Rec. West. Aust. Mus. 1993, 16(2): 175-210

Description of a new genus of goby from southern Australia, including osteological comparisons with related genera

H. S. Gill*

Abstract

The osteology of *Favonigobius suppositus* and *Favonigobius tamarensis* are described and compared with that of *Favonigobius lateralis*, the type species for the genus. Osteological comparisons are also made with members of *Papillogobius* and *Glossogobius*, genera that are closely related to *Favonigobius*. These comparisons, together with data on body proportions, the distribution of the papillae of the cephalic lateral-line system, meristic counts and larval development provide strong evidence that *Favonigobius suppositus* and *Favonigobius tamarensis* should not be placed in the genus *Favonigobius*. Therefore a new genus, *Afurcagobius* is proposed for these species and *A. suppositus* is designated as the type species. A key is provided for these two species and for other Australian genera and species with which, during recent years, they have been associated.

Introduction

The family Gobiidae, which comprises approximately 2000 species, is the second most diverse of all teleost families (Hoese 1984). The large size of the group and a tendency to evolve by reduction have led to difficulties in classifying many of the members of this family (Birdsong *et al.* 1988; Gill *et al.* 1992). These difficulties have often been compounded when genera have been erected with merely a reference to the type species, the descriptions of which themselves are often inadequate and without figures (Hoese and Lubbock 1982; Gill and Miller 1990; Gill *et al.* 1992).

The taxonomic status of *Favonigobius* was recently investigated by Gill and Miller (1990) and this resulted in the transfer of three species from this genus to a new genus, *Papillogobius*. A subsequent study of the morphology and osteology of *Favonigobius, Papillogobius* and *Glossogobius*, which incorporated a detailed analysis of morphometric and papillae pattern data, indicated that two of the four remaining species assigned to *Favonigobius* were more closely related to the last of these genera (Gill *et al.* 1992). Although Whitley (1934) and Koumans (1953) placed *Favonigobius suppositus* (Sauvage, 1880) in *Glossogobius*, there is now clear evidence that this species, and also *Favonigobius tamarensis* (Johnston, 1883), should be assigned to a new genus (Gill *et al.* 1992).

This paper describes a new genus of goby, which is endemic to southern Australia, and incorporates species previously referred to as *Favonigobius suppositus* and *Favonigobius tamarensis*.

* School of Biological and Environmental Sciences, Murdoch University, Murdoch, Western Australia 6150.

Materials and Methods

The methods for counting the meristic characters and for deriving pterygiophore formulae follow those described by Akihito *et al.* (1984). Vertebral counts and osteological examination were undertaken after clearing and double staining the specimens, using the method of Dingerkus and Uhler (1977). All bones of the skeleton were examined in detail after dissection and/or disarticulation in a heated solution of 5% KOH. Nomenclature of the bones follows Birdsong (1975) and Springer (1983).

Description of the cephalic lateral-line system and morphometric measurements follow those of Miller (1969, 1975, 1984) and Gill *et al.* (1992). Terminology of the cephalic lateral-line system follows that given by Miller (1986), which represents a modification of that provided by Sanzo (1911).

Measurements were made to the nearest 0.1 mm (interorbital nearest 0.01 mm) with dial calipers. Illustrations were prepared with the aid of a Wild M8 stereo-microscope and drawing tube attachment.

Details and drawings of the characters examined are given in Tables 1 & 2 and Figures 1-15.

Material from the following institutions was examined: the Australian Museum, Sydney (AMS); The Natural History Museum [formerly the British Museum (Natural History)], London (BMNH); Gulf Coast Research Laboratory, Ocean Springs, Mississippi (GCRL); Rijksmuseum van Natuurlijke Histoire, Leiden (RMNH); J. B. L. Smith Institute of Ichthyology, Grahamstown (RUSI) and the Western Australian Museum, Perth (WAM). Additional material from the collection of Peter Miller (PJM) and from the authors collection (HSG) was also examined.

Key to the Australian species of the genera *Afurcagobius, Favonigobius* and *Papillogobius* and the genus *Glossogobius*

1a Snout shallow (Fig. 1A & B); mouth horizontal/superior (Fig. 1A & B); head long (>27% SL); cephalic lateral-line with row a1 (Fig. 1A & B); 27 vertebrae 2

1b Snout steep (Fig. 1C & D); mouth oblique/terminal (Fig. 1C & D); head short (<25% SL); cephalic lateral-line without row a1 (Fig. 1C & D); 26 vertebrae 4

2a Tongue truncate; prepelvic area naked; nape scales small and indistinct; operculum naked; branchiostegal membrane attached to isthmus to well behind level of preopercular/opercular margin; row a1 of cephalic lateral-line short and connected to medial portion of row a (Fig. 1A) .... *Afurcagobius* 3

2b Tongue forked; prepelvic area scaled or naked; nape scales small and indistinct or large and well defined; operculum often lightly scaled; branchiostegal membrane usually only attached to isthmus to about level of preopercular/opercular margin; row a1 of cephalic lateral-line long and connected to anterior of row a (Fig. 1B) .... *Glossogobius*

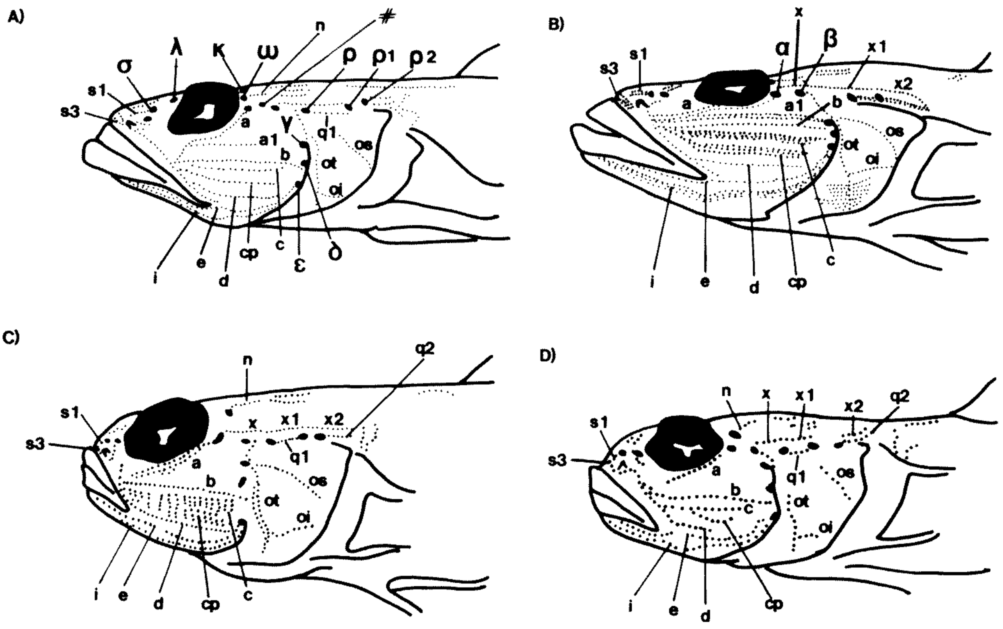


Figure 1 Cephalic lateral-line system in (A) *Afurcagobius*; (B) *Glossogobius*; (C) *Papillogobius*; (D) *Favonigobius*. Modified from Gill *et al.* (1992).

3a A I, 7; P 15-16 . . . . *A. suppositus*

3b A I, 8; P 16-18 . . . . *A. tamarensis*

4a D2 I, 9; A I, 9; D1 may bear large spot anteriorly and may have first ray extended; rows a, c and cp of cephalic lateral-line single (Fig. 1D); row x short extending to pore β; rows x1 and x2 separate . . . . *Favonigobius lateralis*

4b D2 I, 8; A I, 8; D1 never bears large spot, first second and third rays maybe extended but second is always longest; rows a, c and cp of cephalic lateral-line transversely proliferated (Fig. 1C); row x usually long, extending to pore α; rows x1 and x2 contiguous or with small break . . . . *Papillogobius* 5

5a Branchiostegal membranes meeting isthmus below rear of preopercle and usually heavily pigmented; nape scales small and illdefined; cephalic lateral-line row e with distinct break (Fig. 1C); rows x1 and x2 contiguous . . . . *Papillogobius punctatus*

5b Branchiostegal membranes meeting isthmus below orbit and lightly pigmented; nape scales large and well defined; cephalic lateral-line row e continuous or with small break (Fig. 1); rows x1 and x2 usually with small break . . . . *Papillogobius exquisitus*

Systematics

Afurcagobius gen. nov.

Type species

Gobius suppositus Sauvage, 1880: 41 (type locality, Swan River, Western Australia).

Diagnosis

A genus of the subfamily Gobiinae, distinguishable from related genera possessing 26 or 27 vertebrae by, a pterygiophore formula of 3/II II I I 0/9, one epural and a longitudinal cephalic lateral-line system by the presence on the cephalic lateral-line system of an additional suborbital row of papillae, a1, which meets the medial section of row a anteriorly and is reduced posteriorly, and the absence of a large posteroventral process on the coracoid. The genus also differs from related genera by the following combination of characters: 27 vertebrae; operculum and preoperculum without scales or spines; snout shallow and long; basibranchial 4 absent or reduced; asteriscus greatly reduced or absent; prepelvic area without scales; rows a, c and cp of cephalic lateral-line system single and long; row c often joined anteriorly and/or posteriorly to row b; rows e and i single; row h long; row n single and longitudinal; row os short; rows x1 and x2 separate; row x short extending to pore β.

Description

Body moderately elongate. Eyes dorso-lateral. First ray of first dorsal never extended or free at tip. Second dorsal fin with eight soft branched rays. Anal fin with seven or eight soft branched rays. Caudal fin rounded, usually shorter than head. No deepening of caudal peduncle in adults. Pectoral fins without free rays. Pelvic disc complete, posterior edge rarely to anal fin; anterior membrane complete and well developed. Lateral series with 30-38 ctenoid scales. Transverse series with 9-13 ctenoid scales. Predorsal scales 0-4, embedded and very small. Prepelvic scales absent. Belly scales small and cycloid. Head, opercle and cheek naked. Anterior nostril tubular, without tentacles; posterior nostril pore-like, midway between anterior nostril and orbit. Mouth horizontal/superior; jaws subequal, posterior angle of lower jaw between pupil and posterior edge of orbit; chin without barbels or transverse fold. Teeth in jaws erect and caniniform, in several rows medially, outer row of teeth in both jaws enlarged; pharyngeal teeth caniniform. Tongue truncate to slightly notched. Branchiostegal membrane attached to lateral margin of isthmus to level of pectoral base. Gill rakers small and simple to serrate on first arch, spinulose on rest.

Cephalic lateral-line system with anterior and posterior oculoscapular canals carrying pores σ, λ, κ, ω, α, β, **p**, $\mathbf{p}^1$, $\mathbf{p}^2$, and the preopercular canal carrying pores, γ, δ and ε posterior oculoscapular canal often carrying an additional pore (#) between pores α and β (Figure 1). Cheek sensory papillae in eight single rows; row a single and extending from pore α to row b; row a1 extending from row a to between verticals of pores α and β; row b extending from row c to pore δ or just below it; rows c and cp single and extending to vertical of pore β, row c often curving up to join row b both anteriorly and posteriorly;

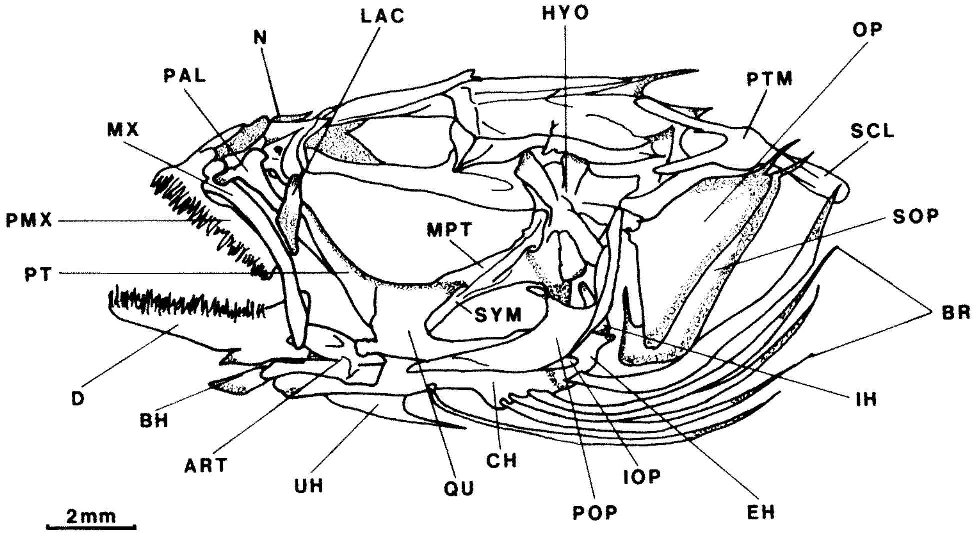


Figure 2 Articulated skull of *Afurcagobius suppositus*, female, 43.5 mm SL, lateral view.

row d extending from row c to vertical of pore β and bearing a short extension running parallel to jaw; rows e and i without break; row ot single and extending to pore γ; row oi extending from row ot to edge of opercle; row os extending from posterior edge of opercle to above level of pore γ but not joined to row ot; rows x and x1 contiguous and extending from pore β to pore $\mathbf{p}^1$; row x2 extending from pore $\mathbf{p}^2$ to above posterior opercular margin; rows q1 and q2 single; row n short and longitudinal; row s1 comprising 5-10 papillae; row s3 long and proliferated.

Skeleton possesses characters diagnostic of the subfamily Gobiinae as described by Miller (1973) (Figures 2-14). Ventromedial strut of exoccipital (V EO) with large expanded foot. Metapterygoid (MPT) and symplectic (SYM) fused; tip of metapterygoid overlapping quadrate (QU). Symplectic cartilage bound to hyomandibular (HYO) and preopercle (POP). Head of palatine bearing additional posteriorly projecting strut (PT2 PAL). Ectopterygoid (PT) long and thin, reaching and bound to PT2 PAL. Symplectic process of preopercle (SYM POP) large. Lateral process of cleithrum (LP CL) small or absent. Scapula (SCA) partially ossified. Posterior process of coracoid (COR) reduced. Asteriscus greatly reduced or absent.

Osteology of *Afurcagobius* and some related genera

In general, the overall shape and articulation of the skeletons of all the genera examined were consistent with Birdsong's (1975) description of *Microgobius signatus*. For this reason, the following description refers only to cases where there are differences from Birdsong's description and for ease of comparison follows his scheme.

