

Redescription of *Gnatholepis cauerensis* (Bleeker, 1853), with discussion of the validity of the species

J.E. Randall & D.W. Greenfield

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John E. Randall, Bishop Museum, 1525 Bernice St., Honolulu, HI 96817-2704, USA (e-mail: jackr@hawaii.rr.com).

David W. Greenfield, California Academy of Sciences, 875 Howard St., San Francisco, CA 94113-3098, USA.

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Thacker (2004b) regarded the gobiid fish *Gnatholepis cauerensis* (Bleeker) as a synonym of *Gnatholepis anjerensis* (Bleeker) and treated *G. scapulostigma* Herre as the replacement name for what other recent authors had identified as *G. cauerensis*. The holotype of *Gobius cauerensis* Bleeker from the Nationaal Natuurhistorische Museum in Leiden is redescribed. Because its colour pattern has faded, the original Bleeker painting is reproduced, the diagnostic colour features noted, and comparison provided with an underwater photograph taken of a specimen before it was collected in the Mentawai Islands (near the type locality of Kauer, Sumatra). *Gnatholepis cauerensis* is a valid species distinct from *G. anjerensis*. *G. scapulostigma* Herre is returned to the synonymy of *G. cauerensis*. *G. thompsoni* Jordan from the Atlantic is also a synonym of *cauerensis*, following Rocha et al. (2005). The validity of *G. knighti* Jordan & Evermann from the Hawaiian Islands, with records for the Cook Islands and Society Islands, is questioned.

Introduction

Bleeker (1853: 269) described *Gobius cauerensis* in 21 lines of Latin text from a specimen 39 mm in total length collected in the sea from Cauer, Sumatra. Bleeker (1860: 41) spelled the locality Kauer in a list of fishes of Sumatra. A colour illustration for this species was planned by Bleeker for his *Atlas Ichthyologique*. His death on 23 January 1878 ended the plans for volumes X to XIV. The surviving colour plates for volumes XI to XIV were printed in 1983 by the Smithsonian Institution, Washington, D.C. and the Rijksmuseum van Natuurlijke Historie, Leiden. Plate 435b, fig. 1 of this compilation is labeled *Acentrogobius cauerensis*, with notes that Bleeker had made for corrections by the artist, such as pearly spots (on cheek) too large, fins without bands, and pelvic fin too blackish. We reproduce here Bleeker's original colour illustration (without Bleeker's notes) as our fig 1. Information on the illustrations in Bleeker's *Atlas* was provided by van Oijen (2005) from the translation of a little-known French paper by P. Bleeker.

Günther (1861: 41) made an English description of *Gobius cauerensis*, following that of Bleeker, and gave the locality as Sea of Cauer (Sumatra). He regarded *Gobius anjerensis* Bleeker, 1851, described from a drawing, as unidentifiable. Bleeker (1874: 318), however,

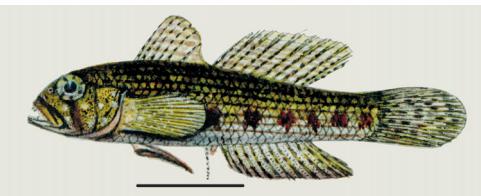


Fig. 1. Unfinished painting of *Gobius cauerensis* planned for Bleeker's *Atlas Ichthyologique*.

designated *Gobius anjerensis* as the type species of the subgenus *Gnatholepis* of the genus *Stenogobius*.

Koumans (1953: 68-71) reclassified *Gobius cauerensis* in the genus *Acentrogobius* and gave the distribution as Red Sea and east coast of Africa to Japan and the Hawaiian Islands. He included the following species as synonyms of *cauerensis*: *Gobius ophthalmotaenia* Bleeker, *G. capistratus* Peters, *Gnatholepis deltoides* Seale, *G. knighti* Jordan & Evermann, *G. davaoensis* Seale, *G. gemmeus* Herre, and *G. corletti* Herre.

