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**A PRELIMINARY REVIEW OF THE INDO-PACIFIC GOBIID FISHES OF
THE GENUS *GNATHOLEPIS***

by

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ABSTRACT

Randall, John E. and David W. Greenfield. 2000. A preliminary review of the Indo-Pacific gobiid fishes of the genus *Gnatholepis*. *Ichthyological Bulletin of the J.L.B. Smith Institute of Ichthyology*, No. 69. 17 pages.

The gobiid fish genus *Gnatholepis* Bleeker is characterised as follows: dorsal-fin rays VI+I, 10–12, the spines slender, none filamentous; anal-fin rays I, 11–12; pectoral-fin rays 14–19, none free of membrane; pelvic disc with a frenum; scales on body largely ctenoid, 28–31 in longitudinal series; gill-rakers short, 1 + 3–4; anterior interorbital pores 2; sensory papillae on cheek primarily in a pattern of 4 or 5 vertical rows; body moderately elongate, the depth 3.8–5.4 in SL; head and body compressed; dorsal profile of head initially near-vertical, often with a slight anterior protuberance above upper lip; lower lip with a ventral flap on side of jaw; mouth inferior, the gape slightly oblique; teeth anteriorly in jaws in several rows, the outer row in upper jaw as slender well spaced canines (outer row of teeth at front of lower jaw may or may not be caniniform); tongue bilobed; gill opening ending slightly below level of lower edge of pectoral-fin base; caudal fin rounded, usually longer than head; a dark line extending ventrally from eye, sometimes with one or more side branches. Of the 21 nominal Indo-Pacific species that have been described in *Gnatholepis*, only 5 are recognised as valid. *G. anjerensis* (Bleeker), for which a neotype is described, occurs from East Africa and the Red Sea to the Hawaiian Islands and French Polynesia [synonyms include *G. deltoides* (Seale), *G. knighti* Jordan and Evermann, and *G. corlettei* (Herre)]. *G. cauerensis* (Bleeker) is provisionally divided into 4 subspecies, mainly by modal differences in pectoral-ray counts and slight colour variation: *G. cauerensis cauerensis* from East Africa to the Society Islands (*G. scapulostigma* Herre and *G. inconsequens* Whitley are synonyms); *G. c. australis* from Rarotonga, Cook Islands to the Pitcairn Islands; *G. c. hawaiiensis* from the Hawaiian Islands; and *G. c. pascuensis* from Easter Island. *G. davaoensis* Seale, also provided with a neotype and description, ranges from the Ryukyu Islands to the Solomon Islands, Papua New Guinea, and Indonesia (*G. gemmus* Herre is a synonym). *G. gymnocara*, n. sp., is described from 26 specimens from shallow water of Queensland and the Northern Territory, Australia; it is unique in having 12 anal-fin soft-rays, prepectoral scales, no scales on cheek and opercle, median predorsal zone naked or with only a few small scales across its anterior part, and a large black spot on fourth interspinous membrane of dorsal fin in males. *Gnatholepis* sp., also a new species from northern Australia, will be described by Helen K. Larson; it is distinct in having 10 dorsal soft-rays, 15–17 pectoral-fin rays, no scales on cheek, opercle, median predorsal zone, or prepectoral area; and the last 2 to 4 mid-lateral blotches of the male dark brown to black. The count of pectoral-fin rays is the most useful meristic character to separate the species and subspecies of *Gnatholepis*: *G. anjerensis*, with 14–17 rays, has a strongly modal count of 16; *G. cauerensis cauerensis* and *G. c. hawaiiensis* have 16–19 rays (strongly modal 17); *G. c. australis* has 17–19 rays (modally 18); *G. c. pascuensis* has 18 or 19 rays, modally 19; *G. davaoensis* has 15–17 rays, modally 17.

A PRELIMINARY REVIEW OF THE INDO-PACIFIC GOBIID FISHES OF THE GENUS *GNATHOLEPIS*

by

John E. Randall¹ and David W. Greenfield²

INTRODUCTION

During our study of gobiid fishes from the Hawaiian Islands, the authors discovered that there are two species of the genus *Gnatholepis* Bleeker in Hawaii, not one as previously recorded. In order to determine the correct names for these two gobies, a review of the species was undertaken.

Herre (1953) wrote a key to 14 species that he classified in *Gnatholepis*. Of these, the following species clearly do not belong in the genus as defined in the diagnosis above: *Gobius baliurus* Valenciennes; *Gnatholepis calliurus* Jordan and Seale, a synonym of *baliurus*, genus undetermined (Helen K. Larson, pers. comm.); *Gobius puntangoides* Bleeker [a synonym of *Exyrias puntang* (Bleeker) (Murdy, 1985)]; *Gnatholepis koumansii* Herre, a species of *Aulopareia* (Larson, pers. comm.); *Gnatholepis hendersoni* Herre, a synonym of *Macrodonogobius wilburi* Herre (Murdy, 1985); *Gnatholepis mingi* Herre, a species of *Hemigobius* (Larson, in press); *Gnatholepis turneri* Roxas and Ablan, no types extant, possibly a species of *Acentrogobius* or *Exyrias* (Peter J. Miller, pers. comm.); and *Gnatholepis volcanus* Herre, a large freshwater species, possibly of the genus *Istigobius* or *Aulopareia* (Larson, pers. comm.).

Gobius canalae Sauvage and *Gobius maculipinnis* Macleay, both placed in *Gnatholepis* by Jordan and Seale (1906), are also not species of this genus. Herre (1953) overlooked *Gobius ophthalmotaenia* Bleeker and *Gobius capistratus* Peters, here regarded as junior synonyms of *Gnatholepis anjerensis*. Also overlooked were *Gnatholepis sindonis* Snyder (1908), a synonym of *Exyrias puntang* (Bleeker) (Murdy, 1985) and *Gnatholepis hololepis* Schultz (1943), a synonym of *Macrodonogobius wilburi* Herre (Murdy, 1985). De Vis (1885) briefly described *Gobius pauper* from a specimen (no length given) from Moreton Bay, Queensland. Judging from the count of 11 dorsal and anal soft rays, 30 lateral-line scales, and a black bar from the orbit to behind the angle of the mouth, it appears to have been a species of *Gnatholepis*. Unfortunately, there is no record of the holotype at the Queensland Museum (Jeff Johnson, pers. comm.).

As noted by Hoese (1986: 790) and others, the genus *Gnatholepis* is in need of revision. Hoese (1986) identified two species from southern Africa as *Gnatholepis* sp. 1 and *Gnatholepis* sp. 2. Two colour illustrations are given for sp. 1 on Plate 123 and one of sp. 2. The two paintings identified as sp. 1 appear to represent different

species. During a recent visit to study gobiid fishes at the J.L.B. Smith Institute of Ichthyology, Helen K. Larson was able to find the specimen that was illustrated as Figure 240.24 (A) on Plate 123. She reported that it is *G. anjerensis* and remarked that the figure is very inaccurate.

It must be stated that the reason *Gnatholepis* has not been revised is not from a lack of material. The Bernice P. Bishop Museum in Honolulu (BPBM) has 172 lots of *Gnatholepis*, most of which were identified only to genus. We have noticed the same preponderance of unidentified or misidentified specimens at other museums. The species of the genus are frustratingly similar in morphology and colour, the sensory papillae on the cheek fail to show specific differences, and there can be considerable individual variation in colour within a species.

The objectives of the present paper are to clarify the definition of the genus *Gnatholepis*, to describe neotypes for *Gnatholepis anjerensis* (Bleeker) [the type-species], and *G. davaoensis* Seale, to provide a key and diagnoses for the Indo-Pacific species and subspecies of which we have specimens, and to describe a new species from Australia. A second, small, new species from northern Australia will be described by Helen K. Larson. A diagnosis and colour figure of this species are presented here. A definitive study of the genus *Gnatholepis* may require the use of molecular techniques.

We have provisionally divided *Gnatholepis cauerensis* (Bleeker) into four subspecies based on differences in colour pattern and a shift in modal pectoral-ray counts, designating only a holotype for each.

Gnatholepis thompsoni Jordan, 1904 is the only species of the genus known from the Atlantic; it is recorded from the tropical western Atlantic (Bermuda, Florida, Bahamas, Central and South America to São Paulo, Brazil), Ascension Island, and St. Helena (Edwards, 1990; Smith-Vaniz et al., 1999). Its occurrence in the eastern Atlantic is evident from an underwater colour photograph taken in the Cape Verde Islands (Debelius, 1997: 244, middle fig.), misidentified as *Bathygobius soporator*. Edward B. Brothers (pers. comm.) provided us with unpublished data on the long larval life of *G. thompsoni* from otolith microstructure of newly recruiting postlarvae in Belize. He reported a range of larval duration of 59-122 days, with a mean of 81.5 days. Sponaugle and Cowen (1994) also determined the length of larval life of this species. They recorded the mean as 60 days, and the longest larval sojourn as 112 days; however, their estimates may be low because their fish were collected during the spring recruitment peak. These data represent the longest larval life presently known for any marine goby.

Although we are unable to differentiate *Gnatholepis thompsoni* from *G. cauerensis cauerensis* morphologically or by colour, we refrain from synonymizing them, pending a DNA comparison of these two taxa.

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MATERIALS AND METHODS

In addition to Bishop Museum material, we examined specimens from the following institutions: Australian Museum, Sydney (AMS); California Academy of Sciences, San Francisco (CAS); Field Museum of Natural History, Chicago (FMNH); Museum and Art Gallery of the Northern Territory, Darwin (NTM); Queensland Museum, Brisbane (QM), and the National Museum of Natural History, Washington, D.C. (USNM).

Lengths for specimens are standard length (SL), the horizontal distance from front of upper lip (or over-hanging snout if more anterior) to base of caudal fin (end of hypural plate); body depth is greatest body depth (often at origin of pelvic fins), and body width is measured at the pectoral-fin bases; head length is from anteriormost point of head in the median plane to posteriormost edge of opercular membrane; snout length is from the same anterior point of head to edge of orbit; head width is taken at posterior edge of preopercles (if opercula are abducted, they are compressed to the normal position); orbit diameter is the greatest fleshy diameter, and interorbital width the least fleshy width; caudal-peduncle depth is the least depth, and caudal-peduncle length the horizontal distance between verticals at base of last anal-fin ray and base of caudal fin; measurements of dorsal-fin spines are made from base to tip when membranes are intact (dorsal spines are curved; when free of membrane they straighten and become longer); longest dorsal and anal soft rays are usually the penultimate rays, at least in adults (rays longer in mature males, thus adding to the variation of this measurement); pectoral-fin length is length of longest ray; pelvic-fin length is from spine base to tip of longest ray.

Longitudinal series of scales were counted from the upper end of the gill opening to the base of the caudal fin; because of crowding of scales just behind the gill opening, the count can vary depending on whether all of the small scales are counted (they were in the present study). Vertical series of sensory papillae just behind the upper end of the gill opening add to the difficulty in counting scales at this location. Transverse scales were counted from the anal-fin origin in an oblique line to the soft dorsal-fin base. Because of irregularity in scalation mid-dorsally on the nape, predorsal scale counts are unreliable.

Gnatholepis Bleeker

Gnatholepis Bleeker, 1874: 318 (proposed as a subgenus of *Stenogobius*; type-species, *Gobius anjerensis* Bleeker, 1851 by original designation; also monotypic).

DIAGNOSIS: Dorsal-fin rays VI+I, 10-12; anal-fin rays I, 11-12; pectoral-fin rays 14-19, the upper and lower rays unbranched; pelvic-fin rays I, 5, joined to form a disk, the frenum well developed (well preserved specimens usually have a delicate fringe on posterior margin); longitudinal scale series 28-31; scales on body mostly ctenoid; gill-rakers short, 1 + 3-4; body moderately elongate, the depth 3.75-5.45 in SL; head and body compressed; dorsal profile of head strongly convex, the part above mouth initially vertical or nearly so, sometimes protruding slightly anterior to mouth; eyes extending slightly above dorsal profile of

head; mouth slightly inferior, the gape slightly oblique; teeth anteriorly in jaws in several rows, the teeth of outer row of upper jaw enlarged as slender well-spaced canines; outer teeth in lower jaw enlarged or not, depending on species; tongue bilobed; lips fleshy, the lower lip with a ventral flap along side of lower jaw; gill opening ending slightly below level of ventral edge of pectoral-fin base (to below rear third of opercle); sensory pores of head type B, as illustrated in Hoese, 1986: 775 (hence 2 anterior interorbital pores); sensory papillae in 4 or 5 vertical rows (rows 1 and 2 and 3 and 4 joined or partly joined ventrally by a horizontal row of papillae; illustrated by Masuda et al., 1984: fig. 84 and by Winterbottom and Emery, 1986: fig. 54); caudal fin rounded, slightly shorter to slightly longer than head (usually longer); branchiostegal rays 5; vertebrae 26; dorsal pterygiophore formula 3-12210 (Birdsong et al., 1988); anal pterygiophores anterior to first haemal spine usually 2; epurals 2; dark line or narrow dark bar, sometimes with lateral branches, below centre of eye.