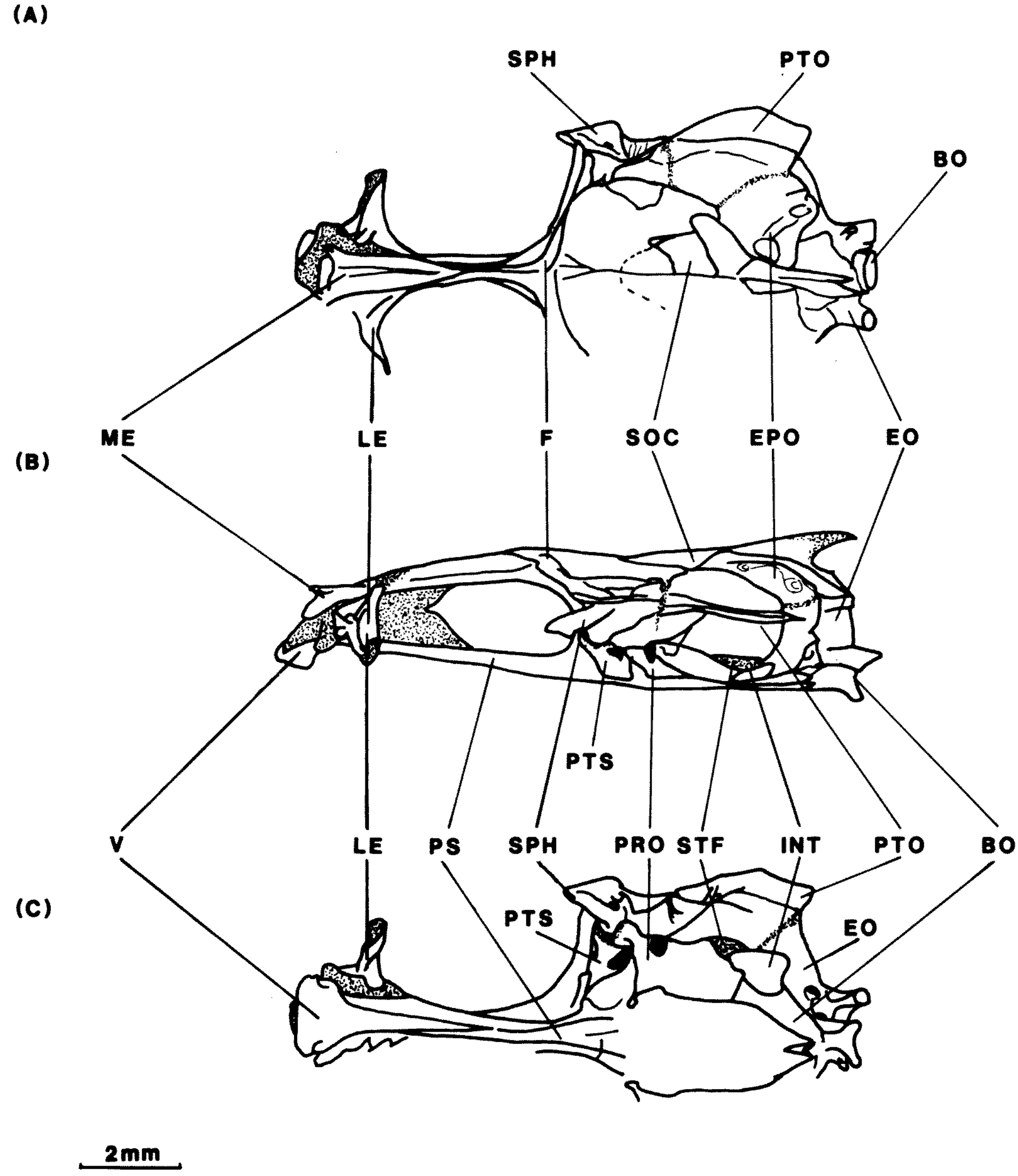


Figure 3 Cranium of *Afurcagobius suppositus*, female, 43.5 mm SL, (A) dorsal view; (B) lateral view; (C) ventral view.

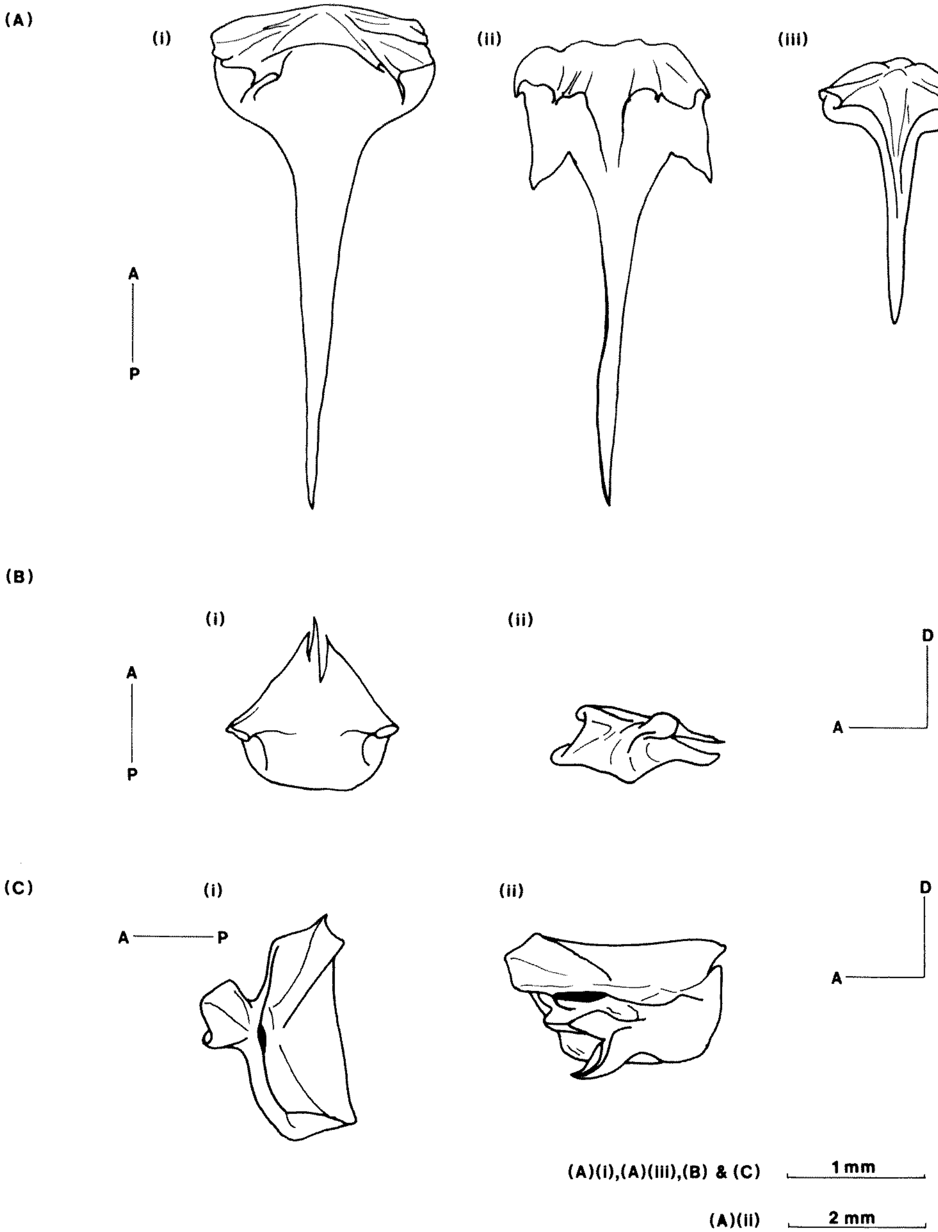


Figure 4 Disarticulated cranial bones of *Afurcagobius suppositus*, female, 43.5 mm SL, (A) vomer, ventral view, (i) *A. suppositus*, (ii) *G. giuris*, female, 71.0 mm SL, (iii) *P. punctatus*, female, 32.2 mm SL; (B) median ethmoid, (i) dorsal view, (ii) anterolateral view; (C) lateral ethmoid, (i) dorsal view, (ii) lateral view.

Head region (Figures 2-12)

Vomer (Figures 3,4).

In *Afurcagobius* the anteriorly broadened head of the vomer (V) bears a large ventral shelf. *Favonigobius* and *Papillogobius* bear no anterior ventral shelf, rather a median process extending onto the posterior process of the vomer. In *Glossogobius* a ventral shelf or a median process may be present, and in addition, the head of the vomer bears two posteriorly directed lateral processes

Median ethmoid (Figures 3,4).

In all genera the median septum of the median ethmoid (ME) extends and is firmly bound to the parasphenoid (PS). The median septum is unossified in *Afurcagobius* and *Glossogobius*, partially ossified in *Papillogobius* and maybe unossified or partially ossified in *Favonigobius*.

Lateral ethmoid (Figures 3,4).

As Birdsong 1975.

Frontal (Figures 3,5).

The frontals (F) are paired but not fused, the sagittal crest is absent or present only as a remnant in *Afurcagobius, Papillogobius* and *Favonigobius*, whereas in *Glossogobius* a small crest is present. A small foramen pierces the broadened posterior section of each frontal in *Favonigobius* and *Papillogobius* but is absent in *Afurcagobius* and *Glossogobius*. Posteriorly the medial edge of the frontal is most deeply cut away in *Afurcagobius* and *Glossogobius*, less so in *Favonigobius* and least of all in *Papillogobius*.

Sphenotic (Figures 3,5).

As Birdsong 1975.

Pterotic (Figures 3,5).

In the specimens of *Afurcagobius* and *Glossogobius* examined in this study the anterolateral surface of the pterotic bones (PTO) bear three to four finger-like processes which overlap the sphenotics (SPH). However, Hoese (pers. comm.) reports observing these processes only in larger specimens of *A. tamarensis* and in none of the specimens of *Glossogobius* (<65 mm) examined by him. These processes are absent in *Favonigobius* and *Papillogobius*.

Epiotic (Figures 3,5).

The posterolaterally directed process of each epiotic (EPO) is large and heavily sculptured in *Glossogobius*, slightly smaller in *Afurcagobius* and present as little more than slight sculpturing in both *Papillogobius* and *Favonigobius*.

Supraoccipital (Figures 3,6).

The anterior lateral margins of the supraoccipital (SOC) are most deeply cut away in *Papillogobius*, less so in *Favonigobius* and *Afurcagobius tamarensis* and least of all in *A. suppositus* and *Glossogobius*. This reduction is inversely proportional to the reduction in the overlapping frontals (F). The anterior and posterior edges of the sagittal crest meet at an acute angle forming a posteriorly directed spur in all genera.

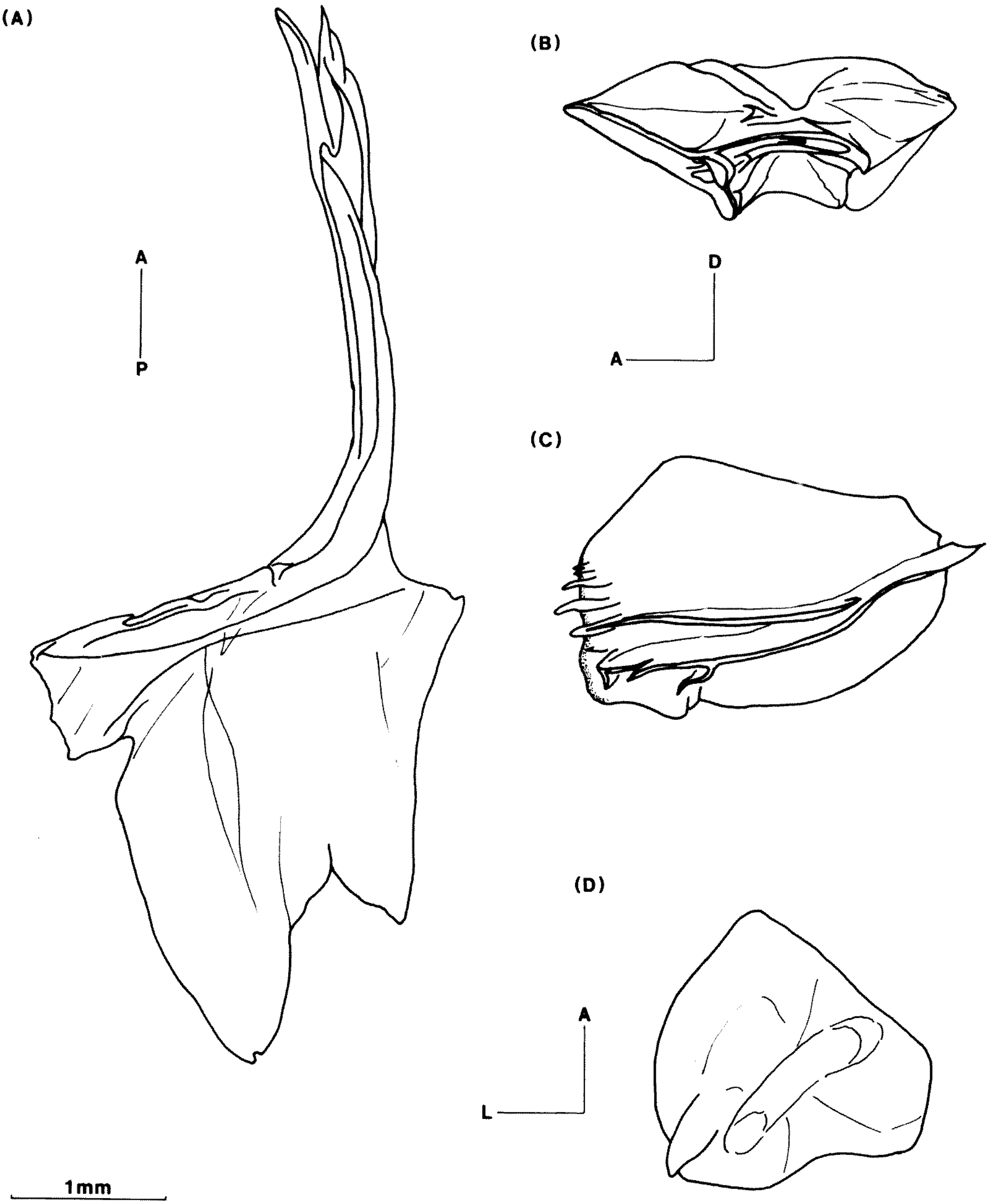


Figure 5 Disarticulated cranial bones of *Afurcagobius suppositus*, female, 43.5 mm SL, (A) frontal, dorsal view; (B) sphenotic, lateral view; (C) pterotic, lateral view; (D) epiotic, dorsal view.

