic characters of *Priolepis* as described by Winterbottom and Burridge (1992), but differ from the hitherto known species by the states of sensory papillae on cheek, fin-ray counts, and coloration. Hence, we here describe them as a new species of *Priolepis* from Japan.

Materials and Methods

Specimens examined in this study are deposited in the following institutions: Biological Labo-

ratory, Imperial Household, Tokyo (BLIH); Department of Biology, Faculty of Science, Kochi University (BSKU); National Museum of Nature and Science (formerly National Science Museum), Tokyo (NSMT).

Counts and the notation of cephalic sensory canals and papillae follow Akihito (1984) and Miller (1986). Measurements follow Winterbottom and Burridge (1992). Meristic counts and skeletal observation were made by radiographs. Cephalic sensory canals and papillae were observed using 1 % cyanine blue solution.

Priolepis winterbottomi sp. nov.

(New Japanese name: Sakura-irezumi-haze)

(Figs. 1–3, Table 1)

Material examined. Four specimens collected from central Tosa Bay. Holotype: BSKU 64659, 31.9 mm SL, female, Susaki fishing port, Susaki City, Kochi Pref., correct depth unknown (probably ca. 40–60 m), bottom trawl, coll. by S. Ide, 3 June 2003. Paratypes: NSMT-P 72655 (formally BSKU 43811), 30.2 mm SL, male, 33°20.80′N, 133°36.54′E–33°19.95′N, 133°33.89′E, 91–95 m depths, R/V Toyohata-Maru, 3 m beam trawl, 1 June 1987; BSKU 81922, 31.2 mm SL, female, BLIH 1994244, 27.1 mm SL, male, off Haruno Town, 33°24.46′N, 133°34.32′E-33°24.34′N, 133°33.73′E, 60–62 m depths, R/V Toyohata-Maru, 3 June 1994.

Fig. 1. Fresh (top and middle) and preserved (bottom) conditions of *Priolepis winterbottomi* sp. nov., holotype, BSKU 64659, female, 31.9 mm SL. Photos by Y. Nogawa.

Diagnosis. The new species is distinguished from congeners by having the following characters: well developed transverse pattern of sensory-papillae rows on cheek; 4 papillae in anterior transverse interorbital row (ATI) and 12 papillae in posterior transverse interorbital row (PTI); 28–29 lateral line scales; 14–15 predorsal scales; 3 ctenoid scales on upper part of opercle, long and slender gill-rakers on outer first arch without denticles on inner rim; pelvic fins with a vestigial membrane, without frenum; body pinkish (like a cherry blossom); vertical fins red; 6 dark bands on body.

Description. Counts for the holotype are given in parentheses where pertinent. Dorsal fin VI–I, 9; anal fin I, 8; pectoral-fin rays 18–19 (18); pelvic fin I, 5; segmented caudal-fin rays 9+8; branched caudal-fin rays 7+6; upper unbranched caudal-fin rays 5; lower unbranched caudal-fin rays 5; longitudinal scale rows 28–29 (28); anterior transverse scales above anal-fin origin 10–11 (10/11); posterior transverse scales above anal-fin origin 8–10 (8); posterior transverse scales below second dorsal-fin origin 8–10 (8); predorsal scales 14–15 (14); scales around caudal peduncle 12; gill-raker on first arch 4+12–14 (4+12); pseudobranch filaments 5–6 (5); branchiostegal rays 5; vertebrae 10+16=26; P–V 3/II II I I 0/9; epurals 1; anal pterygiophores anterior to first haemal spine 2; ribs located on third to 10th abdominal vertebrae.