REMARKS: Fundamental to the classification of the genus is the identity of the type-species, *Gobius anjerensis*. Pieter Bleeker acquired some drawings of fishes in Batavia (now Jakarta) that had been prepared for the naturalists Heinrich Kuhl and Jan Coenraad van Hasselt, who collected fishes in Java in 1821-1823 (Boeseman, 1997). Bleeker (1851) described some gobiid and blennioid fishes from these drawings. *Gobius anjerensis* was described on page 251, and the drawing (Bleeker's Figure 11) is reproduced here as Figure 1. The general morphology of the fish conforms to that of species now classified in the genus *Gnatholepis*. There are 12 soft rays in the dorsal and anal fins on the drawing, but the last ray is not divided to the base in either fin; therefore each posterior divided ray may have been drawn as two separate rays. It is not possible to count the pectoral rays with accuracy, and the longitudinal scale count is 3 or 4 scales short of the usual count of 28-30 for the species of *Gnatholepis*. There are no colour markings on the drawing. Were it not for *anjerensis* being the type species of the genus, it would be regarded as a *nomen dubium*, unidentifiable with any species we know today. Günther (1861: 6) listed *Gobius anjerensis* among the "Species of which the affinity is not determinable."

In order to relate the name *anjerensis* to a recognized species of the genus, it is necessary to describe a neotype. This should be a specimen of a species known to occur in the vicinity of the type locality. Bleeker named *Gobius anjerensis* from Anjer. M. Boeseman, formerly curator of

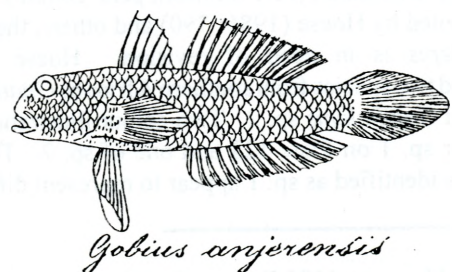


Figure 1. Illustration on which the original description of *Gobius anjerensis* Bleeker, 1851 was based.

fishes at the Nationaal Natuurhistorische Museum in Leiden informed us that Anjer is probably a town now known as Anyer on the northwest corner of Java, hence not far from Jakarta. It seems likely that Kuhl and van Hasselt would have collected a small goby like this near shore. The fish that we here identify as *Gnatholepis anjerensis* is one of the two most common species of the genus found in the East Indian area and the one most often taken in shallow water such as tide pools or along a mangrove shore. It is also the species that most authors have identified as *Gnatholepis anjerensis*. We have no specimens of any *Gnatholepis* from Java, but we do have one from a small island in the Java Sea off Unjung Pandang, Sulawesi (formerly Makassar, Celebes). It is described below as the neotype of *Gnatholepis anjerensis*.

KEY TO INDO-PACIFIC SPECIES AND SUBSPECIES OF *GNATHOLEPIS*

- 1a. Scales present on cheek and opercle; mid-dorsal region of nape scaled to posterior interorbital space; outer teeth at front of lower jaw enlarged as canines, the most lateral strongly recurved 2
- 1b. No scales on cheek or opercle; mid-dorsal region of nape naked or with a few embedded scales just posterior to interorbital space; outer teeth at front of lower jaw not enlarged 7
- 2a. Pectoral-fin rays 14-17 (modally 16 [73%]; only 12% with 17; see Table 1); no black band across interorbital space (short narrow black bar on upper part of eye above or slightly before rear edge of pupil); body depth 3.9-4.6 in SL 3
- 2b. Pectoral rays modally 17-19; narrow black band usually present across interorbital space above centre of pupil; body depth 4.3-5.2 in SL 4
- 3a. Anal fin without prominent black spots; a large dark brown to black blotch containing a small yellow spot above base of pectoral fin; prepelvic scales extending to a vertical at about rear edge of preopercle (Indo-Pacific) *G. anjerensis*
- 3b. Anal fin with 2 or 3 irregular rows of black spots edged with red; no dark brown blotch containing yellow spot above pectoral base; prepelvic scales extend to or nearly to a vertical at rear edge of orbit (within prepelvic scale diameter of a line joining ventral ends of dark eye bar of each side) (Ryukyu Ids to Indonesia and Vanuatu) *G. davaoensis*
- 4a. Pectoral-fin rays modally 17 (East Africa to Society and Marshall Ids) *G. cauerensis cauerensis*
- 4b. Pectoral-fin rays modally 18 or 19 5
- 5a. Caudal-peduncle length 1.7-1.9 times in head length; 2 series of 5 horizontally-elongate, black blotches on body and a black spot at caudal-fin base, the blotches linked with a faint longitudinal yellow line (Easter Id) *G. cauerensis pascuensis*
- 5b. Peduncle length 1.5-1.7 in head; colour not as in 5a (dark blotches, if present, dusky and 6 in series) . . . 6

- 6a. Body with mid-lateral row of large dusky blotches, a darker blotch in humeral region containing a small yellow spot, and longitudinal red to dark brown lines following scale rows (lines may be partially broken); caudal fin with longitudinal dark red to dark brown line on each membrane (Hawaiian Ids) *G. cauerensis hawaiiensis*
- 6b. Body dorsally with longitudinal orange to yellow lines following scale rows; no dark markings on caudal fin (Rarotonga, Austral Ids, Rapa, and Pitcairn Ids). *G. cauerensis australis*
- 7a. Anal-fin soft rays 12; dorsal-fin soft rays 11 (rarely 10); prepectoral scales present (thin and embedded); male with last 3 or 4 mid-lateral blotches on body not darker than more anterior blotches, oval black spot nearly as large as eye on 4th interspinous membrane of first dorsal fin, and anal fin blackish, without small black spots (Queensland and Northern Territory, Australia) *G. gymnocara*
- 7b. Anal-fin soft rays 11; dorsal-fin soft rays 10 (rarely 11); no prepectoral scales; male with last 2 to 4 mid-lateral blotches dark brown to black, no large black spot on first dorsal fin, and anal fin dark brown, with curving rows of pale blue or white spots and short black lines (northern Australia) *Gnatholepis* sp.

Table 1. Pectoral-fin ray counts for Indo-Pacific species and subspecies of *Gnatholepis*; rays counted on both fins of all species except for *G. anjerensis*.

| Pectoral rays | 14 | 15 | 16 | 17 | 18 | 19 |
|-------------------------------|----|----|-----|----|----|----|
| <i>anjerensis</i> | 2 | 47 | 239 | 39 | | |
| <i>cauerensis cauerensis</i> | | | 5 | 62 | 16 | 1 |
| <i>cauerensis hawaiiensis</i> | | | 1 | 44 | 3 | |
| <i>cauerensis australis</i> | | | | 1 | 38 | 16 |
| <i>cauerensis pascuensis</i> | | | | | 5 | 7 |
| <i>davaoensis</i> | | 5 | 60 | 7 | | |
| <i>gymnocara</i> | | 2 | 22 | 52 | 10 | |
| <i>Gnatholepis</i> sp | | 3 | 65 | 53 | 1 | |

Gnatholepis anjerensis

Figs 1, 2; Plate I A-F

- Gobius anjerensis* Bleeker, 1851: 251, fig. 11 (Anjer, Java).
Gobius ophthalmotaenia Bleeker, 1854: 46 (New Selma, Cocos-Keeling Ids).
Gobius capistratus Peters, 1855: 251 (Ibo, Mozambique).
Gobius deltoides Seale, 1901: 125 (Guam).
Gnatholepis knighti Jordan and Evermann, 1903: 204 (Hilo, Hawaii); 1905: 487, pl. 58.
Gnatholepis corlettei Herre, 1935: 418 (Bushman Bay, Malekula Id, Vanuatu); Herre, 1936: 356, fig. 20.

NEOTYPE: BPBM 26651, female, 31 mm, Indonesia, Sulawesi, Boenakeng Id (off Ujung Pandang), bay on southwest side, mangrove shore, 0.5 m, ichthyocide, J. Randall, G. Tribble, & R. Rutherford, 28 August 1978.

DIAGNOSIS: Dorsal fin VI+I,11; anal fin I,11; pectoral-fin rays 14-17 (73% 16, 12% 17; see Table 1); longitudinal

scale series usually 30; usually a few small scales on cheek anterior to dark bar below eye; prepelvic scales extending to vertical at rear margin of preopercle; gill-rakers 1+4 (4th rudimentary); outer teeth anteriorly in jaws enlarged as canines, the most lateral strongly recurved; posterior teeth in outer row of upper jaw curved anteriorly; body depth 3.9-4.6 in SL; head length 3.45-3.6 in SL; caudal fin usually slightly longer than head, 2.8-3.6 in SL. Largest specimen, 84 mm SL (see Remarks).

Colour in alcohol: a series of 6 vertically-elongate dusky blotches along lower side of body, with a horizontal series of dark brown dots or short dark brown lines on each dusky blotch forming a row from beneath upper part of pectoral fin to mid-base of caudal fin; a series of less distinct dusky blotches dorsally on body, not in alignment with lower blotches, and numerous small dark brown dots which tend to form groups in the dusky blotches; a large dark brown blotch containing a small bright yellow spot above base of pectoral fin; a narrow, vertical, dark brown to black bar on cheek below centre of eye (sometimes with 1 or 2 short oblique side branches); a narrow black bar usually present in line with or just anterior to rear edge of pupil; an oblique dark mark on opercle; a dusky stripe on pectoral-fin base at level of sixth to seventh rays and extending onto proximal part of fin; numerous small brown spots on dorsal and caudal fins; large adults with a long brown streak on each inter-radial membrane of second dorsal fin and numerous dark dots on pectoral fins.

DESCRIPTION OF NEOTYPE: Dorsal fin VI+I,11; anal fin I,11; pectoral rays 16, the upper- and lowermost rays unbranched; pelvic fins 1,5, joined to form a disk, the frenum well developed; branched caudal-fin rays 13, upper and lower segmented unbranched rays 2, upper and lower procurent rays 6, the posteriormost rays segmented; longitudinal scale series 30; transverse scale series 9½; circum-peduncular scales 12; predorsal scales extending to rear of interorbital space; prepelvic scales extending to a vertical at rear edge of preopercle; pseudobranch filaments 6.

Body depth 4.15 in SL; body width 1.45 in body depth; head length 3.1 in SL; snout length 2.65 in head length; orbit diameter 3.35 in head; interorbital width 13.5 in head; caudal-peduncle depth 2.85 in head, peduncle length 2.0 in head; predorsal length 2.75 in SL; preanal length 1.8 in SL; prepelvic length 3.2 in SL.

Mouth slightly inferior, the gape slightly oblique; maxilla extending to below anterior edge of orbit, the upper-jaw length 2.85 in head; front of upper jaw with an outer row of 6 incurved slender canines, the front of the lower jaw with 8 canines, the most lateral strongly curved

posterolaterally. Tongue bilobed. Nostrils at level of lower edge of pupil, the rear nostril about a nostril diameter from edge of orbit, the front nostril a short membranous tube slightly more than a nostril diameter from rear nostril. Sensory pores and papillae typical of genus. Gill opening ending just below level of ventral edge of pectoral-fin base.

Scales of body ctenoid except mid-laterally on abdomen, pectoral-fin base, and prepelvic region where cycloid; ctenoid scales extending on side of nape to above middle of opercle; scales on opercle and cheek cycloid except for 2 ctenoid scales posteriorly on opercle; small cycloid scales on cheek extending slightly anterior to narrow dark bar below eye; no scales on fins except basally on caudal and pectorals.

Second to fourth dorsal-fin spines longest, 5.8 in SL; second dorsal soft ray longest, 5.65 in head; penultimate anal ray longest, 5.65 in head; caudal fin rounded, slightly shorter than head, 3.25 in SL; middle pectoral rays longest, 3.5 in SL; pelvic fins reaching origin of anal fin, 3.8 in SL.

Colour in alcohol: body pale yellowish brown with 6 brown blotches on lower side joined dorsally by a faint broad dusky stripe (first brown blotch beneath pectoral fin, about size of eye); dorsal half of body with 6 larger but fainter dusky blotches, progressively smaller posteriorly, the blotches overlaid by short brown dashes, generally one per scale; a few small brown spots in pale interspaces dorsally on body; a dusky blotch above base of pectoral fin merging with first dusky blotch on dorsal half of body; a near-vertical narrow brown bar from below centre of eye to fleshy lower edge of preopercle, the bar with 2 diffuse side branches; a short brown bar on upper part of eye slightly anterior to rear edge of pupil, this bar not crossing interorbital space; a short brown bar on side of upper lip; some diffuse dark pigment following sensory canal posterior to eye; an irregular brown marking on opercle; some small dusky blotches on side of snout; a near-horizontal brown streak on base of pectoral fin, extending proximally onto fin; soft dorsal fin with small brown spots forming rows on rays and adjacent membranes, the last 5 membranes with a brown streak paralleling rays; anal fin dusky; caudal fin with small brown spots forming irregular bars; pectoral fins with faint small dusky spots and numerous dark dots; pelvic-fin membranes dusky.

