

## A review of the glassfishes (Chandidae) of Australia and New Guinea

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### Abstract

The Australian and New Guinean members of the family Chandidae are reviewed. Commonly known as glassfishes because of their semi-transparent appearance when alive, the chandids are inhabitants of fresh and brackish waters of the Indo-West Pacific region. A total of 22 species belonging to four genera are reported from Australia and New Guinea. They are distinguished by various characters including body proportions (particularly maximum depth and the height of the spinous dorsal fin), counts of fin rays, scales, and gill rakers, and the serration pattern of certain head bones. The following species are recognised in the present study (approximate Australian or New Guinean distribution indicated in parentheses after author names): *Ambassis agassizii* Steindachner (eastern Australia and Murray-Darling system), *A. agrammus* Günther (Cape York Peninsula, Northern Territory, and central-southern New Guinea), *A. buruensis* Bleeker (northern New Guinea), *A. elongatus* (Castelnau) (Gulf of Carpentaria drainage of northern Queensland), *A. gymnocephalus* (Lacepède) (northern Australia and New Guinea), *A. interruptus* Bleeker (northern Australia and New Guinea), *A. jacksoniensis* (Macleay) (south-eastern coast of Australia), *A. macleayi* (Castelnau) (south-central New Guinea and northern Australia), *A. macracanthus* Bleeker (northern New Guinea), *A. marianus* Günther (south-eastern coast of Australia), *A. miops* Günther (northern Australia and New Guinea), *A. mulleri* Klunzinger (northern and central Australia), *A. naluva* (Hamilton) (northern Australia and New Guinea), *A. wotaenia* Bleeker (New Guinea and possibly northern Australia), *A. vachellii* Richardson (northern Australia and New Guinea), *Denariusa bandata* Whitley (Northern Territory, north-eastern Queensland, and central-southern New Guinea), *Parambassis altipinnis* Allen (Mamberamo River, Irian Jaya), *P. confinis* (Weber) (central-northern New Guinea), *P. gulliveri* (Castelnau) (northern Australia and south-central New Guinea), *Tetracentrum apogonides* Macleay (south-eastern New Guinea), *T. caudovittatus* (Norman) (north-eastern New Guinea), and *T. honessi* (Schultz) (north-eastern New Guinea). A brief description and illustrations for each taxon are provided, as well as keys to genera and species. *Priopidichthys* and *Telanbassis* of Whitley are placed in the synonymy of *Ambassis*, and *Synechopterus* Norman and *Xenambassis* Schultz are shown to be junior synonyms of *Tetracentrum* Macleay.

### Introduction

The glassfish family Chandidae contains approximately 40 species which are mainly confined to the tropical Indo-West Pacific region. About two-thirds of

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this total dwell in fresh waters of India, Southeast Asia, and the Indo-Australian Archipelago. The remaining species are inhabitants of shallow coastal seas and brackish estuaries of the Indo-West Pacific region. The common appellation is derived from the semi-transparent appearance of many of the species. Chanda perch and perchlets are other widely used common names. Most glassfishes are small, generally under 10 cm, but members of the genus *Parambassis* sometimes attain standard lengths in excess of 25 cm. The similar appearance of many species is responsible for much confusion among taxonomists who attempt to identify them. The only previous comprehensive review of Chandidae was provided by Fraser-Brunner (1954). He recognized 39 species belonging to eight genera. However, from our experience this work is inadequate, particularly for identification of specimens from the Australian region. It contains keys to genera and species, but in most cases these are based on only a few specimens or unreliable literature descriptions. Too much emphasis was placed on the amount and type of serration on the margins and ridges of various head bones. While this feature is useful to a certain degree, Fraser-Brunner failed to take into account the change in serration pattern in a given species with increased growth. There is generally more pronounced serration in adults than in juveniles, which may lack this feature entirely, particularly in the smallest stages.

This group has sometimes been recognised as a subfamily within the Centropomidae (Nelson 1984), but we follow Munro (1967), Johnson (1975) and Greenwood et al (1966) in placing it in a separate family. Chandidae and Ambassidae are names that have been variously used for the group by previous authors. However, in view of its chronological priority and more widespread useage, Chandidae is the appropriate designation. As Nelson (1984) pointed out, the relationships of the family are obscure and require study.

The first Australian species of Chandidae were described in 1867 by Günther (*Ambassis agrammus*) and Steindachner (*A. agassizii*). Macleay (1881) was the first author to present a comprehensive list of the Australian species. He recognized nine species, four of which were described as new. McCulloch's (1929) checklist of Australian fishes included 20 species, and that of Whitley (1964) contained 17 species. Neither of these authors, however, presented descriptive data. Whitley (1935) reviewed 11 of the species inhabiting the Australia-New Guinea region, and also included descriptions of four new genera: *Austrochanda*, *Negambassis* (New Guinea only), *Priopidichthys*, and *Velambassis*. In addition, *Ambassis* Cuvier and *Blandowskiella* Iredale and Whitley were recognized. In the present work we provisionally follow the classification of Fraser-Brunner (1954) in placing most Australian representatives in the genus *Ambassis*. *Priopidichthys* and *Velambassis* have been commonly used, particularly by Australian authors. The former genus was distinguished by the presence of several supraorbital serrae instead of a single spinule characteristic of *Ambassis*, and the latter genus by the presence of relatively weak fin spines. It is our opinion, however, that these differences are insufficient to justify separate generic

distinction. We therefore include both genera in the synonymy of *Ambassis*. Other genera recognized in the present work include the monotypic *Denariusa* Whitley, *Parambassis* Bleeker, and *Tetracentrum* Macleay of eastern New Guinea.

The most comprehensive review to date dealing exclusively with the Australian members of the family is that of Munro (1961) in which 16 species were included. All of these are recognized as valid in the present study except *Ambassis castelnaui*, *A. nigripinnis*, and *A. pallidus*, all of which we regard as synonyms of *A. agassizii*. In addition, we have reidentified Munro's *A. commersoni* as *A. urotaenia* and place *Priopidichthys dussumieri* in the synonymy of *Ambassis vachelli*. The only Australian species recognized by us, but not treated by Munro, are the widely distributed *A. interruptus* and *A. miops*.

The Chandidae of Papua New Guinea were summarised by Munro (1967), who included 16 species belonging to six genera. All but two of these species are recognised in the present work, although, as stated previously, we have reidentified *Ambassis commersoni* as *A. urotaenia*. Two species, *Xenambassis simoni* and *X. lalokiensis*, considered valid by Munro are here regarded as synonyms of *Tetracentrum caudovittatus* and *T. apogonides* respectively. Most of the Munro species were also listed by Kailola (1987) although she included *A. reticulatus*, herein recognized as a synonym of *A. agrammus*.

Glassfishes are common inhabitants of fresh and brackish waters of Australia and New Guinea. The distribution of the 10 species that are principally estuarine encompasses the coast of New Guinea and that of New South Wales, Queensland, Northern Territory, and the northern half of Western Australia. Thus, on the eastern or Pacific coast of Australia the distribution extends to approximately 36°S latitude and on the western or Indian Ocean coast to about 26°S latitude. The distribution of the six Australian freshwater species occupies about two-thirds of the continental land mass or roughly the area lying east of a diagonal line connecting Derby, Western Australia and Melbourne, Victoria, although the inland species are absent from coastal streams of Victoria and most of the region east of the Dividing Range in New South Wales. The estuarine dwellers, with the exception of *Ambassis jacksoniensis* and *A. marianus*, which are endemic to south-eastern Australia, have relatively wide distributions in the tropical Indo-West Pacific or at least are found throughout the Indo-Australian Archipelago. Four of the purely freshwater species, *Ambassis agrammus*, *A. macleayi*, *Denariusa bandata*, and *Parambassis gulliveri*, have distributions that encompass both northern Australia and the central portion of southern New Guinea. These areas, though now separated by shallow seas, were connected by a land bridge throughout much of their geologic history. The connection across the Torres Strait is believed to be as recent as 6,500-8,000 years ago (Walker, 1972). Of the remaining three Australian and five New Guinean freshwater species, most have limited regional distributions, except *Ambassis agassizii* and *A. mulleri* which are relatively widespread. The distributional ranges of species inhabiting the Australia-New Guinea region are summarized in Figures 1-3.

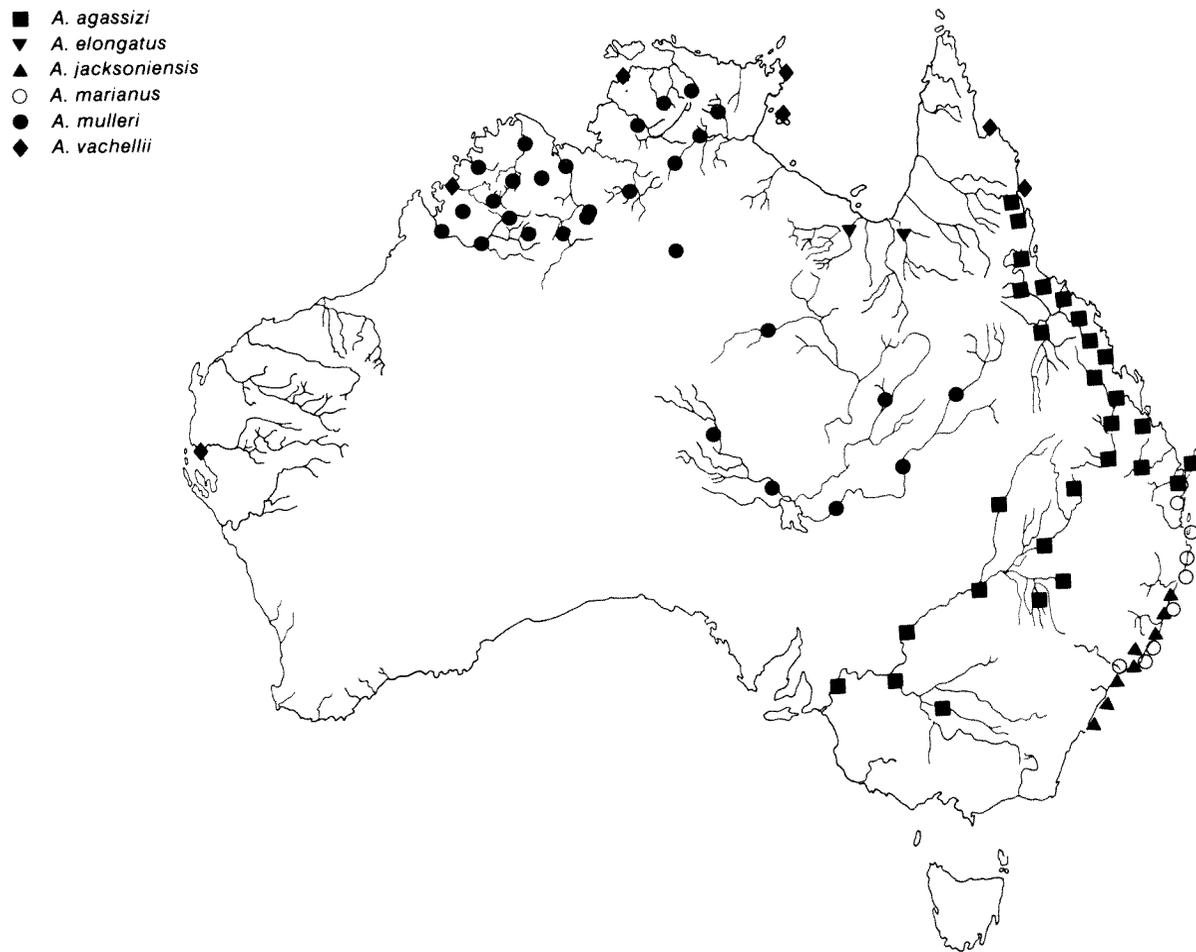


Figure 1. Distribution of Australian species of *Ambassis*.

