Env. Biol. Fish. Vol. 6, No. 2, pp. 139–149, 1981

A new genus and two new species of gobiid fishes (Perciformes) from the Chagos Archipelago, Central Indian Ocean

Richard Winterbottom & Alan R. Emery

Department of Ichthyology and Herpetology, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario M5S 2C6, Canada

Keywords:
Gobiidae, *Trimmatom* n. gen., *T. nanus*, *T. offucius*, Smallest vertebrate, Habitat, Osteology

Synopsis

A recent (1979) expedition to the Chagos Archipelago resulted in the collection of about 40 new taxa of fishes. A new genus, *Trimmatom*, and two new species, *T. nanus* and *T. offucius*, are described here. The new genus is characterized by having all pelvic-fin rays simple (unbranched), a scaleless body, no head pores, a wide gill opening extending anteroventrally to below the eye, and hypurals 1 and 2 fused to the complex formed by the fusion of the ural centrum and hypurals 3 and 4. *T. nanus* and *T. offucius* are differentiated on the basis of fin ray counts and colour pattern. *T. nanus* is the smallest vertebrate yet to be described. Mature females with ovaries full of eggs are 8–10 mm in standard length.

Introduction

The Gobiidae is the most speciose family of marine tropical shore fishes in the world. In spite of there being some 2,000 nominal species in the Indo-Pacific region alone (Lachner, pers. comm.), many of at least the coral reef species are presently undescribed. In the genus *Trimma* there are about 14 nominal species (several of which are junior synonyms) for the approximately 40 species assignable to that genus. A similar situation exists in *Eviota* (where there are 23 nominal species for the approximately 60 species in the genus) and in other gobioid genera.

Although a comprehensive work on the approximately 100 species of Chagos gobioid fishes collected on a recent (1979) expedition to the archipelago is in preparation, the new genus and species are described here partly because of their distinctive characters, and also because one of the new species represents the smallest vertebrate known to science. We follow Hoese (1976) in recognizing the Gobiidae and Eleotridae as distinct families, rather than as subfamilies as Miller (1973) proposed. Several osteological characters place the new genus in the Gobiidae, including the presence of five branchiostegal rays and a single epural.

Received 3.11.1980 Accepted 5.12.1980

Materials and methods

Counts and measurements are standard, except that the measurements were made using a Wild M5 dissecting microscope with a micrometer eyepiece (as opposed to dial calipers). Serial sections were

 0378-1909/81/0062-0139 $02.20.

cut at 7μ and stained with haemotoxylin and eosin. Abbreviations for repositories of material: AM – Australian Museum: BM(NH) – British Museum (Natural History); CAS – California Academy of Sciences; NMC – National Museum of Natural Sciences, Canada; ROM – Royal Ontario Museum; RUSI – J.L.B. Smith Institute of Ichthyology, South Africa; USNM – National Museum of Natural History, Smithsonian Institution.

Taxonomy

Trimmatom n. gen.

Type-species

Trimmatom nanus n. sp.

Diagnosis

Trimmatom may be distinguished from all other gobiids by the following combination of characters: pelvic fin with all five rays simple (Fig. 1); dorsal, anal and pectoral-fin rays simple; no head pores; body scaleless; gill opening extending anteroventrally to below eye. As far as we are aware, the first character has not been reported elsewhere in Indo-Pacific gobiids.

Description

First dorsal fin with six spines, separated from second dorsal fin. Pelvic fins with basal membrane

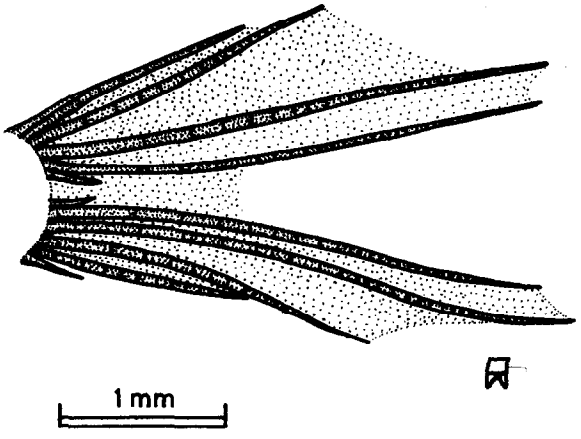

Fig. 1. Ventral view of the pelvic fins of *Trimmatom offucius* (ROM 628 CS, 10.9 mm SL female).

incomplete or absent, no fraenum, fifth ray rudimentary, all rays unbranched. Dorsal, anal and pectoral fins with all rays unbranched. Tip of tongue truncate or slightly rounded. Gill opening wide, lower opercular membrane attached to isthmus below pupil of eye. First gill arch free and not attached to suspensorium laterally by membrane, total number of gill rakers on first epi – and ceratobranchials 10–14, well developed. Anterior nostril tubular, posterior nostril with a raised rim. No flaps on shoulder girdle. Body completely scaleless. No head pores. Head papillae few in number, large, and positioned as in Figures 4 and 7. Outer row of teeth in upper jaw incomplete, consisting of two to four clearly separated, large, curved canines near the symphysis on each side, and an irregular inner row of many small conical teeth (Fig. 2). Lower jaw teeth similar. No teeth on vomer. Genital papilla of males slender and tapering distally, that of females broad and dorsoventrally flattened, with a small lobe at each posterolateral margin.

