

Gnatholepis yoshinoi, a New Gobiid Fish from Okinawa, Japan

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Abstract *Gnatholepis yoshinoi* is described as a new species of gobiid fish from three male specimens collected in 1.5 m on silty sand in Oura Bay, Okinawa, Japan. A reference indicates its presence in Mabul, Malaysia in 10 m, so it should be found in its habitat throughout the Indo-Malayan region. It is most similar to the wide-ranging Indo-Pacific *G. anjerensis*, differing in having 15 pectoral rays (strongly modally 16 in *G. anjerensis*), cheek scales reaching to below the anterior edge of the orbit, a more inferior mouth, narrower body, higher first dorsal fin, and in color.

Key words: Gobiidae, *Gnatholepis*, new species, Indo-Malayan region.

Introduction

Twenty-two species of gobiid fishes have been described in the genus *Gnatholepis* Bleeker, 21 in the Indo-Pacific region, and one in the Atlantic. Randall and Greenfield (2001) reviewed the genus and recognized the following seven species: *G. anjerensis* (Bleeker), the type species, wide-ranging in the Indo-Pacific, but showing regional color variation; *G. cauerensis* (Bleeker), also with a broad distribution in the Indo-Pacific; *G. davaoensis* Seale from Taiwan and the East Indies to Vanuatu; *G. gymnocara*, described as new from Queensland and the Northern Territory of Australia; *G. sp.*, a new species from the Northern Territory for which the description was later provided by Larson and Buckle (2005) as *G. argus*; and *G. thompsoni* Jordan, ranging from Bermuda, Florida and the Bahamas south to São Paulo, Brazil and east to Ascension Island, St. Helena, and the Cape Verde Islands. Neotypes were described for *G. anjerensis* and *G. davaoensis*. *Gnatholepis cauerensis* was provisionally divided into four subspecies, *G. cauerensis pascuensis* from Easter Island, *G. cauerensis australis* from the Pitcairn Islands to the Cook Islands, *G. cauerensis hawaiiensis* from the Hawaiian Islands, and *G. cauerensis cauerensis* from

the rest of the Indo-Pacific region. Randall and Greenfield added that they were unable to differentiate the Atlantic *G. thompsoni* from *G. cauerensis cauerensis*, but refrained from synonymizing the former, pending a DNA comparison of the two taxa. They cited two studies (E. B. Brothers, pers. comm.; Sponaugle and Cowen, 1994) that determined the unusually long duration of larval life of *G. thompsoni* for a goby. One recorded a mean of 81.5 days, and the other a mean of 60 days. The longest pelagic sojourn was 112 days. The genetic study of Rocha *et al.* (2005) placed *G. thompsoni* in the synonymy of *G. cauerensis*. They hypothesized that *G. cauerensis* invaded the Atlantic from the Indian Ocean during an interglacial period 145,000 years ago.

Thacker (2004a) published that *G. cauerensis* Bleeker is a synonym of *G. anjerensis* Bleeker and resurrected *G. scaplostigma* Herre to replace *G. cauerensis*. Randall and Greenfield (2007) provided a redescription of the holotype of *G. cauerensis* and demonstrated that it is not a synonym of *G. anjerensis*. They also did not accept the resurrection of *G. knighti* Jordan & Evermann for specimens of *G. anjerensis* from the Hawaiian Islands, Cook Islands, and Society Islands by Thacker (2004b).

The first author obtained three specimens of a species of *Gnatholepis* from silty sand in Oura Bay, Okinawa that have an unusually high first dorsal fin and a distinctive color pattern. Closer examination revealed them to represent a new species.

Materials and Methods

Type specimens of the new species are deposited in the National Museum of Nature and Science, Tokyo (NSMT), and the Osaka Natural History Museum (ONHM).

Lengths of specimens are given as standard length (SL), measured from the median anterior point of the upper lip to the base of the caudal fin (posterior end of the hypural plate); body depth is measured at both the origin of pelvic fins and the origin of the anal fin, and body width at the posterior end of the opercular membrane; head length (HL) is taken from the most anterior point of the snout to the posterior end of the opercular membrane, and head width over the posterior margin of the preopercle; orbit diameter is the greatest fleshy diameter, and interorbital width the least fleshy width; snout length is measured from the median anterior point of the upper lip to the nearest fleshy edge of the orbit; upper-jaw length from the same anterior point to the posterior end of the maxilla; cheek depth perpendicular from the ventral fleshy edge of the orbit to the ventral fleshy edge of the suborbital; caudal-peduncle depth is the least depth, and caudal-peduncle length the horizontal distance between verticals at the rear base of the anal fin and the caudal-fin base; lengths of spines and rays are measured to their extreme bases; caudal- and pectoral-fin lengths are the length of the longest ray; pelvic-fin length is measured from the base of the pelvic spine to the tip of the longest pelvic soft ray. Scales in longitudinal series are counted as oblique rows of large scales from the upper end of the gill opening to the base of caudal fin; transverse scale rows are counted from the origin of the anal fin obliquely dorsoposteriorly to the base of the second dorsal fin, ignoring a small

half scale at each end. Morphometric data presented in Tables 1 are given as percentages of the standard length. Proportional measurements in the text are rounded to the nearest 0.05.