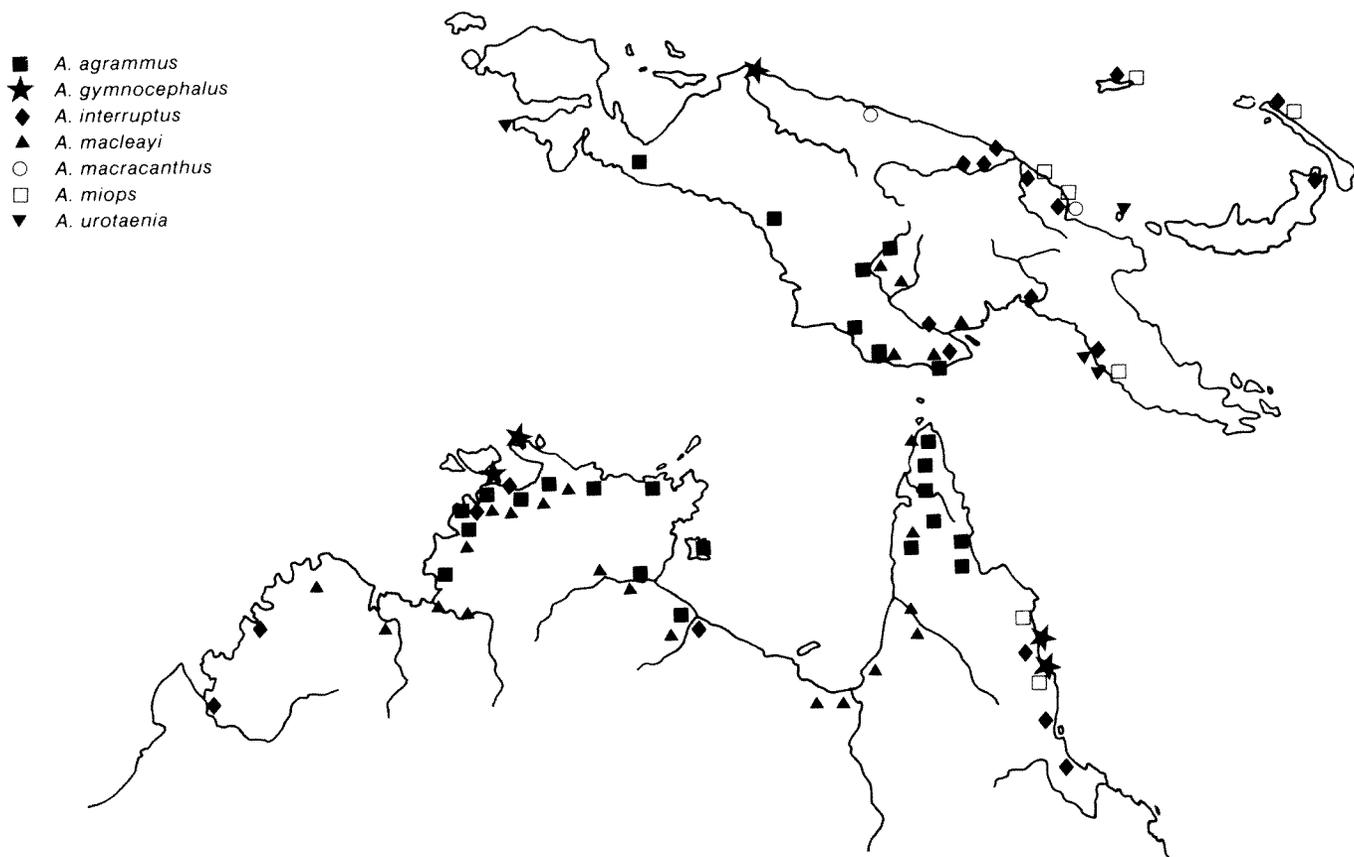


Figure 2. Distribution of Australian and New Guinean species of *Ambassis*.



Figure 3. Distribution of Australian and New Guinean species of *Ambassis*, *Denariusa*, *Parambassis*, and *Tetracentrum*.

Chandidids are adapted to a wide variety of freshwater, marine, and estuarine conditions. The marine and estuarine habitats include the submerged roots of mangrove trees, log snags, dead branches, boulders, and man-made debris. The freshwater species inhabit the vegetated margins of streams, lakes, and swamps. Certain species such as *A. agrammus* and *A. mulleri* tolerate a variety of temperature and pH conditions ranging from about 22°-38°C and 4.8-8.9 respectively. Glassfishes often form large aggregations containing hundreds of individuals. Indeed, in many northern Australian streams they are extremely abundant, perhaps surpassed only by melanotaeniid rainbowfishes. They appear to be nocturnal feeders that disperse during darkness and congregate amongst suitable shelter during the day. Examination of gut contents of several species (mainly *Ambassis agrammus*, *A. macleayi*, *A. mulleri*, *Denariusa bandata*, and *Parambassis confinis*) indicate a diet that includes microcrustaceans (cladocerans, ostracods, and copepods), aquatic insects (chironomid larvae and pupae, and baetid larvae), small arachnids, terrestrial insects, and lesser amounts of fishes and algae.

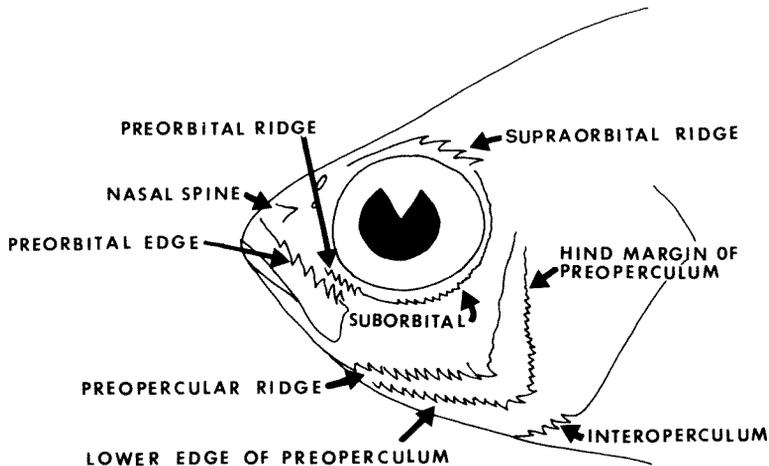
There is little information on reproductive biology. Unpublished studies by K. Bishop of *A. agrammus* and *A. macleayi* in Northern Territory streams reveal they scatter adhesive, demersal eggs, averaging 0.3 mm diameter. These adhere to aquatic vegetation and hatching occurs within 12 to 36 hours. The fry are about 2 mm TL at hatching and growth is rapid, a size of 35-40 mm TL being reached after 150 days. Both species attain sexual maturity within their first year at a SL between 25-35 mm. *Ambassis agrammus* has a well defined breeding season that is initiated at the onset of spring monsoonal rains. *Ambassis macleayi* spawns throughout the year, but also exhibits peak activity at the beginning of the wet season (i.e. November-December).

During the present study chandidids were collected by the senior author on a series of field trips between August 1974 and November 1988. Sampled localities in New Guinea included the Fly-Strickland system, streams around Port Moresby, the vicinity of Safia and Popondetta, and the Markham, Gogol, Ramu, Sepik, and Mamberamo systems of northern New Guinea. Australian field work included visits to the Kimberley drainage of Western Australia, coastal streams and estuaries of the Northern Territory, the Gulf of Carpentaria drainage of Queensland, Cape York Peninsula, the Pacific Coast of Queensland, and the Darling River system of southern Queensland. Most of the localities indicated by symbols in Figures 1-3 are based on specimens in the collections of either the Australian Museum or the Western Australian Museum. All chandid material deposited in the following Australian and New Guinean museums up until March 1986 was examined (abbreviations in parentheses are used in the subsequent text): Australian Museum, Sydney (AMS); CSIRO Fisheries Research Laboratory, Hobart (CSIRO); Kanudi Fisheries Research Station, Port Moresby (KFRS); Museum of Victoria, Melbourne (MV); Northern Territory Museum, Darwin (NTM); Queensland Museum, Brisbane (QM); South Australian

Museum, Adelaide (SAM); and Western Australian Museum, Perth (WAM). We have also examined type specimens or material from Australia and New Guinea at the following European museums: British Museum (Natural History) (BMNH); Museum National d'Histoire Naturelle, Paris (MNHN); Rijksmuseum van Natuurlijke Histoire, Leiden (RMNH); and Zoologisch Museum, Amsterdam (ZMA).

Most of the terms relating to counts and morphological proportions are those commonly employed by current fish systematists. Proportional measurements are given as percentage of the standard length (SL). Caudal peduncle length is the horizontal measurement connecting vertical lines through the base of the last dorsal ray and the caudal fin base. The specialised terminology for the serration of the head bones is primarily from Fraser-Brunner (1954) and the location of these features is shown in Figure 4. The term nasal spine is used for the posteriorly directed spine located on the anterior part of the preorbital bone. This feature is characteristic of all estuarine chandids inhabiting Australia and is lacking in the purely freshwater forms. The lateral line of chandids is composed of a longitudinal series of tubed scales on the upper and middle side of the body that is either continuous throughout its length or interrupted by several non-tubed scales in its central portion. Fin ray and gill raker counts are summarised in Tables 1 and 2. The latitude and longitude for each geographic locality mentioned in the text is given in the gazetteer (Appendix I). Coordinates for rivers indicate the approximate location of the mouth.

A description of the live colouration has been omitted from the individual species accounts of chandids as they are mainly semi-transparent in life with dark pigmentation as indicated under "colour in alcohol."