Proportional measurements are given in Table 1. Body slender, slightly compressed. Head rather depressed, its width 108.8–114.6% of height. Snout short. Eye large, located dorsolaterally. Eye diameter greater than snout length. Interorbital space wide, almost equal to pupil diameter. No dermal ridge on mid-line of nape. Mouth terminal, oblique, forming an angle of about 50° with body axis. Lower jaw projecting beyond upper jaw. Posterior end of jaws reaching between vertical lines at anterior rims of eye and

pupil. Each nasal opening (or "nares") a short tube without a dermal flap, anterior tube more slender than posterior, posterior tube opens near anterodorsal margin of eye. Anterior tip of tongue concaved, free from floor of mouth. Posteroventral margin of lower lip interrupted at symphysis, no mental flap on chin. Gill membrane attached to isthmus, gill opening large, anteroventral margin located on a vertical line at middle of posterior rims of eye and preopercle. No fleshy projection on cleithrum. Posterior margin of preopercle smooth. Outer gill-rakers on first arch long, slender without denticles (a row of 4 denticles observed on fourth raker of upper branch in BSKU 81922), other rakers rounded with distinct denticles. Caudal peduncle moderately long, its height 45.1–50.0% of its length. First dorsal fin a little higher than second dorsal fin, its origin posterior to pectoral fin base, second spine of dorsal fin longest, length 155.0–156.1% of first spine in male, 127% in female, its distal tip reaching posteriorly to base of first soft ray when adpressed in male, not reaching to second dorsal-fin origin in female, all dorsal spines slender, flexible. Interdorsal space narrow without fin membrane, its length 7.5–8.3% of SL. All dorsal-fin rays branched, fifth ray longest. Anal-fin origin located below middle of first and second dorsal rays, a little higher than second dorsal fin; anal spine thin, flexible; all anal-fin rays branched, fiifth ray longest. Second dorsal and anal fins not extended posteriorly to caudal-fin base when adpressed. Caudal-fin rounded, its length 114.3–122.9% of head length (HL). Branched caudal-fin rays bifurcate twice in first and 13th, 3 times in second to 12th rays. Pectoral fin long, pointed, its tip reaching posteriorly to below bases of third and fourth rays of second dorsal fin, rays branched. Pelvic-fin origin below middle of pectoral base; no frenum; connecting (=basal) membrane between pelvic fins delicate and poorly developed, 19.7–21.7% of length of fifth soft ray; all pelvic-fin rays branched, fourth pelvic longest, extending posteriorly to anus in males, a little shorter in females.

Ctenoid scales on posterodorsal region of head (behind "PTI", above "x1"), upper opercle (3 scales), lateral sides of body, and abdomen (Fig. 2). Cycloid scales on pectoral-fin base and on prepelvic area (5–6 scales). Body scales deciduous, increasing gradually in size posteriorly. Snout/interorbital space, cheek, lower two-third of opercle, ventral side of head, and pectoral-fin axilla scaleless.

Upper jaw with an outer row of about 18 canine-like teeth along anterior half, 2 complete inner rows of small conical teeth, 2 largest canines near symphysis inclined posteriorly. Lower jaw with 3–4 rows of teeth anteriorly, narrowing to 2 rows posteriorly: outermost row with 10 or more large canine-like teeth, becoming larger posteriorly, largest teeth visible laterally on upper lip; innermost row with small conical teeth anteriorly, canine-like teeth posteriorly. No teeth on vomer.

No sensory canals or pores on head. Cephalic sensory papillae patterns illustrated in Figure 3. Rows of papillae consisting of a simple series or single units, not forming complex rows. Six well-developed transverse papillae rows on cheek. Rows *5s* and *5i* interrupting by *b*, row *5i* extending below to row *d*, not crossing each other. Row *b* long, oblique, reaching to posterior margin of preopercle; rows *q1* and *q2* both consist of a single papilla. Each papilla in row *i* on ventral side of lower jaw larger than those of row *e*, with wide interspaces between each other. Row *f* behind symphysis of lower jaw straight and moderately long. Anterior transverse interorbital papillae (ATI) and posterior transverse interorbital papillae (PTI) consist of 4 and 6 papillae respectively on each side, both these rows well separated in midline. Transverse rows of about 5 papillae each on lateral sides of body, short, narrower than width of single scale. Longitudinal rows of 3 papillae on caudal fin, extending from posterior margin of scaled area to fourth, seventh, and 10th branched fin-ray, respectively.

Urogenital papilla cylindrical, flat in both sex, multiple fleshy lobes on tip in female.