Osteology

Five branchiostegal rays. No mesopterygoid, metapterygoid not in contact with quadrate, posterior flange of hyomandibular and dorsal process of preopercle in contact or not quite in contact, no process from the pre-opercle to the symplectic (Fig. 2). No first suborbital bone. Epioccipitals (old name = epiotic) almost meet in the midline beneath the posterior process of supraoccipital. Sphenotic separated from supraoccipital by epioccipital. No postcleithrum, four cartilagenous pectoral radials, a notch in the anterior face of the scapular cartilage (= scapular foramen?). No separate coracoid ossification or cartilage, the cartilage in this area being continuous with the scapular cartilage. Urohyal broadly spatulate. Vertebrae 10+15 plus ural centrum (=26). Dorsal pterygiophore formula (of Birdsong 1975) 3(22110). Caudal skeleton (Fig. 3) with a broad haemal spine on preural centrum 2; a short, rod-like parhypural separated from the compound ural centrum by a distance equal to its length; ural centrum and hypurals 1 to 4 all fused together, with a posterior notch indicating the line of fusion of hypurals 1+2 with hypurals 3+4; hypural 5

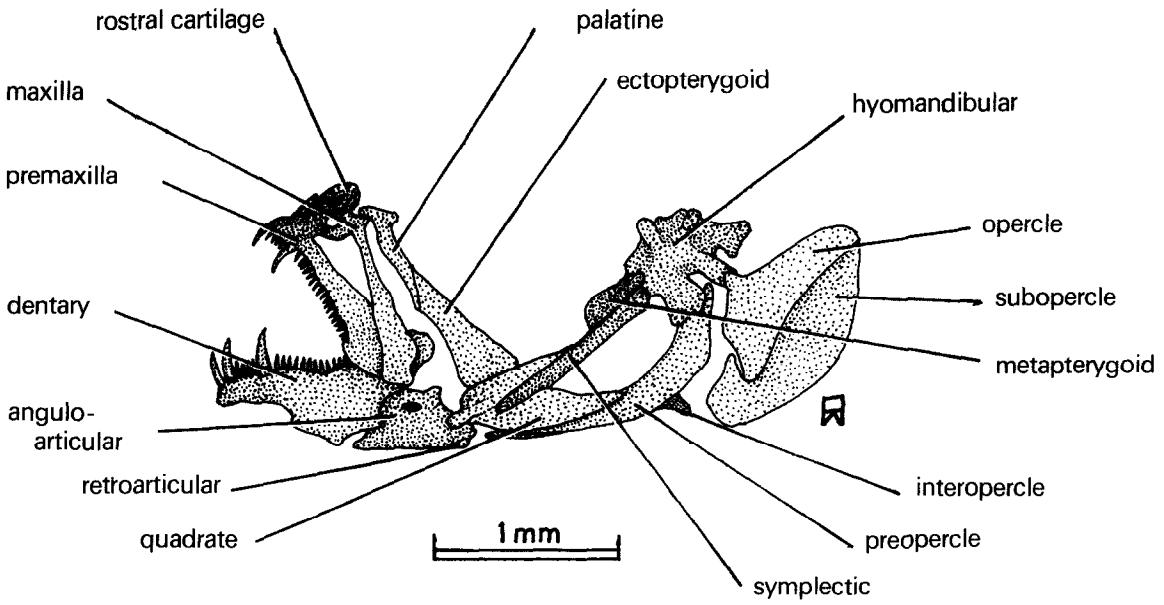

Fig. 2. Left lateral view of suspensorium and jaws of *Trimmatom offucius* (ROM 628 CS, 11.5 mm SL male). Bone shown in fine stipple, cartilage in large stipple.

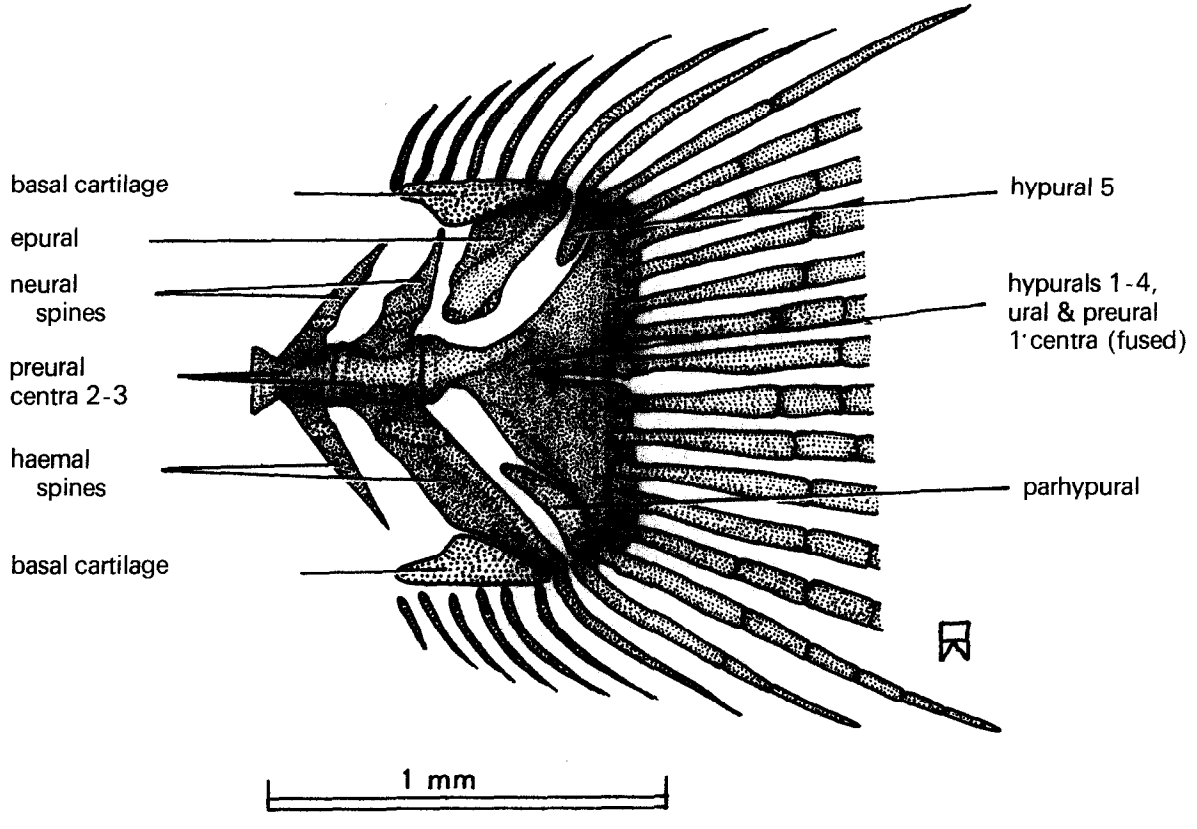

Fig. 3. Left lateral view of caudal skeleton of *Trimmatom offucius* (ROM 628 CS, 10.9 mm SL female). Bone shown in fine stipple, cartilage in large stipple. Only unbranched rays shown in full.

small; a single rod-like epural with a prominent dorsal flange; neural spine of preural centrum 2 well developed, almost reaching dorsal basal cartilage. Six dorsal and five ventral branched caudal-fin rays.