REMARKS: Although not given in the key, the usual presence of small scales completely anterior to the dark eye bar on the cheek of *Gnatholepis anjerensis* and their usual absence from specimens of *G. cauerensis* is a useful additional character. Also, specimens of *G. cauerensis*

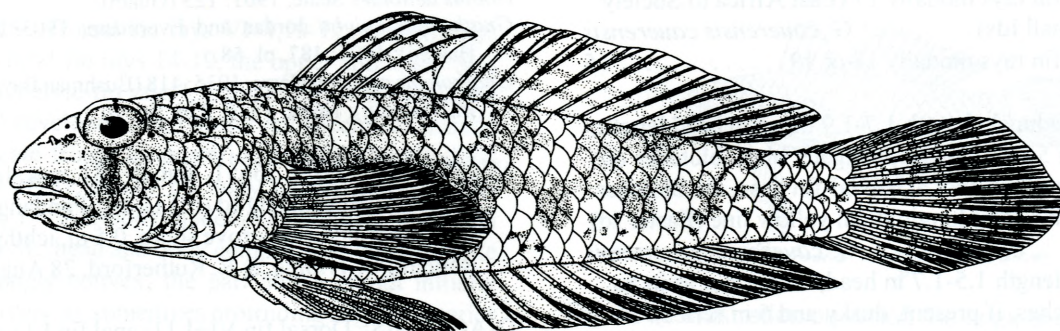


Figure 2. *Gnatholepis anjerensis*, female, neotype, BPBM 26651, 31.0 mm SL, Boenakeng Id, Sulawesi.

tend to have solid lines following the longitudinal scale rows of the body; specimens of *G. anjerensis* usually lack such lines or have them as broken lines or rows of small dark spots (specimens from the southern Great Barrier Reef, Lord Howe Island, and New Caledonia are exceptional in having well developed longitudinal lines on the body). In addition, it is clear that *G. anjerensis* attains a larger size than *G. cauerensis*. Our largest specimen of *G. cauerensis cauerensis* measures 40 mm SL, whereas *G. anjerensis*, can reach 84 mm SL. A specimen of this unusual length was found by Helen K. Larson in the collection of the J.L.B. Smith Institute of Ichthyology (RUSI 2576) that was collected at Thompson's Bay, Natal. The next largest is AMS I.35852-003, 65 mm SL, from One Tree Island, southern Great Barrier Reef, and the third largest, BPBM 19665, 64 mm SL, from Oahu, Hawaiian Islands. This last lot consists of 8 fish, 3 of which are males 57-64 mm SL, and 5 are females 58-61.5 mm SL.

Gnatholepis anjerensis ranges from the Red Sea and South Africa to Australia, Hawaiian and Society Islands. Specimens from the Ogasawara Islands were reported as *Gnatholepis scapulostigma* by Randall et al. (1997). Winterbottom and Emery (1986: 36, fig. 53) recorded the species from the Chagos Archipelago as *G. cauerensis*. Randall and Goren (1993) noted that the Guam syntypes of *Gobius deltooides* Seale are *Gnatholepis anjerensis*. Two paratypes of *G. corletti* from Vanuatu are also *anjerensis*.

Gnatholepis anjerensis may exhibit considerable variation in life colour from different localities (Pl. I A-F), and even within the same locality. No meristic or morphological differences could be found to correlate with the different colour patterns. The most differently coloured specimens (Plate I E) are two fish (BPBM 34326: 54-56 mm) from a mangrove area in 0-0.3 m in New Caledonia (21°57.4' S, 165°58.9' E). Initially these 2 fish were suspected of being an undescribed species, not only from their drab colour, but also by having numerous ctenoid scales on the cheek and the opercle; however, other large specimens of typical *G. anjerensis* were found with ctenoid scales on the opercle and cheek, though not as extensively as one of the New Caledonia fish.

Of 62 Bishop Museum lots of *G. anjerensis* for which there is information on depth of capture, 36 were collected in less than 2 m, many from tidepools, and a few from mangrove areas. The other 26 lots were obtained at depths of 3-25 m, except one from the Red Sea from 46 m. Typically this species (and probably others of the genus as well) lives on sand near coral reefs or rocky substrata in which it hides with the approach of danger.

MATERIAL EXAMINED: RED SEA: Gulf of Aqaba, BPBM 13401, 35 mm; BPBM 13423, 2: 33-38 mm; BPBM 17882, 37 mm; BPBM 18231, 11: 26-38 mm; BPBM 19840, 10: 36-46 mm; BPBM 19886, 2: 18-29 mm; BPBM 31837, 2: 22-46 mm; BPBM 37813, 41 mm. Sinai Peninsula, Ras Muhammad, BPBM 18334, 4: 26-46 mm; BPBM 18353, 25 mm. Sudan, Port Sudan, BPBM 19760, 34 mm; Towartit Reef, BPBM 27442, 4: 19-28 mm; Suakin, BPBM 19750, 4: 21-44 mm. OMAN: south coast, BPBM 34406, 35 mm; BPBM 35973, 18 mm; BPBM 36032, 11: 13-57 mm. Musandam, BPBM 34482, 21 mm. PERSIAN GULF: Saudi Arabia, Jana Id, BPBM 30457, 3: 34-35 mm; BPBM 30481, 37 mm; BPBM 33315, 9: 21-38 mm; BPBM 33350, 2: 30-36 mm; BPBM 33373, 44 mm; BPBM 33374, 2: 32-39 mm; Jurayd Id, BPBM 33270, 6: 16-24 mm. KENYA:

Lamu, BPBM 28033, 5: 18-37 mm. Mombasa, BPBM 27230, 41 mm. Shimoni, BPBM 27262, 36 mm. TANZANIA: Mafia Id, BPBM 16385, 8: 30-49 mm. FARQUAHAR GROUP: USNM 308213, 46: 17-59 mm. MADAGASCAR: Nosy Bé, AMS I.28108-038, 4: 19-44 mm. Tuléar, USNM 260667, 19: 27.5-51 mm. MAURITIUS: BPBM 16302, 2: 22-23 mm; BPBM 20081, 4: 31-47 mm; BPBM 20185, 47 mm; BPBM 21827, 6: 13-48 mm. SEYCHELLES: Mahé, BPBM 35525, 33 mm. Amirante Ids, St. Joseph Id, USNM 308211, 2: 42.5-44 mm. MALDIVES: North Malé Atoll, BPBM 34404, 3: 33-35 mm. Addu Atoll, FMNH 78909, 2: 29-31 mm. Fadiffolu Atoll, FMNH 78972, 11: 23-40 mm. WESTERN AUSTRALIA: Ashmore Id, CAS 57292, 5: 23-32 mm. Rowley Shoals, BPBM 32034, 2: 34-37 mm. INDONESIA: Sulawesi, off Ujung Pandang, BPBM 26651, 31 mm (neotype of *Gnatholepis anjerensis*). Molucca Ids, Saparua Id, USNM 211025, 19: 18-35 mm. Alor, BPBM 37362, 25 mm. PAPUA NEW GUINEA: Madang, BPBM 15792, 28 mm; BPBM 32522, 32 mm; BPBM 32547, 18 mm. PHILIPPINES: Negros, CAS 51515, 15: 33-42 mm. Batanes, USNM 298581, 12: 31-47.5 mm. VIET NAM: Nhatrang, CAS 58304, 2: 17-31 mm. TAIWAN: BPBM 38373, 2: 28-33 mm. JAPAN: Ryukyu Ids, Ishigaki, BPBM 15021, 2: 41-43 mm. Ogasawara Ids: Chichijima, BPBM 35113, 34 mm. QUEENSLAND: Moreton Bay, AMS I.24711-002, 2: 23.5-31 mm. Great Barrier Reef, northern end, AMS I.33711-064, 2: 26-31 mm. Raine Id, AMS I.20757-072, 14: 21-39 mm. Escape Reef, AMS I.22633-072, 12: 20-35 mm. Lizard Id, AMS I.18805-002, 4: 21-32 mm. One Tree Id, AMS I.20561-007, 3: 38-41 mm; AMS I.35852-003, 3: 47-65 mm; USNM 308212, 17: 33-55 mm; USNM 308214, 47 mm; USNM 308215, 44.5 mm. Heron Id, AMS IB.4004, 2: 37.5-43 mm. LORD HOWE Id: BPBM 14829, 50 mm; BPBM 34614, 39.5 mm. CORAL SEA: Middleton Reef, AMS I.27138-055, 6: 21-43 mm. Elizabeth Reef, AMS I.27156-035, 7: 34-53 mm. Chesterfield Ids, BPBM 33582, 3: 21-44 mm. NEW CALEDONIA: BPBM 11470, 40 mm; BPBM 34326, 2: 54-56 mm; ORSTOM uncat., 4: 29-33 mm; 5: 25-37 mm; 3: 22-41 mm. LOYALTY Ids: Ouvéa, ORSTOM uncat., 34.5 mm. SOLOMON Ids: Guadalcanal, BPBM 15677, 10: 21-38 mm; BPBM 16038, 31 mm. VANUATU: Éfaté, AMS IB.3607, 42.5 mm; BPBM 5764, 33 mm. Malekula Id, CAS 124435 (originally SU 24435), 2: 14-14.5 mm (paratypes of *Gnatholepis corletti*). FIJI: Viti Levu, BPBM 5937, 5: 22-31 mm; FMNH 24657, 36: 32-47 mm; FMNH 24693, 2: 24-30 mm. Lau Group, Ono-ilau, USNM 243062, 10: 18-33 mm. Matuko, USNM 259751, 40 mm. WESTERN SAMOA: Upolu, BPBM 6148, 2: 31-42 mm. AMERICAN SAMOA: Tutuila, BPBM 27863, 6: 30-37 mm; BPBM 37898, 15: 28-39 mm. MARIANA Ids: Guam, BPBM 267, 8: 20-44 mm (syntypes of *Gobius deltooides* Seale); BPBM 8447, 2: 28-29 mm; BPBM 24768, 9: 27-44 mm. PALAU: BPBM 9830, 25 mm. MARSHALL Ids: Enewetak Atoll, AMS I.37704-003, 38 mm; BPBM 29103, 3: 23-30 mm; BPBM 29220, 47 mm; BPBM 31327, 2: 41-42 mm; BPBM 31328, 3: 36-42 mm. LINE Ids: Palmyra, BPBM 9393, 2: 31-35 mm; BPBM 15045, 4: 25-30 mm; BPBM 31317, 8: 35-44 mm. Fanning Id (Tabuera), BPBM 14061, 41 mm; BPBM 14093, 14: 20-33 mm. PHOENIX Ids: Canton Id, BPBM 15135, 5: 35-37 mm. SOCIETY Ids: Tahiti, BPBM 8626, 6: 22-25 mm; BPBM 10292, 4: 21-28 mm; BPBM 11968, 3: 29-31 mm; BPBM 15116, 11: 22-44 mm. Moorea, AMS I.21874-001, 2: 36-40 mm; AMS I.30940-006, 7: 16-36 mm; BPBM 11283, 10: 29-48 mm. RAPA: BPBM 38375, 33.5 mm; BPBM 38377, 4: 25-43 mm (formerly BPBM 17319, this number now reserved for one specimen of *Gnatholepis cauerensis australis*). TUAMOTU ARCHIPELAGO: Raroia Atoll, CAS 59407, 5: 26.5-56.5 mm. Marquesas Ids, Nuku Hiva, AMS I.22176-003, 7: 22-38 mm; BPBM 12621, 3: 28-38.5 mm; BPBM 12764, 33 mm. Ua Huka, BPBM 11003, 42 mm. Tahuata, BPBM 10398, 27.5 mm. Fatu Hiva, BPBM 11869, 8: 20.5-53 mm. HAWAIIAN IDS: Hawaii, BPBM 28720, 44 mm. Maui, BPBM 38359, 11: 21-37 mm. Molokai, BPBM 15132, 3: 30-34 mm. Oahu, BPBM 1846, 38

mm; BPBM 5495, 27 mm; BPBM 7306, 5: 33-38 mm; BPBM 15040, 5: 26-44 mm; BPBM 15046, 13: 16-43 mm; BPBM 15130, 42 mm; BPBM 15042, 21: 36-46 mm; BPBM 15136, 29 mm; BPBM 17800, 28 mm; BPBM 19665, 10: 57-64 mm; BPBM 22649, 49: 9-33 mm; BPBM 31319, 27 mm; BPBM 31320, 28: 9.5-31 mm. Kauai, BPBM 15041, 6: 21-31 mm. Midway, BPBM 34795, 22 mm; BPBM 34873, 5: 29-37 mm. JOHNSTON Id, BPBM 15043, 6: 24-30 mm; BPBM 15134, 3: 22-27 mm; BPBM 38361, 25 mm.

Gnatholepis cauerensis cauerensis

Plate I G, H: Plate II A

Gobius cauerensis Bleeker, 1853: 269 (Cauer [= Kauer], Sumatra).

Gnatholepis scapulostigma Herre, 1953: 193 (Enewetak Atoll, Marshall Ids).

Gnatholepis inconsequens Whitley, 1958: 44 (Heron Id, Capricorn Group, Great Barrier Reef).

Acentrogobius cauerensis Bleeker, 1983: pl. 435b, fig. 1 (reproduction of previously unpublished colour figure, without final corrections).