**Figure 4.** Head of a chandid fish showing serrated ridges and edges of bones that are mentioned in the text.

**Table 1** Summary of fin-ray and gill raker counts for species of *Ambassis*.

	Soft dorsal rays					Soft anal rays					Pectoral rays							Gill rakers on lower limb of first arch																	
	7	8	9	10	11	7	8	9	10	11	9	10	11	12	13	14	15	16	17	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
<i>A. agassizii</i>	16	30	4			6	36	8			2	31	11							3	14	18	15												
<i>A. agrammus</i> (Bensbach R. & Daru, P.N.G.)	1	24	10			1	26	8			2	23	10							3	22	10													
<i>A. agrammus</i> (Fly R. P.N.G.)		3	31	1		5	29	1			2	17	16							1	7	18	9												
<i>A. agrammus</i> (Australia)	54	26				63	14	3			5	33	36	6						17	30	16	16												
<i>A. buruensis</i>		16				2	14									16											1	2	12	1					
<i>A. elongatus</i>	35					4	31							22	13					15	20														
<i>A. gymnocephalus</i>		15				15										3	12									1	4	6	2	2					
<i>A. interruptus</i>	35	3				32	6							4	17	13										5	18	12							
<i>A. jacksoniensis</i>	6	32	5			3	10							16	27							3	2	7	6	3									
<i>A. macleayi</i>	8	35	2			8	34	3						30	15																13	17	15		
<i>A. macracanthus</i>		13				13								7	8											2	5	6							
<i>A. marianus</i>	6	32				36	2							3	13	21										12	20	6							
<i>A. miops</i>	20	2				3	19							7	14	1						1	9	5	5	2									
<i>A. mulleri</i>	32	2				30	4				11	28	4							4	21	4	2												
<i>A. nalua</i>		33	4			34	3							2	13	22						3	5	5	5	3									
<i>A. urotaenia</i>		5				2	3									5												3	2						
<i>A. zachellii</i>	16					16								11	3	2										5	8	3							

**Table 2** Summary of fin-ray and gill raker counts for species of *Denariusa*, *Parambassis*, and *Tetracentrum*.

	Soft dorsal rays					Soft anal rays					Pectoral rays							Gill rakers on lower limb of first arch																	
	7	8	9	10	11	7	8	9	10	11	9	10	11	12	13	14	15	16	17	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
<i>D. bandata</i>		27	13			5	26	9			32	8								4	7	12													
<i>P. altipinnis</i>		15	5			11	6									13	7													3	15	2			
<i>P. confinis</i>		15				13	2									13	2					2	3	4	6										
<i>P. gulliveri</i>		23	5			25	3							2	9	17																4	15	3	
<i>T. apogonides</i>		20				20								1	17	2										6	14								
<i>T. caudovittatus</i>	3	14				1	1	10	5					14	3											1	5	9	2						
<i>T. honessii</i>		10	19			5	23	2						11	19											4	9	17							

## Systematics

## Key to the Chandid Genera of Australia and New Guinea

- 1a. Spinous dorsal fin with a shallow notch, continuous with soft dorsal fin, the last dorsal spine not much longer than penultimate spine (Eastern New Guinea) ..... *Tetracentrum* Macleay (p. 194)
- 1b. Spinous dorsal fin deeply notched, the last spine more than twice the length of penultimate one ..... 2
- 2a. Scales relatively small, 36-52 in longitudinal series from upper edge of gill opening to caudal fin base; transverse scale rows on cheek 3 or 4.... *Parambassis* Bleeker (p. 187)
- 2b. Scales larger, 24-34 in longitudinal series from upper edge of gill opening to caudal fin base; transverse scale rows on cheek usually 1 or 2 (occasionally 3) ..... 3
- 3a. Gill rakers well developed, 15 or more on lower limb of first gill arch (including raker at angle); pores on preorbital, supraorbital, and preopercular bones not conspicuous; pectoral-fin rays 11 to 17; colour more or less uniform pale without vertical bars ..... *Ambassis* Cuvier (p. 148)
- 3b. Gill rakers reduced to rudimentary stumps, about 7-9 on lower limb of first gill arch; enlarged and conspicuous pores present on preorbital, supraorbital, and preopercular bones; pectoral-fin rays 9 or 10; series of 6 narrow dark bars often present on sides ..... *Denariusa* Whitley (p. 185)

Genus *Ambassis* Cuvier

*Ambassis* Cuvier (in Cuvier and Valenciennes) 1828: 176 (type species: *Centropomus ambassis* Lacepède 1802, by absolute tautonymy).

*Pseudoambassis* Castelnau 1878: 43 (type species: *Pseudoambassis macleayi* Castelnau 1878, by subsequent designation of Jordan 1919).

*Blandowskiella* Iredale and Whitley 1932: 95 (type species: *Pseudoambassis castelnau* Macleay 1881 (= *Ambassis agassizii* Steindachner 1867), by original designation).

*Austrochanda* Whitley 1935: 357 (type species: *Pseudoambassis macleayi* Castelnau 1878. Substitute name for *Pseudambassis* and therefore taking the same type species).

*Priopidichthys* Whitley 1935: 364 (type species: *Pseudoambassis ramsayi* Macleay 1881 (= *Ambassis marianus* Günther 1880), by original designation).

*Uelambassis* Whitley 1935: 365 (type species: *Pseudoambassis jacksoniensis* Macleay 1881, by original designation).

*Komopickia* Whitley 1937: 133 (type species: *Ambassis mulleri* Klunzinger 1879, by original designation).

### Diagnosis

Dorsal fin deeply notched; mouth relatively large, the maxillary length 10.1 to 18.0% of SL; gill rakers well developed, about 16 to 29 on lower limb of first gill arch; pectoral rays 11 to 17; lateral-line development variable, poorly to well developed, either continuous or interrupted in middle portion; usually 1 to 5 supraorbital spines; vertical limb of preopercle edge smooth or serrate; scale size variable, 21 to 31 in longitudinal series from upper edge of gill opening to caudal fin base; horizontal scale rows from anal fin origin to base of dorsal fin 9 to 11; transverse scale rows on cheek usually 2 (occasionally 1); colour usually uniform pale (semi-transparent in life), often with melanophores concentrated on scale margins; maximum size ranging from about 50 to 90 mm SL; freshwater, brackish and marine habitats.

### Remarks

The genus *Ambassis* as presently defined contains about 21 species which are primarily inhabitants of brackish estuaries and the lower reaches of freshwater streams. However, *A. agassizii*, *A. agrammus*, *A. elongatus*, and *A. mulleri* of the Australia-New Guinea region are restricted to purely freshwater habitats, sometimes hundreds of kilometres inland. The distribution of the group includes Mauritius and Madagascar, the east African coast from Natal northwards, the Arabian Peninsula and eastward along the coast of southern Asia to the Indo-Australian Archipelago. A few species range northward to Japan and eastward into Oceania where they are mainly restricted to high islands as far east as the Samoan Group in the South Pacific and Ponape, Caroline Islands in the North Pacific. A total of 15 species have been recorded from Australia and New Guinea.

### Key to the Species of *Ambassis* of Australia and New Guinea

- 1a. Supraorbital spines usually 3 to 5 (rarely 2); nasal spine well developed; habitat consisting of marine embayments, brackish estuaries, tidal creeks and lower reaches of freshwater streams ..... 2
- 1b. Usually a single supraorbital spine; nasal spine either well developed or absent; habitat variable, estuarine to pure fresh water ..... 4
- 2a. Hind margin of preoperculum (i.e. vertical limb) with about 6 to 13 small serrae (widespread northern Australia) ..... *A. vachellii* (Richardson)

- 2b. Hind margin of preoperculum usually smooth or weakly crenulate without distinctive serrae ..... 3
- 3a. Soft anal rays usually 10, rarely 11, predorsal scales 16 to 18; eye relatively small, 10.7 to 12.7% of SL; caudal peduncle relatively short and deep, its length and depth 16.1 to 20.8% and 14.4 to 16.3% respectively (southern Queensland to central New South Wales) ..... *A. marianus* (Günther)
- 3b. Soft anal rays usually 9; predorsal scales 11 to 14; eye larger, 13.0 to 13.9% of SL; caudal peduncle more slender, its length and depth 20.6 to 22.2% and 13.0 to 14.8% of SL respectively (widespread northern Australia) ..... *A. gymnocephalus* (Lacepède)
- 4a. Cheek with two or more scale rows ..... 5
- 4b. Cheek with one row of scales (estuaries and tidal creeks of northern Australia and New Guinea) *A. wrotaenia* Bleeker
- 5a. Lateral line continuous from upper edge of gill opening to caudal fin base ..... 6
- 5b. Lateral line either terminating on anterior part of body or interrupted in middle portion ..... 9
- 6a. Pectoral rays usually 16 or 17, rarely 15; nasal spine absent; body relatively deep, maximum depth 45.3 to 50.6% of SL (widespread northern Australia and New Guinea) ..... *A. nalua* (Hamilton)
- 6b. Pectoral rays 13 to 15; nasal spine present, although may be blunt and subcutaneous; body more slender, maximum depth 29.2 to 44.7% of SL ..... 7
- 7a. Spinous dorsal fin relatively low, its height 18.9 to 22.9% of SL; fin spines relatively weak and flexible; soft dorsal rays usually 10, occasionally 9 or 11; soft anal rays usually 8 or 9; body slender, maximum depth 29.2 to 33.2% of SL; head length 32.0 to 34.0% of SL; (estuaries and tidal creeks of New South Wales and southern Queensland) ..... *A. jacksoniensis* (Macleay)
- 7b. Spinous dorsal fin taller, its height 24.0 to 31.9% of SL; fin spines relatively strong and stiff; soft dorsal

- rays usually 9, rarely 10; soft anal rays 9 or 10; body deeper, maximum depth 33.4 to 44.7% of SL; head length 35.5 to 40.4% of SL .....8
- 8a. Predorsal scales 17 to 22; horizontal scale rows from anal fin origin to base of dorsal fin 12 or 13; second dorsal spine longer than third dorsal spine (northern coast of New Guinea) ..... *A. macracanthus* Bleeker
- 8b. Predorsal scales 12 to 15; horizontal scale rows from anal fin origin to base of dorsal fin 9 or 10; second dorsal spine slightly shorter than third dorsal spine or spines about equal (New Guinea and eastern Cape York Peninsula) ..... *A. miops* Günther
- 9a. Nasal spine present; lateral line always well developed consisting of 8 to 13 tubed scales in anterior section and 9 to 14 tubed scales in posterior section; inhabits estuaries and lower sections of freshwater streams .....10
- 9b. Nasal spine absent; lateral line often poorly developed consisting of 9 to 14 tubed scales in anterior section and 0 to 15 tubed or pitted scales in posterior section; inhabits fresh water only .....11
- 10a. Margin of interoperculum with 2 to 10 small serrae; height of spinous dorsal fin 34.0 to 38.0% of SL; depth of body 37.2 to 47.8% of SL (northern Australia and New Guinea) ..... *A. interruptus* Bleeker
- 10b. Margin of interoperculum smooth; height of spinous dorsal fin 27.6 to 32.7% of SL; depth of body 32.9 to 39.5% of SL (New Guinea) ..... *A. buruensis* Bleeker
- 11a. Rakers on lower limb of first gill arch 24 to 29; dorsal and anal soft rays usually 10 (occasionally 9 or 11); pectoral rays 14 or 15; base of pectoral fin frequently blackish (eastern Kimberley district of Western Australia to Gulf of Carpentaria drainage; also central-southern New Guinea) ..... *A. macleayi* (Castelnau)
- 11b. Rakers on lower limb of first gill arch 15 to 20; dorsal and anal soft rays usually 8 or 9 (rarely 7 or 10); pectoral rays 11 to 14; base of pectoral fin pale ..... 12