Color when fresh. Color pattern of the holotype is shown in Figure 1. Ground color of head

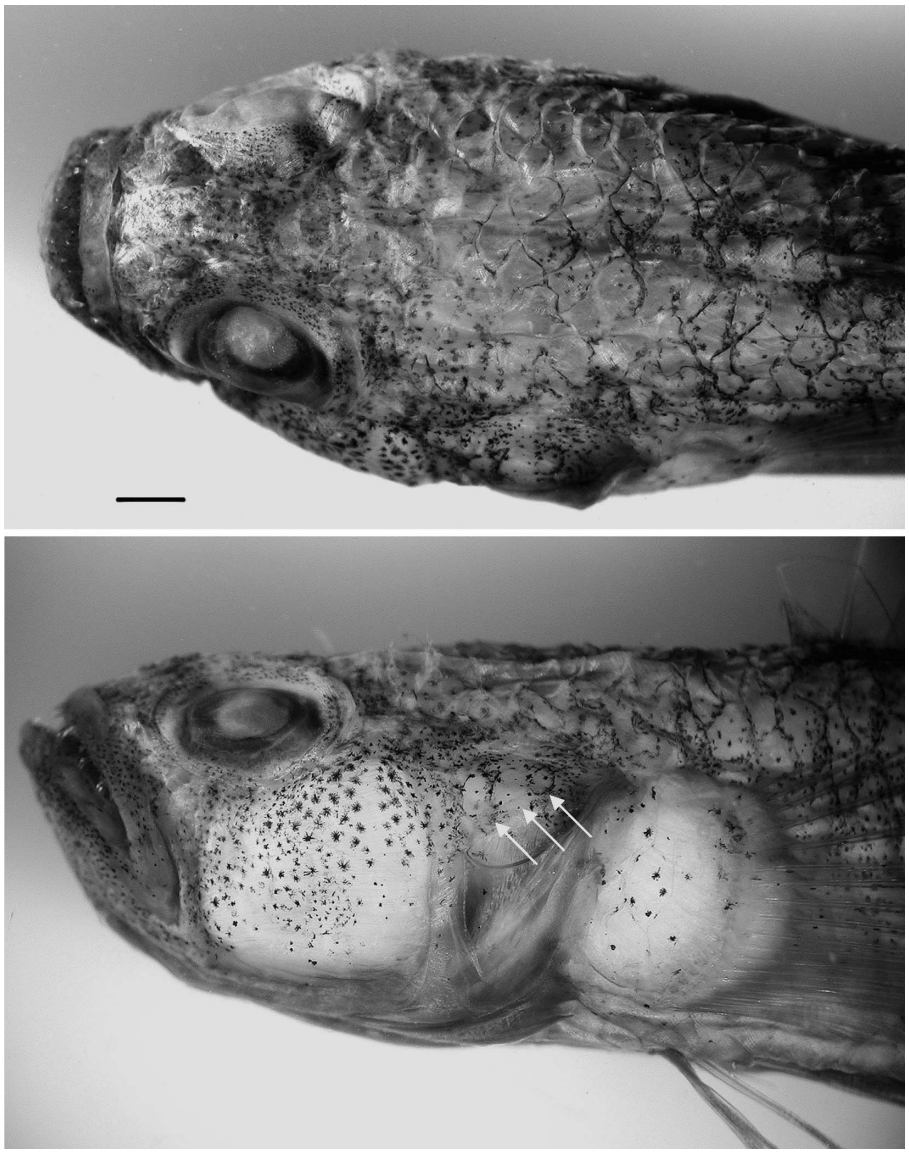

Fig. 2. Dorsal (top) and lateral (bottom) views of head of *Priolepis winterbottomi*, holotype, BSKU 64659, 8.4 mm HL. Arrows indicate scales on upper opercle. Scale bar indicates 1 mm. Photos by Y. Nogawa.