Gnatholepis yoshinoi sp. nov.

[New Japanese name: Hishihire-oomonhaze]

(Figs. 1–3; Table 1)

Gnatholepis anjerensis (non Bleeker) Kuitert and Tono-zuka, 2001: 671, fig. E (Mabul, Malaysia).

Holotype. NSMT-P 91420 (formerly OMNH-P 34760). male, 30.8 mm, Japan, Ryukyu Islands, Okinawa, Oura Bay, 26°32'50.32"N, 128°02'32.95"E, silty sand bottom with a green alga, *Caulerpa racemosa* var. *lamourouxii*, 1.5 m, hand net, K. Abe, 28 Aug. 2008.

Paratypes. OMNH-P 34761, male, 31.3 mm, 19 Aug. 2008, and OMNH-P 34800, male, 24.9 mm, 31 Aug. 2008, both with same locality data as holotype.

Diagnosis. Dorsal-fin rays VI+I, 10 or 11; anal-fin rays I, 11; pectoral-fin rays 15; longitudinal scale series 27; scales on cheek extending nearly to a vertical at anterior edge of orbit; median predorsal scales extending to posterior interorbital space; prepectoral area fully scaled; gill rakers 2+4; body depth at origin of pelvic fins 3.9–4.25 in SL; body very compressed, the width 1.55–1.8 in body depth; head length 3.25–3.3 in SL; first dorsal fin higher than second, the longest spine 1.25–1.5 in HL; caudal fin longer than head, 2.7–2.8 in SL; color in alcohol whitish with five large blackish blotches on side of body, progressively smaller posteriorly; a darker blackish blotch larger than pupil behind upper end of gill opening containing a pale dot; a narrow black bar below orbit, with a blackish blotch centered over it; no narrow black bar dorsally on eye or in interorbital space; dorsal fins brown with pale spots smaller than pupil, a row of blackish blotches at base that extend onto back, and a black spot on outer part of first membrane of spinous dorsal fin, with an adjacent smaller spot on next membrane; color in life brown, shading to yellowish white ventrally, with blackish mark-



Fig. 1. Holotype of *Gnatholepis yoshinoi*, male, NSMT-P 91420, 30.8 mm SL, Okinawa (photograph by Toshiyuki Suzuki).

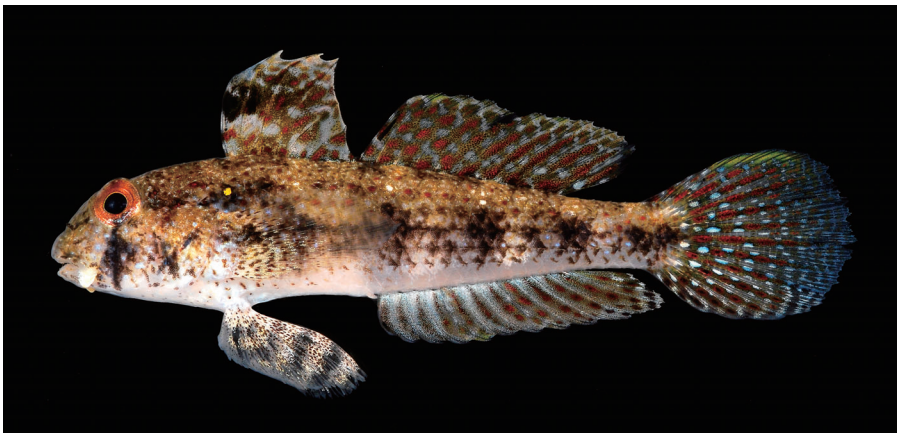


Fig. 2. Paratype of *Gnatholepis yoshinoi*, male, OMNH-P 34761, male, 31.3 mm SL, Okinawa (photograph by Toshiyuki Suzuki).



Fig. 3. Paratype of *Gnatholepis yoshinoi*, male, OMNH-P 34800, male, 24.9 mm SL, Okinawa (photograph by Toshiyuki Suzuki).