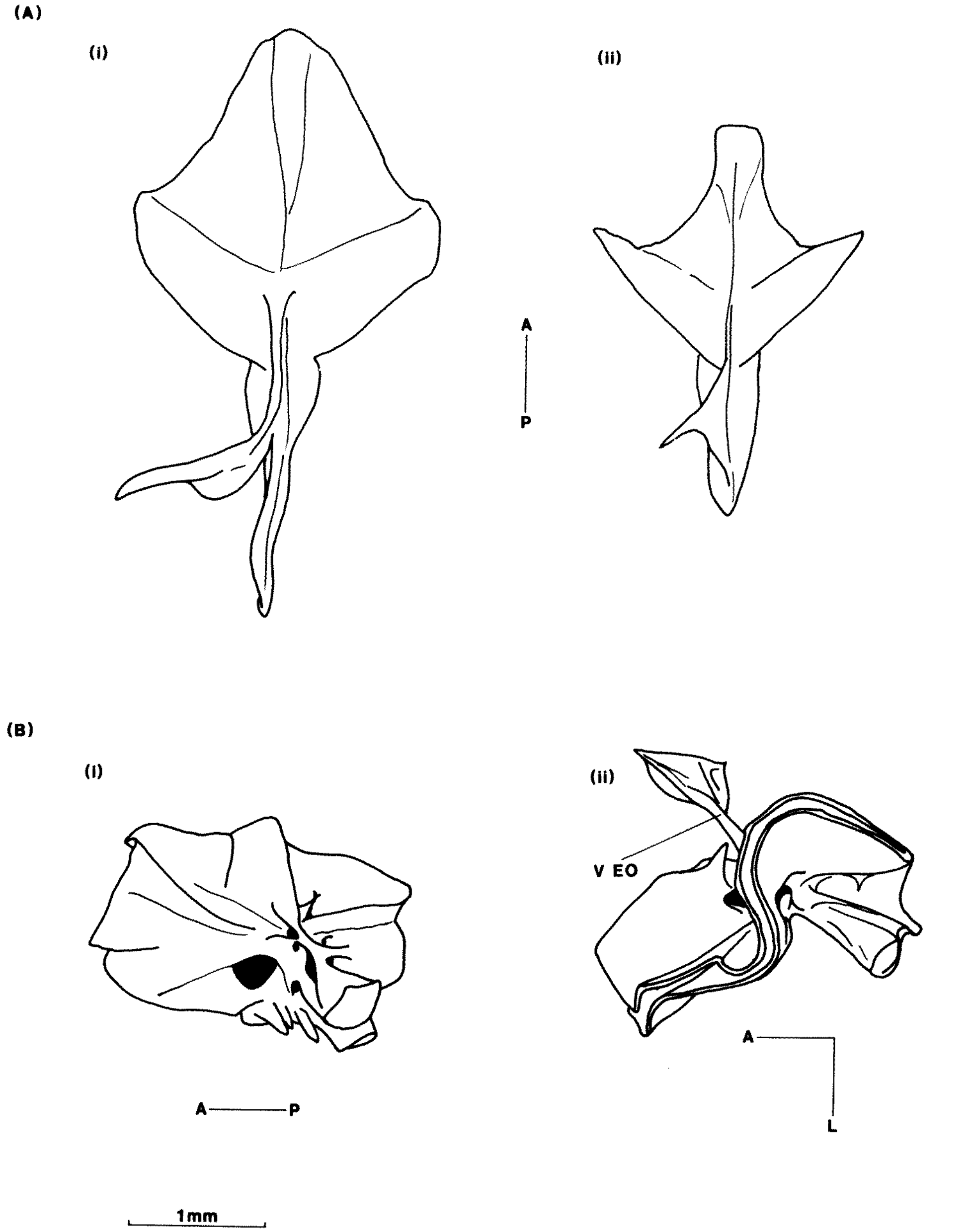


Figure 6 Disarticulated cranial bones of *Afurcagobius suppositus*, female, 43.5 mm SL, (A) supraoccipital, dorsal view, (i) *A. suppositus*, (ii) *P. punctatus*, female, 32.2 mm SL; (B) exoccipital, (i) lateral view, (ii) dorsal view.

Exoccipital (Figures 3,6).

The internal ventromedial strut (V EO) of each exoccipital (EO) bears a large foot in both *Afurcagobius* and *Glossogobius*. In *Favonigobius* the foot is small, whereas in *Papillogobius* the foot is greatly reduced or absent.

Basioccipital (Figures 2,3 and 7).

As Birdsong 1975.

Intercalar (Figures 3,7).

In contrast to the condition described by Birdsong 1975 for *Microgobius signatus*, the paired intercalars (INT) are well separated from the parasphenoid (PS) in the four genera examined. The posterolaterally directed process is always present although highly variable in size and form in *Afurcagobius, Glossogobius* and *Papillogobius*. In *Favonigobius*, however, the process is either absent or greatly reduced. Both *Papillogobius* and *Favonigobius* often bear an indent on the anterior edge of the intercalar. This indent maybe present as either a simple indent, or as a break in the bone leading to a foramen.

Subtemporal fossa (Figure 3).

In all four genera the subtemporal fossae (STF) are relatively small cartilaginous areas, each is bound by the prootic (PRO) anteriorly and medially, the pterotic (PTO) anteriorly and laterally and the intercalar (INT) posteriorly.

Prootic (Figures 3,7).

In *Afurcagobius* and *Glossogobius* the internal lamina of each prootic (PRO) forms a large anterior process which is synchondrally joined to the internal surface of the pterosphenoid (PTS). Neither *Favonigobius* or *Papillogobius* bear such a process. The anterior notch forming the ventral and lateral walls of the trigemino-facial foramen is deeper in *Afurcagobius* and *Glossogobius* than in either *Papillogobius* or *Favonigobius*.

Pterosphenoid (Figures 3,7).

The pterosphenoid bones (PTS) are similar in shape and attachment points to those in *Microgobius signatus*. However, in *Afurcagobius* and *Glossogobius* the ventromedial process is bifid, the lateral and medial extensions of which are synchondrally bound to the prootic (PRO) and parasphenoid (PS) respectively. In *Papillogobius* and *Favonigobius* the ventromedial process is pierced by a foramen and is splayed at its tip to form a highly sculptured spear shaped attachment point. This sculptured surface is very firmly bound to the overlying parasphenoid from which it could only occasionally be separated. Even after heating in 5% KOH the bone normally broke at the foramen.

Parasphenoid (Figures 3,8).

As Birdsong 1975.

Lacrymal (Figures 2,8).

The lacrymal bones (LAC) are poorly ossified fan shaped bones in all four genera.

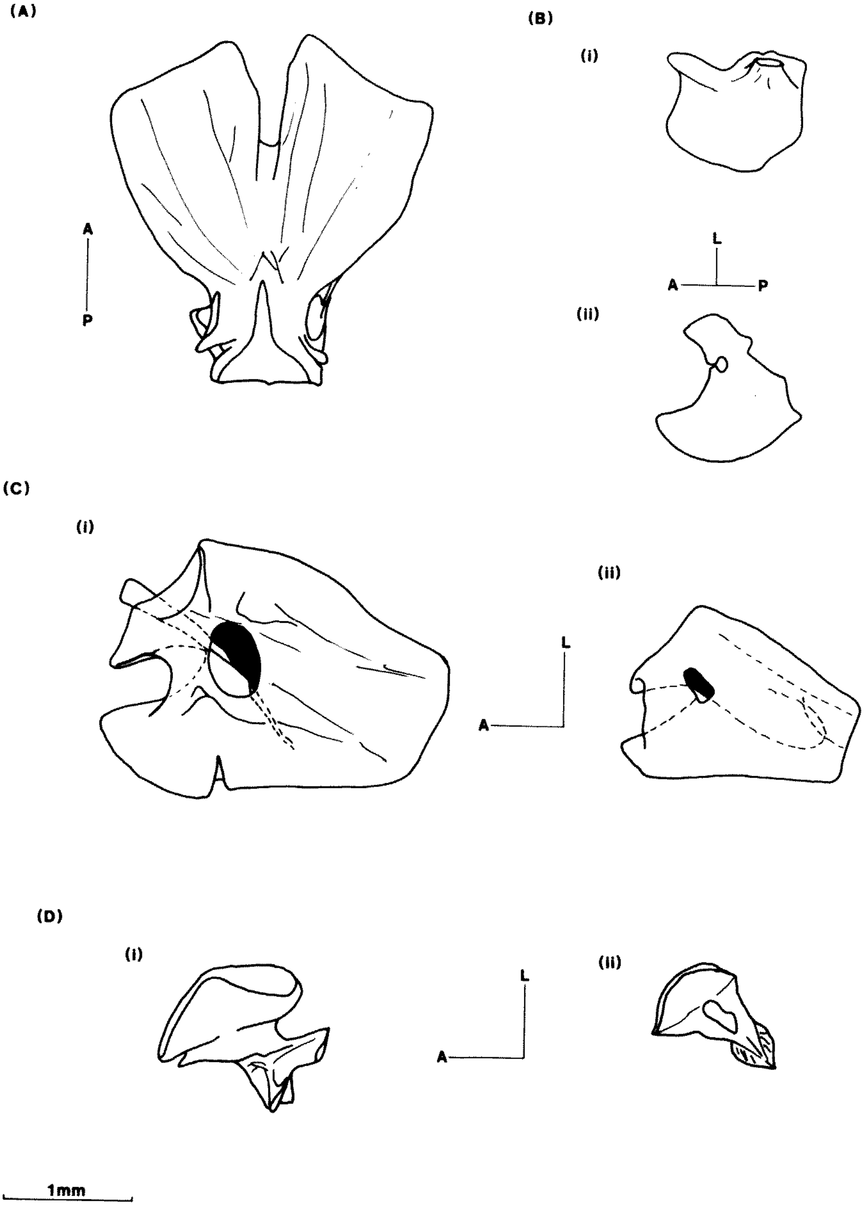


Figure 7 Disarticulated cranial bones of *Afurcagobius suppositus*, female, 43.5 mm SL, (A) basioccipital; (B) intercalar, ventral view, (i) *A. suppositus*, (ii) *P. punctatus*, female, 32.2 mm SL; (C) prootic, ventral view, (i) *A. suppositus*, (ii) *P. punctatus*, female, 32.2 mm SL; (D) pterosphenoid, ventral view (i) *A. suppositus*, (ii) *P. punctatus*, female, 32.2 mm SL.

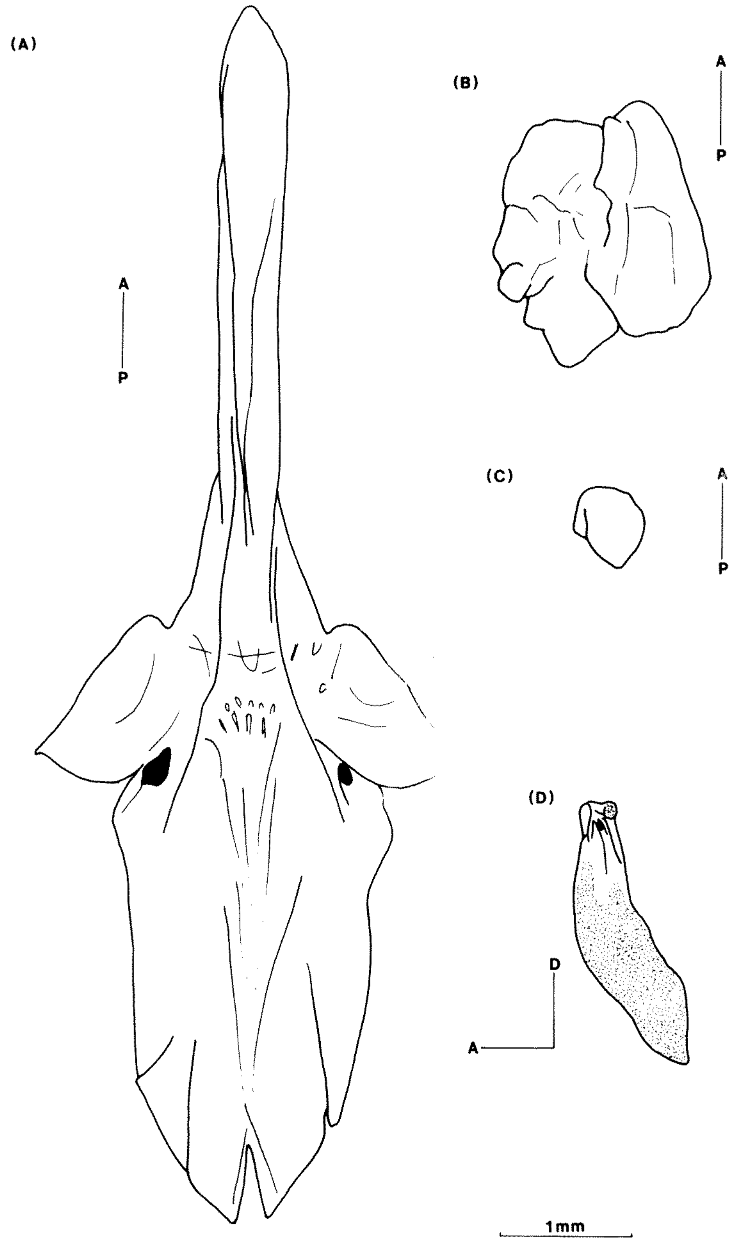


Figure 8 Disarticulated cranial bones of *Afurcagobius suppositus*, female, 43.5 mm SL, (A) parasphenoid, ventral view; (B) sagitta, dorsal view; (C) lapillus, dorsal view; (D) lacrymal.

Nasal (Figure 2).

In *Afurcagobius, Glossogobius* and *Papillogobius* the nasal (N) bones are greatly reduced and usually only ossified in the larger specimens. These bones are relatively large and well ossified in *Favonigobius*.

Otoliths (Figure 8).

The sagittal otoliths in *Afurcagobius* and *Glossogobius* are characterised by the presence of both anterior and posterior processes. In *Favonigobius* the sagittae bear only posterior processes while in *Papillogobius* these otoliths are highly sculptured anteriorly but bear no processes. In all four genera the lapillus and asteriscus are small and lightly sculptured. The asteriscus is particularly small and is often absent in *Afurcagobius* and *Glossogobius*.

Upper jaw (Figures 2,9).

Birdsong (1975) shows the premaxilla (PMX) extending posteriorly well beyond the postmaxillary process (PM PMX) and the teeth in his figures of *Microgobius signatus* (Figures 1,7). In the four genera examined their is no such extension, the postmaxillary process marking the posterior extent of this bone. The postmaxillary process is lower and longer in *Afurcagobius* and *Glossogobius* than in *Favonigobius, Papillogobius* or *Microgobius signatus*. However, Hoese (pers. comm.) reports that this is only the case in larger specimens of *A. tamarensis* and *Glossogobius* and that in smaller specimens the process is a similar shape and size to that found in the other genera. In all four genera the premaxillary teeth are in four rows anteriorly and two rows posteriorly, the outer row bearing 12-20 large recurved caninoid teeth and the inner rows bearing 30-40 smaller caninoid teeth.