- 12a. Predorsal scales 8 to 10; lateral line well developed anteriorly, consisting of 10 to 14 tubed scales, development of posterior section variable, but usually with 10 to 14 tubed scales (occasionally only a few tubed scales or none) (Gulf of Carpentaria drainage, Queensland) ..... *A. elongatus* (Castelnau)
- 12b. Predorsal scales 11 to 15; lateral line usually poorly developed (except in some Fly River examples from New Guinea), often with 0 to 6 weakly tubed or pitted scales in both anterior and posterior sections, but scalation variable ranging from 0 to 11 and 0 to 15 in anterior and posterior sections respectively..... 13
- 13a. Scales in longitudinal series from upper edge of gill opening to caudal fin base 28 to 34; spinous dorsal fin relatively tall, 29.1 to 41.8% of SL, usually greater than 33.0% (Cape York Peninsula, Northern Territory, and central-southern New Guinea) ..... *A. agrammus* Günther
- 13b. Scales in longitudinal series from upper edge of gill opening to caudal fin base 24 to 26 (rarely 27); spinous dorsal fin usually shorter, 18.4 to 36.8% of SL, usually less than 33% ..... 14
- 14a. Circumpeduncular scales usually 16, occasionally 15; height of spinous dorsal fin 24.0 to 36.8% of SL ( $\bar{x}$  = 28.5) (Kimberley district of Western Australia to Gulf of Carpentaria drainage, Queensland; also drainages of central Australia) ..... *A. mulleri* Klunzinger
- 14b. Circumpeduncular scales usually 14 or less; height of spinous dorsal fin 18.4 to 27.6% of SL ( $\bar{x}$  = 23.8) (eastern Australia and Murray-Darling system) ..... *A. agassizii* Steindachner

***Ambassis agassizii* Steindachner**

(Figures 5a and 8)

*Ambassis agassizii* Steindachner 1867: 9 (Fitzroy River, Queensland).

*Pseudoambassis castelnaui* Macleay 1881: 339 (Murrumbidgee River, New South Wales).

*Pseudambassis pallidus* De Vis 1884: 393 (Queensland).

*Pseudambassis nigripinnis* De Vis 1884: 393 (Brisbane River, Queensland).

*Priopis olivaceus* Ogilby 1911: 11 (Brisbane, Queensland).

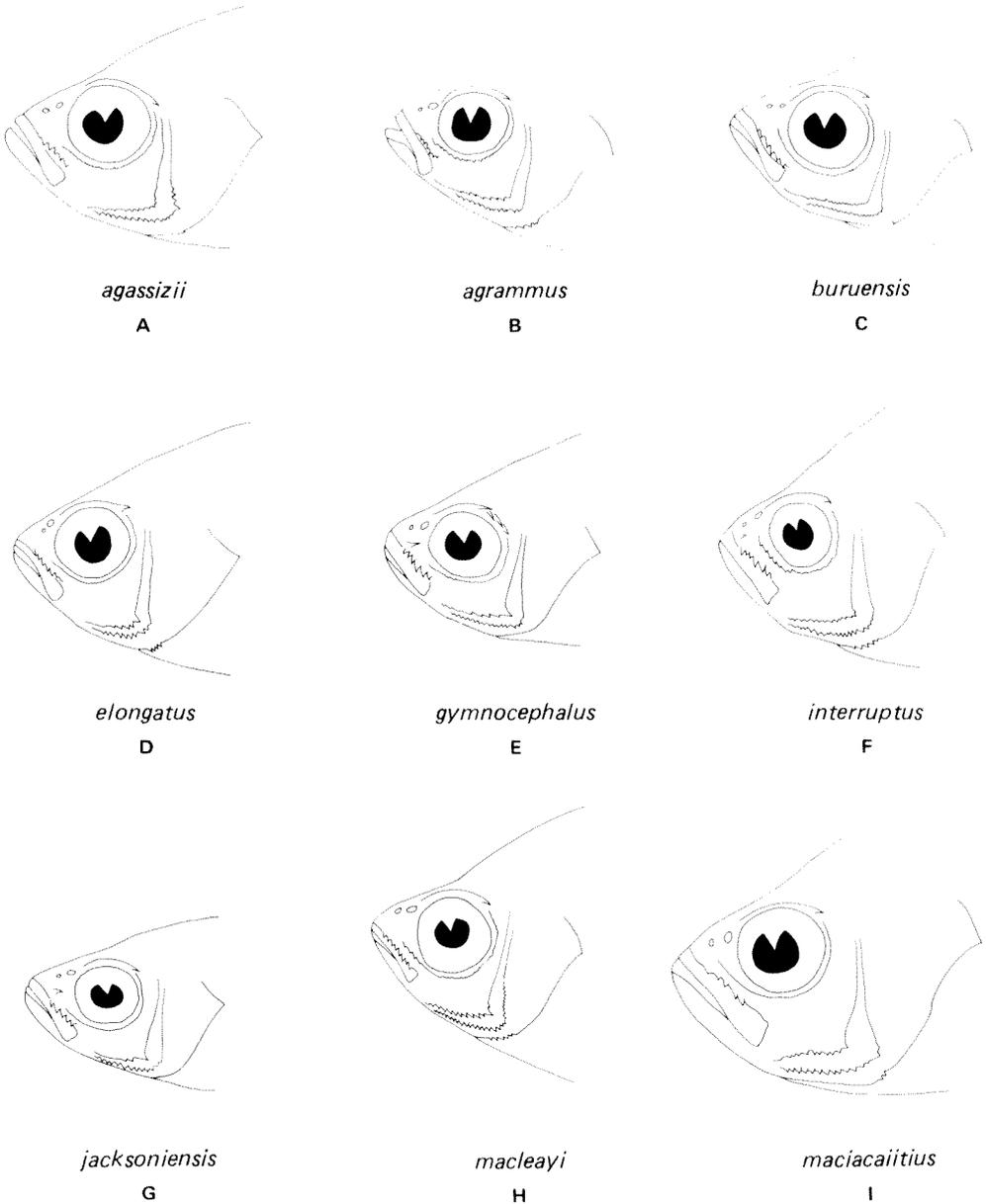
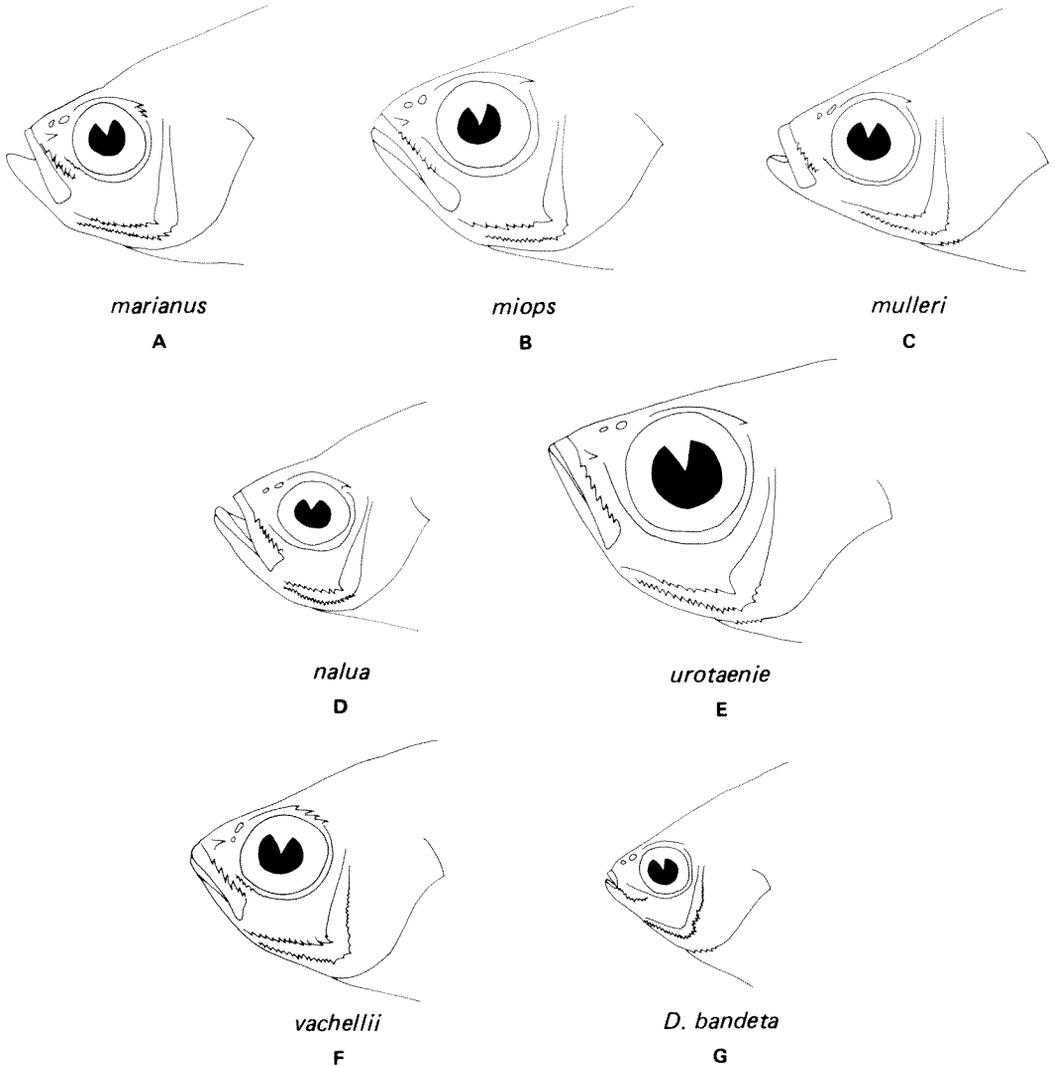


Figure 5. Heads of *Ambassis* species showing serration patterns: (A) *A. agassizii*; (B) *A. agrammus*; (C) *A. buruensis*; (D) *A. elongatus*; (E) *A. gymnocephalus*; (F) *A. interruptus*; (G) *A. jacksoniensis*; (H) *A. macleayi*; (I) *A. macracanthus*.