Table 1. Proportional measurements of the type specimens of *Gnatholepis yoshinoi* as percentages of the standard length.

| | Holotype | Paratypes | |
|---------------------------------------|-----------------|-----------------|-----------------|
| | NSMT-P 91420 | OMNH-P 34761 | OMNH-P 34800 |
| Standard length (mm) | 30.8 | 31.3 | 24.9 |
| Sex | male | male | male |
| Body depth (at P ₂ origin) | 25.5 | 25.2 | 23.6 |
| Body depth (at A origin) | 22.8 | 22.6 | 21.3 |
| Body width | 15.6 | 16.0 | 13.3 |
| Head length | 30.9 | 30.7 | 30.3 |
| Head width | 18.5 | 18.1 | 17.5 |
| Snout length | 10.6 | 10.6 | 10.8 |
| Orbit diameter | 8.5 | 8.6 | 8.9 |
| Interorbital width | 2.7 | 2.8 | 2.4 |
| Upper-jaw length | 10.6 | 10.4 | 10.4 |
| Caudal-peduncle depth | 9.2 | 9.1 | 10.7 |
| Caudal-peduncle length | 16.3 | 16.6 | 16.1 |
| Predorsal length | 32.5 | 32.0 | 31.9 |
| Preanal length | 52.8 | 54.2 | 52.7 |
| Prepelvic length | 27.7 | 28.0 | 28.8 |
| Base of dorsal fins | 55.3 | 42.0 | 56.5 |
| First dorsal spine | broken | 16.3 | 19.0 |
| Third dorsal spine | 22.1 | 20.5 | 24.0 |
| Spine of second dorsal fin | 16.1 | 15.7 | 16.2 |
| Longest dorsal ray | 24.4 | 23.7 | 22.9 |
| Base of anal fin | 31.6 | 29.5 | 30.3 |
| Anal spine | 9.8 | 9.8 | 10.1 |
| Longest anal ray | 24.8 | 22.9 | 24.1 |
| Caudal-fin length | 37.0 | 35.4 | 36.8 |
| Pectoral-fin length | 27.7 | 27.9 | 27.2 |
| Pelvic-spine length | 8.9 | 9.0 | 8.5 |
| Pelvic-fin length | 29.7 | 29.1 | 30.0 |

ings as in alcohol; blue dots on ventral two-thirds of body; a few white dots dorsally on body and on head; a yellow dot in blackish humeral spot behind upper end of gill opening; iris bright red.

Description. Dorsal-fin rays VI+I,11 (10 or 11); anal rays I,11; all dorsal and anal soft rays branched, the last to base; pectoral-fin rays 15, branched, except uppermost; pelvic-fin rays I,5, joined medially, the frenum well developed; branched caudal rays 13; upper and lower procurrent caudal rays 7, the posterior 2 segmented; scales in longitudinal series on body 27, the last scale overlapping end of hypural plate; transverse scale rows 7; circumpeduncular scales 12; median prepelvic scales about 7 (embedded anteriorly); gill rakers 2+4; pseudobranchial filaments 6.

Body depth at origin of pelvic fins 3.9

(3.95–4.25) in SL; body depth at origin of anal fin 4.4 (4.45–4.7) in SL; body very compressed, the width 1.65 (1.55–1.8) in body depth; head length 3.25 (3.25–3.3) in SL; dorsal profile of head evenly convex; eye extending slightly above dorsal profile of head; orbit diameter 3.65 (3.4–3.6) in HL; snout length 2.9 (2.8–2.9) in HL; interorbital width 11.4 (11.0–12.6) in HL; caudal-peduncle depth 3.35 (2.85–3.35) in HL; caudal-peduncle length 1.9 (1.85–1.9) in HL.

Mouth distinctly inferior, the anterior margin of the lower lip not reaching posterior edge of upper lip when mouth closed; mouth slightly oblique and curved; maxilla reaching a little posterior to a vertical at anterior edge of orbit, the upper-jaw length 3.1 (2.75–3.05) in HL; posterior third of lower lip expanded into a subtriangular ventral flap; front of upper jaw with a row of eight well-spaced, slender, incurved canine teeth; followed by nine slender conical teeth along side of jaw that curve slightly anteriorly; lateral canine at front of upper jaw curving outwardly as well as posteriorly; a row of small, slender, strongly recurved teeth behind anterior canines; front of lower jaw with two well-separated rows of about 10 slender, incurved canines, the lateral two in first row also curving outwardly; outer canines of lower jaw about three-fourths size of comparable upper teeth, the inner row smaller; canine teeth at front of jaws interdigitating when mouth closed; a band of villiform teeth behind anterior canines of lower jaw; two to three rows of much smaller, strongly incurved teeth along side of jaw; tongue slightly bilobed.