Discussion

Of the 106 species of gobioids studied by Akihito (1969), six species have the fifth pelvic ray unbranched and only one, *Leucopsarion petersi*, has all pelvic rays unbranched (and, additionally, is scaleless). However, *L. petersi* has only three rays in the pelvic fin, it lacks a first dorsal fin, the pelvic fins are united into a sucking disc by the presence of a fraenum, and it has a long-based anal fin (I 17–18). It would not appear to be closely related to *Trimmatom*. *Eviota* has the first four pelvic rays much branched, a restricted gill opening, most species with head pores, and scales, and thus would not appear to be closely related. *Paratrimma*, from islands off the Chilean coast, lacks head pores and has a wide gill opening and well developed gill rakers on the first gill arch. The genus is closely allied to *Trimma* (Hoese & Brothers 1976) but differs from that genus and *Trimmatom* in possessing a pointed tongue, a complete outer row of teeth in the upper jaw and a crest on the nape. *Paratrimma* differs further from *Trimmatom* in the presence of four branched rays in the pelvic fin, scaled body, more gill rakers on the first gill arch (14–18) and more dorsal (17–22) and anal 18–24) fin rays. The last three characters appear to be autapomorphies for *Paratrimma*. Two genera of small coral reef gobiids share with *Trimmatom* a relatively wide gill opening with well developed gill rakers on the first arch, a lack of head pores, and a similar disposition and form of head papillae. These are *Trimma* and *Priolepis* (synonyms of the latter include *Zonogobius* and *Quisquilius*, Hoese, pers. comm.). In *Priolepis*, the gill opening does not extend anteriorly to below the pupil of the eye. The two genera differ from *Trimmatom* in having at least the first four pelvic-fin rays branched; in having at least some dorsal, anal and pectoral-fin rays branched; and in having scales. Although, as stated above, we have been unable to discover any described gobiid with five unbranched pelvic-fin rays, the number of branched rays in the pectoral fin can be size dependent, as can the development of scales. Thus, these two characters could be viewed as neotenic. However, we note that another very small goby, *Pandaka pygmaea*, in which females mature at 10–11 mm SL, has well developed scales and branched pelvic-fin rays. The two species of *Trimmatom* also share the fused nature of hypurals 1 and 2 to hypurals 3 and 4 and the compound ural centrum. This condition, although found elsewhere, is described as '...both rare and specialized in gobioids' (Birdsong 1975, p. 173). Birdsong reports fused hypurals for the *Gobiosoma* group of American seven-spined gobies and the kraemeriids, neither of which for numerous other reasons seems closely related to *Trimmatom*. Hypural fusion is also present in two of six species of *Eviota* we examined (*E. sebreei* and an undescribed form related to it). Autapomorphies for *Eviota* include the nature of fin ray branching in the first four pelvic-fin rays, and, possibly, the presence of an inner enlarged canine near the angle of the dentary. No species of *Eviota* shares the autapomorphies listed below for *Paratrimma*, *Priolepis*, *Trimma* and *Trimmatom*. We therefore conclude that the fused nature of the hypural plates in the two species of *Eviota* is not homologous to the fused plates in *Trimmatom*. We note that this fusion is, in these forms at least, correlated with an elongate, slender body, and therefore likely the result of convergent evolution. The nature of the pelvic-fin rays and the fusion of the lower hypurals described above thus appear to be autapomorphies defining *Trimmatom* as a monophyletic taxon. We suggest that it forms a monophyletic group with *Paratrimma*, *Priolepis* and *Trimma* because of the lack of head pores, pattern of head pore papillae and the relatively wide gill opening with well developed gill rakers on the first gill arch. We further suspect that *Paratrimma*, *Trimma* and *Trimmatom* together form a monophyletic assemblage, based on the very wide gill opening (although such occurs elsewhere in gobiids, and may be so variable a character as to be of limited phylogenetic value). We are presently unaware of any characters that define *Trimma* as a monophyletic group to the exclusion of *Trimmatom* or *Paratrimma*. However, we describe *Trimmatom* because it is monophylectic, and because we feel

that once the phylogeny of the species grouped under *Paratrimma*, *Trimma* and *Trimmatom* is determined, it will prove desirable to subdivide this group into two or more monophyletic genera. We believe *Trimmatom* will be one of these.

Etymology

From the generic name '*Trimma*', to which the new taxon appears to be closely related, and 'atom', derived from the Greek 'atomon', a very small particle, in allusion to the very small size at maturity of both species. Gender masculine.

Trimmatom nanus n. sp. (Figs. 4–6)

Material

Holotype. – ROM 36617, 9.5 mm SL, male. Chagos Archipelago, Salomon Atoll, oceanic drop-off 150 m off eastern tip of Isle de la Passe (5°18′4″S, 72°15′44″E); depth 18–25 m; substrate of coral, rock and sand with seafans and sponges, rotenone. Coll: A.R. Emery, R. Winterbottom, A. Ryan and B. Simm; 23 Mar. 1979; field number WE79–91.