The lateral head of the maxilla (L MX) is pierced by a large foramen in both *Afurcagobius* and *Glossogobius*. A small foramen is often present in *Papillogobius*. In *Favonigobius* the lateral head is deeply recessed but only rarely bears a foramen. In *Afurcagobius* and *Glossogobius* the posterior extent of the maxilla is rarely ossified and bears a thin cartilaginous tip. In all but the smallest specimens of *Favonigobius* and *Papillogobius* examined the maxilla was fully ossified.

Lower jaw (Figures 2,9).

In all four genera examined the coronoid process (COR D) of the dentary (D) is relatively short. The posterior margin of the dentary is usually unossified in *Afurcagobius* and *Glossogobius*. As with the maxilla in all but the smallest specimens of *Favonigobius* and *Papillogobius* the dentary is fully ossified.The ventromedial shelf although narrower is longer than that described by Birdsong and as such appears as a process rather than a shelf. In *Afurcagobius, Glossogobius* and *Papillogobius* the tip of this process is rarely ossified. The tip is ossified in *Favonigobius*. In all the genera examined the teeth are in three rows; the outer row comprising 6-10 large caninoid teeth and the inner rows 35-50 smaller caninoid teeth.

Posterodorsally the articular bone (ART) bears a complex articulation point that accepts the articular process of the quadrate (QU) as follows; anterolaterally there is a simple socket upon which the tip of the articular process articulates; just posterior to this

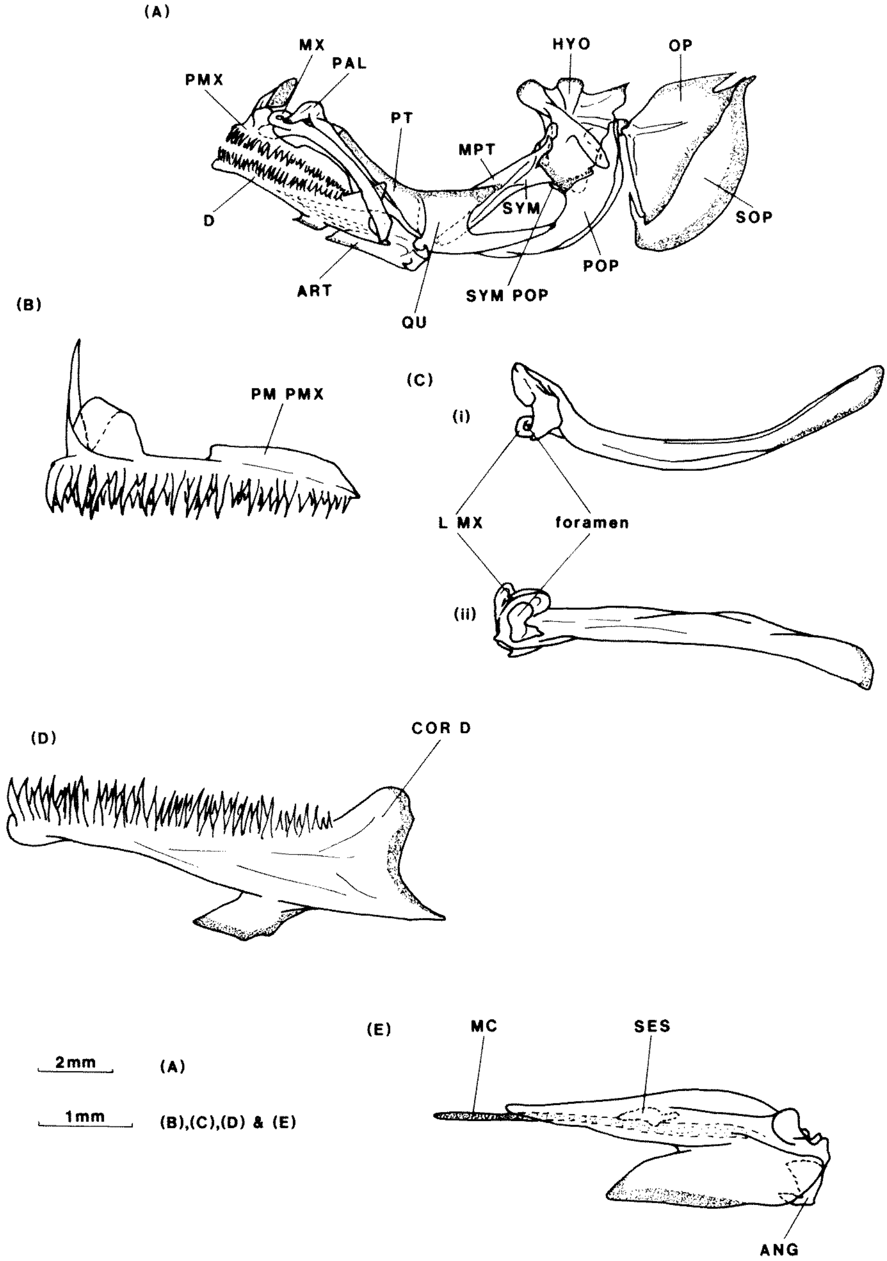


Figure 9 Suspensorium, opercular bones and jaws of *Afurcagobius suppositus*, female, 43.5 mm SL, (A) articulated suspensorium, lateral view; (B) premaxilla, lateral view; (C) maxilla, (i) dorsal view, (ii) lateral view; (D) dentary, lateral view; (E) articular, lateral view.

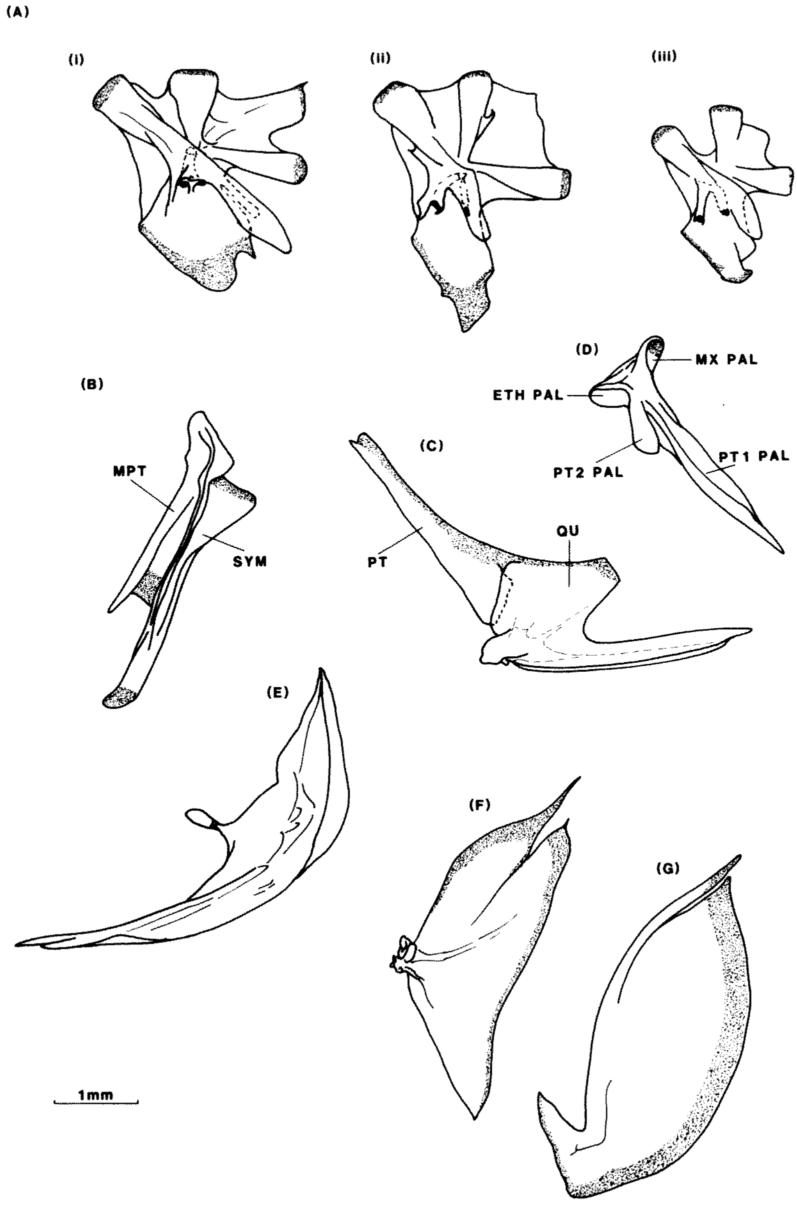


Figure 10 Suspensorium, opercular bones and jaws of *Afurcagobius suppositus*, female, 43.5 mm SL, (A) hyomandibular, lateral view, (i) *A. suppositus*, (ii) *F. lateralis*, female, 41.3 mm SL, (iii) *P. punctatus*, female, 32.2 mm SL; (B) metapterygoid and symplectic, lateral view; (C) ectopterygoid and quadrate, lateral view; (D) palatine, ventral view; (E) preopercle, lateral view; (F) opercle, lateral view; (G) subopercle, lateral view.

socket, but on the medial surface, is a smaller socket on which the medial articulation point of the quadrate bears and running posteriorly a channel surrounds the articular process posteroventrally. Posteriorly, the lateral wall of the channel bears a small hook which firmly clasps the articular process of the quadrate (the medial wall occasionally bears a smaller hook). The tip of the ventral ramus of the articular remains unossified in *Afurcagobius* and *Papillogobius*.

Meckel's cartilage (MC), sesamoid articular (SES) and angular bones (ANG) are as described by Birdsong 1975.

Hyomandibular and Palatine arch (Figures 2,9 and 10).

Both the posterolaterally directed flange and the posterodorsal sheet of the hyomandibular (HYO) tend to be larger in *Afurcagobius* and *Glossogobius* than in *Favonigobius* and *Papillogobius*. In *Papillogobius* the dorsal sheet of the hyomandibular is usually greatly reduced or missing.

In all the genera examined the metapterygoid (MPT) and symplectic (SYM) are fused to form a single complex bone which could not be separated even after heating in KOH. In all four genera the anterior strut of the metapterygoid overlaps the quadrate (QU). No differences in the form of this complex bone were observed between the sexes.

The dorsal arm of the quadrate (QU) is unossified dorsally and is heavily sculptured posterolaterally and posteromedially. The posteromedial sculpturing receiving the cartilaginous extension of the symplectic (SYM). The articular process of the quadrate is developed to produce two ball joints which articulate with the articular bone (ART) as described above.

The ectopterygoid (PT) is a simple triangular shaped bone in all genera and extends toward the head of the palatine (PAL) in *Afurcagobius*, *Glossogobius* and *Favonigobius*. In *Papillogobius* the ectopterygoid is often short, extending only half way up the palatine. When short, a thin sliver of bone, the medial process of the ectopterygoid, arising on the ventromedial surface of the ectopterygoid is firmly bound to the second ectopterygoid process of the palatine (PT2 PAL). In *Afurcagobius* and *Glossogobius* the dorsal surface of the ectopterygoid is unossified, whereas in *Papillogobius* and *Favonigobius* the bone is fully ossified.

Opercular series (Figures 2,9 and 10).

Both the dorsal and posterior margins of the opercle (OP) and the posterior and anteroventral margins of the subopercle (SOP) are unossified in *Afurcagobius* and *Glossogobius*. In *Papillogobius* the dorsal and dorsoposterior margins of the opercle are unossified, whereas in *Favonigobius* only the dorsoposterior margin is unossified. In both *Papillogobius* and *Favonigobius* the anteroventral margin of the subopercle is fully ossified.

The preopercle (POP) in *Afurcagobius* and *Glossogobius* bears a large symplectic process extending and synchondrally bound to the symplectic (SYM), in *Papillogobius* the symplectic process is large but only occasionally reaches the symplectic and in *Favonigobius* the process is present as a remnant only.

The remaining bones of the series are as described by Birdsong 1975.

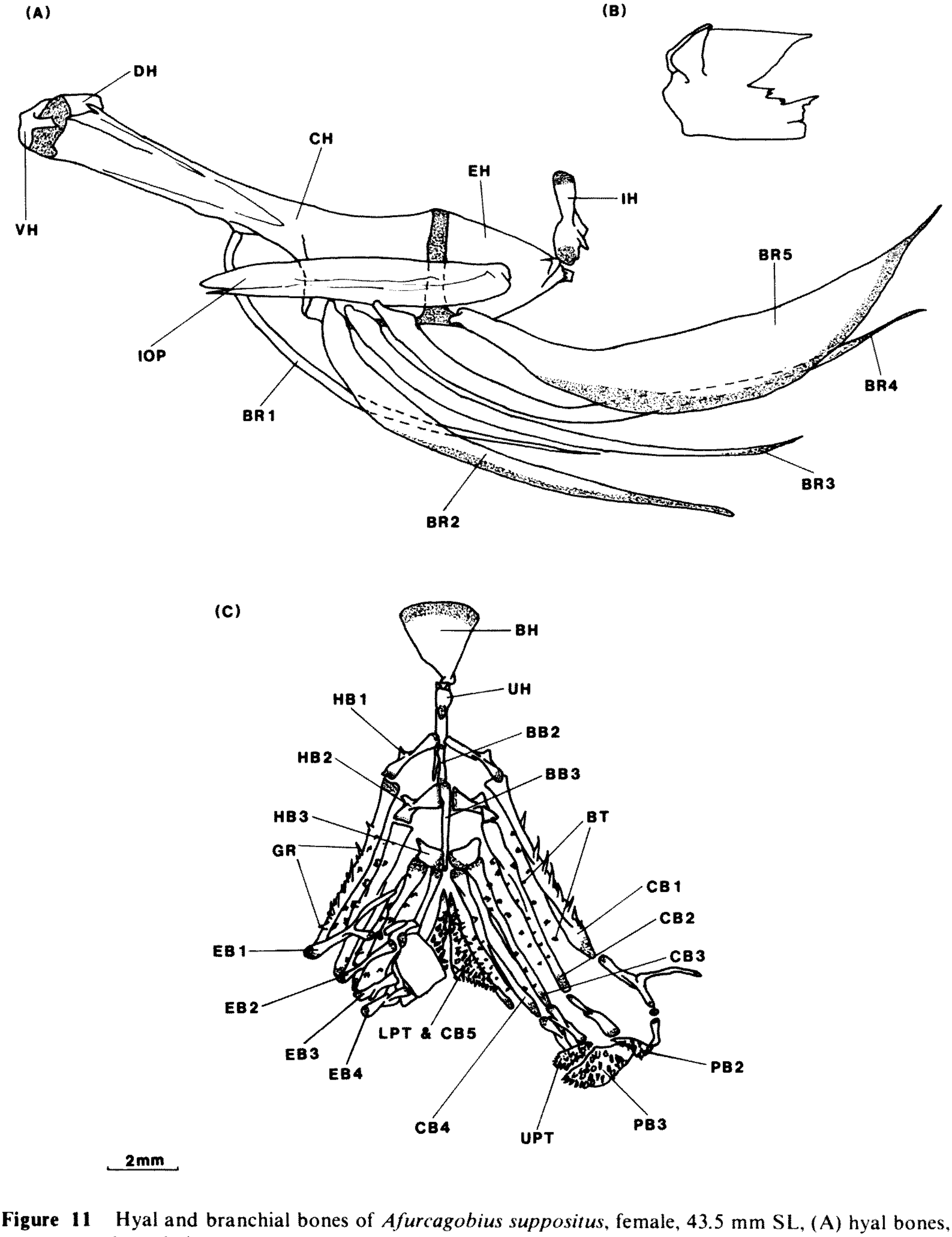


Figure 11 Hyal and branchial bones of *Afurcagobius suppositus*, female, 43.5 mm SL, (A) hyal bones, lateral view; (B) urohyal, lateral view; (C) branchial bones, dorsal view.