Gill opening extending only slightly ventral to lower end of pectoral-fin base (arrows of Fig. 4); gill filaments about one-half orbit diameter; gill rakers short, the longest at angle about one-fifth length of gill filaments; anterior nostril tubular (AN in Fig. 4), at level of lower edge of orbit; posterior nostril (PN in Fig. 4) dorsoposterior, at bony edge of orbit, with a distinct rim. Cephalic sensory pores and papillae typical of the genus (Fig. 4).

Scales ctenoid on body except ventrally on abdomen and on prepectoral and prepelvic areas

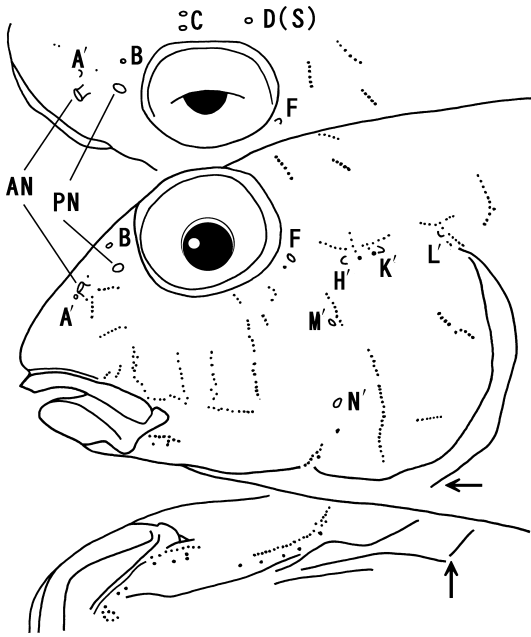


Fig. 4. Head of holotype of *Gnatholepis yoshinoi* showing cephalic sensory pores and papillae. Top: dorsal view; middle: lateral view; bottom: ventral view. Single alphabet letters indicate the sensory canal pores and the terminal pores are denoted by prime marks. (S) means a single pore. AN: anterior nasal pore; PN: posterior nasal pore.

where cycloid (most prepelvic scales embedded); scales on head cycloid; scales on cheek extending forward to a vertical at front edge of orbit, progressively more embedded anteriorly; predorsal scales extending slightly into posterior interorbital space; a single row of small half scales on extreme base of dorsal and anal fins; base of caudal fin with three rows of scales, progressively smaller posteriorly.

Origin of first dorsal fin over upper base of pectoral fins, the predorsal length 3.1 (3.1–3.15) in SL; first dorsal fin higher than second dorsal fin (when fins are normally elevated); dorsal spines slender, flexible, and curving posteriorly in distal part, only the tips emergent (except smallest paratype); third dorsal spine longest (fourth nearly as long), 1.4 (1.25–1.5) in HL; spine of second dorsal fin 1.9 (1.85–1.95) in HL; longest dorsal soft ray 1.25 (1.3) in HL; origin of

anal fin slightly posterior to a vertical at base of first dorsal soft ray, the preanal length 1.9 (1.85–1.9) in SL; anal spine 3.15 (3.0–3.15) in HL; longest anal ray 1.25 (1.25–1.35) in HL; caudal fin rounded, longer than head, 2.7 (2.7–2.8) in SL; middle pectoral rays longest, 3.6 (3.6–3.7) in SL; pelvic fins joined medially, the fifth rays longest, reaching base of second anal soft ray, 3.4 (3.35–3.45) in SL; pelvic frenum strong, curving to tip of flexible pelvic spines.

Color of holotype in alcohol whitish with five large blackish blotches on side of body, progressively smaller posteriorly, the first largely beneath pectoral fin; a darker blackish blotch larger than pupil behind upper end of gill opening, adjacent to first large blotch, and containing a pale dot (yellow in life); a narrow black bar below orbit with a blackish blotch centered over it; no narrow black bar dorsally on eye, and no narrow transverse black band in interorbital space; a blackish blotch behind eye, and another on lower part of operculum, the latter forming a diffuse X-shape; a row of 10 blackish blotches averaging pupil size dorsally on body, the first eight extending slightly into base of dorsal fins, the last two dorsally on caudal peduncle; dorsal fins gray-brown with small transparent spots centered along rays; a jet black spot as large as pupil just above middle of first membrane of spinous dorsal fin, with an adjacent smaller black spot on second membrane; anal fin largely gray-brown; caudal fin gray-brown basally, less pigmented distally, with longitudinal rows of pale spots; pectoral fins translucent with brown flecks along rays, and a square blackish spot basally on fourth to sixth membranes; pelvic fins gray-brown.