He recognized *Gnatholepis anjerensis* as a valid species, noting that no type specimen exists (Koumans, 1953: 171-172).

Herre (1953) described *Gnatholepis scapulostigma* from Enewetak Atoll, Marshall Islands and provided a key to what he regarded as the 14 species of the genus.

Randall & Greenfield (2001) published a preliminary review of the genus *Gnatholepis*. With the assistance of Helen K. Larson, they concluded that only one of the 14 species of Herre's key is a valid species of *Gnatholepis*, noting the source of each generic name change. They described a neotype for *Gobius anjerensis*, selecting a specimen of the species that most authors have identified as *Gnatholepis anjerensis*. They listed *Gobius ophthalmotaenia* Bleeker, *G. capistratus* Peters, *G. deltoides* Seale, *Gnatholepis knighti* Jordan & Evermann, and *G. corlettei* Herre as synonyms of *anjerensis*. The material of *G. anjerensis* that they examined ranged from the Red Sea and east coast of Africa to the Hawaiian Islands and Tuamotu Archipelago. They recognized *Gnatholepis davaoensis* Seale as a valid species, with *G. gemmeus* Herre as a synonym, described *G. gymnocara* as a new species from Queensland, and gave a diagnosis for a new species from the Northern Territory of Australia, indicating that the description was planned by Helen K. Larson (since described by Larson & Buckle, 2005, as *G. argus*). They divided *Gnatholepis cauerensis* into four subspecies, *cauerensis cauerensis* from the east coast of Africa to the Society Islands, *cauerensis australis* from the Pitcairn Islands to the Cook Islands, *cauerensis pascuensis* from Easter Island, and *cauerensis hawaiiensis* from the Hawaiian Islands. They presented a table of counts of pectoral-fin rays (reproduced here as table 1; *Gnatholepis* sp. in the table is now *G. argus*) to show the strong modal difference in the counts of *anjerensis* from *cauerensis*. *Gnatholepis scapulostigma* Herre and *G. inconsequens* Whitley were placed in the synonymy of *G. cauerensis cauerensis*. *Gnatholepis thompsoni* Jordan, the only species of the genus from the Atlantic, could not be differentiated morphologically or by colour from *G. cauerensis cauerensis*. Winterbottom & Emery (1986) experienced difficulty separating *G. thompsoni* from their Chagos Archipelago material of *G. cauerensis*.

Thacker (2004a) came to surprisingly different conclusions on the species of *Gnatholepis* by analysis of mitochondrial DNA and heavy reliance on the presence or absence of a dark shoulder spot. This dark brown spot above the base of the pectoral fin often contains a small yellow spot. She regarded *cauerensis* as a synonym of *anjerensis*, distinguishing it as a species lacking the shoulder spot, and resurrected *G. scapulostigma* Herre as the species with the shoulder spot.

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

	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		
<i>Gnatholepis</i> sp. is now <i>G. argus</i> .						

We did not use the dark shoulder spot as a diagnostic character to distinguish *anjerensis* from *cauerensis* in our review of the genus because of its variability within a species. The spot may be present or absent in freshly collected specimens of both *anjerensis* and *cauerensis*, even within a series of specimens from the same locality. The colour figures of *Gnatholepis anjerensis* and *G. cauerensis* in our review of the genus show specimens with and without the typical shoulder spot. Richard Winterbottom (pers. comm.) informed us that he has seen specimens with the spot on one side of the body and absent on the other. In addition, there is the problem of the loss of the spot on faded museum specimens. Thacker evidently did not regard our strong modal pectoral-count difference as important because "the ranges of counts overlap."

Bleeker recorded the total length of the holotype of *Gobius cauerensis* as 39 mm. Richard Winterbottom of the Royal Ontario Museum requested a loan of the specimen in 1980 from what was then the Rijksmuseum van Natuurlijke Historie in Leiden. The Curator of Fishes at that time, M. Boeseman, wrote to Winterbottom on 29 August 1980, "The (presumed) *cauerensis* holotype is in RMNH 4523 and was recently examined by Hoese. I will ask my assistant to send you the specimen." Winterbottom provided us with descriptive information that he recorded for the specimen, including pectoral-ray counts of 16 on one side and 17 on the other. His measurement of the standard length was 29.7 mm.