Hyoid arch (Figures 2,11).

In *Papillogobius* the second branchiostegal ray (BR 2) is broad and blade-like and broader than rays three and four. In the other genera branchiostegal ray two is broadest at its base and approximately the same size as rays three and four.

In all four genera the ventral and dorsal hypohyals (VH and DH) are synchondrally joined. These bones sit in a groove located on the anterodorsal surface of the ceratohyal (CH), to which they are firmly bound by cartilage.

In *Glossogobius* the basihyal (BH) is preceded by two plates of cartilage which give support to the bilobed tongue. These plates are not present in the other three genera. The basihyal is rounded to truncate and the urohyal (UH) is notched or V-shaped in all the genera examined.

Branchial arches (Figs 2,11).

In *Glossogobius* the junctions of pharyngobranchials two and three (PB 2 and 3) and pharyngobranchial three and the pharyngeal tooth plate (UPT) are each overlain by a cartilaginous plate. This plate is absent in the other genera.

Basibranchial 4 (BB 4) is greatly reduced or absent in *Afurcagobius*. When present, and in all the other genera, it is unossified.

The gill rakers (GR) of the first branchial arch comprise a large central blade and one or two small lateral blades. The lateral blades are most highly developed in *Papillogobius*, less so in *Favonigobius* and least of all in *Afurcagobius* and *Glossogobius*. There are 6-9 rakers on the ceratobranchial (CB) in all genera; 0-2, 1-2 and 1-3 rakers on the epibranchial (EB) in *Afurcagobius* and *Glossogobius*, *Papillogobius* and *Favonigobius* respectively and no rakers are present on the hypobranchial (HB) of any of the genera. The medial face of ceratobranchial one and the medial and lateral faces of ceratobranchials two to four all bear a row of five to eight patches of branchial teeth (BT). Each patch bears from one to twelve teeth which are very small in *Afurcagobius* but relatively large in *Glossogobius*, *Papillogobius* and *Favonigobius*.

Pectoral girdle and paired fins (Figure 12).

The cleithrum (CL) bears a large lateroventral process which is T-shaped in cross-section in *Papillogobius*. This process is large but simple in *Favonigobius* and small or absent in both *Afurcagobius* and *Glossogobius*.

The scapula (SCA) is partially ossified in *Afurcagobius* and *Glossogobius*, but is completely unossified in both *Papillogobius* and *Favonigobius*.

In *Afurcagobius* the coracoid (COR) always bears a large anteroventral process and a small posteroventral process. Both processes are large in *Glossogobius*, *Papillogobius* and *Favonigobius*.

In all the genera examined the medial portions of radials two, three and four (RAD 2, 3 and 4) maybe fused in larger specimens, radial four is a roughly rectangular shaped bone. There are usually 15-16 pectoral rays in *A. suppositus*, *Favonigobius* and *Papillogobius*; 16-18 in *A. tamarensis* and 14-22 in *Glossogobius* (Akihito and Meguro 1975; Allen and Coates 1990; Hoese and Allen 1990).

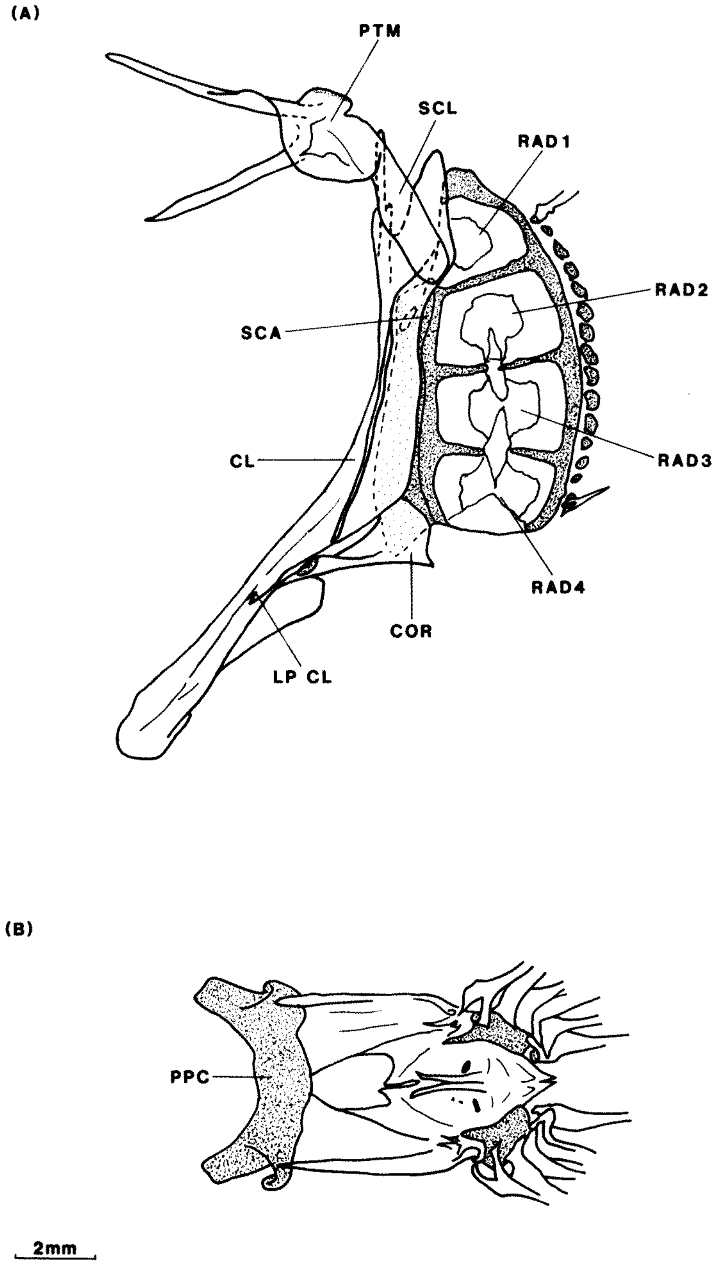


Figure 12 Pectoral and pelvic girdles of *Afurcagobius suppositus*, female, 43.5 mm SL, (A) pectoral girdle, lateral view; (B) pelvic girdle, ventral view.

Pelvic girdle and fins (Figure 12).

The medial shelf of each pelvic bone bears an anteriorly directed process at the symphysis with its partner. The processes are the largest in *Favonigobius* and reach to the pectoral/pelvic cartilage (PPC). In *Papillogobius* the processes reach about three quarters way to the cartilage, whilst in *Afurcagobius* and *Glossogobius* they only reach about half way to the cartilage. The medial shelf bears from one or two (*Afurcagobius* and *Glossogobius*) to up to approximately 12 (*Papillogobius* and *Favonigobius*) small fenestrations at the base of each ventral process. The ventral processes are divergent for at least half of their length.

Vertebral column and median fins

Vertebral column (Figures 13,14).

Afurcagobius suppositus and *Glossogobius* have 11 precaudal (PCV) and 16 caudal vertebrae (CV). *Afurcagobius tamarensis* has 10 precaudal and 17 caudal vertebrae. *Papillogobius* and *Favonigobius* both have 10 precaudal and 16 caudal vertebrae. However, the vertebral count for the species of *Glossogobius* which are endemic to Papua New Guinea is highly variable (precaudal, 10-15; caudal, 15-18)(Hoese and Allen, 1990; Hoese, pers. comm.). The precaudal and caudal vertebrae in *Papillogobius* and *Favonigobius* are difficult to distinguish since the parapophyses (PAP) of the final two precaudal vertebrae each bear a posteromedial process which is fused with its partner, thereby forming a haemal arch (HA) without an associated haemal spine. In contrast the haemal arches of the caudal vertebrae are formed by the fusion of the distal portions of the ventrally curved parapophyses. In this case a haemal spine is formed. Since radiographs were used to obtain many of the vertebral counts available for the gobies (see in particular Akihito *et al.*, 1984; Birdsong *et al.*, 1988) it would not have been possible to distinguish vertebrae with this type of haemal arch from those without an arch i.e. precaudal vertebrae. Thus both of the above studies give counts of 10 precaudal and 16 caudal vertebrae for members of *Papillogobius* and *Favonigobius*. Therefore, since the two types of haemal arch are not homologous and to concur with these published counts the presence of a haemal spine (HS) in the caudal vertebrae has been used to differentiate the vertebral types (Akihito *et al.*, 1984). As the vertebral formula appears to be one of the better characters available for helping to characterize major groupings in the gobies (Birdsong *et al.*, 1988), it would be prudent to distinguish between "true" precaudal vertebra (without a haemal arch or spine), "pseudocaudal" vertebrae (with an arch but no spine) and "true" caudal vertebrae (with an arch and a spine). I therefore propose that, when cleared and stained material is available the vertebral formulae is given in two parts; the first giving precaudal and caudal counts based on the presence or absence of a haemal spine and the second giving the "true" precaudal and pseudocaudal count of the precaudal vertebrae. Although this approach may appear unwieldy it allows direct comparison with published counts and with any future counts taken from radiographs alone and, more importantly, does not lose information. Although posteromedial processes are often present on the last precaudal vertebra of *Afurcagobius* and *Glossogobius* they are small and never met in the

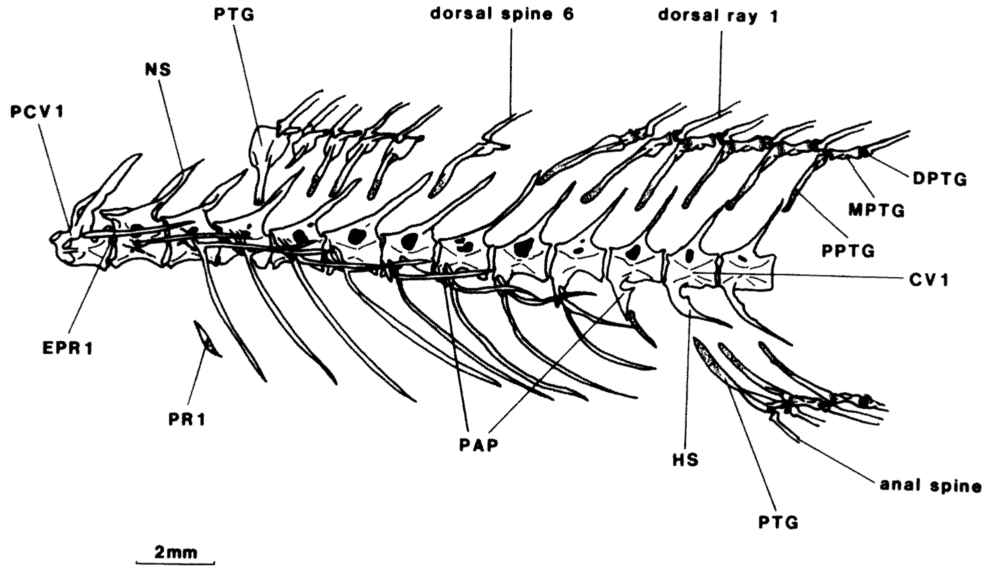


Figure 13 Vertebral column of *Afurcagobius suppositus*, female, 43.5 mm SL, lateral view.

specimens I examined. Hoese (pers. comm.) reports, however, that they did meet in some of the species of *Glossogobius* that he examined.

A reduced pleural rib (PR) is often present in connective tissue lateral to the second precaudal vertebrae of *Afurcagobius, Glossogobius* and *Favonigobius*. In *Papillogobius* this second pleural rib articulates with the epipleural rib (EPR), but it is significantly smaller than the third pleural rib. The epipleural and pleural ribs of the more anterior vertebrae may be fused. This condition is most prevalent in *Afurcagobius*. In *Afurcagobius tamarensis*, and in species of *Glossogobius* with 10 precaudal vertebrae the final precaudal vertebra bears both a pleural and an epipleural rib (Hoese, pers. comm.). There is a pleural but no epipleural rib in *A. suppositus* and species of *Glossogobius* with more than 10 precaudal vertebrae, whereas in both *Papillogobius* and *Favonigobius* the final precaudal vertebrae bears an epipleural rib but no pleural rib.

Although the vertebral zygopophyses are generally larger in *Papillogobius* and *Favonigobius* than in *Afurcagobius* and *Glossogobius*, they are similar in position and shape and are as follows. The first vertebrae bears small dorsal postzygapophyses; the second to fourth or fifth vertebrae bear well developed dorsal pre- but poorly developed postzygapophyses; from vertebrae 5-6 up to vertebrae 16-17 the dorsal prezygapophyses are poorly developed or absent; the dorsal prezygapophyses on vertebrae 16-17 to 23 or 24 get progressively larger, while the the final three bear no dorsal prezygapophyses; vertebrae 6 to 24 bear dorsal postzygapophyses which are relatively well developed in *Papillogobius* and *Favonigobius*; vertebrae 10 to 13 bear large ventral

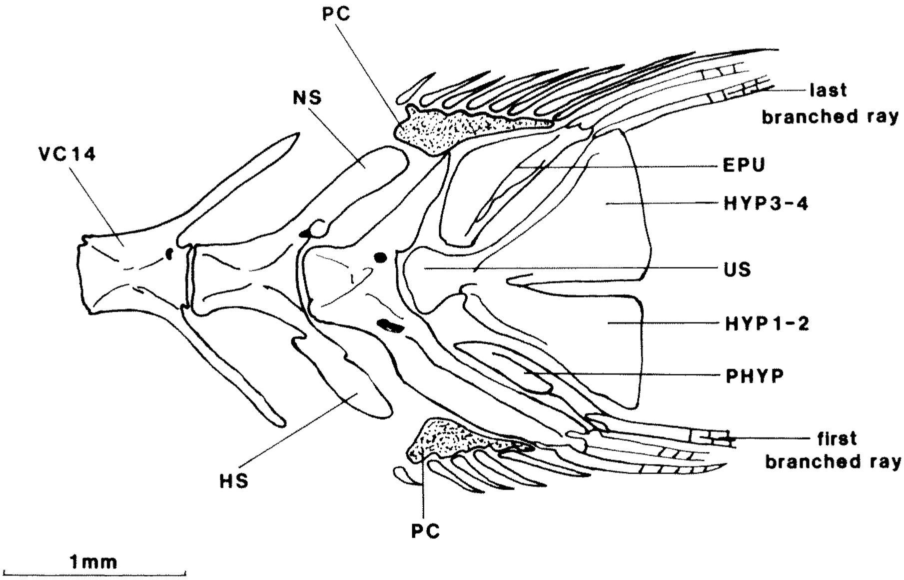


Figure 14 Caudal skeleton of *Afurcagobius suppositus*, female, 43.5 mm SL, lateral view.

postzygapophyses; vertebrae 14 to 22 bear poorly developed postzygapophyses, and finally vertebrae 20 to 26 bear increasingly well developed ventral prezygapophyses.