dark to yellowish brown anterodorsally, lighter laterally and ventrally; snout and jaws rather darker. Ground color of body faint cherry-blossom pink. Prepelvic and upper edge of pectoral-fin base orange. Dorsal and lateral sides on head with 5 pale pinkish transverse bars: first across interorbital space between ATI and PTI, from anteroventral margin of eye to posterior end of upper jaw; second across behind PTI, from ventromedial margin of eye to cheek; third just behind eyes to cheek; fourth from anterior region of nape, bending to posterior rim of eye, and then extending posteroventrally to anterior preopercle; fifth from middle of nape to upper opercle, rather vague at nape. Body with 7 wide, transverse, darkish bars on lateral sides with sparse melanophores: first across upper part of pectoral-fin base; second below base between origin and

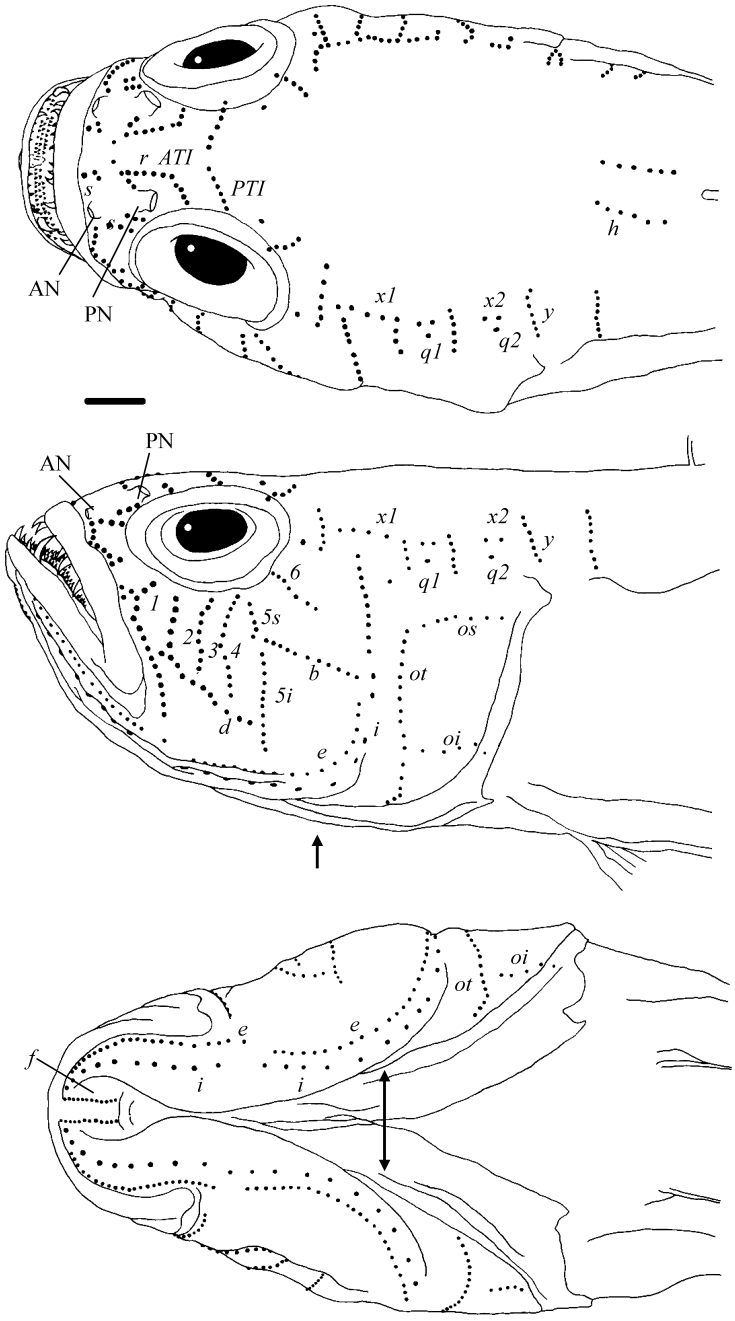

Fig. 3. Dorsal (top), lateral (middle) and ventral (bottom) views of head of *Priolepis winterbottomi*, holotype, BSKU 64659, showing cephalic sensory papillae. Dots represent sensory papillae (rows identified by italic letters and numerals). AN and PN, anterior and posterior nares, respectively. Arrows show position of gill membrane attachment to isthmus. Scale bar indicates 1 mm. Drawn by Y. Nogawa.