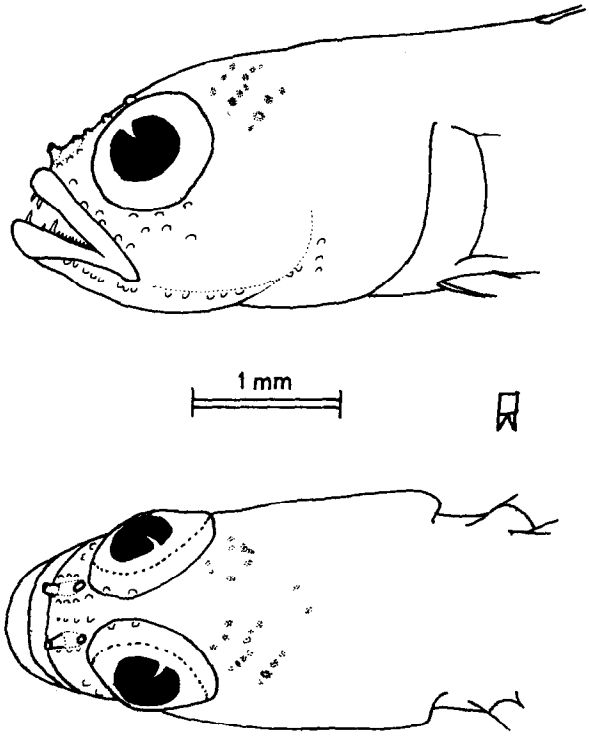

Fig. 4. Left lateral (above) and dorsal (below) views of the head of *Trimmatom nanus* (ROM 36616, paratype, 9.1 mm SL male) showing pattern of head papillae and melanophores.

Paratypes. – 92 specimens in 21 lots, 7.1–10.2 mm SL, all from the Chagos Archipelago and all collected with rotenone.

AM I. 21979-001, 4, 8.8–9.9 mm SL. Peros Banhos Atoll, drop-off 250 m off north end of Isle Poule, 20-25 m. 29 Mar. 1979, WE79-102.

BM(NH) 1980.8.18. 1–4, 4, 7.4–9.2 mm SL. Peros Banhos Atoll, drop-off 300 m off Isle Fouquet, 18 m. 21 Feb. 1979, WE79–32.

CAS 46636, 3, 7.4–8.9 mm SL. Salomon Atoll, drop-off 300 m off north end of Isle Fouquet, 18–25 m. 27 Mar. 1979, WE79–101.

NMC 80–618, 4, 7.5–9.9 mm SL. Salomon Atoll, drop-off 300 m off north end of Isle Diabole, 20–26 m. 17 Mar. 1979, WE79–76.

ROM 36610, 4, 8.2–9.5 mm SL. Peros Banhos Atoll, lagoon patch reef 300 m off south end of Isle du Coin, 7 m. 6 Feb. 1979, WE79–06. ROM 36649, 5, 7.9–9.6 mm SL. Salomon Atoll, lip of reef top off north end of Isle Diabole, 6–10 m. 14 Mar. 1979, WE79–67. ROM 36611, 4, 9.0–9.7 mm SL. Salomon Atoll, reef top 150 m off middle of Isle Anglaise, 7–10 m. 16 Mar. 1979, WE79–73. ROM 629 CS, 5, 8.2 10.2 mm SL (cleared and stained). Salomon Atoll, drop-off 200 m off north end of Isle Diabole, 20–25 m. 18 Mar. 1979, WE79–77. ROM 36612, 5, 7.6–9.6 mm SL. 40 m north of ROM 629 CS, 20–25 m. 18 Mar. 1979, WE79–79. ROM 36613, 1, 7.6 mm SL (specimen sectioned). Salomon Atoll, drop-off between Isle Anglaise and Isle Diabole, 15–20 m. 19 Mar. 1979, WE79-81. ROM 36614, 1, 9.1 mm SL. Salomon Atoll, drop-off 500 m off Isle Poule, 33–43 m. 21 Mar. 1979, WE79–87. ROM 36615, 8, 7.4–9.1 mm SL (6 specimens cleared and stained = ROM 630 CS). Salomon Atoll, drop-off 75 m off south end of Isle Anglaise, 20–25 m. 21 Mar. 1979, WE79–88. ROM 36616, 9, 7.1–10.2 mm SL. Salomon Atoll, drop-off 500 m off Isle Poule, 18–25 m. 22 Mar. 1979, WE79–89. ROM 36618, 6, 7.5–9.9 mm SL, collected with the holotype. ROM 36619, 2, 8.7–8.8 mm SL. Salomon Atoll, reef top 50 m off middle of Isle Boddam, 5–7 m. 23 Mar. 1979, WE79–92. ROM 36620, 6, 7.6–9.6 mm SL. Salomon Atoll, drop-off 100 m off west end of Isle Boddam, 18–25 m. 24 Mar. 1979, WE79–94. ROM 36621, 1, 9.5 mm SL. Salomon Atoll, reef top 75 m

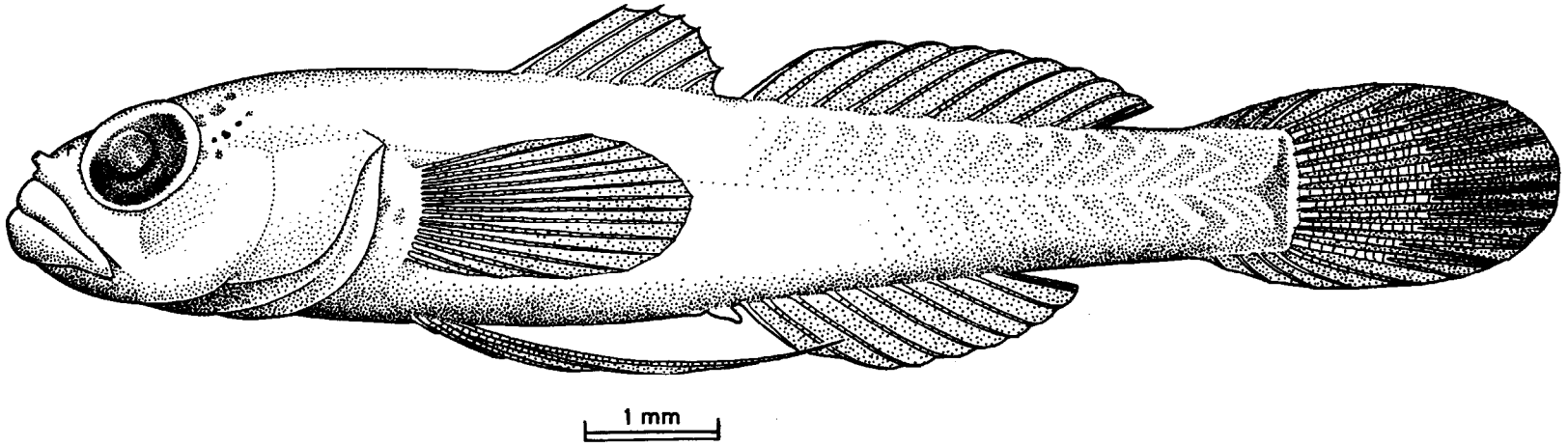

Fig. 5. Left lateral view of the holotype of *Trimmatom nanus* (ROM 36617, 9.5 mm SL male). Light phase. Drawn by Anker Odum.