DIAGNOSIS: Dorsal fin VI+ I,11; anal fin I,10-12; pectoral rays 16-19 (74% 17, 6% 16, 19% 18); longitudinal scale series usually 30; usually no scales on cheek completely anterior to dark bar below eye; preopercle scales extending to a vertical at rear margin of preopercle; gill-rakers 1+4 (4th rudimentary); dentition as in *G. anjerensis*; body depth 4.25-5.15 in SL; head length 3.2-3.55 in SL; caudal-peduncle length 1.7-1.9 in head; caudal fin slightly longer than head, 2.75-3.5 in SL. Largest specimen, BPBM 28073, 40 mm SL, from Fanning Id, Line Islands.

Colour in alcohol of a specimen from Mentawai Islands, Sumatra (BPBM 27641, 29.8 mm SL): body whitish with 7 or 8 longitudinal dark brown lines containing a darker brown dot on each scale; a series of 6 roundish dark brown blotches on lower side, progressively smaller posteriorly (the first 2 covered by pectoral fin), with a seventh small blotch at base of caudal fin; 2 longitudinal series of smaller, less distinct, dark brown blotches on upper third of body; a diffuse, dark brown blotch above base of pectoral fin; head heavily mottled with small dark brown blotches and spots; a narrow dark brown bar extending ventrally from eye and passing through a brown blotch about three-fourths size of eye; a dark brown spot on side of upper lip; dorsal and caudal fins with small dark brown spots forming irregular bands (caudal fin spots only on membranes); anal fin with a brown line at base, then a translucent whitish band, the outer two-thirds or more dusky (when fin not extended, the broad outer dusky band appears as a black margin); base of pectoral fins with 4 dusky lines, 2 of which extend onto proximal part of fin; pectoral fins with small faint dusky spots; pelvic fins dusky.

In life, the body of this fish was pale greenish grey dorsally, shading to whitish below, the dark brown lines on body, the irregular dark markings on head, and spots in fins reddish brown; no yellow spot in dark blotch above pectoral base (usually present in this subspecies); dark bar below eye brownish red; dark reddish brown line dorsally on eye; cheek with about 10 blue dots; pelvic fins whitish.

Individuals of this species collected from pale habitats, such as white sand, have much paler markings. Some fish, such as the one described above, lack the yellow spot

within a black blotch in the shoulder region; this is especially true of more melanistic fish.

REMARKS: As mentioned, the linear colour pattern of *Gnatholepis cauerensis cauerensis* is more pronounced, in general, than that of *G. anjerensis*; however, *anjerensis* from the southwest Pacific and specimens from dark habitats, such as on volcanic sand, may have continuous dark lines on the body (see Remarks for *anjerensis*).

Richard Winterbottom examined the holotype of *Gobius cauerensis* at the Nationaal Natuurhistorische Museum in Leiden (RMNH 6523, 29.7 mm SL); his data (including counts of 17 and 16 pectoral rays) are consistent with those of Bleeker, except the specimen is faded and no notes could be made of colour. Bleeker's (1853) original description of the colour of the 39 mm TL holotype from Sumatra precisely matches the above description of our specimen from the Mentawai Islands off Sumatra. Also very similar is Bleeker's (1983: Plate 435b, Fig. 1) unfinished colour painting of *Acentrogobius cauerensis*.

Herre (1953) described *Gnatholepis scapulostigma* from a 36.5 mm SL specimen without indicating where the type was deposited. He noted that most scales were missing (giving the longitudinal scale count as 24-32), and did not record the number of pectoral rays. After we determined that the holotype was not in the University of Washington fish collection, it was found at the National Museum of Natural History (USNM 344429). Although it was not designated as a type; the Enewetak locality, length, and collector (Arthur D. Welander) indicate that this specimen is the holotype. It is in poor condition and unusual in having only 10 anal-fin soft rays; the pectoral-fin rays are 17-17, and the body depth 4.6 in SL.

Whitley (1958) described *Gnatholepis inconsequens* very briefly from a 35 mm SL specimen, AMS IB.3916. He wrote that it agrees well with the description of *G. scapulostigma*, noting a few differences such as several vertical rows of small sensory papillae on the cheek (which Herre had failed to see on *scapulostigma*). He added that because of copper-stained formalin, the colour is "green without definite markings, apart from an indistinct dusky bar below the eye and a dark smudge over pectoral axil occupying three scales." Sally Reader of the Australian Museum counted 17 pectoral-fin rays on both sides.

Yoshino in Masuda et al. (1984: 252, pl. 240 R) recorded the subspecies as *G. scapulostigma* from the Ryukyu and Ogasawara Islands.

The Bishop Museum has 21 lots of *G. cauerensis cauerensis* from the following localities: southern Oman, Tanzania, South Africa, Maldives (recorded as *G. scapulostigma* by Randall and Goren, 1993), Similan Ids (Andaman Sea), Indonesia, Papua New Guinea, Philippines, Ogasawara Ids, Mariana Ids, Wake Id, Marshall Ids, Fiji, American Samoa, and the Society Ids.

Two specimens of *Gnatholepis cauerensis* (BPBM 8108, 35 mm; BPBM 12007, 38 mm) collected off Papara, Tahiti on a rubble bottom in 37-46 m are unusual in having 2 prominent brown stripes on the body which break into dashes posteriorly. Although the specimens seem typical of *G. cauerensis cauerensis* on other characters, we are not including them with this subspecies.

The first author and associates collected 14 *G.*

cauerensis from the Marquesas Islands (BPBM 10398, 11003, 11869, 12620 and 12764), and we have 7 fish from the Australian Museum (AMS I.22176-033) collected by Barry Goldman in Nuku Hiva. These appear to be the subspecies *cauerensis* from morphology and colour (Pl. II A); however, the pectoral-ray counts have a higher percentage with 18 (counts of both fins are 9 with 18, 11 with 17, and one with 16). And 4 of the Marquesan fish are larger (42-53 mm SL) than the largest *G. cauerensis cauerensis* (40 mm SL). We reserve our judgement of the taxonomic status of these Marquesas fish, and their pectoral-ray counts are not included in Table 1.

All 21 Bishop Museum lots of *G. cauerensis cauerensis* have data on depth of capture. Four lots were from 2 m or less, and one from 7 m, 6 lots were taken in 12 m or more, 7 were from 30 m or more, and 3 from more than 45 m. It is clear that *G. cauerensis cauerensis* is not as apt to be found in shallow water as *G. anjerensis* (36 of 62 lots were from less than 2 m).

MATERIAL EXAMINED: SOUTH AFRICA: Natal, BBPM 21713, 2: 30-32 mm. TANZANIA: Mafia Id, BPBM 16892, 30 mm; COMORO Ids: Grande Comore, CAS 34512, 31 mm; CAS 35233, 12: 18-33.5 mm; CAS 35274, 5: 20-36 mm; CAS 35516, 5: 22-36 mm. AGALEGA Ids: USNM 308208, 21: 27-39.5 mm. OMAN: Masirah Id, BPBM 36143, 34 mm. MALDIVE Ids: North Malé Atoll, BPBM 34390, 2: 21-31 mm. THAILAND: Andaman Sea, Similan Ids, BPBM 22804, 32 mm. INDONESIA: Sumatra, Mentawai Ids, BPBM 37641, 31 mm. Sulawesi, Manado, BPBM 36718, 27 mm. Bali, BPBM 32249, 36 mm. Banda Sea, BPBM 36631, 31 mm; BPBM 36644, 38 mm; BPBM 36650, 32 mm. PHILIPPINES: Luzon, Batangas, BPBM 23455, 25 mm; Caban Id, BPBM 22453, 35 mm. Cebu, Sumilon Id, BPBM 28519, 27 mm. Buton Id (5°24'30"S, 122°37'28"E), USNM 308208, 36.5 mm. JAPAN: Ogasawara Ids, Chichi-jima, BPBM 35113, 34 mm. PAPUA NEW GUINEA: Madang, BPBM 15534, 33 mm; BPBM 15868, 32 mm. Port Moresby, BPBM 15924, 34 mm. MARIANA Ids: Guam, BPBM 38371, 28 mm. WAKE Id: BPBM 4870, 28 mm; BPBM 37883, 2: 17-37 mm. MARSHALL Ids: Enewetak Atoll, USNM 344429, 36 mm (holotype of *Gnatholepis scapulostigma*); Kwajalein Atoll, BPBM 19984, 2: 31-34 mm. FIJI: BPBM 14591, 2: 29-32 mm. AMERICAN SAMOA: Tutuila, BPBM 17547, 33 mm. LINE Ids: Fanning Id (Tabuera), BPBM 28073, 3: 30-40 mm. SOCIETY Ids: Tahiti, BPBM 8108, 2: 25-35 mm. Moorea, BPBM 12032, 35 mm.

***Gnatholepis cauerensis australis*, n. ssp.**

Plate II B

HOLOTYPE: BPBM 17276, female, 41 mm, French Polynesia, Rapa, at entrance to Haurei Bay, reef with coral rubble and ledges, 15-18 m, rotenone, J. Randall and D. Cannoy, 10 February 1971.

OTHER MATERIAL: Rapa: BPBM 17267, 38 mm; BPBM 17319, 37 mm; BPBM 38376, 35 mm. Pitcairn Group: Pitcairn Id, BPBM 16846, 2: 40-42 mm; BPBM 16880, 33 mm. Oeno Atoll, BPBM 16532, 7: 25-49 mm; BPBM 16538, 10: 21-48 mm; BPBM 38423, 2: 22-22.5 mm. Austral Ids: Rurutu, BPBM 13715, 4: 31-39 mm. Cook Ids: Rarotonga, BPBM 13980, 39 mm.

DIAGNOSIS: Dorsal-fin rays VI+I, 11; anal-fin rays I, 11; pectoral-fin rays 17-19 (modally 18); scales in longitudinal series 30; usually a few small scales on cheek completely

anterior to dark bar below eye; preopercle scales extending to a vertical at rear margin of preopercle; gill-rakers 1 + 4 (the 4th a rudiment); body depth 4.65-5.2 in SL; head length 3.3-3.6 in SL; caudal-peduncle length 1.55-1.7 in head length; caudal fin slightly longer than head, 2.75-3.4 in SL. Size of largest specimen, 56 mm SL, from Rapa.

Colour in alcohol: pale yellowish, some fish with no dark markings except a faint narrow dark bar below eye and dark bar on upper part of eye crossing mid-interorbital space; other specimens with darker eye and interorbital bars and showing faint longitudinal lines following scale rows of upper half of body; no markings on fins.

Colour in life as given below for the holotype.

DESCRIPTION OF HOLOTYPE: Dorsal-fin rays VI+I, 11; anal-fin rays I, 11; pectoral-fin rays 19, the upper and lowermost rays unbranched; branched caudal-fin rays 15, 2 upper and 2 lower short segmented unbranched rays, and 6 upper and lower procurent caudal rays; pelvic-fin frenum with a fringed free edge; longitudinal scale series 30; transverse scale series 9½; circumpeduncular scales 12; predorsal scales extending to a single slightly enlarged scale at edge of posterior interorbital pore; preopercle scales somewhat embedded, extending to a vertical at rear edge of preopercle; pseudobranch filaments 6.

Body depth 4.8 in SL; body width 1.35 in body depth; head length 3.4 in SL; snout length 2.85 in head length; orbit diameter 3.7 in head; interorbital width 17 in head; caudal-peduncle depth 2.3 in head, peduncle length 1.6 in head; predorsal length 2.85 in SL; preanal length 1.75 in SL; preopercle length 3.15 in SL.

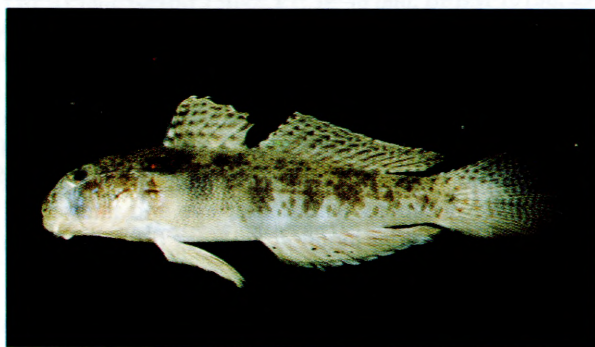
Mouth slightly inferior, the gape slightly oblique; maxilla extending to below front edge of orbit, the upper-jaw length 2.8 in head; dentition typical of genus, with an outer row of 6 incurved slender canines at front of upper jaw and 8 at front of lower jaw, the most lateral strongly curved posterolaterally. Nostrils at level of lower edge of pupil; rear nostril about a nostril diameter from edge of orbit; front nostril a short membranous tube a nostril diameter from rear nostril.

Scales of body ctenoid except anteriorly on ventral part of abdomen, pectoral-fin base, and preopercle region where cycloid; ctenoid scales extend to above base of pectoral fin; scales on opercle and cheek cycloid; 2 or 3 scales on cheek entirely anterior to narrow dark bar below eye; no scales on fins except basally on caudal and pectorals.