Table 1. Proportional measurements of *Priolepis winterbottomi* sp. nov.

	Holotype	Paratypes		
	BSKU 64659	NSMT-P 72655	BSKU 81922	BLIH 1994244
Standard length (mm)	31.9	30.2	31.2	27.1
As % of standard length				
Head length	26.3	26.8	26.3	25.8
Head depth	17.9	17.2	17.9	17.7
Head width	19.4	19.5	19.9	20.3
Snout length	6.0	5.6	5.4	5.5
Eye diameter	8.8	8.9	8.7	9.2
Interorbital width	4.4	4.3	4.5	4.4
Jaw length	12.5	12.6	12.8	12.5
Body depth at first dorsal-fin origin	18.8	17.5	17.3	17.7
Body depth at anal-fin origin	19.1	17.9	17.0	17.3
Body width at first dorsal-fin origin	13.2	14.9	15.7	15.9
Body width at anal-fin origin	11.6	11.3	12.5	12.2
Nape width	16.0	16.9	16.3	17.3
Predorsal length	33.5	34.1	34.0	35.4
Prepelvic length	29.5	29.1	27.9	27.3
Preanal length	59.9	59.6	59.3	58.7
Caudal-peduncle length	24.5	26.2	26.3	25.8
Caudal-peduncle depth	12.2	11.9	11.9	11.8
First dorsal-fin base length	17.9	18.5	19.6	18.8
Second dorsal-fin base length	23.8	22.2	22.4	22.9
Anal-fin base length	18.8	18.9	18.6	18.8
Pectoral-fin length	32.3	32.8	33.0	35.1
Pelvic-fin length	25.4	27.2	26.0	28.4
First dorsal-fin spine length	15.0	13.6	15.4	14.8
Second dorsal-fin spine length	19.1	21.2	damaged	22.9
Last dorsal-fin spine length	12.9	11.3	12.2	15.1
Length of first dorsal-fin soft ray	15.7	15.6	15.7	17.0
Length of longest dorsal-fin soft ray	damaged	20.2	18.6	20.3
Length of anal-fin spine	10.0	9.9	10.6	11.4
Length of first anal-fin soft ray	damaged	12.3	13.1	14.4
Length of longest anal-fin soft ray	21.6	21.2	20.5	22.5
Length of pelvic-fin spine	7.2	8.3	7.4	7.4
Length of first pelvic-fin soft ray	12.2	12.9	12.5	13.3
Length of fourth pelvic-fin soft ray	23.8	26.5	24.0	26.2
Caudal-fin length	30.1	31.1	31.7	31.7
As % of head length				
Head depth	67.9	64.2	68.3	68.6
Head width	73.8	72.8	75.6	78.6
Snout length	22.6	21.0	20.7	21.4
Eye diameter	33.3	33.3	32.9	35.7
Interorbital width	16.7	16.0	17.1	17.1
Jaw length	47.6	46.9	48.8	48.6

fourth spine of first dorsal fin, not reaching to abdomen; third below base between fifth spine and end of first dorsal fin, not reaching to abdomen; fourth below base between midpoint of first spine and first ray, and fifth ray of second dorsal fin; fifth below base between sixth ray and end of second dorsal-fin; sixth below middle of caudal peduncle; seventh below posterior peduncle, not extending to caudal-fin base, last 4 bars become narrow ventrally. Margin of scale pockets on bars dark brown. Fin spines and rays except pectoral and caudal fins translucent. First dorsal-fin red basally, with yellow beginning anterior to fifth spine about a pupil-width distal to fin base, and dark margin posteriorly. Second dorsal-fin red with yellow longitudinal lines and dark margin.

Anal fin red with dark longitudinal bar on middle and margin. Caudal fin red, except yellowish posterodorsal area. Pectoral fin yellowish anterodorsally, rather orangish anteroventrally, transparent posteriorly. Pelvic-fin membrane may be transparent (but unclear due to poor condition).

Color in alcohol. Ground color of head and body dark yellowish to tan. Dark brown to blackish coloration with melanophores in fresh specimens remain as dull grayish-brown. Yellow, orange, and red coloration in fresh disappear.