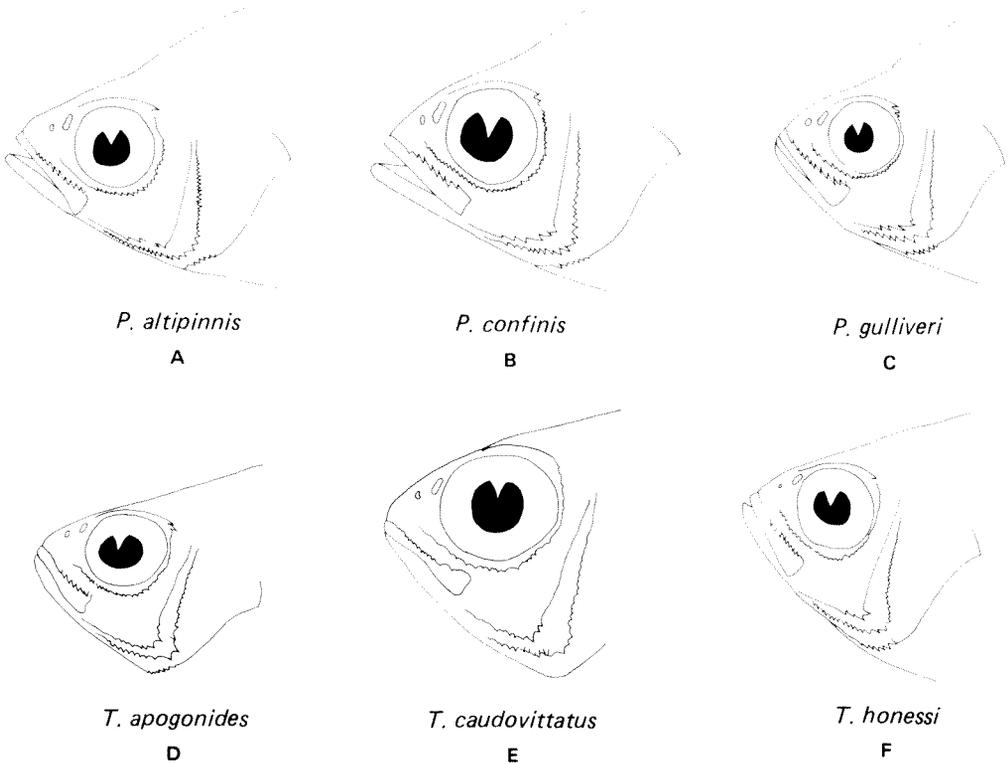


**Figure 6.** Heads of *Ambassis* and *Denariusa* species showing serration patterns: (A) *A. marianus*; (B) *A. miops*; (C) *A. mulleri*; (D) *A. nalua*; (E) *A. urotaenia*; (F) *A. vachellii*; (G) *D. bandata*.

### Diagnosis

A species of *Ambassis* with the following combination of characters: a single supraorbital spine (rarely 0 or 2); 2 transverse scale rows on cheek; a weakly developed (sometimes absent) lateral line either terminating on anterior part of body or interrupted in middle portion; nasal spine absent; gill rakers on lower

limb of first arch 15 to 18. It is most similar to *A. agyammus* and *A. mulleri*, but has fewer scales in a longitudinal series and a shorter first dorsal fin than *A. agyammus*, and fewer circumpeduncular scales and usually a shorter first dorsal fin than *A. mulleri*. Details of these differences are presented in the key to *Ambassis* (couplets 13 and 14).



**Figure 7.** Heads of *Parambassis* and *Tetracentrum* species showing serration patterns: (A) *P. altipinnis*; (B) *P. confinis*; (C) *P. gulliveri*; (D) *T. apogonides*; (E) *T. caudovittatus*; (F) *T. honessi*.

### Description

(Proportional measurements based on 30 specimens, 32-63 mm SL). Dorsal rays VII,I,7 to 9; anal rays III,7 to 9; pectoral rays 11 to 13; lateral line with 0 to 11 + 0 to 15 scales, usually terminating below spinous dorsal fin or anterior to this point, occasionally continued in the form of a few weakly tubed or pitted scales on middle of caudal peduncle; vertical scale rows from upper edge of gill opening to caudal fin base 24 to 27; horizontal scale rows from anal fin origin to base of dorsal fin 10 to 12 (usually 11 or 12); transverse scale rows

on cheek 2; predorsal scales 11 to 14; gill rakers on lower limb of first arch 15 to 18. Fin ray and gill raker counts are summarised in Table 1.

A single supraorbital spine (rarely none or 2); nasal spine absent; preorbital ridge smooth or with 1 to 7 very small serrae; suborbital occasionally smooth, usually with 3 to 14 small serrae; preorbital edge with 4 to 7 serrae; preopercular ridge with 3 to 13 serrae on lower limb or concentrated around angle, vertical limb mainly smooth (at least on upper part); lower edge of preoperculum with 7 to 13 serrae and hind margin with additional series of 1 to 10 (occasionally none) small serrae; interoperculum usually with 1 to 6 moderate to weakly developed serrae.

Body depth 33.8 to 43.6; head length 35.1 to 40.4; snout length 7.1 to 9.6; eye diameter 11.6 to 14.8; maxilla length 12.0 to 15.7; caudal peduncle depth 13.1 to 16.5; caudal peduncle length 21.1 to 23.9; height of first dorsal fin 18.4 to 27.6; second dorsal spine longer than third dorsal spine or these spines about equal; third anal spine longer than second anal spine.

*Colour in alcohol:* generally uniform pale tan to yellowish or with dusky scale margins, sometimes forming network pattern particularly on upper side; melanophores frequently concentrated on nape, along base of dorsal fin, and on upper and lower edges of caudal peduncle; a thin black line along middle of side, particularly evident on posterior half; fins mainly translucent except membrane between second and third dorsal spines frequently blackish, and often a dusky, blackish blotch or vertical band on posterior portion of soft dorsal and anal fins, and similar marking on anterior part of pelvic fins.

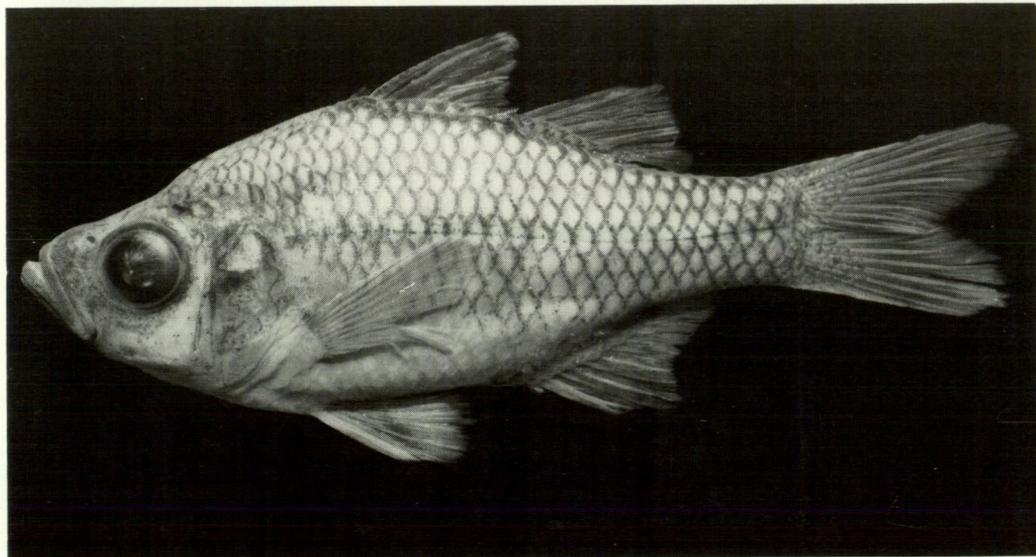


Figure 8. *Ambassis agassizii*, 53 mm SL, Mary River, Queensland.

### Distribution (Figure 1)

Murray-Darling river system of Queensland, western New South Wales, Victoria, and South Australia; also coastal drainages of New South Wales and Queensland east of the Great Dividing Range. The most southerly specimen we have examined is from the Murray River near Swan Reach, South Australia (approximately 34° 34'S). The eastern distribution in coastal drainages extends from about Lake Hiawatha, New South Wales northward to the Mowbray River, north Queensland.

### Habitat

Rivers, creeks, and swamps, usually among aquatic vegetation.

### Material examined

We have examined the following type specimens: *Pseudoambassis castelnaui*, 4 specimens (syntypes), 39-49 mm SL (AMS L16313-001); *Pseudambassis pallidus* (lectotype), 48 mm SL (QM L513); *Priopis olivaceus* (holotype), 43 mm SL (QM L1588); and *Pseudambassis nigripinnis*, 10 specimens (syntypes), 19-28 mm SL (QM L92). In addition, 325 specimens, 17-63 mm SL, from the Murray-Darling system and Pacific coastal drainages of New South Wales and Queensland were studied at AMS, MV, QM, SAM and WAM.

### Remarks

The type specimen is presumably lost. It was not located during a visit to the Steindachner collection at Naturhistorisches Museum, Vienna by the senior author. As evident from the above synonymy we consider *Ambassis nigripinnis* and *A. castelnaui* as junior synonyms of *A. agassizii*. Previous authors (e.g. Merrick and Schmida 1984) have used the name *Ambassis nigripinnis* for eastern coastal populations and *A. castelnaui* for the inland Murray-Darling population. A frequently used character to separate these two forms is the presence of blackish blotches on the dorsal, anal, caudal, and pelvic fins in *nigripinnis* and their absence in *castelnaui*. We have examined large numbers of individuals of both inland and coastal forms and find no characters of value for consistently separating them nor for maintaining either as distinct from *agassizii*. The fin markings are useful in separating out some coastal populations, but even within a single collection the fin colours are variable and in other coastal populations these markings are absent. Moreover, the dark patches on the fins appear in all members of the *agrammus*-complex (i.e. *agrammus*, *agassizii*, and *mulleri*), particularly in young specimens.

We have not seen the type of *A. agassizii*, but Steindachner's description is diagnostic and agrees well with specimens from the Fitzroy River system of Queensland (type locality) examined by us at AMS.

### *Ambassis agrammus* Günther

(Figures 5a and 9)

*Ambassis agrammus* Günther 1867: 57 (Cape York, Queensland).

*Ambassis interruptus* var. *reticulatus* Weber 1913: 574 (Merauke and Lorentz rivers, southern New Guinea).

### Diagnosis

A species of *Ambassis* with the following combination of characters: a single supraorbital spine; 2 transverse scale rows on cheek; a weakly developed (sometimes absent) lateral line either terminating on anterior part of body or interrupted in middle portion; nasal spine absent; gill rakers on lower limb of first arch 16 to 20. It is most similar to *A. agassizii* and *A. mulleri*, but has a taller first dorsal fin and more scales in a longitudinal series. Details of these differences are presented in the key to *Ambassis* (couplet 13). Another species that *A. agrammus* might be confused with is *elongatus* from the Gulf of Carpentaria drainage. The latter is distinguished by 8 to 10 predorsal scales and a more strongly developed lateral line, usually consisting of 10 to 14 tubed scales in the anterior section and 7 to 11 tubed scales posteriorly, although posterior tubes are lacking in a few specimens. *Ambassis agrammus*, by contrast, generally has 12 to 14 predorsal scales and a weakly developed lateral line, usually consisting of 2 to 11 tubed scales anteriorly and lacking posterior tubes in most specimens.