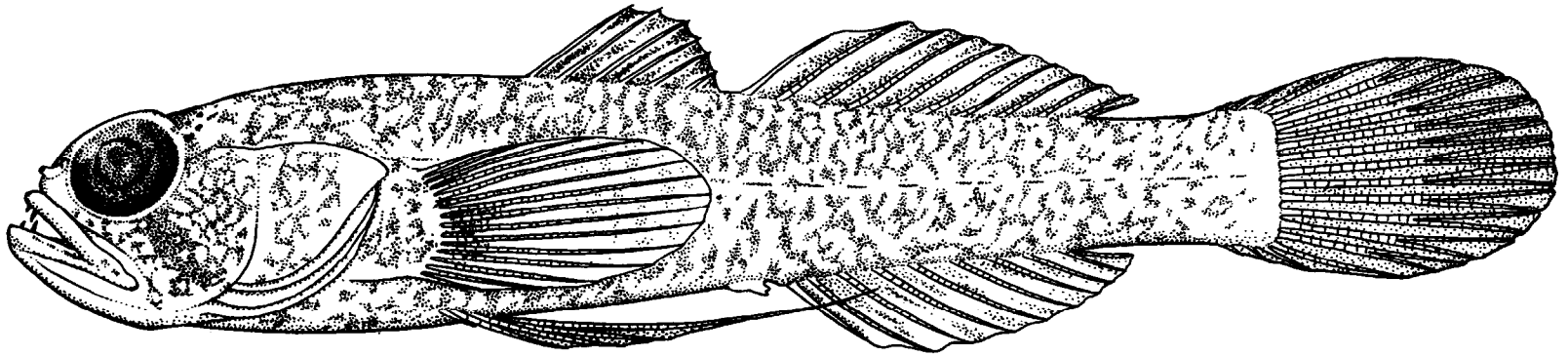

Fig. 6 Left lateral view of a paratype of *Trimmatom nanus* (ROM 36623, 9.1 mm SL female). Dark phase. Drawn by Anker Odum.

off Isle Anglaise, 4–7 m. 24 Mar. 1979, WE79–95. ROM 36622, 6, 7.5–9.2 mm SL. Peros Banhos Atoll, drop-off 300 m off north end of Isle Poule, 36 m. 30 Mar. 1979, WE79–104. ROM 36623, 9, 7.6–9.6 mm SL (one specimen sectioned). Peros Banhos Atoll, drop-off 200 m off pass between Isle Anglaise and Isle Montpatre, 20–25 m. 30 Mar. 1979, WE79–106.

RUSI 459, 2, 8.9 mm SL. Salomon Atoll, drop-off 200 m off south-west end of Isle Boddam, 23–25 m. 25 Mar. 1979, WE79–96.

USNM 224881, 3, 7.6–8.3 mm SL. Peros Banhos Atoll, drop-off 350 m off south end of Isle Poule, 30–33 m. 29 Mar. 1979, WE79–103.

Diagnosis

A species of *Trimmatom* with 8–9 second dorsal-fin rays, 7–9 anal-fin rays, 14–16 pectoral-fin rays, 9–10 gill rakers on the lower limb of the first gill arch and no stripe below the eye.

Comparison

Related to *T. offucius* by the characters given in the generic diagnosis. It can be separated from that species in having fewer dorsal, anal and pectoral-fin rays (usual values of 9 vs 10, 8 vs 9, 15 vs 20 respectively), fewer lower gill rakers (9–10 vs 11–12) and in lacking a bar beneath the eye (vs bar present).

Description

Morphometrics based on 20 specimens (10 males, including holotype, 10 females); meristics based on these specimens plus 11 cleared and stained specimens (value for holotype in italics).

Dorsal fins VI + I 8 or *9* ($\bar{x} = 8.8$, SD = 0.37), second to fourth spines longest, reaching to the interspace between the two dorsal fins when depressed; A I 7, *8* or 9 ($\bar{x} = 8.0$, SD = 0.25); P 14, *15* or 16 ($\bar{x} = 15.0$, SD = 0.42), reaching to a vertical in line with or just anterior to anus; V I 5, fifth ray rudimentary, all rays simple, no fraenum, basal membrane vestigial or absent, longest ray reaching posteriorly to the base of the fourth ray of the anal fin. Procurrent (unbranched) caudal-fin rays with 8–10 ($\bar{x} = 8.6$) upper (dorsal) rays and 7–9 ($\bar{x} = 8.1$) lower (ventral) rays. No scales on head or body. Gill opening wide, extending to below the posterior half of the pupil anteroventrally. Mouth terminal, inclined dorsally at about 45°. Teeth in both jaws of an incomplete outer row of two to four enlarged, well separated, curved canines near the symphysis and a complete inner row of small conical teeth. Anterior nostril tubular, posterior nostril a pore with a raised rim. Tongue bluntly rounded. First gill slit open, gill rakers well developed. Longest gill raker about 30% of length of first ceratobranchial. Gill rakers on first arch 0–1 ($\bar{x} = 0.7$) + 9–10 ($\bar{x} = 9.4$). Pseudobranch with four lobes.

Morphometrics are presented as the mean, followed by the range and standard deviation in parentheses. As percentage standard length: head length 30.1 (28.7–32.0; 0.93); tip of snout to origin of first dorsal fin 39.8 (36.3–41.9, 1.28); tip of snout to origin of second dorsal fin 58.0 (54.7–63.0, 1.50); tip of snout to origin of anal fin 59.1 (54.1–62.8, 2.15); caudal peduncle length 22.6 (19.6–24.6, 1.49); body depth at first dorsal fin origin 18.6 (16.4–20.0, 1.06). As percentage head length: eye diameter 32.8 (30.2–35.7, 1.52); snout length 15.2 (12.2–17.2, 1.46); upper jaw length 36.6 (31.7–40.5, 2.10). Caudal peduncle depth as percentage caudal peduncle length 45.5 (40.0–56.1, 4.66).