Distribution. Known only from the type locality, central Tosa Bay, off Kochi Prefecture of Shikoku, Japan.

Etymology. Named after Dr. Richard Winterbottom, who has greatly contributed to the systematics of *Priolepis* species and related group.

Remarks. The new species belongs to "*Priolepis profunda*" grade (sensu Winterbottom and Burridge, 1992) in having well-developed papillae on cheek and predorsal scales. In this group, 8 species are presently included: *P. profunda* (Weber, 1909), *P. anthioides* (Smith, 1959), *P. aithiops* Winterbottom and Burridge, 1992, *P. fallacincta* Winterbottom and Burridge, 1992, *P. randalli* Winterbottom and Burridge, 1992, *P. sticta* Winterbottom and Burridge, 1992, *P. goldshmidtae* Goren and Baranes, 1995, *P*. sp. (Japanese "Kokuten-benkeihaze" in Akihito *et al*., 2002; *P*. RW sp. 8 in Winterbottom and Burridge, 1992). *Priolepis winterbottomi* is clearly different from all other species of this group in body shape (small head and slender body), combination of some counts, and color pattern. For the numbers of transverse interorbital papillae, *P. winterbottomi* (4 ATI, 12 PTI) differs from all the species (0–4, 2–6) except *P. aithiops* (4, >10), *P. sticta* (5, >10) and *P. goldshmidtae* (not in original description) (see Winterbottom and Burridge, 1992: table 1; Goren and Baranes, 1995). Further, it differs from *P. aithiops* in having 18–19 pectoral-fin rays (16–17), all pectoral-fin rays branched (dorsal- and ventral-most rays unbranched), 28–29 lateral line scales (25), 14–15 predorsal scales (18), transverse bars on head and body (absent), and red anal- and caudal-fin (black), from *P. sticta* in having 8 anal-fin soft rays (9), all pectoral-fin rays branched (dorsal- and ventral-most rays unbranched), and dorsal fins without distinct pattern (irregular white bans), and from *P. goldshmidtae* in having 9 dorsal-fin soft rays (10–11), 8 anal-fin soft rays (9), 18–19 pectoral-fin rays (20–21), all pectoral-fin rays branched (ventral-most two rays unbranched), interorbital width 47–52% of eye diameter (18–22%), bars on body transverse (oblique), and collecting depth range of ca. 40–95 m (400 m). Senou *et al*. (2004) reported two undescribed species of *Priolepis*, sp. 1 and sp. 2, based on underwater photographs taken in shallow waters around Iriomote Island, Okinawa Prefecture. The former of these species is close to, or identical with, *P. semidoliata*, the second species resembles *P. triops*. *Priolepis winterbottomi* differs from these two species in general coloration and depth range.

Winterbottom and Burridge (1992: fig. 12) hypothesized that the genera *Egglestonichthys*, *Priolepis*, *Trimma*, *Trimmatom*, and *Paratrimma* formed a monophyletic group among gobiids being supported by having no cephalic sensory pores, wide gill openings, barred color pattern, and presence of denticules on gill-rakers of the first arch. Among them, *Egglestonichthys patriciae* (first offshoot) and paraphyletic *Priolepis* were regarded as basal members of the group. For *Priolepis*, however, Goren and Baranes (1995) mentioned that *P. goldshmidtae* lacked the denticules on gill-rakers. Larson and Hoese (1996) also pointed out that the denticles on gill-rakers occurred homoplastically on some gobiine genera, and that the intrageneric variation was observed among the species of *Egglestonichthys*. In *P. winterbottomi*, the denticules are absent in 3 specimens, but present in BSKU 81922 (a row of 4 denticles on fourth gill-raker of upper limb). Compared with all the characters of the new species, we regard this difference as a variation, rather than individual atavism. Phylogenetic position among gobiines and the validity of the genus need further study.