Color when fresh as shown in Fig. 1 of the holotype and Figs. 2 and 3 of the paratypes, all males. The holotype differs from the paratypes in having blue dots on lower three-fourths of body.

Etymology. We are pleased to name this new goby for Tetsuo Yoshino of the University of the Ryukyus, in recognition of his extensive taxonomic research on the fishes of Japan.

Remarks. We were surprised to find three specimens of a new species of the gobiid genus

Gnatholepis at the well-collected island of Okinawa. The relatively high first dorsal fin with a conspicuous black spot on the first two membranes was the first indication that the fish might be undescribed. The count of 15 pectoral rays for all three specimens provided additional evidence. As may be seen in the extensive pectoral-ray counts in Table 1 of Randall and Greenfield (2001: 3), all other species and subspecies of the genus have strongly modally 16, 17, or 18 pectoral rays.

We found the same species illustrated as *Gnatholepis anjerensis* in Kuitert and Tono-zuka (2001: 671, fig. E) with a locality of Mabul, Malaysia and a depth of 10 m; therefore the species should be expected at other localities of this habitat throughout the Indo-Malayan region.

Gnatholepis yoshinoi is most similar to *G. anjerensis* (Bleeker), differing in having 15 vs. modally 16 pectoral rays, a more inferior mouth, the cheek scales extending forward to below the anterior edge of the orbit, a more compressed body, higher first dorsal fin, and in color. It has only one longitudinal row of large blackish spots along the side of the body, compared to two for *G. anjerensis*, and it has a conspicuous black spot anteriorly on the first dorsal fin that is lacking in *G. anjerensis*.

The habitat was muddy sand with a green alga, *Caulerpa racemosa* var. *lamourouxii*. Other gobies collected from the same area were *Istigobius ornatus* (Rüppell), *I. campbelli* (Jordan and Snyder), *Macrodontogobius wilburi* Herre, and *Asterropteryx semipunctata* Rüppell.

Acknowledgments

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specimens of the new species of *Gnatholepis*. The manuscript was reviewed by David W. Greenfield and Helen A. Randall.

References

- Kuitert, R. H. and T. Tono-zuka, 2001. Pictorial Guide to Indonesian Reef Fishes, Part 3. Jawfishes–Sunfishes. Opistognathidae–Molidae. pp. 623–893. Zoonetics, Seaford, Victoria.
- Larson, H. K. and D. Buckle, 2005. A new species of the circumtropical goby genus *Gnatholepis* Bleeker (Teleostei: Gobiidae: Gobionellinae) from northern Australia. *The Beagle, Records of the Museums and Art Galleries of the Northern Territory*, **21**: 67–72.
- Masuda, H., K. Amaoka, C. Araga, T. Uyeno and T. Yoshino (eds.), 1984. The Fishes of the Japanese Archipelago. Vol. 1, xxii+437 pp. Tokai University Press, Tokyo.
- Randall, J. E. and D. W. Greenfield, 2001. A preliminary review of the Indo-Pacific gobiid fishes of the genus *Gnatholepis*. *Ichthyological Bulletin of the J.L.B. Smith Institute of Ichthyology*, **69**: 1–17.
- Randall, J. E. and D. W. Greenfield, 2007. Redescription of *Gnatholepis cauerensis* (Bleeker, 1853), with discussion of the validity of the species. *Zoologische Mededelingen* (Leiden), **81**: 303–308.
- Rocha, L. A., D. R. Robertson, C. R. Rocha, J. L. van Tassell, M. T. Craig and B. W. Bowen, 2005. Recent invasion of the tropical Atlantic by an Indo-Pacific coral reef fish. *Molecular Ecology*, **14**: 3921–3928.
- Sponaugle, S. and R. K. Cowen, 1994. Larval durations and recruitment patterns in two Caribbean gobies (Gobiidae): contrasting early life histories in demersal spawners. *Marine Biology*, **120**: 133–143.
- Thacker, C. E., 2004a. Phylogeny and species boundaries in the gobiid genus *Gnatholepis* (Teleostei: Perciformes). *Zoological Journal of the Linnean Society*, **142**: 573–582.
- Thacker, C. E., 2004b. Population structure in two species of the reef goby genus *Gnatholepis* (Teleostei: Perciformes) among four South Pacific island groups. *Coral Reefs*, **23**: 357–366.