Head papillae as in Figure 4. Gut short, S-shaped, dorsal part of peritoneum usually with melanophores. Gut contents (from cleared and stained specimens) of harpacticoid copepods, ostracods and radiolarians. Caudal skeleton as for *T. offucius* (Fig. 3), but more cartilagenous (the ural centrum and the hypural plates fused to it are at least partly ossified even in the smallest specimen, 7.2 mm SL).

Colour pattern. Freshly dead: not recorded. Preserved: varying from off-white with a few melanophores on the occiput and in the dorsal fin and anal fin to the whole body mottled, often with faint light cross-bars over the dorsum (cf Fig 5 and 6). Usually (but not always) smaller specimens are mottled and larger ones are light.

Discussion

T. nanus appears to be primarily an inhabitant of

the oceanic drop-offs between 20–30 m, where 67% of the specimens were taken. It was collected at all twelve stations made in this area, but only in half of the drop-off stations made both above and below this depth range, in three of the 14 reef top stations and in one of the 37 stations in the lagoon. *T. nanus* was not observed alive, but with an average of 4.4 specimens per lot (maximum number taken was 9) it is unlikely to be a schooling species.

Mature females of *T. nanus* having the abdominal cavity swollen with fully developed eggs, which are visible through the body wall, are present from a standard length of 8 mm and greater. We note that Lachner & Karnella (1978, p. 6) report that females of an unnamed species of *Eviota* '... mature at 9 mm SL and represent the smallest known species among fishes', and that they later (1980) record a mature female of *E. infulata* at 8.9 mm SL (Table 1, p. 116). Previous to this, the shortest named vertebrate species was *Pandaka pygmaea* Herre, in which females mature at 10–11 mm SL. However, as Bruun (1940) points out, 'smallness' needs to be qualified for it could mean mass or length. In the former case, Bruun found that *Schindleria praematurus* (Schindleriidae) weighs in at 2–8 mg for specimens from 10–21 mm SL, with *P. pygmaea* weighing 6–22 mg for specimens 8–11.5 mm SL. Although the trend is undoubtedly accurate, Bruun's material had different histories of preservation. When dealing with such small masses, we believe that the errors potentially introduced using alcohol preserved specimens weighed in air largely obviate the usefulness of the exercise. Forty-five specimens of *T. nanus* were identifiable as males, and had a mean standard length of 8.6 mm (SD = 0.82). The 39 identifiable females had a mean standard length of 8.9 mm (SD = 0.75). A single 8.7 mm SL female contained 54 eggs, 0.16–0.29 mm in diameter, with a mean diameter of 0.25 mm. The eggs would thus seem smaller than those reported for another very small gobiid, *Mistichthys luzonensis*, which matures at 10–14 mm Sl and has eggs of 0.4 mm in diameter (Te Winkel 1935). A 7.6 mm SL female of *T. nanus* was sectioned serially at 7 μ, and the ovaries were found to contain developing ova. Maximum ovum diameter was 0.07 mm. The testes of a serially sectioned 7.6 mm SL male were developed, but no spermatozoa were visible.

Etymology

Named 'nanus' from the Latin word for a dwarf, in allusion to the very small size at sexual maturity, and to it's position as the shortest vertebrate yet to be described. To be treated as a noun in apposition.

Trimmatom offucius n.sp. (Figs. 7, 8)

Material

Holotype. – ROM 36626, 13.8 mm SL, male. Chagos Archipelago, Salomon Atoll, oceanic drop-off 200 m off northwest tip of Isle Diabole (5° 20′ 39″ S, 72° 12′ 33″ E); depth 20–25 m; substrate a vertical rock wall with caves, corals, sponges, hydroids and antipitharians, rotenone. Coll: R. Winterbottom, A.R. Emery, S. Syson, R. Perry, J. Liptrot, J. Griffiths; 18 Mar. 1979; field number WE79–77.

Paratypes. – 168 specimens in 16 lots, 7.6–14.6 mm SL, all from the Chagos Archipelago and all collected with rotenone. In most cases, specimens

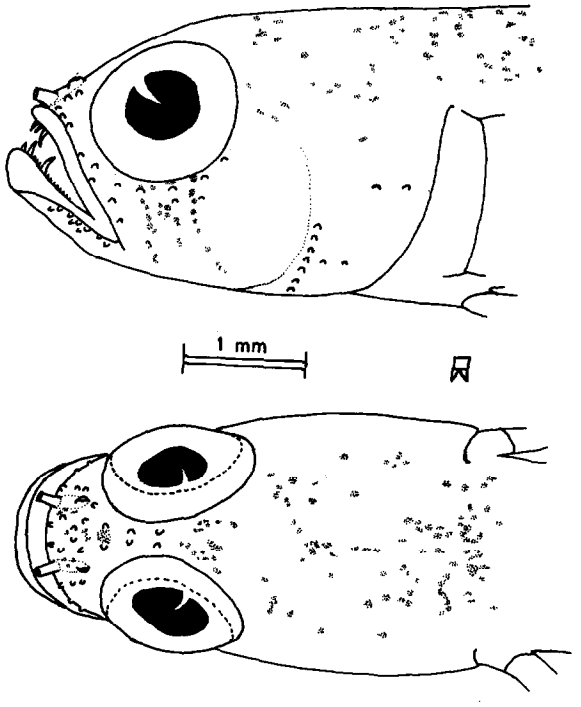

Fig. 7. Left lateral (above) and dorsal (below) views of the head of *Trimmatom offucius* (ROM 36626, holotype, 13.8 mm SL male) showing pattern of head papillae and melanophores/chromatophores.