Helen K. Larson (pers. comm.) examined the holotype in Leiden in 1988. She found a second specimen in the jar of similar size. Bleeker was known to later place additional specimens of a species that he described with the same lot with the holotype. The smaller of the two specimens (the one sent on loan to Winterbottom) was the closest in total length to Bleeker's measurement for the holotype. Larson made a sketch and notes, which she passed on to us. One note stated, "Looks like Atlas fig." Peter J. Miller of the University of Bristol borrowed the two specimens in 1989 and also provided his data. we obtained a loan of the two specimens in July 2006. The condition of the holotype is poor, as might be expected from its age, evidence that it had been dried at one time, and its examination by several persons. Many fin rays are broken, many scales are missing, and there are no remaining colour markings.

We were uncertain of the locality Cauer (or Kauer) in Sumatra, so we asked Martien J.P. van Oijen if he could provide this. He and Lipke Holthuis were unable to find Kauer on any current map, but they finally located a village and a small bay with this name on the southwest coast of Sumatra on a map dated 1892. The coordinates are 4°44'S, 103°15'E.

We include an underwater photograph of *Gnatholepis cauerensis* taken by the first author at the Mentawai Islands off the southwest coast of Sumatra. The fish was collected after it was photographed and deposited in the Bishop Museum, Honolulu as BPBM 37641, 29.8 mm SL. We illustrate it here as fig. 2 to provide for comparison with the painting of this species that had been intended for Bleeker's *Atlas Ichthyologique*.

Thacker (2004a) also regarded *Gnatholepis knighti* Jordan & Evermann, type locality, Hilo, Hawai'i, as a valid species. She wrote, "This species was named in honour of Knight Starr Jordan, the son of David Starr Jordan." The name of the son, however, was Eric Knight Jordan. Any Indo-Pacific goby that is found in the Hawaiian Islands might be expected to show some difference in DNA from elsewhere in its range because of the isolation of the Hawaiian Archipelago and the very high percentage of endemism



Fig. 2. Underwater photograph of *Gnatholepis cauerensis*, Mentawai Islands, Indonesia.

among shore fishes, especially in species such as gobies that lay demersal eggs. However, Thacker included records of *knighti* from the Cook Islands and Society Islands, indicating that she did not regard it as a Hawaiian endemic. Thacker (2004b) compared the population structure of *G. anjerensis* and *G. scapulostigma* among four South Pacific island groups, including the Cook Islands and Society Islands, but she made no mention of the populations of *knighti* from these islands.

Thacker (2004a) recognized the Atlantic species of *Gnatholepis* as *G. thompsoni* Jordan. However, Rocha et al., (2005) have shown that it is a synonym of *G. scapulostigma* (Luiz Rocha, pers. comm., explained that they used the name *cauerensis* in their manuscript, but were told they had to change it to *scapulostigma* because that was the latest name that had been published). Their study determined that *scapulostigma* (now *cauerensis*) invaded the Atlantic from the Indian Ocean during an interglacial period about 145,000 years ago.

Methods

Methods of making counts and measurements follow Randall & Greenfield (2001). No count was made of the gill rakers of the holotype of *Gobius cauerensis*.

Redescription of holotype of *Gobius cauerensis* (fig. 1; table 2)

Dorsal rays VI + I,11; anal rays I,11; dorsal and anal rays branched, the last to base; segmented caudal rays 17; upper procurent caudal rays 6; lower procurent caudal rays 5; pectoral rays 16/17; pelvic rays I,5, joined medially to form a disc; scales in longitudinal series on body about 29; transverse scales 9; median predorsal scales about 11, reaching posterior interorbital space; branchiostegal rays 5; vertebrae 26.