### Description

(Proportional measurements based on 35 specimens, 31-62 mm SL). Dorsal rays VII,I,7 to 10 (usually 8 or 9); anal rays III,7 to 10 (usually 8 or 9); pectoral rays 11 to 14; lateral-line with 0 to 11 + 0 to 10 scales, usually terminating below spinous dorsal fin or interrupted in middle portion by series of tubeless scales; vertical scale rows from upper edge of gill opening to caudal fin base 28 to 34; horizontal scale rows from anal fin origin to base of dorsal fin 12 to 14; transverse scale rows on cheek 2 (one specimen with 3); predorsal scales 12 to 15; gill rakers on lower limb of first arch 16 to 20. Fin ray and gill raker counts are summarised in Table 1.

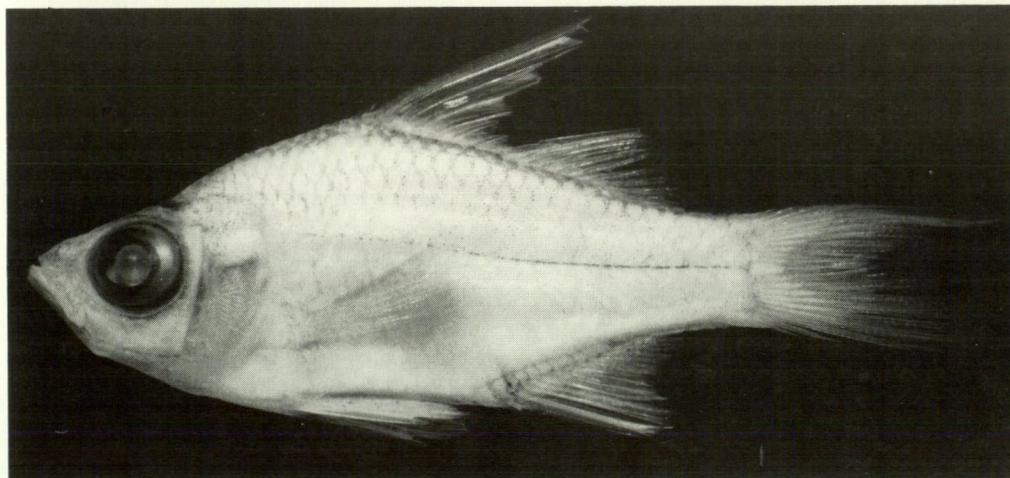


Figure 9. *Ambassis agrammus*, 33 mm SL, Fly River, Papua New Guinea.

A single supraorbital spine (one specimen with 3 spines); nasal spine absent; preorbital ridge smooth or with 1 to 4 small serrae, suborbital usually with 2 to 17 small serrae, or sometimes smooth or weakly crenulate; preorbital edge with 3 to 10 serrae; preopercular ridge with 7 to 12 serrae mainly on lower limb, vertical limb mostly smooth; lower edge of preoperculum with 8 to 18 serrae, hind margin with additional series of 3 to 12 small serrae or weak crenulations; interoperculum with 3 to 10 weakly developed serrae.

Body depth 39.5 to 51.1; head length 36.0 to 41.7; snout length 7.0 to 9.3; eye diameter 11.6 to 11.0; maxilla length 11.0 to 13.5; caudal peduncle depth 11.1 to 17.0; caudal peduncle length 18.1 to 23.0; height of first dorsal fin 29.1 to 41.8; second dorsal spine longer than third dorsal spine; third anal spine longer than second anal spine.

*Colour in alcohol:* generally tan to yellowish white with dusky scale margins forming network pattern on side; a thin black stripe along middle of side from edge of operculum to base of caudal fin; dorsal fin mainly translucent with slight duskiness except membrane between second and third spines blackish; caudal fin translucent with basal portion slightly dusky; basal part of anal fin translucent, outer half with broad blackish band; pelvic fins with broad blackish area on outer portion, remainder of fins translucent; pectoral fins translucent.

### **Distribution** (Figure 2)

*Ambassis agrammus* has a disjunct distribution composed of three major populations: (1) Cape York Peninsula, north of approximately 15° South latitude, (2) coastal streams of the Northern Territory from the Victoria River eastward to the McArthur River, and (3) central-southern New Guinea in drainages that flow into the Arafura Sea and Gulf of Papua including the Fly-Strickland, Merauke, Lorentz, and Setakwa rivers and Jamur Lake.

### **Habitat**

Rivers and creeks flowing through rainforest habitat, sometimes in stagnant pools or slow flowing rivulets. It also occurs in swamps and along the margins of lakes. It usually forms large aggregations that shelter amongst aquatic vegetation.

### **Material examined**

We have examined three syntypes of *A. agrammus*, 35-43 mm SL, at BMNH (registration no. 1867.5.6.32-33), and also 60 syntypes, 34-64 mm SL, of *A. reticulatus* at ZMA (112.388-93). In addition 264 specimens, 21-51 mm SL, from New Guinea and 354 specimens, 12-64 mm SL, from Australia were studied at AMS, KFRS, NTM, QM, RMNH, SAM, WAM, and ZMA.

### **Remarks**

There are modal differences in dorsal and anal fin ray counts (see Table 1) between Australian and New Guinean populations. Fish from the latter area usually have nine dorsal and nine anal soft rays compared to eight for each

fin in those from Australia. However, New Guinean examples from Daru and the Bensbach River, situated more or less directly opposite Cape York across the Torres Strait, are more similar to Australian specimens in this regard. A further modal difference involves the height of the spinous dorsal fin; this fin is usually taller in Australian specimens ( $\bar{x}$  = 35.7% of SL, N = 48) than in New Guinean fish ( $\bar{x}$  = 33.0% of SL, N = 45). We do not believe these modal differences are sufficient, however, for separating these populations at the specific level as many individuals from these two regions are indistinguishable from one another.

Munro (1967) placed *A. reticulatus* in the synonymy of *A. macleayi*, however examination of the syntypes of the former species indicate it has the lower fin ray and gill raker counts typical of *A. agrammus* (see Table 1). The syntypes also lack the dark bar on the pectoral base typical of *A. macleayi*.

### *Ambassis buruensis* Bleeker

(Figures 5c and 10)

*Ambassis buruensis* Bleeker 1857: 79 (Buru, Indonesia).

#### Diagnosis

A species of *Ambassis* with the following combination of characters: a single supraorbital spine; 2 transverse scale rows on cheek; lateral line interrupted in middle portion; nasal spine present. It is most similar to *A. interruptus*, but differs in having a smooth interopercular margin, a shorter first dorsal fin, and a more slender body shape. Details of these differences are presented in the key to *Ambassis* (couplet 10).

#### Description

(Proportional measurements based on 15 specimens, 38-52 mm SL). Dorsal rays VII,I,9; anal rays III,8 or 9 (usually 9); pectoral rays 15; lateral line with

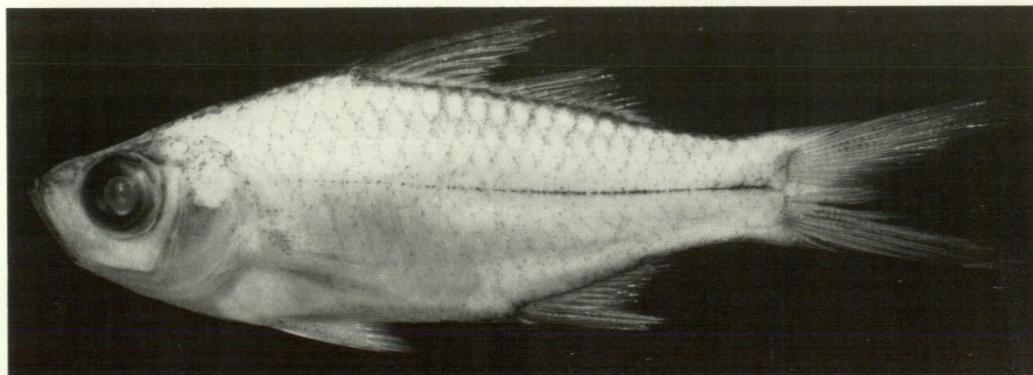


Figure 10. *Ambassis buruensis*, 45 mm SL, Madang, Papua New Guinea.

8 to 13 + 11 to 11 scales, interrupted in middle portion by several tubeless scales; vertical scale rows from upper edge of gill opening to caudal fin base 26 to 28; horizontal scale rows from anal fin origin to base of dorsal fin 10; transverse scale rows on cheek 2; predorsal scales 11 to 14; gill rakers on lower limb of first arch 23 to 26. Fin ray and gill raker counts are summarised in Table 1.

A single supraorbital spine; nasal spine well developed; preorbital ridge with 2 to 4 very weak serrae; suborbital smooth; preorbital edge with 5 or 6 serrae; preopercular ridge with 7 to 11 serrae on lower limb, vertical limb smooth; lower edge of preoperculum with 17 to 24 serrae, hind margin mainly smooth; interoperculum smooth except flattened spine at posterior angle.

Body depth 32.9 to 39.5; head length 34.2 to 34.9; snout length 5.3 to 7.7; eye diameter 11.5 to 12.2; maxilla length 10.0 to 12.2; caudal peduncle depth 13.2 to 15.4; caudal peduncle length 19.8 to 22.1; height of first dorsal fin 27.6 to 32.7; second dorsal spine longer than third dorsal spine; third anal spine longer than second anal spine.

*Colour in alcohol:* overall light yellowish tan, fins slightly paler; scattered melanophores on top of head and on upper sides; scale margins of upper side often narrowly dark; thin black stripe running along middle of side.

#### **Distribution** (Figure 3)

Reported by Weber and de Beaufort (1929) from Sumatera, Java, Bali, Sulawesi, Buru, Ambon, Timor, and the Philippines. Collette (1983) obtained specimens near Wewak and the senior author collected it near Madang, Papua New Guinea and at Bintuni Bay, Irian Jaya.

#### **Habitat**

Mangrove estuaries and the lower reaches of freshwater streams. In the latter habitat the senior author has not encountered it more than about 4 or 5 km upstream.

#### **Material examined**

We have examined 42 specimens, 18-59 mm SL, from the vicinity of Madang, Papua New Guinea and Bintuni Bay, Irian Jaya at WAM.

### *Ambassis elongatus* (Castelnau)

(Figures 5D and 11)

*Pseudoambassis elongatus* Castelnau 1878: 44 (Norman River, Queensland).