The penultimate vertebra (vertebra 26 in *Afurcagobius* and *Glossogobius*, and vertebra 25 in *Papillogobius* and *Favonigobius*) is modified in the manner described by Birdsong 1975. The haemal spine usually receives one or two, but may receive upto three, segmented and unbranched rays.

Caudal fin (Figure 14).

These genera have a total of 17 segmented caudal rays, 14 of these rays are branched and three are unbranched. The 14 branched and segmented caudal rays are generally arranged as follows. The first ray inserts on the parahypural (PHYP), the next five insert on hypurals one and two, the next seven on hypurals three and four and the final branched ray on hypural five (HYP 1-5). Above and below the branched rays are one and one to three unbranched rays inserting on the epural (EPU) and last haemal spine (HS), respectively. There are six to eight unsegmented procurrent rays preceding the segmented rays. This arrangement may vary by the addition, deletion or substitution of a ray or rays on any particular caudal element.

Hypural five is often absent in *Afurcagobius suppositus*.

Spinous dorsal fin (Figure 13).

The overall morphology and arrangement of the elements of the dorsal fin are as described by Birdsong, excepting that the seventh dorsal spine and associated pterygiophore (PTG) are lacking.

Second dorsal fin (Figure 13).

The second dorsal fin is composed of one spine and eight soft rays in *Afurcagobius* and *Papillogobius*, one spine and nine soft rays in *Favonigobius* and one spine and 7-12 soft rays in *Glossogobius* (Akihito and Meguro 1975; Allen and Coates 1990; Hoese and Allen 1990). The two anterior pterygiophores (PTG) insert into interneural spaces eight and nine respectively. The arrangement of the pterygiophore elements is as described by Birdsong 1975. The final ray appears as two distinct elements arising from the final pterygiophore, but, as in most recent works, it is counted as one ray (Akihito *et al.* 1984; Birdsong *et al.* 1988; Murdy 1989; Gill and Miller 1990).

Anal fin (Figure 13).

The anal fin is composed of one spine and seven soft rays in *Afurcagobius suppositus*, one spine and eight soft rays in *Afurcagobius tamarensis* and *Papillogobius*, one spine and seven to nine soft rays in *Glossogobius* (Akihito and Meguro 1975; Allen and Coates 1990; Hoese and Allen 1990) and one spine and nine soft rays in *Favonigobius*. The two anterior pterygiophores (PTG) insert anterior to the first haemal spine. However Hoese (pers. comm.) reports that there is variability in the *Glossogobius* species from Papua New Guinea, with between one and five pterygiophores inserting anteriorly to the first haemal spine. The arrangement of the pterygiophore elements is as described by Birdsong. As for the dorsal fin, the final ray appears as two distinct elements which are counted as one ray.

Etymology

The name *Afurcagobius* is derived from *furca*, fork, and refers to the lack of a forked tongue. This is the most obvious distinguishing character between this genus and the morphologically similar genus *Glossogobius*.

***Afurcagobius suppositus* (Sauvage, 1880)**

Figures 1, 15 and 16; Tables 1-2

Eleotris obscurus Castelnau, 1873: 134 (type locality, Fremantle, Western Australia) (in Sauvage, 1880: 41; non *Gobius obscurus* Peters, 1855).

Gobius suppositus Sauvage, 1880: 41 (type locality, Swan River, Western Australia).

Glossogobius vomer Whitley, 1929: 135, pl. 32, fig. 1 (type locality, Swan River, Western Australia) (in Whitley, 1934).

Material examined

WAM P. 1815-7, 2 specimens, 43-45 mm SL, Harvey River, WA; WAM P. 3054, 1 specimen, 71 mm SL, Gin Gin Brook, WA; WAM P. 14187, 1 specimen, 66 mm SL, Moore River, WA; WAM P. 21755, 1 specimen, 59 mm SL, Gin Gin Brook, WA; WAM P. 24820, 1 specimen, 72 mm SL, Hardy Inlet, WA; WAM P. 25069-001, 1 specimen, 83 mm SL, Yunderup, WA; WAM P. 26019-001, 2 specimens, 72-75 mm SL, Denmark River, WA; WAM P. 27026-001, 1 specimen, 74 mm SL, Moore River, WA; WAM P. 29738-001, 7 cleared and stained specimens, Swan River, WA; HSG, 73 specimens, 34-83 mm SL, Swan River, WA, osteological data were taken from 46 of these specimens; HSG, 1 specimen, 53 mm SL, Peel-Harvey Estuary, WA; HSG, 1 specimen, 59 mm SL, Princess Royal Harbour, Albany, WA; HSG, 3 specimens, 67-80 mm SL, Swan River, WA; HSG, 1 specimen, 51 mm SL, Warren River, WA.

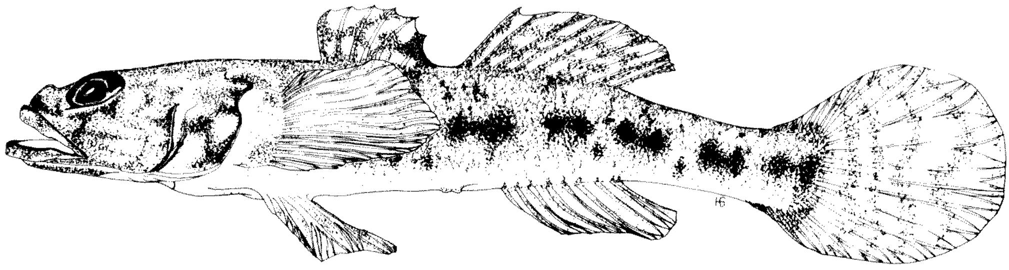


Figure 15 *Afurcagobius suppositus*, female, 48.0 mm SL, Swan River, W.A.

Diagnosis

A species most similar to *Afurcagobius tamarensis* but distinguished from it by the anal count I, 7 (cf. I, 8), the pectoral count 15-16 (cf. 16-18), the transverse scale count 10-13+1 (cf. 9-10) and the vertebral count 11 + 16 (cf. 10 + 17). This species differs from the superficially similar species from the genera *Favonigobius, Papillogobius* and *Glossogobius* by a combination of the following characters (mode in parentheses): predorsal scales 0-4 (0-2); scales in lateral row 30-38 (34-36); prepelvic area naked; cheek and operculum naked; tongue truncate; cephalic lateral-line row a1 short.

Description

Body proportions are given in Table 1; other features as for genus. Body moderately elongate, laterally compressed towards tail and highest just anterior to first dorsal fin (juveniles) to middle of first dorsal fin (adults). Postorbital profile shallow. Snout shallow, longer than eye diameter in larger adults (>45 mm) but shorter in juveniles and smaller adults (<45 mm), juveniles and small adults bearing a small bump on the end of the snout. Head proportions vary greatly with size, sex and breeding condition.

Fin ray and scale counts are given in Table 2. First dorsal fin (D1) arising above proximal third of pectoral fin; last ray arising above distal third of pectoral fin; no rays free at tip; usually only three quarters height of second dorsal (D2), never taller. D2 commencing above or just posterior to anus; last ray above or just posterior to vertical of penultimate anal ray and tip only extending to proximal third of caudal peduncle. Anal fin commencing below D2 2/3; tip of last ray behind posterior tip of D2. Pectoral fin extending back to origin of D2 and occasionally to D2 1. Pelvic disc relatively short, only occasionally extending to anus in males. Caudal fin rounded and usually slightly shorter than head.

Coloration

Fresh specimens light brown to black dorsally and pale ventrally, preserved specimens usually much paler. Lateral series bearing seven or occasionally six dark blotches which are often very pale or indistinct in preserved specimens; anteriormost a large blotch below D1 I-III; second below D1 V-VI and is often pale or missing; third and fourth below D2 1-3 and D2 4-7 respectively; fifth just posterior to D2; sixth at centre of caudal peduncle and seventh on caudal peduncle at base of caudal fin. In dorsal view; three to

Table 1 Body proportions of *Afurcagobius suppositus* from the Swan River, W.A. and *A. tamarensis* from Margate, Tasmania. Range and, in parentheses, mean ± standard deviation.

Species	*A. suppositus*		*A. suppositus*		*A. tamarensis*	
Sex	Males		Females		Females	
SL(mm)	43.0-83.4		49.7-79.9		24.5-41.7	
n	10		10		5	
%SL,						
H	27.1-31.9	(30.0±1.97)	28.0-31.7	(29.4±1.04)	27.3-27.7	(27.6±0.47)
HW	12.2-15.6	(13.7±1.07)	12.4-14.7	(13.4±0.62)	12.1-13.0	(12.5±0.36)
Mw	10.0-17.0	(13.1±2.23)	10.9-13.4	(12.1±0.84)	7.5-9.6	(8.3±0.82)
SN/D1	36.4-39.3	(37.9±0.96)	36.1-40.1	(37.7±1.10)	35.0-37.3	(35.7±0.90)
SN/D2	54.4-58.1	(56.2±1.19)	55.3-58.3	(56.5±1.05)	53.2-54.4	(53.8±0.47)
SN/AN	52.6-57.2	(55.4±1.48)	53.6-58.9	(56.2±1.48)	49.5-53.5	(51.7±1.52)
SN/A	57.2-61.5	(59.2±1.41)	59.2-63.3	(61.2±1.32)	55.6-58.4	(57.1±1.01)
SN/V	28.2-33.7	(31.4±1.40)	29.6-32.5	(31.0±0.91)	25.4-28.4	(27.1±1.10)
CP	23.0-27.0	(24.6±1.21)	20.5-25.2	(23.5±1.38)	26.0-28.4	(27.2±1.00)
D1b	10.7-12.0	(11.5±0.44)	10.2-12.0	(11.2±0.61)	10.4-12.1	(11.4±0.63)
D2b	19.2-22.5	(20.7±1.16)	18.4-21.9	(19.9±1.10)	17.1-20.6	(19.3±1.38)
D1/2	5.6-8.0	(6.8±0.87)	6.2-8.6	(7.6±0.78)	5.6-8.0	(6.8±0.89)
Ab	15.1-17.6	(16.1±0.84)	13.7-17.0	(15.4±1.18)	13.8-16.8	(15.7±1.18)
Cl	24.3-30.7	(28.0±1.97)	23.0-27.7	(25.7±1.22)	24.4	
Pl	21.4-25.7	(23.7±1.54)	20.7-24.2	(22.8±1.22)	17.3-21.5	(19.8±1.78)
Vl	19.6-24.4	(22.5±1.61)	19.4-22.1	(21.2±0.80)	24.5-27.5	(25.8±1.31)
Vd	15.3-20.1	(17.2±1.58)	15.9-19.0	(17.6±0.99)	13.3-15.1	(13.9±0.76)
Ad	13.3-17.4	(15.0±1.36)	13.9-17.3	(15.6±1.00)	11.6-14.2	(12.9±1.07)
Aw	7.7-10.7	(9.5±0.74)	8.1-12.1	(10.0±1.24)	7.8-8.9	(8.6±0.48)
CPd	7.9-9.5	(8.8±0.50)	7.9-9.6	(8.6±0.53)	7.4-8.8	(8.2±0.51)
V/AN	22.2-25.7	(24.1±1.18)	21.4-28.0	(25.2±1.88)	23.9-26.2	(24.8±1.05)
%CP,						
CPd	29.5-40.6	(36.0±3.40)	33.0-43.2	(36.8±2.83)	28.1-31.6	(30.1±1.57)
%H,						
SN	25.0-31.9	(27.6±2.07)	23.9-29.4	(27.4±1.73)	18.7-26.4	(21.9±2.85)
E	20.7-29.0	(23.7±2.89)	18.9-25.5	(22.0±2.33)	27.3-34.8	(31.4±2.94)
PO	46.5-54.8	(51.9±2.39)	50.4-57.2	(53.6±2.04)	45.3-50.6	(48.0±2.01)
CHd	20.4-36.9	(28.4±5.64)	23.5-34.1	(26.9±3.31)	13.3-20.4	(16.9±2.60)
Hw	42.5-48.9	(45.7±1.89)	42.4-49.3	(45.6±1.88)	43.9-47.5	(45.4±1.52)
Mw	35.1-54.1	(43.7±6.27)	34.3-45.0	(41.1±3.06)	27.1-35.2	(30.1±3.20)
%E,						
I	21.4-45.1	(35.1±8.37)	28.7-51.7	(40.2±7.24)	12.8-17.7	(14.0±2.10)
%V/AN,						
V	77.4-110.1	(93.5±9.01)	63.9-89.1	(80.2±6.61)	95.6-111.6	(104.3±6.11)

Abbreviations used. Ab: anal fin base; Ad and Aw: body depth and width at origin of anal fin; Cl: caudal fin length; CHd: cheek depth; CP and CPd: caudal peduncle length and depth; Dlb and D2b: first and second dorsal fin bases: D1/2: distance between last ray of first dorsal fin and first ray of second dorsal fin; E: eye diameter; H and Hw: head length and width; I: interorbital width; Mw: maxillary width; Pl: pectoral fin length; PO: postorbital distance; SL: standard length; SN: snout length; SN/A and SN/V: distance from the snout to the verticals passing through the origin of the anal fin and the origin of the pelvic disc; SN/Dl and SN/D2: distance from the snout to the verticals passing through origins of the first and second dorsal fins; V/AN: distance from the origin of the pelvic disc to the anus; Vd: body depth at the origin of the pelvic disc; Vl: pelvic disc length.

Table 2 Meristics of *Afurcagobius suppositus* from the Swan River, W.A. and *A. tamarensis* from Margate, Tasmania and Botany Bay, N.S.W. Range and, in parentheses, mode are given.