Body depth 4.55 in SL; body width 1.35 in body depth; head length 4.95 in SL; head width 1.15 in head length; snout length 3.85 in head length; dorsal profile of snout forming an angle of about 55° to horizontal axis of body; eye diameter 4.05 in head length; interorbital space narrow, the least width 8.4 in head length; caudal-peduncle depth 2.4 in head length; caudal-peduncle length 1.7 in head length.

Mouth slightly inferior and oblique, forming an angle of about 20° to horizontal axis of body; maxilla reaching slightly posterior to a vertical at front edge of orbit, the upper-jaw length 3.0 in head length; two rows of teeth anteriorly in jaws, narrowing to one row posteriorly; outer row of teeth at front of upper jaw consisting of two pairs of slender well-spaced curved canines; outer row of teeth at front of lower jaw with three pairs of curved canines, the most posterior largest and most strongly recurved; teeth on side of upper jaw curving forward and medially, those on side of lower jaw curving medially; lips fleshy; lower lip with a prominent flap on side; tongue bilobed.

Posterior nostril near fleshy edge of orbit at level of ventral edge of pupil, with a slight rim; anterior nostril a short membranous tube anteroventral to posterior nostril, the internarial distance slightly greater than diameter of posterior nostril. Sensory pores typical of the genus, as illustrated by Prince Akihito in Masuda et al. (1984: 252, fig. 84) for *Gnatholepis anjerensis*; sensory papillae too damaged to reveal the pattern.

Scales ctenoid except on head, nape, and prepectoral and pelvic areas, where cycloid; cheeks scaled, but some scales missing; fins without scales except caudal fin and pectoral fins with a few scales on base.

Origin of first dorsal fin slightly posterior to rear base of pelvic fins, the predorsal length 3.45 in SL; second dorsal spine longest, 4.95 in SL, but third and fourth spines nearly as long; origin of anal fin below base of second dorsal soft ray, the preanal length 1.8 in SL; origin of pelvic fins below posterior end of head, the prepelvic length 3.6 in SL; fifth pelvic rays longest, just reaching origin of anal fin, 3.7 in SL; pelvic frenum present but damaged.

Colour in alcohol brown, the fins pale yellowish. Colour when fresh shown by the Bleeker painting of fig. 1.

Remarks.—Because of the poor condition of the holotype and the lack of any colour pattern, we rely heavily on the Bleeker illustration of the specimen (fig. 1) for colour. It

Table 2. Proportional Measurements of Holotype of *Gobius cauerensis* as Percentages of the Standard Length

	Holotype RMNH 4523
Standard length (mm)	29.7
Sex	male
Body depth (pelvic origin)	22.0
Body depth (2nd dorsal origin)	18.3
Body width (pectoral origin)	13.6
Body width (2nd dorsal origin)	10.0
Head length	28.6
Head depth	20.2
Head width	17.6
Snout length	7.4
Orbit diameter	7.1
Interorbital width	3.4
Upper-jaw length	9.5
Caudal-peduncle depth	11.8
Caudal-peduncle length	16.7
Predorsal length	28.9
Preanal length	55.6
Prepelvic length	27.6
Base of first dorsal fin	16.2
First dorsal spine	18.7
Second dorsal spine	20.2
Base of second dorsal fin	32.5
Spine of second dorsal fin	18.6
Longest dorsal soft ray	broken
Base of anal fin	22.0
Anal spine	13.8
Longest anal soft ray	broken
Caudal-fin length	broken
Pectoral-fin length	broken
Pelvic-fin length	26.9

shows the strong longitudinal linear pattern on the body that is typical of the species as illustrated by Randall & Greenfield (2001). Also the seven large dark spots along the lower side of the body are more sharply defined, and the dark spot above the base of the pectoral fin is distinctly triangular. We conclude that *Gnatholepis cauerensis* (Bleeker) is a valid species of gobiid fish, distinct from *G. anjerensis* (Bleeker).

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