#### **Diagnosis**

A species of *Ambassis* with the following combination of characters: a single supraorbital spine; 2 transverse scale rows on cheek; lateral line usually

interrupted in middle part by 2 to 5 tubeless scales, but sometimes terminating in middle of side; nasal spine absent. It is similar in general appearance to *A. agrammus*, but differs by having the lateral line well developed in its anterior portion, usually with 10 to 14 tubed scales and with 0 to 11 tubed scales in the posterior section, although in a few specimens there is poor development posteriorly. In addition, the preorbital ridge and adjoining suborbital series are smooth in *elongatus* and usually serrated in *agrammus*.

### Description

(Proportional measurements based on 25 specimens, 35.0-39.8 mm SL). Dorsal rays VII,I,8; anal rays III,7 or 8; pectoral rays 13 or 14; lateral line with 10 to 14 + 0 to 11 scales, usually interrupted in middle portion by 2 to 5 tubeless scales or sometimes terminating at this point; vertical scale rows from upper edge of gill opening to caudal fin base 25 or 26; horizontal scale rows from anal fin origin to base of dorsal fin 11; transverse scale rows on cheek 2; predorsal scales 8 to 10; gill rakers on lower limb of first arch 17 or 18.

A single supraorbital spine; nasal spine absent; preorbital ridge smooth; suborbital smooth; preorbital edge with 6 to 9 serrae; preopercular ridge with 4 to 8 serrae on lower limb, vertical limb mainly smooth; lower edge of preoperculum with 2 to 5 moderate to weakly developed serrae; interoperculum with 2 to 5 serrae.

Body depth 33.0 to 38.0; head length 35.7 to 39.7; snout length 7.2 to 7.7; eye diameter 12.7 to 13.9; maxilla length 13.0 to 13.9; caudal peduncle depth 13.6 to 15.9; caudal peduncle length 18.9 to 23.1; height of first dorsal fin 20.9 to 27.4; second dorsal spine slightly longer than third dorsal spine or spines

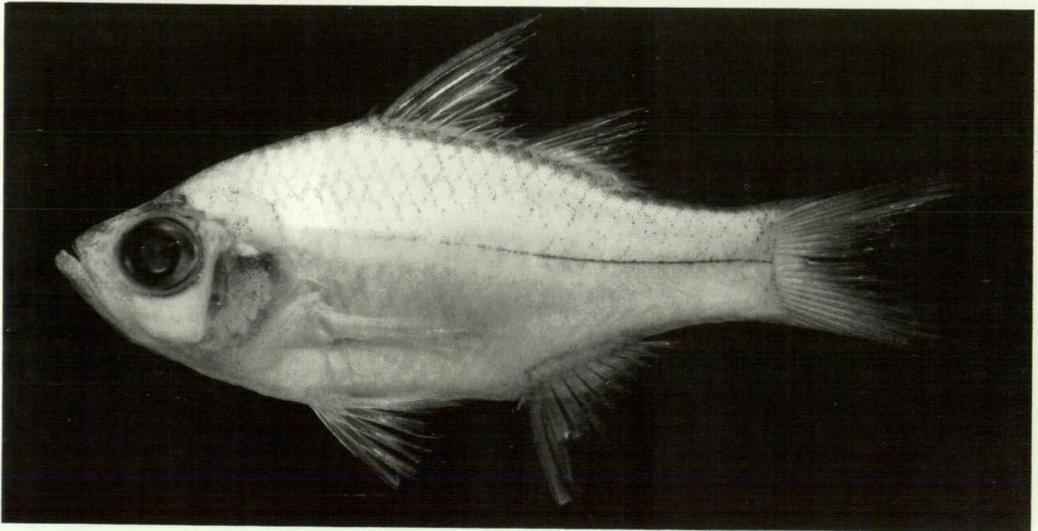


Figure 11. *Ambassis elongatus*, 41 mm SL, Norman River, Queensland.

about equal in length; third anal spine slightly longer than second anal spine.

*Colour in alcohol:* generally pale yellowish with slight duskiness on scale margins of back and forehead; a thin blackish mid-lateral stripe, particularly evident on posterior half of body; fins translucent except membrane between second and third dorsal spines and outer portion of second dorsal fin dusky.

### **Distribution** (Figure 1)

*Ambassis elongatus* is thus far known only from the O'Shannessy River (Gregory River system), Leichhardt River and the Norman River system. These locations are in the Gulf of Carpentaria drainage of northern Queensland.

### **Habitat**

Freshwater streams that frequently have moderate to high turbidity levels.

### **Material examined**

We have examined 87 specimens, 16-44 mm SL, mainly from the Norman River system, in the AMS collection.

### **Remarks**

Castelnau's (1878) description is very brief, but agrees with the specimens examined by us in the present study. Apparently the type specimen is lost. It is not among the collections of AMS or MNHN.

## *Ambassis gymnocephalus* (Lacepède)

(Figs. 5E and 12)

*Lutjanus gymnocephalus* Lacepède 1802: 181 and 216 (Indo-Pacific).

### **Diagnosis**

A species of *Ambassis* with the following combination of characters: supraorbital spines 2 to 4 (usually 3 or 4); nasal spine present; rear margin of preoperculum smooth or weakly crenulate. It is one of two tropical Australian ambassids characterized by a multiple series of spinules (usually 3 to 5, occasionally 2) at the rear edge of the supraorbital ridge. It differs from the other species, *A. vachelli*, by lacking small serrae on the hindmargin of the preoperculum. Both species generally have less than 15 predorsal scales and the second dorsal spine is slightly longer than the third or the spines are about equal in length. *Ambassis marianus* of subtropical Queensland and New South Wales differs by possessing 17 or 18 predorsal scales and has the third dorsal spine slightly longer than the second. It further differs from *A. gymnocephalus* in having 10 or 11 soft anal rays instead of 9, a smaller eye, and a shorter, deeper caudal peduncle (details of these differences are presented in couplet 3 of the key to *Ambassis*).

## Description

(Proportional measurements are based on 10 specimens, 29-42 mm SL). Dorsal rays VII,I,9; anal rays III,9; pectoral rays 15 or 16; lateral line with 12 to 14 + 10 to 14 scales, interrupted in middle portion by 1 or 2 tubeless scales; vertical scale rows from upper edge of gill opening to caudal fin base 27 or 28; horizontal scale rows from anal fin origin to base of dorsal fin 9 or 10; transverse scale rows on cheek 2; predorsal scales 11 to 14; gill rakers on lower limb of first arch 23 to 26. Fin ray and gill raker counts are summarised in Table 1.

Supraorbital spines 2 to 4; nasal spine well developed; preorbital ridge with 2 or 3 small serrae; suborbital smooth or with 1 to 3 minute serrae; preorbital edge with 5 or 6 serrae; preopercular ridge with 7 to 11 serrae on lower limb, vertical limb smooth; lower edge of preoperculum with 11 to 17 serrae, hind margin smooth; interoperculum smooth except flattened spine at posterior angle.

Body depth 33.3 to 38.2; head length 33.8 to 36.3; snout length 6.5 to 8.5; eye diameter 13.0 to 13.9; maxilla length 10.4 to 14.1; caudal peduncle depth 13.0 to 14.8; caudal peduncle length 20.6 to 22.2; height of first dorsal fin 26.0 to 30.3; second and third dorsal spines about equal or second spine slightly longer; third anal spine longer than second anal spine.

*Colour in alcohol:* generally whitish or pale tan with peppering of melanophores on scale margins of upper side; scales darkly pigmented along base of dorsal and anal fins, and on upper and lower edges of caudal peduncle; thin black stripe along middle of side; fins mainly translucent except membrane between second and third dorsal spines blackish and caudal fin lobes slightly dusky.

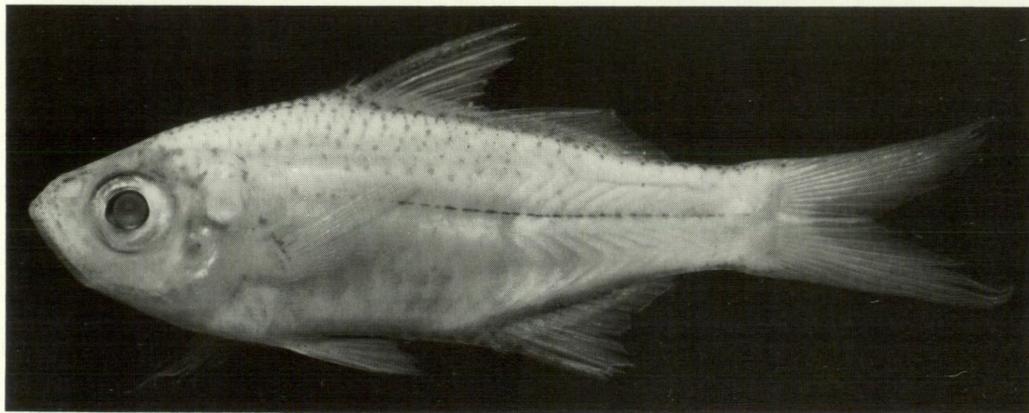


Figure 12. *Ambassis gymnocephalus*, 25 mm SL, Daintree River, Queensland.

## Distribution (Figure 2)

*Ambassis gymnocephalus* was reported from northern Australian waters by McCulloch (1929), Weber and de Beaufort (1929), and Munro (1961). None of

these authors, however, provide details for these records. Collette (1983) collected it in the Northern Territory near Darwin and at Croker Island, and also near the mouth of the Mamberamo River, Irian Jaya. We have also examined specimens from Hartley's Creek and the mouth of the Daintree River, both between Cairns and Cooktown in northern Queensland. Weber and de Beaufort (1929) reported this species from numerous Indonesian localities as well as East Africa, India, China, Singapore, and the Philippines.

### Habitat

Brackish inlets and estuaries. Specimens were collected by the senior author in a tidal creek lined with dense mangrove growth at the mouth of the Daintree River, Cape York Peninsula.

### Material examined

We have examined 38 specimens, 11-12 mm SL, at AMS and WAM. Most were collected from the mouth of the Daintree River.

### Remarks

We follow previous authors (Bleeker 1874; Weber and de Beaufort 1929; Fowler and Bean 1930; Fraser-Brunner, 1954; Munro 1961, 1967) in using the name *gymnocephalus* for this species. Lacepède's original description is very inadequate as Weber and de Beaufort (1929) pointed out. The type specimen is apparently lost. It could not be located by the senior author during a recent visit to the Museum national d'Histoire naturelle, Paris.

## *Ambassis interruptus* Bleeker

(Figs. 5F and 13)

*Ambassis interruptus* Bleeker 1852b: 696 (Wahai, Ceram; Batavia, Java).

*Ambassis elevatus* Macleay 1881: 338 (Endeavour River, Queensland).

*Ambassis dalyensis* Rendahl 1922: 187 (Daly River, Northern Territory).

### Diagnosis

A species of *Ambassis* with the following combination of characters: a single supraorbital spine; 2 transverse scale rows on cheek; lateral line interrupted in middle portion; nasal spine present. It is most similar to *A. buruensis*, but differs in having a serrate interopercular margin, a higher first dorsal fin, and a deeper body. Details of these differences are presented in the key to *Ambassis* (couplet 10). A good field character for identification of *A. interruptus* is the presence of a brilliant white patch on the distal portion of the membrane between the second and third anal spines.