Counts	*A. suppositus*		*A. tamarensis*	
SL(mm)	34.4-83.4		24.5-45.8	
n	73		7	
D1	VI		VI	
D2	I,8		I,8	
A	I,7		I,8	
P	15-16		16-18	
V	I,5		I,5	
C	9/8		9/8	
LL	30-38	(34-36)	30-34	(33)
TR	10-13+1	(12-13)	9-10	
PD	0-4	(0-2)	0-1	
P-VC	3/II II I I 0/9		3/II II I I 0/9	
VC	11 + 16		10 + 17	

four diffuse bars across nape; a heavily pigmented spot in mid-line of nape anterior to D1; large saddle across D1 and smaller saddles across anterior, medial section and posterior of D2 and caudal peduncle. Head usually heavily pigmented epidermally and dermally; epidermal pigmentation present as mottling over whole head; dermal pigmentation extending from corner of jaw to below orbit and over snout anteriorly, to just behind interorbital posteriorly and extending as a thin line over cheek and preoperculum laterally, often most obvious in preserved or pale specimens. Preoperculum and operculum bearing dark mottling epidermally and dorsally bearing dermal pigmentation. Dorsal and caudal fins with series of brown or black reticulating lines; D1 bearing prominent dark spot between D5 and distal margin. Pectoral fin transparent. Pelvic and anal fins pale, darker during breeding season.

Pigmentation varies with site of capture, sex, breeding condition and preservation, and is usually strongest in breeding males. Although some specimens show virtually no pigmentation, the dermal pigmentation of the head, preoperculum, operculum, and mid-line nape spot and the epidermal pigmentation of the first dorsal spot are usually obvious (Figures 15 and 16).

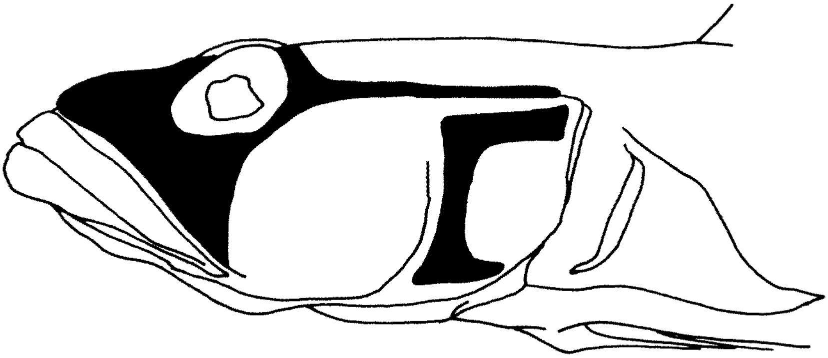
Distribution

This species is found in estuaries, coastal lakes and rivers of south-western Australia, extending from the Moore River (30° 59′S 115° 42′E) in the north to Esperance (33° 52′S 121° 54′E) in the south-east. The species is common in the freshwater streams of the south-west (Gill unpubl. data) and shows a strong preference for heavy cover (Humphries 1991; Humphries and Gill in prep.).

Size

Reaches about 110 mm.

(A)



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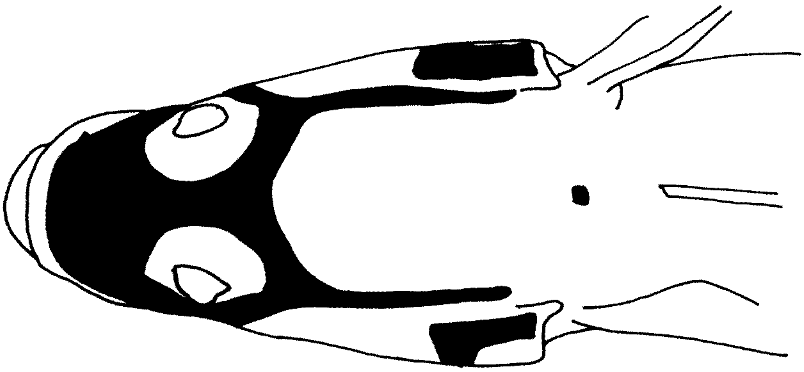

Figure 16 Dermal pigmentation of *Afurcagobius suppositus*, (A) lateral view; (B) dorsal view.

Etymology

The name *suppositus* is derived from the latin, *suppono*, to substitute or falsify, presumably referring to the substitution of this name, by Sauvage (1880), for that of *obscurus* (Castelnau 1873) which was preoccupied by *Gobius obscurus* Peters 1855.

***Afurcagobius tamarensis* (Johnston, 1883)**

Tables 1-2

Gobius tamarensis Johnston, 1883: 120 (type locality, Tamar River, Tasmania, Australia).

Gobius tasmanicus Whitley, 1929: 62 (type locality, Tamar River, Launceston, Tasmania)(Hoese, pers. comm.).

Material examined

HSG, 2 specimens, 40-46 mm SL, Botany Bay, NSW; HSG, 5 specimens, 25-42 mm SL, Margate, Tasmania. Osteological data were taken from all specimens.

Diagnosis

Anal elements I, 8; pectoral elements 16-18; vertebral count 10 + 17. A species most similar to *Afurcagobius suppositus* but distinguished from it by the anal count I, 8 (cf. I, 7), the pectoral count 16-18 (cf. 15-16), the transverse scale count 9-10 (cf. 10-13+1) and the vertebral count 10 + 17 (cf. 11 + 16). This species differs from the superficially similar species from the genera *Favonigobius, Papillogobius* and *Glossogobius* by a combination of the following characters: predorsal scales 0-1; scales in lateral row 30-34 (33); prepelvic area naked; cheek and operculum naked; tongue truncate; cephalic lateral-line row a1 short.

Description

Body proportions are given in Table 1; other features as for genus. Body moderately elongate, laterally compressed towards tail and highest at middle of first dorsal fin. Postorbital profile shallow. Snout shallow, shorter than eye diameter in juveniles and small adults (<45 mm), the figure by Scott (1935) (67.5 mm, TL) indicates snout longer than eye diameter in larger adults.

Fin ray and scale counts are given in Table 2. First dorsal fin (D1) arising above proximal third of pectoral fin; last ray arising above distal third of pectoral fin; no rays free at tip; usually full height of second dorsal (D2). D2 commencing above or just posterior to anus; last ray above or just posterior to vertical of penultimate anal ray and tip only extending to proximal third of caudal peduncle. Anal fin commencing below D2 1/2; tip of last ray behind posterior tip of D2. Pectoral fin extending back to origin of D2 and occasionally to D2 1. Pelvic disc usually extending to anus and often well onto genital papilla. Caudal fin rounded and usually slightly shorter than head.

Coloration

Specimens examined were in ethanol and had no discernible markings; except in the lack of dermal head pigmentation, the description by Hoese and Larson (1980) and Plate 49 in Allen (1989) indicate that the coloration is similar to that of *A. suppositus.*

Distribution

This species lives on silt or mud bottoms in the estuaries and coastal lakes of New South Wales, Victoria, Tasmania and South Australia and often penetrates into fresh water (Hoese and Larson 1980).

Size

Reaches about 110 mm (Hoese and Larson 1980).

Etymology

The trivial name, *tamarensis*, refers to the type locality (Tamar River).

Discussion

Afurcagobius, Glossogobius, Favonigobius and *Papillogobius* each possess the osteological and canal pore characters described by Miller (1973) as diagnostic of the subfamily Gobiinae, namely: one epural bone; fan-hypurals usually not fused; five branchiostegal rays; four pectoral radials; metapterygoid bridge between hyomandibular and quadrate; scapula reduced (foramen open) or absent and preopercular canal with no more than three primary pores. In addition, all possess a pterygiophore formula of 3/II II I I 0/9, a full longitudinal papillae pattern and are superficially similar. This marked similarity, combined with the erection of many gobiid genera without formal descriptions, has led to much confusion over the status of what I now term *Afurcagobius suppositus* and *A. tamarensis* and accounts for the placing of these species in several different genera by different workers (Castelnau 1855; Sauvage 1880; Johnston 1883; Whitley 1934; Scott 1935; Koumans 1953; Hoese and Larson 1980).

Detailed osteological and morphological examination confirm the close relationship of these genera and suggests that *Afurcagobius* is more closely related to *Glossogobius* than to either of the other two genera. A current study by Hoese and Allen (pers. comm.) suggests that *Glossogobius* has undergone an extensive radiation within Papua New Guinea and to a lesser extent within northern Australia. Associated with this radiation is a plasticity of many characters that may usually be considered conservative within a genus. Notwithstanding this plasticity of characters *Afurcagobius* shares the following characters with the majority of *Glossogobius* species (variations for *Glossogobius*, as kindly supplied by D. F. Hoese, are given in parentheses): 27 vertebrae (26 in dwarf species and up to 31); pterotic bearing finger-like projections (maybe absent in small specimens); prootic bearing large anterior process; ventromedial process of pterosphenoid bifid; sagittal otoliths bearing anterior and posterior processes; asteriscus greatly reduced or absent; dorsal surface of ectopterygoid unossified; postmaxillary process of premaxilla low (in larger specimens); presence of row a1 of cephalic lateral-line system; scales in transverse series >9 (7-12); snout long and shallow (occasionally short, but usually longer than in *Favonigobius* or *Papillogobius*); mouth horizontal (up to 45° in some species) and superior and a maximum SL greater than 100 mm (25 mm in dwarf species). In addition to these similarities, the larvae of *Afurcagobius suppositus* and *Glossogobius olivaceus* hatch possessing a large yolk sac, a condition which is not found in either *Favonigobius lateralis* or *Papillogobius punctatus* (Dotsu *et al.* 1988; Neira unpubl. data).

The similarities exhibited by *Afurcagobius* and *Glossogobius* are not solely morphological. The majority of the species found in Papua New Guinea and all of the seven species of *Glossogobius* found in northern Australia penetrate well into fresh water (Allen 1989; Hoese and Allen 1990), a situation also found with *Afurcagobius* in southern Australia. In contrast members of *Favonigobius* and *Papillogobius* are strictly marine/estuarine (Hoese and Larson 1980; Allen 1989; Gill and Miller 1990).

Although *Afurcagobius* and *Glossogobius* are very similar, they are nevertheless distinguishable, each bearing two unique characters. Thus, in *Afurcagobius* the coracoid bears a reduced posteroventral process and the cephalic lateral-line system bears a posteriorly shortened row a1 which meets the medial section of row a anteriorly. In *Glossogobius* the basihyal is preceded by two cartilage plates which give support to the forked tongue and row a1 is long and meets the most anterior section of row a.

Comparative material

Acentrogobius gracilis (Jenyns, 1835): WAM P. 25118-004, 21 specimens, 27-55 mm SL, Dampier Archipelago, West Lewis Island, WA, 17 November 1974.

Acentrogobius griseus (Day, 1878): BMNH (uncatalogued), 2 specimens, 34-75 mm SL, Sawak Lake, about 30 km NW Samawak Town, 19 July 1973.

Acentrogobius janthinopterus (Bleeker, 1852): PJM, 1 specimen, Lizard Island, Queensland, 15 September 1981.

Acentrogobius viridipunctatus (Cuvier and Valenciennes, 1837): PJM coll. No. 0, 4 specimens, 38-66 mm SL; PJM coll. No. 4, 2 specimens 50-58 mm SL.

Arenigobius bifrenatus (Kner, 1865): WAM P. 11959-62, 4 specimens, 58-74 mm SL, Preston Point, Swan River, WA, 18 January 1965; WAM P. 16758, 1 specimen, 89 mm SL, Moore River, WA, 7 June 1969; WAM P. 24388-92, 5 specimens, 39-82 mm SL, Hardy Inlet, WA, 26 March 1974; WAM P. 25064-005, 1 specimen, 91 mm SL, Hardy Inlet, WA, 20 March 1974; PJM, 6 specimens, 70-81 mm SL, Swan River, WA.

Arenigobius frenatus (Gunther, 1861): AMS I. 19896-002, 4 specimens, 36-57 mm SL.

Barbuligobius boehlkei Lachner and McKinney, 1974: WAM P. 28284-027, 10 specimens, 21-24 mm SL, N.W. side of Six Mile Island, Israelite Bay, WA, 4 April 1984; WAM P. 29933-018, 1 specimen, 24 mm SL, Rottnest Island, WA, December 1986.

Bathygobius andrei (Sauvage, 1880): PJM 1461, 2 specimens, 65-107 mm SL, 1984; PJM 1469, 3 specimens, 67-89 mm SL, May 1984.

Bathygobius burtoni (O'Shaughnessy, 1875): PJM, 8 specimens, 16-50 mm SL, Mile 6, kei Victoria, Kamerun, 4 December 1976.

Bathygobius casamancus (Rochebrune, 1880): PJM, 6 specimens, 29-57 mm SL, Baia des Gatas, 10 km E Mindelo Island, San Vincente.

Bathygobius curacao (Metzelaar, 1919): GCRL V73:10318, 1 specimen, 34 mm SL, Limon Bay, Colon, Panama, 13 November 1972; GCRL V75:14019, 3 specimens, 26-36 mm SL, Limon Bay, Colon, Panama, 20 April 1971; GCRL V76:14598, 3 specimens, 33-36 mm SL, Limon Bay, Colon, Panama, 16 January 1976.

Bathygobius cyclopterus (Cuvier and Valenciennes, 1837): PJM, 6 specimens, 44-61 mm SL, Port Shelta, Hong Kong, 28 July 1983.

Bathygobius fuscus (Ruppell, 1830): PJM, 6 specimens, 38-53 mm SL, Kat-O shore, Hong Kong, 2 June 1966.

Bathygobius krefftii (Steindachner, 1866): WAM P. 27078-005, 7 specimens, 27-56 mm SL, Arrawarra Headland, NSW, 25 December 1980.

Bathygobius laddi: WAM P. 27967-034, 54 specimens, 12-33 mm SL, Fitzroy Reefs, Point Quobba, WA.

Bathygobius mystacium Ginsburg, 1947: GCRL V:11141, 11 specimens, 26-61 mm SL, San Blas, Isla Miru, Panama.

Bathygobius soporator (Cuvier and Valenciennes, 1837): GCRL V72:9987, 6 specimens, 36-74 mm SL, Boca del Rio Cienquita, Golfo de Honduras, Cortes, Honduras, 19 June 1971.

Bryaninops amplus Larson, 1985: HSG 75-321, 2 specimens, 10-15 mm SL, near Palfrey Island, Lizard Island area, Queensland, 13 November 1975, det. D. F. Hoese; HSG 75-442, 4 specimens, 7-14 mm SL, North Point, Lizard Island, Queensland, 28 November 1975, det. D. F. Hoese; HSG 80-18, 4 specimens, 8-23 mm SL, Rib Reef, Great Barrier Reef, Queensland, 4 December 1980, det. H. Larson.

Bryaninops ridens Smith, 1959: HSG 75-14, 1 specimen, 16 mm SL, Eagle Island, Lizard Island area, Queensland, 7 November 1975, det. H. Larson; HSG 75-96, 1 specimen, 13 mm SL, lagoon, Lizard Island, Queensland, 7 February 1975, det. D. F. Hoese.