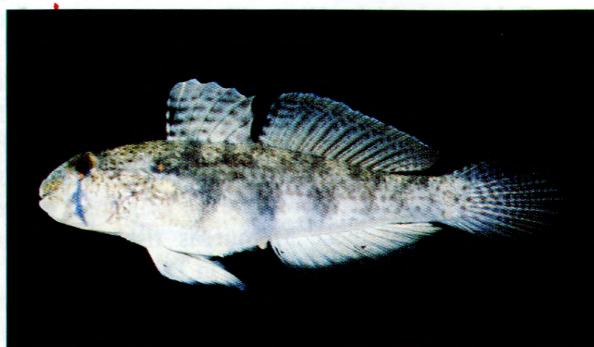
Second to fourth dorsal-fin spines longest, 5.8 in head; second and penultimate dorsal soft rays longest, 5.85 in SL; penultimate anal ray longest, 5.4 in SL; caudal fin rounded, slightly shorter than head, 3.0 in SL; middle pectoral rays longest, 3.5 in SL; pelvic fins reaching anal-fin origin, 4.0 in SL.

Colour in alcohol: body pale yellowish, with 7 brown longitudinal lines following centres of scale rows, the first dorsally on nape ending at origin of spinous dorsal fin, the second line soon breaking into a series of small spots which end at rear base of soft dorsal fin, the sixth line mid-lateral and most evident, passing through centres of 7 faint dusky blotches that are progressively smaller posteriorly, the last on caudal-fin base; seventh longitudinal line faint, ending above middle of anal fin; no dark blotch above pectoral-fin base (only the anterior ends of third and fourth

PLATE I



A



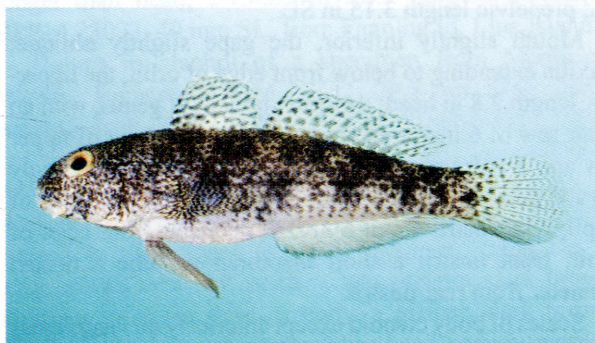
B



C



D



E



F



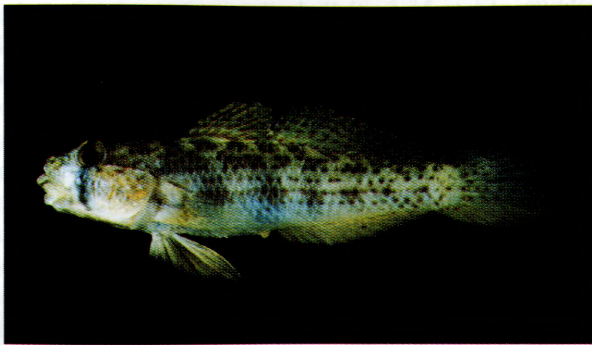
G



H

A. *Gnatholepis anjerensis*, 44 mm, BPBM 18334, Ras Muhammad, Sinai Peninsula, Red Sea. B. *Gnatholepis anjerensis*, 41 mm, BPBM 27230, Kenya. C. *Gnatholepis anjerensis*, 47 mm, BPBM 20185, Mauritius. D. *Gnatholepis anjerensis*, 35 mm, BPBM 34404, Maldivé Ids. E. *Gnatholepis anjerensis*, 54 mm, BPBM 34326, New Caledonia. F. *Gnatholepis anjerensis*, 60 mm, BPBM 19665, Oahu, Hawaiian Ids. G. *Gnatholepis cauerensis cauerensis*, 34 mm, BPBM 35113, Ogasawara Ids, Japan. H. *Gnatholepis cauerensis cauerensis*, Bali, Indonesia.

Plate II



A



B



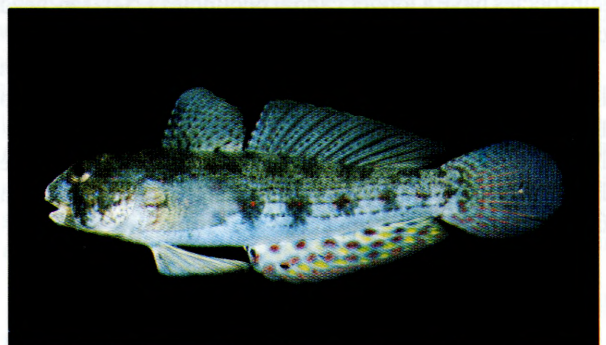
C



D



E



F



G



H

A. *Gnatholepis cauerensis cauerensis*, 38.5 mm, BPBM 12621, Marquesas Ids. B. *Gnatholepis cauerensis australis*, 56 mm, Rapa (specimen lost). C. *Gnatholepis cauerensis hawaiiensis*, holotype, 35.8 mm, BPBM 37847, Oahu. D. *Gnatholepis cauerensis hawaiiensis*, Kona, Hawaii. E. *Gnatholepis cauerensis pascuensis*, Easter Id. F. *Gnatholepis davaoensis*, neotype, 52.3 mm, BPBM 18670, Taiwan. G. *Gnatholepis davaoensis*, 30.5 mm, BPBM 34074, Flores, Indonesia. H. *Gnatholepis* sp., male, 23.0 mm, BPBM 38378, Dudley Point, Northern Territory, Australia.

pectoral-fin base (only the anterior ends of third and fourth longitudinal lines); broad dark brown bar extending ventrally below eye, and another from above pupil across interorbital space; an irregular dark line on side of snout above nostrils, and 2 dark lines mid-dorsally at front of snout; dusky bar on side of upper lip; fins pale, the dorsal fins with some faint dusky streaks and small spots.

Colour when fresh, as in Plate II B (BPBM 12965, 56 mm SL from Rapa, now lost; tentatively identified as *G. anjerensis* by Randall et al., 1990). Note the lack of dark markings on this fish (typical for *G. cauerensis australis*), the faint dark eye bar, the orange mid-lateral line on the body, the faintly dusky yellowish lines dorsally, the absence of a dark blotch above the pectoral-fin base, the 24 small pale blue spots on the cheek and opercle, and the whitish caudal fin without markings.

REMARKS: Our only colour photograph is of the Rapa fish just mentioned. We identified specimens from the Pitcairn Group, Austral Islands, and Rarotonga as this subspecies, because of their similar morphology and pale colouration in alcohol. Knowledge of their live colour patterns would be necessary to confirm the identification.

We name this taxon *Gnatholepis cauerensis australis* in reference to the southern location of the islands in southeast Oceania where it has been found.

This subspecies differs in colour from *G. cauerensis cauerensis* to the west and in more equatorial waters and *G. cauerensis pascuensis* at Easter Island to the east. *Gnatholepis cauerensis australis* and the Hawaiian subspecies have a longer caudal peduncle (1.5-1.7 in head compared to 1.7-1.9 for the other subspecies).

Of the 11 lots of this subspecies, 3 were collected in less than 3 m, 3 in 15-18 m, and the rest in 30-58 m. Two Rapa collections in 2-6 m, also contained *G. anjerensis*. No specimens of *G. anjerensis* were obtained at the Pitcairn Group, Austral Islands, or Rarotonga (though fish collecting at the last 2 localities was limited).

Gnatholepis cauerensis hawaiiensis, n. ssp.

Plate II C, D

HOLOTYPE: BPBM 37847, female, 35.8 mm, Hawaiian Ids, Oahu, north shore, off Pupukeya, sand, 20 m, hand net, R. Holcom, early August 1997.

OTHER MATERIAL: Hawaii, BPBM 28734, 17 mm; BPBM 37860, 40.2 mm; BPBM 37861, 3: 14-41 mm. Maui, BPBM 15131, 14: 18.5-42 mm. Oahu, BPBM 7930, 34 mm, BPBM 12284, 33.5 mm; BPBM 37859, 34 mm. Midway, BPBM 15137, 23 mm; BPBM 34770, 2: 29-33.3 mm.

DIAGNOSIS: Dorsal fin VI+I,11; anal fin I,11; pectoral rays 16-18 (80% 17); scales in longitudinal series usually 30; usually no scales on cheek completely anterior to dark bar below eye; preopercle scales extending to a vertical at rear edge of preopercle; gill-rakers 1+4 (4th a rudiment); body depth 4.25-5.15 in SL; head length 3.35-3.55 in SL; caudal-peduncle length 1.5-1.7 in head; caudal fin longer than head, 3.05-3.5 in SL. Largest specimen, BPBM 15131, 42 mm SL, from Maui.

Colour in alcohol: whitish to pale yellowish brown

with 3 longitudinal rows of dusky blotches, the lower series of 6 blotches, at level of pectoral fin, the most prominent; brown longitudinal lines following centre of scale rows on body (lines may be partially broken or may contain darker brown dots, generally one per scale); a dark brown to black blotch above pectoral-fin base, usually containing a pale spot in upper part; a narrow blackish bar from above centre of pupil, crossing interorbital space; a prominent narrow black bar extending ventrally and slightly posteriorly from below middle of eye; a diffuse dusky stripe from opercle to base of pectoral fin; a black bar on side of upper lip; spinous dorsal fin with a dusky band near base and 2 faint narrower outer bands; soft dorsal with longitudinal rows of faint oblique dusky streaks (or in large specimens dark lines, one per membrane); anal and pelvic fins dusky; caudal fin with a dark brown line on membranes between rays; pectoral fins a little dusky, especially on rays.

In life the dark longitudinal lines on the body may be red, orangish brown, or dark brown; a large blue area around and below large dark blotches of lateral series (blue less apparent on posterior blotches); numerous small blue spots around and above lateral series of dark blotches, also on operculum, cheek, and middle of pectoral-fin base; a vertically elongate bright yellow spot in black humeral blotch; dark bar under eye may be black or dark brownish red; lines on caudal fin varying from red to dark brown.

DESCRIPTION OF HOLOTYPE: Dorsal fin VI+I,11; anal fin I,11; pectoral rays 18, the upper- and lowermost rays unbranched; branched caudal-fin rays 13, 2 upper and 2 lower short segmented unbranched rays, and 7 upper and 7 lower procurent caudal rays; pelvic-fin frenum with a fringe laterally on free edge; longitudinal scale series 30; transverse scale series 9½; circum-peduncular scales 12; predorsal scales extending to rear of interorbital space; preopercle scales extending to rear edge of preopercle; gill-rakers 1+4; pseudobranch filaments 5.

Body depth 4.8 in SL; body width 1.25 in body depth; head length 3.55 in SL; snout length 3.35 in head length; orbit diameter 3.3 in head; interorbital width 16.5 in head; caudal-peduncle depth 2.25 in head, peduncle length 1.7 in head; predorsal length 2.8 in SL; preanal length 1.85 in SL; prepelvic length 3.5 in SL.

Mouth slightly inferior, the gape slightly oblique; maxilla extending to vertical at front edge of pupil (less on other specimens), upper-jaw length 2.7 in head; dentition typical of genus, with an outer row of 6 incurved slender canines at front of upper jaw and 8 at front of lower jaw, the lateralmost teeth strongly curved posterolaterally. Tongue bilobed. Nostrils at level of lower edge of pupil, rear nostril about a nostril diameter from front edge of orbit; front nostril a short membranous tube a nostril diameter from rear nostril. Sensory pores and papillae typical of genus. Gill opening ending slightly ventral to pectoral base.

Ctenoid body scales extending to below dorsal-fin origin; cycloid scales ventrally on abdomen, prepectoral and prepelvic regions, nape, opercle and cheek (larger fish may have a few ctenoid scales on opercle); one small scale on cheek entirely anterior to dark bar below eye on one side (no scales anterior to bar found on other specimens); no scales on fins except basally on caudal and pectorals.

Gnatholepis cauerensis pascuensis, n. ssp.

Plate II E

Second to fourth dorsal-fin spines longest, 5.95 in SL; second to penultimate dorsal soft rays subequal, 5.6 in SL; penultimate anal ray longest, 6.0 in SL; caudal fin rounded, slightly longer than head, 3.35 in SL; middle pectoral rays longest, 4.0 in SL; pelvic fins just reaching origin of anal fin, 3.9 in SL.

Colour in alcohol as described above for the subspecies in general except the lower series of large dark blotches are enlarged by dusky ventral extensions, and the 2 upper series of dark blotches are joined.

Colour when fresh: pale brown dorsally, shading to whitish ventrally, with orangish brown lines following scale rows (except the 2 lateral rows become red when passing over the lower series of dark blotches); large bluish black spot above base of pectoral fin with an oblique bright yellow spot in its upper posterior part; a diffuse dark brown bar below eye with a dark-edged orange line in the middle; a few faint small blue spots on opercle, and some present on sides of body in life; a narrow orange-red streak on gill membranes; a narrow orange stripe on prepectoral region, extending basally into pectoral fin; spinous dorsal fin with an irregular red band narrowly edged in greenish yellow near base, a narrower band above, and 2 short red streaks in outer part of fin; soft dorsal fin with 5 rows of red dashes, one per membrane for each row, the dashes of lower row nearly horizontal, the upper rows oblique; last 3 membranes of soft dorsal with a red line paralleling rays; anal fin white, finely speckled with grey, with an orange line near base, pale purplish margin and red submarginal band; caudal fin translucent whitish with red lines, one per membrane, paralleling rays; pectoral fins pale yellowish; pelvic fins brown, the ray tips violet, the spine paler than rest of fin.