The new species is an inhabitant of sandy bottom in depths between about 40 and 100 m. The habitat is different from most *Priolepis* species associated with coral reefs, except *P. goldshmidtae*, known from sandy bottom of 400 m deep in the Red Sea, and *P. aithiops* and *P. sticta*, both recorded from shallow muddy habitats. In addition, *Egglestonichthys* also occupies a similar non-reef habitat (e.g., *E. patriciae* known from muddy bottom of 79 m deep), which may well prove to be the ancestral habitat within the clade of Winterbottom and Burridge (1992): i.e., coral reefs are secondary (derived) habitat for the crown group including most *Priolepis* species, *Trimma*, *Trimmatom*, and *Paratrimma*.

Comparative materials. *Priolepis boreus* (3 specimens): BSKU 59605, female, 25.8 mm SL, Kumanoura, Saga Town, Kochi Pref., 24 Aug. 2002; BSKU 67190, male, 22.1 mm SL, Karyogo, Nahari Town, Kochi Pref., 13 Nov. 2003; BSKU 70158, female, 23.2 mm SL, Uranouchi Inlet, Kochi Pref., 20 Apr. 2004; *P. cincta* (5): BSKU 55022, female, 16.5 mm SL, Okinoshima Is., Kochi Pref., 10 July 2001; BSKU 55052, male, 29.9 mm SL, Okinoshima Is., Kochi Pref., 11 July 2001; BSKU 70274, male, 29.0 mm SL, Tosashimizu City, Kochi Pref., 25 Apr. 2004; BSKU 72223 (2), 21.0–34.4 mm SL, Tosashimizu City, Kochi Pref., 27 June 2004; *P. fallacincta* (8): BLIH 19930007, male, 31.0 mm SL, Kashiwajima Is., Otsuki Town , Kochi Pref., 15 Jan. 1993; BLIH 19930166, female, 24.9 mm SL; BLIH 19950039, male, 24.1 mm SL; BLIH 19960038, male, 24.2 mm SL; BLIH 19960209, female, 25.4 mm SL; BLIH 19960225, male, 22.1 mm SL; BLIH 19980085 (4), 13.4–22.5 mm SL; BLIH 20000062, male, 24.9 mm SL, Iriomote Is, Okinawa Pref., 2 July 2000; *P. latifascima* (2): BSKU 7676, male, 17.7 mm SL, Hata District, Kochi Pref., Dec. 1952; BSKU 8786, female, 16.5 mm SL, Kashiwajima Is., Otsuki Town, Kochi Pref., 14–18 Aug. 1959; *P. semidoliata* (1): BSKU 72370, male, 24.0 mm SL, Tosashimizu City, Kochi Pref., 15 Aug. 2004; *P*. sp. ("Kokuten-benkei-haze", 16): BLIH 20040446, female, 45.5 mm SL, off Kamogawa City, Chiba Pref., 9 Dec. 2004; BLIH 19890722, male, 29.1 mm SL, Morode, Misyo Town, Ehime Pref., 26 Sept. 1989; BLIH 19870324, female, 40.6 mm SL, Yokojima, Uchiumi Town, Ehime Pref., 11 Sept. 1987; BLIH 19920506, female, 51.7 mm SL, Uchiura, Numazu City, Shizuoka Pref., 6 June 1992; BLIH 19910404, female, 43.2 mm SL, Kashiwajima Is., Otsuki Town, Kochi Pref., 13 Aug. 1991; BLIH 19950200, female, 44.9 mm SL, Morode, Misyo Town, Ehime Pref., 18 Jan. 1995; BLIH 19920028, male, 55.6 mm SL, Kashiwajima Is., Otsuki Town, Kochi Pref., 10 Aug. 1992; BLIH 19930350, female, 43.1 mm SL, Kashiwajima Is., Otsuki Town, Kochi Pref., 5 Aug. 1993; BLIH 19890241, male, 44.8 mm SL, Futo, Ito City, Shizuoka Pref., 5 March 1989; BLIH 19930010, 21.7 mm SL (sex unknown), 44.1 mm SL (female), 60.7 mm SL (male), Kashiwajima Is., Otsuki Town, Kochi Pref., 2 May 1993; BLIH 19920199, 35.8 mm SL (male), 50.9 mm SL (male), Kashiwajima Is., Otsuki Town, Kochi Pref., 29 Nov. 1992.

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