Cabillus lacertops Smith, 1959: WAM P. 24481-001, 1 specimen, Clerke Reef Lagoon, Rowley Shoals, WA, 3 October 1973.

Cabillus tongarevae (Fowler): WAM P. 29041-023, 1 specimen, 29 mm SL, Ashmore Reef, Timor Sea, 12 September 1986.

Cristatogobius sp.: WAM P. 29595-018, 1 specimen, 25 mm SL, Madang, PNG, 29 September 1987; WAM P. 29595-031, 3 specimens, 25-28 mm SL, Madang, PNG, 29 September 1987.

Cryptocentroides cristatus (Macleay, 1881): WAM P. 28812-001, 1 specimen, 64 mm SL, Moreton Bay, Queensland, 28 September 1974; WAM P. 28837-005, 1 specimen, 32 mm SL, Port Hacking, NSW.

Drombus sp.: PJM, 1 specimen, 43 mm SL, Lizard Island, Queensland, 15 September 1981.

Exyrias belissimus (Smith, 1959): WAM P. 27662-030, 1 specimen, 74 mm SL, Clerke Reef, Rowley Shoals, WA, 23 July 1982; WAM P. 29054-003, 1 specimen, 77 mm SL, West Island, Ashmore Reef, Timor Sea, 17 September 1986; WAM P. 29928-019, 7 specimens, 37-77 mm SL, Pulo Blau, Cocos-Keeling Island, Indian Ocean, 26 February 1989.

Exyrias puntang (Bleeker, 1851): WAM P. 25231-004, 5 specimens, 30-77 mm SL, Ambon, Molucca Island, Batu Kuning Stream, Kutekote, 19 January 1975; WAM P. 26955-001, 2 specimens, 55-60 mm SL, Mowbray River, Mossman, Queensland, 13 September 1980; WAM P. 29595-025, 4 specimens, 37-93 mm SL, Madang, PNG, 29 September 1987; PJM, 6 specimens, 41-85 mm SL, Lizard Island, Queensland, 15 September 1981.

Favonigobius lateralis (Macleay, 1881): AMS I. 16386-001, syntypes, 3 specimens, 46-49 mm SL, King George's Sound, WA; AMS I. 9733-9735, paratypes (var. *obliquus*), 5 specimens, 33-44 mm SL, Rose Bay, Port Jackson, NSW; WAM P. 24393-6, 4 specimens, 46-50 mm SL, Hardy Inlet, WA; WAM P. 24413-7, 2 specimens, 45-46 mm SL, Hardy Inlet, WA; WAM P. 24900, 2 specimens, 40-50 mm SL, Hardy Inlet, WA; WAM P. 28806-001, 6 specimens, 25-32 mm SL, Moreton Bay, Queensland; HSG, 40 specimens, 33-55 mm SL, Port Hacking, NSW; HSG, 12 specimens, 30-43 mm SL, Rockingham Bay, WA; HSG, 103 specimens, 29-55 mm SL, Swan-Avon Estuary, WA, osteological data were taken from 63 specimens and 9 were lodged at the Western Australian Museum, WAM P. 29736-001.

Glossogobius aureus Akihito and Meguro, 1975: PJM H. B., 2 specimens, 132-133 mm SL.

Glossogobius biocellatus (Cuvier and Valenciennes, 1837): PJM, 1 specimen, 53 mm SL, Gazi, Kwale District, Kenya, 20 August 1982.

Glossogobius brunnoides (Nichols, 1951): WAM P. 28202-001, 6 specimens, 60-79 mm SL, Teti River, PNG, 12 October 1983; WAM P. 28204-002, 1 specimen, 71 mm SL, Rau Creek, Mt. Hagen, PNG, 5 October 1983.

Glossogobius celebius (Cuvier and Valenciennes, 1837): WAM P. 29613-008, 6 specimens, 45-104 mm SL, Bogia, PNG, 19 October 1987.

Glossogobius concavifrons (Ramsay and Ogilby, 1887): WAM P. 27803-007, 1 specimen, 65 mm SL, tributary of Tedi, Tabubil airstrip, PNG, 17 September 1982.

Glossogobius giuris (Hamilton, 1822): WAM P. 25414-005, 2 specimens, 71-78 mm SL, Stn. B1-3, Carson River, Western Australia, 12 December, osteological data were taken from these specimens; WAM P. 25424-010, 5 specimens, 35-112 mm SL, Stn. C5-1, Drysdale River, WA, 19 August 1975; WAM P. 25867-003, 20 specimens, 49-81 mm SL, Maitland River, WA; PJM H. B., 4 specimens, 65-133 mm SL.

Glossogobius koragensis Herre, 1935: WAM P. 27838-001, 20 specimens, 23-65 mm SL, Chambri Lake, Sepik River, PNG, 22 October 1982.

Glossogobius olivaceus (Temminck and Schlegel, 1845): PJM, 6 specimens, 99-133 mm SL, Hamana Lake, Japan, 1983.

Glossogobius sparsipapillus Akihito and Meguro, 1976: PJM coll. No. 6, 3 specimens, 88-97 mm SL, Thailand.

Glossogobius tenuiformis Fowler, 1934: RUSI 24741, 5 specimens, 31-39 mm SL, Pongolo Floodplain.

Glossogobius sp.: PJM coll. No. 6, 1 specimen, 88 mm SL.

Hazeus baliuris (Cuvier and Valenciennes, 1837): PJM, 1 specimen, 49 mm SL, Gulf of Thailand 1964; PJM, 7 specimens, 65-81 mm SL.

Istigobius cambelli (Jordan and Snyder, 1901)(labelled *"hongkongensis"*): PJM, 6 specimens, 53-74 mm SL, Sharp Island, Hong Kong, 27 April 1965.

Istigobius ornatus (Ruppell, 1830): WAM P. 27274-025, 17 specimens, 39-67 mm SL, Gantheume Point, Broome, WA, 18 January 1981; WAM P. 28155-011, 61 specimens, 19-48 mm SL, Daru, PNG, September 1983; PJM, 8 specimens, 34-54 mm SL, Kuste vorden Leuchtturm der Altstadt, Galle, 6 February 1981; PJM, 2 specimens, 72-84 mm SL.

Lesueurigobius freisii (Malm, 1874): PJM, 2 specimens, 63-67 mm SL, Irish Sea, west of Isle of Man, 27 May 1952; PJM, 5 specimens, 58-69 mm SL, NW Brada, 20 May 1960.

Oplopomops diacanthus (Schultz, 1943): PJM, 1 specimen, 34 mm SL, Malne, 30 September 1954.

Oplopomus caninoides (Bleeker, 1852): PJM, 2 specimens, 43-47 mm SL, Momboza, June 1985.

Oplopomus oplopomus (Cuvier and Valenciennes, 1837): WAM P. 25168-014, 1 specimen, 65 mm SL, Shark Bay, WA.

Oplopomus sp.: WAM P. 23350-001, 1 specimen, 56 mm SL, Exmouth Gulf, WA.

Papillogobius exquisitus (Whitley, 1950): AMS IB. 1413, holotype, 46 mm SL, Toukley, NSW, 20 March 1945; AMS I. 17355-004, 30 specimens, 28-47 mm SL, Sugar-Loaf Bay, NSW; AMS I. 25396-002, 2 specimens, Cowan Creek, NSW, 4 December 1984; HSG, 18 specimens, 26-39 mm SL, Rozzell Bay, NSW, osteological data were taken from five specimens.

Papillogobius melanobranchus (Fowler, 1934): RUSI 10149, 1 specimen, 22 mm SL, Kosi Bay, Zululand, osteological data were taken; WAM P. 25667-005, 11 specimens, 22-26 mm SL, Pt. Warrender, WA.

Papillogobius punctatus Gill and Miller, 1990: WAM P. 29724-001, holotype, 51 mm SL, Joel Terrace, Swan-Avon Estuary, WA; WAM P. 29723-001, paratypes, 5 specimens, 39-43 mm SL, Sandy Beach, Swan-Avon Estuary, WA; WAM P. 29725-001, paratype, 39 mm SL, Joel Terrace, Swan-Avon Estuary, WA; WAM P. 29726-001, paratypes, 5 specimens, 41-53 mm SL, Joel Terrace, Swan-Avon Estuary, WA; WAM P. 29727-001, paratype, 43 mm SL, Joel Terrace, Swan-Avon Estuary, WA; WAM P. 29728-001, paratypes, 2 specimens, 44-45 mm SL, Point Belcher, Swan-Avon Estuary, WA; WAM P. 29737-001, paratypes, 6 cleared and stained specimens, Joel Terrace, Swan-Avon Estuary, WA; AMS I. 29327-001, paratypes, 5 specimens, 36-45 mm SL, Joel Terrace, Swan-Avon Estuary, WA; HSG, 72 specimens, 27-47 mm SL, osteological data were taken from 52 specimens.

Papillogobius reichei (Bleeker, 1853): RMNH 4672, 1 specimen, 44 mm SL, Padang, Sumatra, 1853; RUSI 74-80, 4 specimens, 34-44 mm SL, Inhaca Islands; RUSI 10149, 24 specimens, 16-37 mm SL, Kosi Bay, Zululand, osteological data were taken from 4 specimens; RUSI 16790, 4 specimens, 23-35 mm SL, Mahe, Seychelles.

Parachaeturichthys polynema (Bleeker, 1853): PJM, 6 specimens, 64-84 mm SL, Plover Cove, Hong Kong, May 1967.

Parkraemeria ornata Whitley, 1951: AMS I. 26707-001, 1 specimen, south bank, Lake Merimbula, NSW, 17 March 1976; AMS I. 27222-001, 3 specimens, Shelley Beach, north of Townsville, Queensland, 1978.

Pleurosicya mossambica Smith, 1959: HSG 75-28, 2 specimens, 8-15 mm SL, lagoon, Lizard Island, Queensland, 29 January 1975, det. D. F. Hoese; HSG 77-65, 3 specimens, 14-16 mm SL, Bird Island, Lizard Island area, Queensland, 14 February 1977, det. H. Larson; HSG 78-151, 1 specimen, 23 mm SL, Decapolis Reef, Great Barrier Reef, Queensland, 2 December 1978, det. D. F. Hoese; HSG 81-3, 1 specimen, 16 mm SL, Mrs Watsons Bay, Lizard Island, Queensland, 18 September 1981, det. H. Larson.

Pleurosicya muscarum (Jordan and Seale, 1906): HSG 75-95, 1 specimen, 15 mm SL, lagoon, Lizard Island, Queensland, 7 February 1975, det. D. F. Hoese.

Porogobius sp.: PJM, 1 specimen, Port Hearcourt, Nigeria.

Silhouettea aegyptia (Chabanaud, 1933): PJM, 5 specimens, 26-29 mm SL.

Silhouettea dotui (Takagi, 1957): PJM, 1 specimen, 41 mm SL, Teradomari, Santo-gun, Niigata Prefecture, Japan, 17 August 1980; PJM, 1 specimen, 35 mm SL, Hichirinagahama, Aomoki Prefecture, Japan, 1 September 1980.

Yongeichthys caninus (Cuvier and Valenciennes, 1837): PJM coll. No. 5, 5 specimens, 84-92 mm SL, Thailand.

Yongeichthys criniger (Cuvier and Valenciennes, 1837): WAM P. 27779-001, 28 specimens, 29-59 mm SL, mouth of Daintree River, Queensland, 2 September 1982; PJM coll. No. 0, 3 specimens, 61-93 mm SL; PJM, 5 specimens, 82-97 mm SL, Thailand.

Yongeichthys thomasi (Boulenger, 1916): PJM, 4 specimens, 19-40 mm SL, Port Hearcourt, Nigeria; PJM, 10 specimens, 25-40 mm SL.

Acknowledgements

I would like to thank D. F. Hoese (AMS) and G. R. Allen (WAM) for material, helpful comments on the genera examined and contributions to the final manuscript and in particular for their data on specimens of *Glossogobius* taken from an unpublished manuscript. I would also like to thank I. C. Potter (Murdoch University) for criticisms of the manuscript and P. J. Miller (University of Bristol) and J. B. Hutchins (the Western Australian Museum, Perth) for much of the comparative material.

Abbreviations used in text and figures

ANG	angular
AR PMX	articular process of premaxilla
ART	articular
ASC PMX	ascending process of premaxilla
BB	basibranchial
BH	basihyal
BO	basioccipital
BR	branchiostegal ray
BT	branchial tooth patch
C	centrum
CB	ceratobranchial
CH	ceratohyal
CL	cleithrum
COR	coracoid
COR D	coronoid process of dentary
CV	caudal vertebra
D	dentary
DH	dorsal hypohyal
DPTG	distal radial
EB	epibranchial
EH	epihyal
EO	exoccipital
EPO	epiotic
EPR	epipleural rib
EPU	epural
ETH PAL	ethmoid process of palatine
F	frontal
GR	gill raker
HB	hypobranchial
HS	haemal spine
HYO	hyomandibular
HYP	hypural
IH	interhyal
INT	intercalar
IOP	interopercle
L MX	lateral head of maxilla
LAC	lacrymal
LE	lateral ethmoid
LP CL	lateral process of cleithrum
LPT	lower pharyngeal tooth plate
MC	Meckel's cartilage
ME	medial ethmoid
MPT	metapterygoid
MPTG	medial radial
MX	maxilla
MX PAL	maxillary process of palatine
N	nasal
NA	neural arch
NC	neural canal
NS	neural spine
OP	opercle
PAL	palatine
PB	pharyngobranchial
PC	procurrent cartilage

PCV	precaudal vertebra	QU	quadrate
PHYP	parhypural	RAD	pectoral radials
PM PMX	postmaxillary process of premaxilla	RC	rostral cartilage
		SCA	scapula
PMX	premaxilla	SCL	supracleithrum
POP	preopercle	SES	sesamoid articular
PPC	pectoral/pelvic cartilage	SOC	supraoccipital
PPTG	proximal radial	SOP	subopercle
PR	pleural rib	SPH	sphenotic
PRO	prootic	STF	subtemporal fossa
PS	parasphenoid	SYM	symplectic
PT PAL	ectopterygoid process of palatine	UH	urohyal
		UPT	upper pharyngeal tooth plate
PT	ectopterygoid	US	urostyle
PTG	pterygiophore	V	vomer
PTM	posttemporal	V EO	ventromedial strut of exoccipital
PTO	pterotic		
PTS	pterosphenoid	VH	ventral hypohyal

Abbreviations used as orientation guide

A, anterior;	D, dorsal;	L, lateral;	M, medial;
P, posterior;	V, ventral;	EX, external;	IN, internal.

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Received 17 February 1992 Accepted 3 December 1992 Published 1 June 1993