REMARKS: We discovered that there are two species of *Gnatholepis* in the Hawaiian Islands; the more common and more inshore species is *G. anjerensis*, as described above. We initially identified the second as *G. cauerensis cauerensis*; however, we found that it differs slightly by having a shorter caudal peduncle (1.5-1.7 in head length, compared to 1.7-1.9 for *G. c. cauerensis*), the caudal fin has a dark line on each membrane instead of small dark spots, and there are numerous small blue spots on the lower side of the body in life that are lacking on *G. c. cauerensis*. Accordingly, we regard the Hawaiian population as a distinct subspecies, *G. c. hawaiiensis*.

Of the 8 lots with depths of capture, one was taken in 2 m, one from 7 m, and the rest from 14-29 m. The fish were encountered on sand very near reef or rocky substratum where they take refuge when alarmed.

The subspecific identification of 3 lots of *Gnatholepis cauerensis* from Johnston Id (BPBM 11043, 7: 34-40 mm; BPBM 15138, 3: 21-33 mm; BPBM 15133, 2: 18.5-34.5 mm) is deferred until the life colour of fish at this locality can be determined. These gobies are paler than Hawaiian material, but this could be due to the much paler environment of Johnston, an atoll dominated by white sand, in contrast to the generally darker marine environment of the volcanic main Hawaiian Ids. The Johnston specimens also differ in having a slightly shorter caudal peduncle (1.6-1.8 in head length) and small scales on the cheek anterior to the dark eye bar.

Gnatholepis sp. DiSalvo et al., 1988: 461 (Easter Id).

HOLOTYPE: BPBM 32850, female, 34 mm, Easter Id, off Tahai, 18-20 m, rotenone, J. Randall, L. DiSalvo, and A. Cea Egaña, 13 February 1985.

OTHER MATERIAL: Easter Id: BPBM 6743, 31.0 mm; BPBM 32851-53, 4: 36.3-44.4 mm.

DIAGNOSIS: Dorsal fin VI+I,11; anal fin I,11; pectoral rays 18-19; scales in longitudinal series 30; usually one or 2 small scales on cheek completely anterior to dark bar below eye; prepelvic scales extending to a vertical at rear margin of preopercle; gill-rakers 1+4 (the 4th a rudiment); body depth 4.4-5.15 in SL; head length 3.25-3.5 in SL; caudal-peduncle length 1.7-1.9 in head length; caudal fin longer than head, 2.8-3.3 in SL.

Colour in alcohol: body pale yellowish brown with 2 longitudinal rows of 5 horizontally elongate dark brown blotches, the most prominent row commencing beneath pectoral fin; a third row of smaller dark blotches along upper edge of back; a dark brown bar across interorbital and through eye to throat; no dark markings on fins except a small dark blotch on mid-base of caudal fin and 2 brown streaks in pelvic disk.

Colour when fresh as described below for holotype.

DESCRIPTION OF HOLOTYPE: Dorsal fin VI+I,11; anal fin I,11; pectoral rays 19, the upper- and lowermost unbranched; branched caudal-fin rays 13, 2 upper and 2 lower short segmented unbranched rays, and 8 upper and 7 lower procurent caudal rays; pelvic-fin frenum with a fringed free edge; longitudinal scale series 30; transverse scale series 9½; circumpeduncular scales 12; predorsal scales extend to rear of interorbital space; prepelvic scales extending to a vertical at rear edge of preopercle; gill-rakers 1+4 pseudobranch filaments 5.

Body depth 4.4 in SL; body width 1.3 in body depth; head length 3.5 in SL; snout length and orbit diameter 3.2 in head length; interorbital width 16.0 in head; caudal-peduncle depth 2.3 in head, peduncle length 1.85 in head; predorsal length 2.85 in SL; preanal length 1.85 in SL; prepelvic length 3.6 in SL.

Mouth slightly inferior, the gape slightly oblique; maxilla extending to a vertical at front edge of pupil (less on other fish), the upper-jaw length 2.6 in head; dentition typical of genus, with an outer row of 6 incurved slender canines at front of upper jaw and 8 at front of lower jaw, the most lateral canine strongly curved posterolaterally. Tongue bilobed. Nostrils at level of lower edge of pupil, the rear nostril about a nostril diameter from edge of orbit, the front nostril a short membranous tube a nostril diameter from rear nostril. Sensory pores and papillae typical of genus. Gill opening ending slightly below pectoral base.

Scales of body ctenoid anteriorly to below origin of dorsal fin; scales cycloid ventrally on abdomen, prepectoral and prepelvic regions, nape, and on opercle and cheek (44-mm specimen with ctenoid scales posteriorly on opercle); 2 scales on cheek entirely anterior to dark bar below eye; no

scales on fins except basally on caudal and pectorals.

Second to fourth dorsal-fin spines longest, 6.2 in SL; penultimate dorsal ray longest, 5.6 in SL; penultimate anal ray longest, 5.95 in SL; caudal fin rounded, slightly longer than head, 3.25 in SL; middle pectoral rays longest, 3.8 in SL; pelvic fins just reaching origin of anal fin, 3.6 in SL.

Colour in alcohol: pale yellowish brown, with 2 series of 5 horizontally elongate dark brown blotches on side of body, the lower series commencing beneath pectoral fin; first blotch of upper series merging with a smaller, more densely pigmented spot just above pectoral-fin base; a third row of smaller dark brown blotches dorsally on body, the first just anterior to first dorsal fin and the last at base of last dorsal ray; a dusky horizontal streak on opercle continuing onto middle of prepectoral region; dark brown bar across middle of interorbital space and continuing onto upper part of iris; a dark brown bar extending ventrally and slightly posteriorly from below middle of eye; dusky band from behind eye to dark spot above pectoral-fin base; fins pale, except for a small brown spot at mid-base of caudal fin and a broad brown band centred on fourth pelvic rays of each side of disk (other specimens with faint small dusky spots and irregular lines in dorsal fins, the caudal and anal dusky, the latter with a clear margin).

Colour when fresh: greenish white, shading to whitish ventrally, with dark brown to black blotches as described above, the first 2 of lower series each within a large blue blotch; faint orange-yellow longitudinal lines following scale rows of body except ventrally and where obscured by dark blotches; interorbital and subocular bar black; numerous small pale blue spots on operculum and faint ones on cheek anterior to dark eye bar; a dusky yellow stripe extending posteriorly from dark eye bar at level of corner of mouth, becoming dark yellowish brown on opercle and prepectoral region where edged in pale blue; a dusky spot on side of upper lip; dorsal fins pale; caudal fin brown, darkest along ventral margin, with a small dark brown spot at mid-base of fin; anal fin pale brown, shading to darker brown distally, with a pale margin; pectoral fins pale except for extension of yellowish brown line of prepectoral region onto scaled basal part of fin; pelvic fins with a broad median zone of yellowish brown, the edges whitish. An underwater photograph (Pl. II E) shows a prominent bright blue spot within the dark brown stripe on the opercle.

REMARKS: This subspecies of *Gnatholepis cauerensis* is named *pascuensis* for Easter Island, known also by its Spanish name Isla de Pascua. Initially this taxon was thought to be a distinct species, because of its colour pattern and high pectoral-ray counts; but it is only the intensification of the dark blotches that makes it appear so different, and the high pectoral-ray count is linked through the intermediate counts of *G. c. australis* to the modal 17 counts of *G. c. cauerensis*. It has a short caudal peduncle, like *G. c. cauerensis*, in contrast to that of *G. c. australis* and *G. c. hawaiiensis*.

Only 6 *G. c. pascuensis* were obtained during 1969 and 1985 field trips to Easter Island; all were collected on sand near reef or rocky bottom in depths of 17–21 m. The underwater photograph was taken in 31 m.

Gnatholepis davaoensis

Plate II F, G

Gnatholepis davaoensis Seale, 1909: 537 (Samal Id, Gulf of Davao, Mindanao, Philippines).

Gnatholepis gemmeus Herre, 1927: 135, pl. 9, fig. 3 (Samal Id, Gulf of Davao, Mindanao).

NEOTYPE: BPBM 18670, male, 52.3 mm, Taiwan, south end at Hou Pi Hoo, tidepool in 0–0.2 m, rotenone, J.E. Randall, A. Choi, and C.K. Wong, 11 June 1975.

DIAGNOSIS: Dorsal fin VI+I, 11; anal fin I, 11; pectoral rays 15–17 (83% 16); longitudinal scale series usually 30; usually a few small scales on cheek anterior to dark bar below eye; prepelvic scales extending to a vertical at rear edge of orbit (also to a line joining ventral ends of dark eye bar of each side); gill-rakers 1+4 (the 4th a rudiment); dentition as in *G. anjerensis*; body depth 3.85–4.3 in SL; head length 3.45–3.6 in SL; caudal-peduncle length 1.55–1.75 in head length; caudal fin usually slightly longer than head, 2.9–3.35 in SL.

Colour in alcohol: light brown with 3 series of 6 dark brown blotches on body, the most prominent at level of pectoral fin; series of blotches not in vertical alignment, the upper row dorsally on body as pairs of blotches; dotted or dashed dark brown lines following longitudinal scale rows of body (lines irregular dorsally on some specimens); a small, dark brown to black blotch at mid-base of caudal fin (usually darker than other blotches of body); a dark brown to black bar extending ventrally and slightly posteriorly from below middle of eye; a dark brown bar on upper part of eye above posterior half of pupil, not extending across interorbital; a dusky blotch on opercle and a dusky horizontal band on prepectoral region, extending into base of pectoral fin; a dark spot on side of upper lip and adjacent snout, but not entirely across lip; spinous dorsal fin with small brown spots on first spine; other spots mainly on membranes; a prominent small black spot at base of fourth dorsal spine, and another at base of sixth dorsal spine (these 2 spots more evident in smaller specimens); second dorsal fin with scattered small dark brown spots in small specimens, narrow dark bands, one per membrane, in large ones (bands developing posteriorly first); a small dark brown to black spot at base of eighth and last membranes of soft dorsal fin; anal fin with 2 or 3 irregular rows of brown to black spots on membranes (darker in small specimens); caudal fin of small specimens with small black spots on membranes, becoming faint in larger specimens that have, in addition, small brown spots on rays; pectoral fins of small specimens dusky; larger specimens with rows of small brown spots forming faint irregular bars; pelvic fins more intensely pigmented but without small spots.

Colour in life: blotches on body varying from grey to dusky red, those of lower row encircled with blue spots; centres of first 3 dark blotches in lower row with 1–2 small, bright red or yellow spots; a row of 3 or 4 small red spots from lower part of eye to above pectoral fin; numerous, small, pale blue spots on operculum and cheek; dark bar below eye varying from black to dark red; dorsal and caudal fins with red-edged black spots (or red-edged lines in soft dorsal of large specimens); anal fin with 2 or 3 irregular rows of black spots broadly edged in bright red, alternating

with bright yellow spots; pelvic fins yellowish, sometimes with a bluish margin and blackish submarginal line.

DESCRIPTION OF NEOTYPE: Dorsal fin VI+I,11; anal fin I,11; pectoral rays 16, the upper- and lowermost rays unbranched; branched caudal-fin rays 13, 2 upper and 2 lower unbranched segmented rays, 7 upper and 7 lower procurrent caudal rays; pelvic-fin frenum without a fringe (but evident on most other specimens); longitudinal scale series 30; transverse scale series 9; circumpeduncular scales 12; predorsal scales extend to posterior interorbital space; prepelvic scales extending to rear edge of orbit (also to a line connecting ventral end of dark eye bar from each side); gill-rakers 1+4; pseudobranch filaments 6.

Body depth 3.9 in SL; body width 1.5 in body depth; head length 3.55 in SL; snout length 2.9 in head length; orbit diameter 3.8 in head; interorbital width 12.0 in head; caudal-peduncle depth 2.1 in head, peduncle length 1.65 in head; predorsal length 3.15 in SL; preanal length 1.9 in SL; prepelvic length 3.5 in SL.

Mouth slightly inferior, the gape slightly oblique; maxilla extends to below front edge of pupil, the upper-jaw length 2.5 in head; dentition typical of genus, with an outer row of 6 incurved slender canines at front of upper jaw and 10 (8 in smaller specimens) at front of lower jaw, the most lateral canines strongly curved posterolaterally. Tongue strongly bilobed. Nostrils at level of lower edge of pupil, the rear nostril about a nostril diameter from front edge of orbit, the front nostril a short membranous tube slightly higher posteriorly, about a nostril diameter from rear nostril. Sensory pores and papillae typical of genus. Gill opening ending slightly below pectoral base.

Scales of body ctenoid to above upper end of gill opening; scales on prepelvic and prepectoral region, operculum, and cheek cycloid except for a few ctenoid scales on prepectoral region and posteriorly on opercle; no small scales on cheek entirely anterior to dark eye bar (a few fish with one or 2 scales anterior to dark bar); no scales on fins except basally on caudal and pectorals.