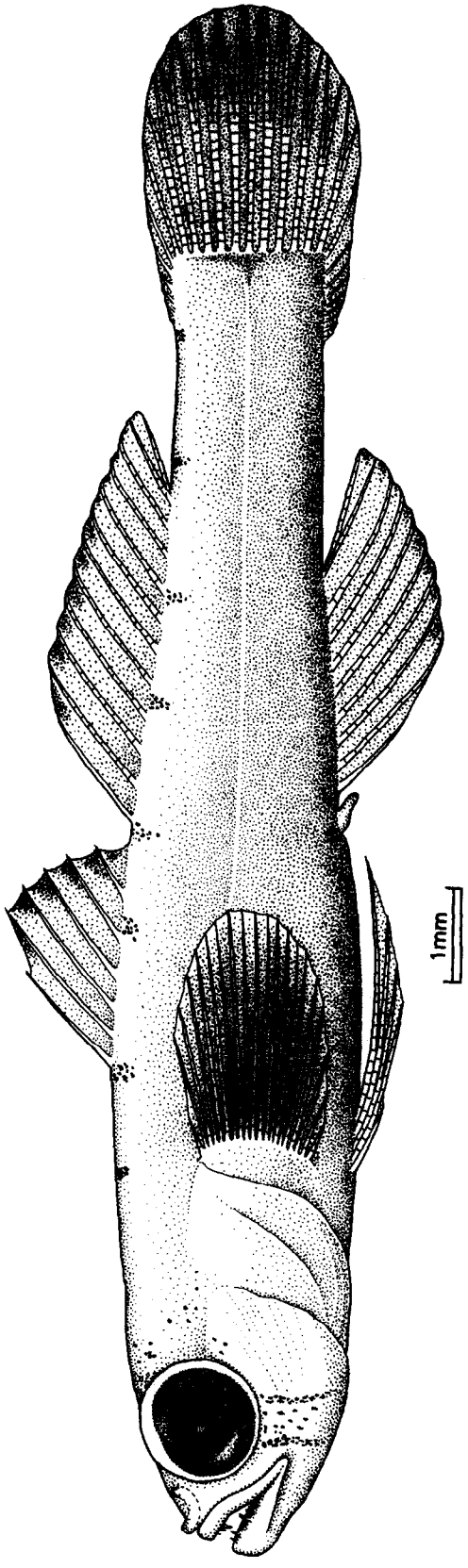

Fig. 8. Left lateral view of the holotype of *Trimmatom afluctus* (ROM 36626, 13.8 mm SL male). Some details of pigment pattern added from ROM 36629 (paratypes). Drawn by Anker Odum.

were collected with *T. nanus*, and the locality data can be found under the latter species by a designation of 'See...', followed by the relevant abbreviation and/or catalogue number.

AM I. 21980–001, 7, 8.3–10.7 mm SL. See AM I. 21979–001.

BM(NH) 1980.8.18.5–6, 2, 10.4–10.5 mm SL. Peros Banhos Atoll, drop-off 500 m off east side of Isle Fouquet, 42 m. 6 Mar. 1979, WE79–54.

CAS 46637, 2, 8.6–13.4 mm SL. See ROM 36613.

NMC 80–619, 5, 9.3–11.6 mm SL. Salomon Atoll, drop-off 300 m off northwest end of Isle Anglaise, 23–25 m. 25 Mar. 1979, WE79–97.

ROM 36624, 1, 12.0 mm SL. Peros Banhos Atoll, drop-off 750 m off east side of Isle Fouquet, 41–48 m. 7 Mar. 1979, WE79–56. ROM 36625, 15, 7.9–13.3 mm SL. Locality as for ROM 36624 above, 40–43 m. 8 Mar. 1979, WE79–58. ROM36627, 36, 8.4–13.8 mm SL, collected with the holotype. ROM 36628, 54, 7.9–14.2 mm SL. See ROM 36612. ROM 628 CS, 7, 7.6–11.5 mm SL. See ROM 36614. ROM 36629, 16, 7.6–14.6 mm SL. See ROM 36615. ROM 36630, 1, 7.8 mm SL. See ROM 36616. ROM 36631, 1, 12.8 mm SL. See ROM 36620. ROM 36632, 1, 11.3 mm SL. See RUSI 459. ROM 36633, 14, 7.6–12.9 mm SL. See ROM 36622.

RUSI 460, 1, 13.4 mm SL. See NMC 80–618.

USNM 224882, 5, 8.0–11.6 mm SL. See USNM 224881.

Diagnosis

Dorsal fins usually VI + I 10, anal fin usually I 9, pectoral-fin rays usually 19–21, 11–12 gill rakers on the lower limb of the first gill arch. A dark-edged bar below eye, up to eight short narrow bars across dorsum.

Comparison

See *T. nanus*.

Description

The meristic values are based on the holotype (value in italics), 19 specimens (9 males, 10 females) from ROM 36627 and seven cleared and stained

specimens (ROM 628 CS). Morphometrics are based on the holotype, and 9 males and 10 females from ROM 36627. Format as for *T. nanus*.

Dorsal fins VI + I 9, *10* or 11 ($\bar{x} = 10.1$, SD = 0.4), second to fourth spines longest, reaching to the interspace between the two dorsal fins when depressed; A I *8*, 9 or 10 ($\bar{x} = 9.0$, SD = 0.34); P 19, *20*, 21 or 22 ($\bar{x} = 20.1$, SD = 0.56), reaching posteriorly to the region beneath the sixth spine of the first dorsal fin; V I 5, all rays unbranched, fifth ray rudimentary, longest ray reaching posteriorly to the region between the anus and the origin of the anal fin, basal membrane varying between vestigal (possibly due to damage during collecting/preserving) and extending one quarter of the length of the fins, no fraenum. Scales absent. Gill opening wide, the anteroventral membrane of the opercular apparatus attaching to the isthmus below the midpoint of the pupil. Mouth terminal, inclined obliquely upwards. Teeth in both jaws of an outer row of three to five moderately spaced, enlarged, curved canines near the symphysis and one to two irregular inner rows of small conical teeth. Anterior nostril tubular, posterior nostril pore-like, with a raised rim. Tongue truncate. First gill slit open, not attached to the suspensorium by membrane laterally, gill rakers well developed, longest raker 30–45% of length of first ceratobranchial, 1–2 + 11 — 12. Pseudobranch with four lobes. Caudal fin with 6 dorsal and 5 ventral branched rays and 8–10 dorsal and 8–9 ventral unbranched fin rays.