First dorsal-fin spine longest, 5.25 in SL (on smaller specimens second to fourth dorsal spines equal to or longer than first); penultimate dorsal ray longest, 4.45 in SL; penultimate anal ray longest, 4.8 in SL; caudal fin rounded, slightly shorter than head, 3.1 in SL; middle pectoral rays longest, 3.7 in SL; pelvic fins reaching slightly posterior to spine of anal fin, 3.7 in SL.

Colour in alcohol: light brown with 3 series of 6 dark brown blotches on body, the most prominent at level of pectoral fin; series of blotches not in vertical alignment, the upper row dorsally on body as pairs of blotches; a small slightly darker blotch at mid-base of caudal fin; dotted dark brown lines following scale rows on lower side of body (lines irregular dorsally on body, with additional small spots obscuring rows); a dark brown bar extending ventrally and slightly posteriorly from below middle of eye; dark brown bar on upper part of eye above rear half of pupil, not extending across interorbital; dusky blotch on opercle and dusky horizontal band on prepectoral region, extending onto pectoral-fin base; numerous small brown spots and short irregular lines on snout; dark spot on side of upper lip and adjacent snout, but not entirely across lip; first dorsal-fin spine with 5

small brown spots on leading edge; rest of fin with a few small brown spots, a very dark brown spot at base of fourth dorsal spine and one at base of sixth spine; second dorsal fin with small reddish brown spots on rays and a narrow brown band on each membrane parallel with rays; anal fin with 3 irregular rows of brown spots on membranes; caudal fin pale, with small brown spots on rays and faint dusky dots on membranes; pectoral fins with rows of small brown spots forming faint irregular bars; pelvic fins a little darker than pectorals, without small spots.

Colour when fresh: pale grey, shading ventrally to bluish white, with dark blotches and longitudinal lines on body as described above; first 3 blotches of main lower series with 1-2 small bright red spots in centre; remaining blotches with large dusky red centres; blotches of lower series rimmed with indistinct small pale blue spots; other small blue spots above pectoral fin and on operculum and cheek; two dark blotches with red centre beneath pectoral fin between first two main blotches one above and one below their level; a horizontal series of 4 small red spots from below eye to below middle of spinous dorsal fin; blackish bar below eye containing small blue spots; a faint oblique red line on opercle; spine of first dorsal fin with 6 blackish spots; rest of fin with numerous small dusky red spots except a small black one at base of fourth spine and another at base of sixth spine; soft dorsal fin with dusky red streaks in membranes (except first two partially as spots) and small spots on rays which are blackish basally, becoming dusky red distally; anal fin with 2 rows of large red spots with dusky centres and blue edges, becoming 3 rows posteriorly in fin, alternating with yellow spots nearly as large as red ones; margin of anal fin light red, the ray tips bluish; caudal fin with red streaks or rows of small red spots (some with small dusky centres) on membranes and small dusky red spots on rays; pectoral fins with faint dusky spots on rays, especially basally, and a dusky streak at base leading to dusky orange line in prepectoral region; pelvic fins pale yellowish, the ray tips dark bluish.

REMARKS: Seale's (1909) colour description was based on a 45-mm preserved specimen, but his mention of the anal fin being "most peculiarly colored with round black and white spots alternating as on a checker board" confirms the identification of the specimens listed herein as *Gnatholepis davaoensis*. Seale's holotype was deposited in the Bureau of Science in Manila, but Herre (1927) noted that it was no longer present.

Herre (1927) described *Gnatholepis gemmeus* from 25 specimens, 25-45 mm SL, that were deposited in the Bureau of Science in Manila, which was destroyed during World War II. Herre's description leaves little doubt that his specimens are conspecific with Seale's *G. davaoensis*. Herre (1936: 357) identified 3 specimens, 25-30 mm SL, from Malekula Island, New Hebrides (now Vanuatu) as *G. gemmeus*. One of these specimens, FMNH 24695, 26 mm SL, was sent on loan to us; it is *G. davaoensis*.

In addition to the neotype, the Bishop Museum has 6 lots of this species; all were collected in less than 2 m. BPBM 27050 and 34074 were taken near the mouth of a river; BPBM 38372 from a seagrass bed adjacent to a mangrove area, and two Taiwan lots from rocky shore.

Yoshino in Masuda et al. (1984: 252, Pl. 240 Q)

recorded this species, as *Gnatholepis deltoides*, from the Yaemaya Islands, southern Japan, and Shen (1993: 529, Pl. 177, fig. 2), as *Gnatholepis cauerensis*, from Taiwan.

MATERIAL EXAMINED: TAIWAN: BPBM 18670, 52.3 mm (neotype of *G. davaoensis*); BPBM 23244, 33.3 mm; BPBM 38374, 6: 27.5–52 mm. PHILIPPINES: Cebu, USNM 261645, 34 mm; Mactan Id, AMS I.21931-004, 5: 34–40 mm. Negros, CAS 51508, 8: 16–31 mm; CAS 51511, 2: 27–29 mm; CAS 51513, 2: 29–31 mm; CAS 51514, 3: 28–35.5 mm; CAS 51519, 32 mm; CAS 75215, 3: 25–38 mm; FMNH 47458, 4: 27–34 mm; FMNH 47461, 4: 20.5–23 mm; USNM 261647, 29: 22–36 mm. Nonoc Id (9°49'30" N, 125°37' E), CAS 30806, 31 mm. Luzon, Batangas, AMS I.24136-001, 37 mm. INDONESIA: Halmahera, USNM 266393, 36 mm. Ambon, USNM 243456, 2: 24–28 mm; USNM 243469, 25.5 mm. Flores, BPBM 34074, 30.5 mm. PAPUA NEW GUINEA: Madang, Province, AMS I.32492-004, 2: 15–30 mm; AMS I.32492-009, 27 mm; CAS 65724, 24.5 mm. Milne Bay, USNM 308210, 21: 17–33 mm. SOLOMON Ids: Guadalcanal, BPBM 27050, 2: 29–30 mm; BPBM 38372, 5: 29–40 mm. New Georgia, AMS I.31088-001, 26 mm. SANTA CRUZ Ids, Vanikoro, CAS 51506, 23: 28.5–34 mm. VANUATU: Malekula Id, FMNH 24695, 26 mm.

***Gnatholepis gymnocara*, n. sp.**

Figs 3 & 4

HOLOTYPE: AMS I.34318-051, 32.2 mm, male; Australia, Queensland, Townshend Id, Supply Bay, 22°12.24' S, 150°28.53' E; depth 0–0.2 m, mud bottom, depression with rocks and coral rubble at low tide; rotenone; S. Reader, J. Leis, M. McGrouther, B. Carson-Ewart and M. Ricketts, 16 September 1993.

PARATYPES: QUEENSLAND: AMS I.22102-001, 35.4 mm, Caloundra, 26°48' S, 153°8' E, H. Kesteven, July 1903; QM I.7399, 36.6 mm, Moreton Bay, Mud Id, V.F. Collin, 29 January 1942; AMS IB.1276, 35.0 mm, Wide Bay, Teebar Creek, 25°52' S, 153°1' E, CSIR Fisheries, G.P. Whitley, 8 March 1943; QM I. 22797, 2: 27.1–29.9 mm, Sarina Inlet, rock pool, 0–0.5 m, rotenone, R.J. McKay and J. Johnson, 10 April 1987; QM I.28364, 4: 19.5–32.8 mm, Sabina Point, sandy pool with rocks and weeds, 0.5 m, J. Johnson and R.J. McKay, 14 September 1993; AMS I.34318-032, 32: 17.0–32.9 mm; BMNH 1998.9.11, 2: 29.0–31.5 mm; BPBM 38458, 4: 30.7–33.0 mm; NSMT-P 55638, 2: 28.8–31.5 mm; USNM 350585, 2: 31.2–31.8 mm, all with same data as holotype; NTM S.I3944-001, 2: 28.5–31.5 mm, Moreton Bay, Wellington Point, sandy substrate, Queensland University party, October, 1993; NTM S.I3945-001, 3: 18.7–24.8 mm, same data as preceding except date, April 1994.

NORTHERN TERRITORY: AMS I.23930-011, 2: 14.5–27.6 mm, Darwin, East Point, 12°24' S, 130°48' E, 0–1 m, rotenone, D. Renniss, 1 August 1983.

DIAGNOSIS: Dorsal fin VI+I, 11; anal fin I, 11–12 (rarely 11); pectoral rays 15–19 (modally 17); longitudinal scale series usually 29; no scales on cheek or opercle; no median predorsal scales or with a few scales just posterior to interorbital space; no prepectoral scales; a few small embedded prepelvic scales; gill-rakers 1+3; body depth 4.0–5.1 in SL (body more slender in males); head length 3.45–3.85 in SL; caudal-peduncle length 1.6–2.0 in head length; caudal fin longer than head, 2.55–2.8 in SL (longer in males).

Colour in alcohol: body pale with small dusky spots

or flecks, mostly one per scale, and a mid-lateral row of 6 dusky blotches, each containing a horizontal row of darker dots or flecks; an irregular black mark at upper base of caudal fin; an irregular, cross-shaped, dark mark on cheek below eye; dark dots or flecks on dorsal and caudal fins, the first dorsal fin of male with elongate black spot on fourth membrane; anal fin of females dusky, of males blackish.

DESCRIPTION OF HOLOTYPE (data from paratypes in parentheses): Dorsal fin VI+I, 11; anal fin I, 12 (11 in 2 of 42 paratypes); pectoral rays 17 (15–18; see Table 1), the upper- and lowermost rays unbranched; pelvic fins I, 5; branched caudal-fin rays 15 (13–15), segmented caudal rays 16 (16–17); upper and lower procurent unsegmented caudal rays 7 (6–7); longitudinal scale series 29 (28–30); transverse scale rows 9.5; gill-rakers 1+3; pseudobranch filaments 4 (3–5).

Greatest body depth 5.1 (4.15–5.0) in SL; depth at origin of anal fin 5.2 (4.6–5.15) in SL; body compressed, the width 1.2 (1.2–1.4) in body depth; head length 3.75 (3.45–3.85) in SL; head slightly compressed; dorsal profile of head initially vertical or nearly so (some paratypes with a protuberance extending slightly anterior to mouth), then continuing at an angle of about 45°; eyes extending slightly above dorsal profile of head; snout length 2.7 (2.7–2.85) in head; orbit diameter 3.4 (3.0–3.5) in head; interorbital width 16.7 (15.3–19.1) in head; caudal-peduncle depth 2.2 (2.1–2.5), peduncle length 1.65 (1.6–2.0) in head.

Mouth slightly oblique, the lower jaw inferior; maxilla reaching a vertical at or slightly posterior to front edge of pupil, the upper-jaw length 2.8 (2.5–2.85) in head length. Upper jaw with outer row of slender, incurved, well-spaced canine teeth, progressively smaller posteriorly (posterior teeth not anteriorly curved as on previous 3 species), and an inner band of 2 or 3 irregular rows of small incurved conical teeth anteriorly; lower jaw with 3–4 irregular rows of slender conical teeth, the outer teeth not noticeably longer, narrowing to a single row of teeth posteriorly. Tongue bilobed. Anterior nostril a short membranous tube, higher posteriorly, at level of lower edge of pupil about three-fourths pupil diameter in front of fleshy edge of orbit; rear nostril oval, with a slight rim, dorsoposterior to front nostril, the internarial distance slightly larger than diameter of rear nostril. Sensory pores and papillae typical of genus (Figs. 3 and 4). Gill opening ending slightly below lower end of pectoral-fin base and not extending forward beyond rear third of opercle. Gill-rakers short, the longest at angle about one-fourth length of longest gill filaments, which is about two-thirds orbit diameter.

Scales on body ctenoid, becoming cycloid on side of nape; no scales on cheek or opercle; no median predorsal scales or with a few small scales just posterior to interorbital space (one such scale found on holotype); a few embedded cycloid scales anterior to pectoral and pelvic fins; no scales on fins except basally on caudal fin.

First dorsal-fin origin over basal fifth of pectoral fin, the predorsal length 3.0 (3.0–3.2) in SL; dorsal spines slender, flexible, curved, none filamentous; first 5 spines subequal, the first usually longest, 1.3 (1.25–1.6) in head; spine of second dorsal fin 1.4 (1.35–1.7) in head; penultimate dorsal ray usually longest, 1.05 (1.05–1.7) in head; anal-fin origin below or slightly anterior to base of second dorsal soft ray;

anal spine 2.35 (2.25-3.3) in head; penultimate anal ray usually longest, 1.2 (1.15-1.65) in head; caudal fin rounded, 2.8 (2.85-3.45) in SL; pectoral fin pointed, the middle rays longest, 3.5 (3.6-3.95) in SL; pelvic fins joined to form a rounded disc, reaching anal-fin origin in holotype (varying from just to anus to origin of anal fin in paratypes), 3.5 (3.55-3.95) in SL; pelvic frenum well developed, the free edge with a distinct fringe of slender papillae (29 on holotype).

Colour of holotype in alcohol: pale yellowish, very finely peppered with melanophores (hence slightly dusky overall) with a midlateral row of dusky blotches averaging eye diameter in size, each with a horizontal dark brown line or row of small dark brown spots; body below row of blotches with a small dusky spot on each scale; body above with groups of small dark spots or flecks forming blotches in 2 longitudinal rows, aligned vertically as 5 pairs; head with a distinct cross-shaped mark below eye, extending irregularly below; a broad dusky bar across side of lips; nostrils in a dusky blotch; postorbital head and opercle with a few indistinct dark blotches; first dorsal fin dusky, the leading edge with 6 small dark brown spots, 12 scattered small dark brown to black spots, and a large black spot on outer half of fourth membrane and extending partly onto adjacent membranes; second dorsal fin darkly dusky, paler along margin, with scattered small dark brown to black spots; caudal fin finely mottled with brown, with numerous horizontally elongate small black spots on membranes and a pupil-size dark brown spot at base of fin just above centre, with an elongate small black spot extending posteriorly from its upper edge and one

from the lower edge; anal fin blackish, becoming pale at margin; pectoral fins lightly dusky with a broken brown line from in front of fin onto base of fin about one-third distance from upper edge; pelvic fins dark brown, the rays and frenum a little paler than membranes.

Colour in alcohol: females similar to males but paler, the dorsal fins with numerous small dusky spots or dashes (no dark brown to black spots) in oblique rows, no large black spot in first dorsal fin; anal fin dusky, not blackish.

REMARKS: The species is named *gymnocara* from the Latin for 'naked head', in reference to the absence of scales on the cheek and opercle.

Gnatholepis gymnocara is a small species; the largest examined is 36.6 mm SL. Of the 50 paratypes, 24 have come from the coast of Queensland at 22-27°S, and 2 from off Darwin, Northern Territory. All specimens with depth data have been taken in shallow water, generally less than 0.5 m; at least one lot came from a brackish habitat.

In addition to colour characters, there are noteworthy differences in body and fin proportions of males and females (see Table 2). Males are more slender, have longer median fins, and usually shorter heads.

This goby appears to be most closely related to the undescribed species diagnosed below, which is also known only from northern Australia. These two species lack scales on the cheek and opercle and all or most of the median predorsal region of the nape, and they lack an outer row of enlarged teeth anteriorly in the lower jaw. Both are small species with the same range (but not mode) of pectoral-ray counts and much similarity in colour. Were it

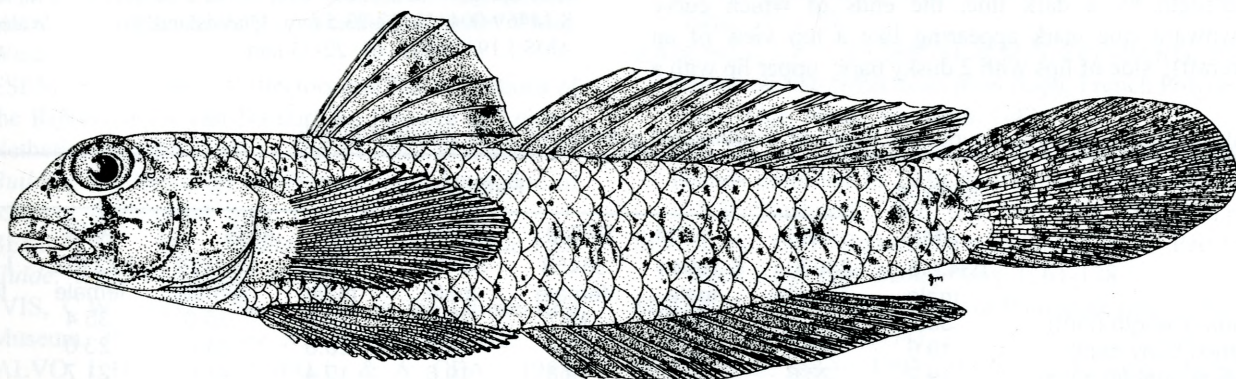


Figure 3. *Gnatholepis gymnocara*, male, holotype, AMS I.34318-051, 32.2 mm SL, Queensland.

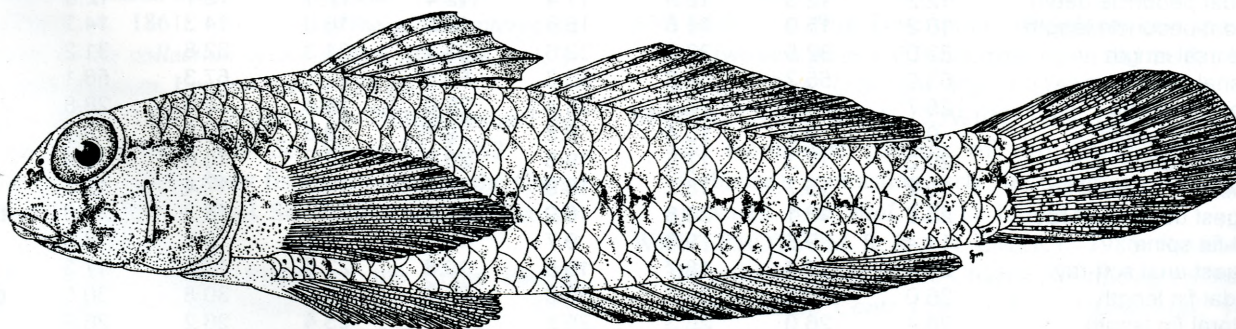


Figure 4. *Gnatholepis gymnocara*, female, paratype, BPBM 38458, 33.0 mm SL, Queensland.

not for *gymnocara* having 11 dorsal and nearly always 12 anal soft rays (compared to 10 and 11, respectively, for *Gnatholepis* sp.) and having prepectoral scales, the females would be difficult to distinguish. The males, however, are easily separated by the black spot in the first dorsal fin of *gymnocara*, its blackish anal fin, and by the much darker posterior mid-lateral blotches of the male *Gnatholepis* sp.

Gnatholepis sp.

Plate II H

DIAGNOSIS: Dorsal fin VI+I, 10-11, usually 10 (6 of 70 fish with 11); anal fin I, 11 (one of 70 with 12); pectoral rays 15-18; longitudinal scale series usually 29; no scales on opercle or cheek; no median predorsal scales (but cycloid scales on side of nape extending nearly to eye); no prepectoral scales; a few small embedded prepelvic scales; gill-rakers 1+3; dentition as in *G. gymnocara*; body slender, the depth 4.4-4.9 in SL; head length 3.5-3.65 in SL; caudal-peduncle length 1.5-1.7 in head length; caudal fin longer than head, 2.75-3.2 in SL. A small species, the largest examined, 32.8 mm SL.

Colour in alcohol of females: pale tan with a row of 6 dark blotches on body, the first beneath middle of pectoral fin, the second below tip of pectoral fin, and the last posteriorly on caudal peduncle (within each blotch a horizontal line of 2 or 3 blackish dots); dorsal half of body with dusky flecks that group to form 2 longitudinal rows of indistinct dusky blotches; a dusky line extending ventrally and slightly posteriorly from eye, bifurcating faintly at the ventral end, and crossed perpendicularly at about its midlength by a dark line, the ends of which curve downward (the mark appearing like a top view of an aircraft); side of lips with 2 dusky bars; upper lip with a

dusky median bar; anterior nostril dusky, linked by a dusky band to lower edge of rear nostril; indistinct dark blotches on postorbital head and opercle; dorsal fins with oblique rows of small dusky spots; caudal fin base with irregular blackish mark on upper half, the fin membranes with irregular vertical rows of small dusky spots; anal and pelvic fins dusky, the ray tips pale; pectoral fins pale with a narrow dusky band from base onto proximal part of fin.

Males have the last 2 to 4 dark blotches on the body much darker, the anal fin blackish, the small dusky spots in the median fins black and fewer in number. A fresh male (Plate II, H) shows prominent pale blue spots on the body (many encircling the last 4 mid-lateral blackish blotches) and median fins (those on second dorsal and anal fins in oblique rows, the anal rows curved with an irregular broken black line between each row); small black spots in second dorsal and caudal fins broadly rimmed in orange.

REMARKS: This species will be described by Helen K. Larson of the Northern Territory Museum. The specimen shown on Plate II H was caught in 0-1.5 m near Darwin. Other specimens were also taken in shallow water.

Gnatholepis sp. is the smallest species of the genus; the largest of 301 specimens examined measures 32.8 mm SL. It is most similar to *G. gymnocara* (see above).

MATERIAL EXAMINED: AUSTRALIA: Northern Territory, Darwin, AMS I.24677-003, 12: 23.5-28.5 mm; Gunn Point, BPBM 38459, 10: 19-25 mm (formerly AMS I.24694-004); Dudley Point, BPBM 38378, 2: 21-23 mm; Coburg Peninsula, Buford Id, NTM S.10005-034, 131: 8.5-26 mm; Cape Wessel, Rimbaja Id, NTM S.13237-038, 37: 12.5-32 mm; Field Id, NTM S.14469-004, 48: 12-23.5 mm. Queensland, Prince of Wales Id, AMS I.19356-016, 61: 22-33 mm.

Table 2. Measurements of type-specimens of *Gnatholepis gymnocara* in % standard length.

| | Holotype | | | Paratypes | | | | | |
|-------------------------------------|----------------|----------------|----------------|---------------|---------------|---------------|----------------|----------------|--------------|
| | AMS I.34318 | AMS I.23930 | NTM S.13944 | BPBM 38458 | BPBM 38458 | BPBM 38458 | AMS IB.1276 | AMS I.22102 | QM I.7399 |
| Sex | male | female | male | female | male | male | female | female | female |
| Standard length (mm) | 32.2 | 27.6 | 28.9 | 30.7 | 30.8 | 32.0 | 35.0 | 35.4 | 36.6 |
| Greatest body depth | 19.6 | 22.8 | 20.7 | 22.7 | 20.4 | 20.0 | 24.0 | 23.0 | 21.3 |
| Depth at anal-fin origin | 19.2 | 20.6 | 19.7 | 19.8 | 19.6 | 19.4 | 21.0 | 21.7 | 20.0 |
| Body width | 15.9 | 16.4 | 14.2 | 14.8 | 15.3 | 15.0 | 16.4 | 16.3 | 16.4 |
| Head length | 26.7 | 27.1 | 26.0 | 26.7 | 27.7 | 25.9 | 28.4 | 28.0 | 29.0 |
| Head width | 16.5 | 16.3 | 16.2 | 16.3 | 16.5 | 16.0 | 17.7 | 17.8 | 17.7 |
| Snout length | 10.0 | 10.1 | 9.4 | 9.5 | 9.8 | 9.4 | 10.3 | 10.4 | 10.5 |
| Orbit diameter | 8.1 | 9.0 | 8.7 | 8.8 | 8.5 | 8.0 | 8.8 | 8.6 | 8.2 |
| Interorbital width | 1.6 | 1.5 | 1.7 | 1.4 | 1.6 | 1.4 | 1.6 | 1.7 | 1.6 |
| Caudal-peduncle depth | 12.2 | 12.3 | 12.5 | 11.4 | 12.4 | 12.3 | 12.1 | 12.0 | 11.6 |
| Caudal-peduncle length | 16.2 | 15.9 | 15.6 | 15.6 | 16.2 | 16.0 | 14.3 | 14.1 | 16.3 |
| Predorsal length | 33.0 | 32.5 | 32.3 | 32.6 | 33.1 | 31.3 | 32.8 | 31.2 | 32.4 |
| Preanal length | 53.0 | 55.2 | 52.8 | 55.3 | 53.5 | 52.7 | 57.3 | 56.1 | 57.4 |
| Prepelvic length | 25.7 | 28.8 | 27.7 | 28.4 | 26.0 | 25.6 | 28.6 | 28.8 | 28.7 |
| Upper-jaw length | 9.6 | 9.8 | 10.4 | 9.8 | 9.7 | 9.8 | 10.8 | 9.9 | 10.4 |
| Longest dorsal spine | 20.2 | 17.3 | 17.5 | 19.8 | 20.0 | 20.9 | 18.6 | 18.5 | 17.8 |
| Spine of 2 nd dorsal fin | 19.2 | 15.7 | 18.2 | 16.9 | 19.5 | 19.3 | 17.4 | 17.3 | 16.8 |
| Longest dorsal soft-ray | 25.2 | 16.1 | 20.8 | 16.9 | 25.9 | 25.4 | 18.3 | 17.5 | broken |
| Anal-fin spine | 11.4 | 9.5 | 9.3 | 9.7 | 11.3 | 11.4 | 8.6 | 8.6 | 9.6 |
| Longest anal soft-ray | 22.4 | 17.4 | 18.7 | 16.5 | 19.8 | 22.5 | 17.7 | 17.3 | 17.6 |
| Caudal-fin length | 36.0 | 29.0 | 31.2 | 32.6 | 35.2 | 35.3 | 30.8 | 30.5 | broken |
| Pectoral-fin length | 28.4 | 26.0 | 25.3 | 25.8 | 27.7 | 25.4 | 26.2 | 26.9 | 26.5 |
| Pelvic-fin length | 28.8 | 25.4 | 25.3 | 26.3 | 28.0 | 27.5 | 26.1 | 27.3 | 27.3 |

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