As percentage standard length: head length 27.6 (26.4–29.3, 0.79); tip of snout to origin of first dorsal fin 37.7 (34.3–41.4, 1.76); tip of snout to origin of second dorsal fin 55.7 (50.5–60.5, 2.00); tip of snout to origin of anal fin 57.1 (51.5–60.5, 1.90); caudal peduncle length 23.5 (21.5–26.7, 1.24); body depth at origin of first dorsal fin 19.0 (17.5–21.4, 1.00). As percentage head length: eye diameter 35.4 (32.1–38.3, 2.01); snout length 15.5 (13.0–18.5, 1.61); upper jaw length 36.6 (32.0–39.4, 2.00). Caudal peduncle depth as percentage caudal peduncle length 48.6 (40.5–55.6, 3.67).

Head pores absent, head papillae as in Figure 7. Intestine S-shaped, peritoneum with melanophores dorsally (especially evident in ripe females). Gut contents of harpacticoid copepods, ostracods and radiolarians. Colour pattern (freshly dead): body colour pale orange-yellow, with more intense yellow pigment along the mid-lateral septum and the bases of the dorsal and anal fins, opercle suffused with orange-red, a well developed (about pupil diameter) orange-red bar across cheek below eye. Distal margins of dorsal and anal fins with a scattering of melanophores and iridocytes. The short bars across the dorsum (see description below) are not visible in the available colour slides, since the specimen was inadvertently photographed from a ventrolateral position. The nature of the chromatophores suggests that these bars may have been orange-red, for they are very similar in appearance to those of the orange-red bar on the cheek. Colour pattern of formalin fixed, ethyl alcohol preserved specimens: body light (straw coloured), bar beneath eye with well defined margins and a scattering of melanophores between the margins, occiput and dorsal opercular regions with melanophores. Up to eight short bars across the dorsum (may be faint, particularly posteriorly, in some specimens). First bar on nape above pectoral-fin base, second just anterior to first spine of first dorsal fin, third between the bases of the fifth and sixth spines of the first dorsal fin, fourth at the base of the spine of the second dorsal fin, fifth at the base of the third or fourth dorsal-fin ray, sixth at the base of the sixth or seventh dorsal-fin ray, seventh just posterior to the base of the last dorsal-fin ray and eighth a little anterior to the first dorsal procurrent (unbranched) caudal-fin ray.

Discussion

T. offucius, like *T. nanus*, appears to be an inhabitant of oceanic drop-offs in depths of 20–30 m, where 72% of the specimens were collected. It seems to prefer slightly deeper water than *T. nanus*, for 99% of the specimens were taken between 20–50 m (no deeper collections were made). Two specimens were taken in a collection made at 15–20 m at the edge of the drop-off. No specimens were collected in the lagoons or from the reef top.

The relatively large number of specimens taken in certain collections (e.g. 54, 37) may indicate that *T. offucius* is a schooling species under at least some circumstances. Some, but apparently not all, species

of *Trimma* school, and these species are plankton pickers. The presence of radiolarians in the gut of *T. offucius* indicates that at least some feeding occurs off the substrate. The two largest collections of the species (mentioned above) were made in and around large caves in a vertical wall, and the next three largest collections (14, 15 and 16 individuals) were made on vertical walls, with small caves noted at two of the stations. The association of *T. offucius* with caves in the walls of the drop-off below 20 m would seem more than coincidental.

Etymology

From the Latin 'offucius', a paint or wash, usually red in colour, used on the face, in allusion to the orange-red bar beneath the eye which characterizes the new species. To be treated as a noun in apposition.

Acknowledgements

The specimens reported on here were collected on the 1978–79 Joint Services Chagos Research Expedition of the British Armed Forces. Our participation was at least in part due to the generous transportation facilities offered by the Canadian and British Armed Forces. Special thanks to our comrades who helped us with the collections or warded off sharks during these activities: H. Arnold, R. Crawford, S. Crellin, R. Crosby, J. Griffiths, J. Liptrot, P. Ormerod, R. Perry, A. Ryan, B. Simm, J. Smith and S. Syson. We would also like to record our deep gratitude to C. Sheppard and J. Griffiths who, as respective scientific and military leaders of the expedition, supplied us with every conceivable type of assistance and equipment, and to P. Winch, whose ketch made the expedition feasible.

We thank E.A. Lachner and R. Birdsong for their most useful comments on a draft of this paper, and Anker Odum (ROM) for his skill and patience in producing the figures of these minute fishes.

References cited

Akihito, Prince. 1969. A systematic examination of the gobiid fishes based on the mesopterygoid, postcleithra, branchiostegals, pelvic fins, scapula, and suborbital. Jap. J. Ichthyol. 16: 93–114.

Birdsong, R.S. 1975. The osteology of *Microgobius signatus* Poey (Pisces : Gobiidae), with comments on other gobioid fishes. Bull. Florida State Mus., Biol. Sci. 19: 135–187.

Bruun, A.F. 1940. A study of a collection of the fish *Schindleria* from south Pacific waters. Dana Rept. 21: 1–12.

Hoese, D.F. 1976. Higher classification of gobioid fishes. Rev. Trav. Inst. Peches marit. 40: 605.

Hoese, D.F. & E.B. Brothers. 1976. *Paratrimma*, a new genus of gobiid fishes and two new species. Copeia 1976: 494–497.

Lachner, E.A. & S. Karnella. 1978. Fishes of the genus *Eviota* of the Red Sea with descriptions of three new species (Teleostei: Gobiidae). Smith, Contrib. Zool. 286: 1–23.

Lachner, E.A. & S. Karnella. 1980. Fishes of the Indo-Pacific genus *Eviota*, with descriptions of eight new species (Teleostei: Gobiidae). Smith. Contrib. Zool. 315: 1–127.

Miller, P.J. 1973. The osteology and adaptive features of *Rhyacichthys aspro* (Teleostei: Gobioidei) and the classification of gobioid fishes. J. Zool Lond. 171: 397–434.

Te Winkel, L.E. 1935. A study of *Mistichthys luzonensis* with special reference to conditions correlated with reduced size. J. Morph. 58: 463–535.