### Description

(Proportional measurements based on 20 specimens, 44-81 mm SL). Dorsal rays VII,1,9 or 10; anal rays III,9 or 10; pectoral rays 14 to 16; lateral line with

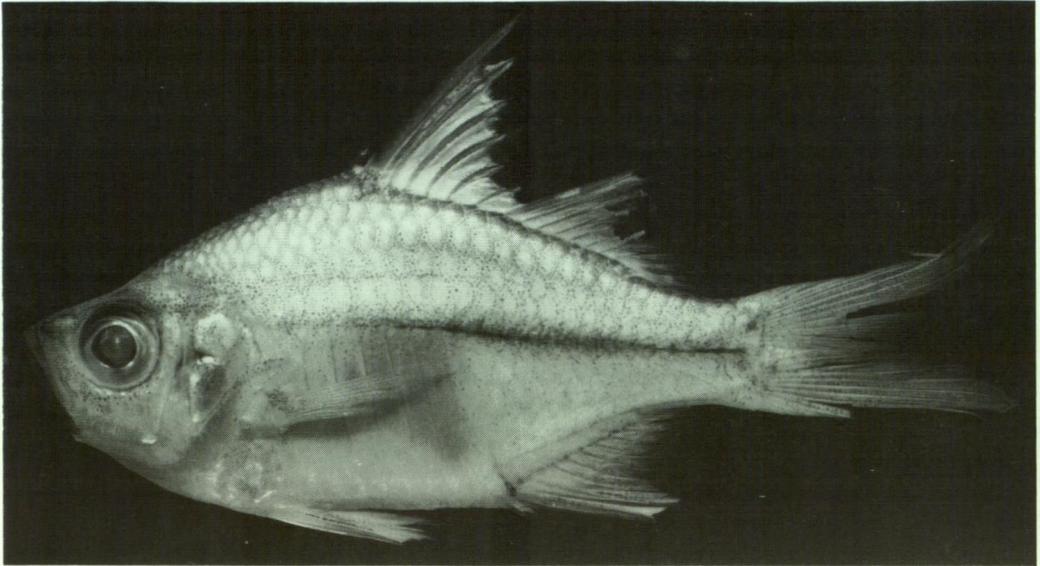


Figure 13. *Ambassis interruptus*, 75 mm SL, Ramu River, Papua New Guinea.

11 to 13 + 9 to 13 scales, interrupted in middle portion by about 3 to 6 tubeless scales; vertical scale rows from upper edge of gill opening to caudal fin base 27 or 28; horizontal scale rows from anal fin origin to base of dorsal fin 10; transverse scale rows on cheek 2; predorsal scales 13 to 16; gill rakers on lower limb of first arch 24 to 27. Fin ray and gill raker counts are summarised in Table 1.

A single supraorbital spine; nasal spine well developed; preorbital ridge with 3 to 6 small serrae; suborbital smooth; preorbital edge with 5 to 8 serrae; preopercular ridge with 9 to 20 serrae on lower limb, vertical limb smooth; lower edge of preoperculum with 13 to 25 serrae, hind margin smooth; interoperculum with 2 to 10 moderate to weakly developed serrae.

Body depth 37.2 to 47.8; head length 35.8 to 42.3; snout length 6.7 to 8.7; eye diameter 12.3 to 15.7; maxilla length 13.6 to 14.5; caudal peduncle depth 13.5 to 16.1; caudal peduncle length 15.2 to 19.6; height of first dorsal fin 28.4 to 40.5 (usually 34.0 to 38.0); second dorsal spine longer than third dorsal spine; third anal spine slightly longer than second anal spine or spines about equal in height.

*Colour in alcohol:* generally uniform pale yellowish or with scattered melanophores on scale margins of upper side; scales along base of dorsal and anal fins and on upper and lower edge of caudal peduncle darkly pigmented; thin black stripe along middle of side (sometimes not apparent on anterior half of body); fins mainly translucent except membrane between second and third dorsal spines blackish and caudal lobes sometimes dusky.

### Distribution (Figure 2)

*Ambassis interruptus* is relatively widespread throughout the Indo-Australian Archipelago. Weber and de Beaufort (1929) recorded it from the Andaman Islands, the Philippines, Indonesia, New Guinea, and New Caledonia. In addition we have examined specimens from Vanuatu and the following Australian localities: Townsville, Cardwell, Daintree River, and Cape Tribulation, all on the east coast of northern Queensland; Gulf of Carpentaria; vicinity of Darwin, Northern Territory; and the Prince Regent and Fitzroy Rivers of northern Western Australia. It is likely that this species has a more or less continuous distribution around the north coast of Australia from central Queensland to about King Sound, Western Australia.

Localities in Papua New Guinea where it was collected by the senior author include the Oriomo and Fly rivers in the south and in the north from streams near Madang, the lower Sepik and Ramu rivers, and at Manus Island. In addition Collette (1983) collected it near Wewak.

### Habitat

Brackish mangrove estuaries and the lower reaches of freshwater streams. In the latter habitat it is usually found within about 20 km of the sea.

### Material examined

We have examined 17 specimens, 30-81 mm SL, from the Bleeker Indonesian collection (RMNH 5560). The original description indicated eight type specimens, 90-120 mm TL from Batavia (Jakarta) and Ceram. The five largest specimens from RMNH 5560, 91-105 mm TL, are probably Bleeker syntypes according to M. Boeseman, former Curator of Fishes at RMNH. We have also studied 656 specimens, 19-88 mm SL, from New Guinea (Madang and Bintuni Bay), Vanuatu (Luganville), and northern Australia (Queensland, Northern Territory, and Western Australia) at AMS, QM, and WAM. This material includes the syntypes of *A. elevatus*, six specimens, 39-49 mm SL (AMS I.16314-001).

### Remarks

We have not seen the type specimen of *Ambassis dalyensis*, which according to McCulloch (1929) is deposited in the Royal Zoological Museum, Oslo. However, Rendahl's description is diagnostic, particularly his mention of a well developed, interrupted lateral line consisting of 13 + 14 scales. *Ambassis agrammus*, which also occurs in the Daly River, has a weakly developed lateral line consisting of a few tubed scales anteriorly and usually lacking tubed scales posteriorly. Rendahl also noted that the hindmost lateral line scales have their tips notched, a feature found in *A. interruptus*, but lacking in *A. agrammus*.

### *Ambassis jacksoniensis* (Macleay)

(Figures 5G and 14)

*Pseudambassis jacksoniensis* Macleay 1881: 340 (Port Jackson, New South Wales).

### Diagnosis

A species of *Ambassis* with the following combination of characters: a single supraorbital spine (rarely 2); 2 transverse scale rows on cheek; lateral line continuous from upper edge of gill opening to caudal fin base; second dorsal spine shorter than third dorsal spine; body relatively slender, 29.2-33.2% of SL; pectoral rays 14 or 15; nasal spine present. It is sympatric with only one other member of the family, *A. marianus*. The two species are readily separated on the basis of body depth, supraorbital spination, and the lateral line pattern. *Ambassis jacksoniensis* is a more slender fish with the maximum depth ranging from about 33 to 38% of the standard length compared with 37 to 44% for *A. marianus*. The latter species is characterised by a multi-serrate supraorbital in contrast to the usual complement of a single small supraorbital spine in *A. jacksoniensis*. The lateral line of *A. jacksoniensis* is continuous whereas that of *A. marianus* is interrupted in its middle portion.

### Description

(Proportional measurements based on 30 specimens, 23.1-43.5 mm SL). Dorsal rays VII,I,9 to 11; anal rays III,8 or 9; pectoral rays 14 or 15; lateral line with 27 to 29 scales, continuous throughout its length; vertical scale rows from upper edge of gill opening to caudal fin base 27 to 29; horizontal scale rows from anal fin origin to base of dorsal fin 10 or 11; transverse scale rows on cheek 2; predorsal scales 11 to 14; gill rakers on lower limb of first arch 19 to 23. Fin ray and gill raker counts are summarised in Table 1.

A single supraorbital spine (rarely 2); nasal spine present; preorbital ridge smooth to slightly crenulate; suborbital smooth or slightly crenulate; preorbital edge with 4 to 7 serrae; preopercular ridge with 2 to 4 serrae concentrated around angle, vertical limb mainly smooth; lower edge of preoperculum with 9 to 13 serrae, hind margin smooth; interoperculum smooth.

Body depth 29.2 to 33.2; head length 32.0 to 34.0; snout length 6.1 to 7.7; eye diameter 11.8 to 12.6; maxilla length 12.0 to 13.0; caudal peduncle depth

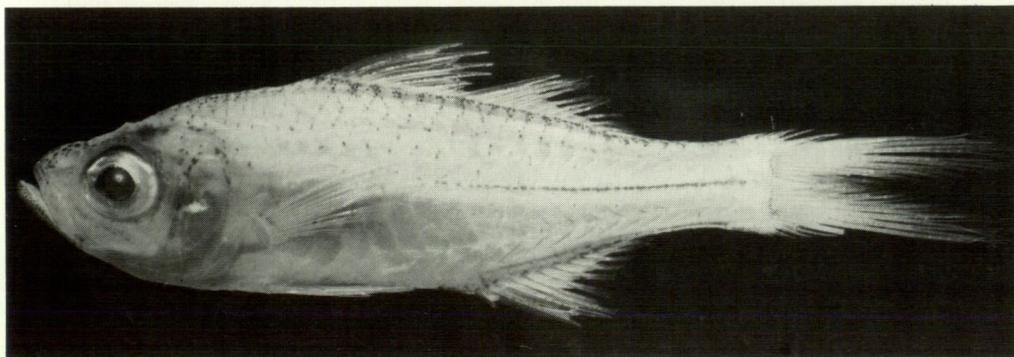


Figure 14. *Ambassis jacksoniensis*, 35 mm SL, Narooma, New South Wales.

11.7 to 13.1; caudal peduncle length 21.7 to 25.3; height of first dorsal fin 18.9 to 22.9; third dorsal spine longer than second dorsal spine; third anal spine longer than second anal spine.

*Colour in alcohol:* generally pale tan or yellowish peppered with melanophores on scale margins of upper side; scales darkly pigmented along base of dorsal and anal fins, and on upper and lower edges of caudal peduncle; a thin black stripe along middle of side, particularly evident on posterior half of body; operculum silvery; fins mainly translucent.

### **Distribution** (Figure 1)

*Ambassis jacksoniensis* is known only from the south-eastern coast of Australia. The known range extends from about Narooma, New South Wales northward to Moreton Bay, Queensland.

### **Habitat**

Protected coastal inlets, estuaries, and brackish, mangrove-lined tidal creeks.

### **Material examined**

We have examined the syntypes (AMS I.16315-001), 24 specimens, 32-45 mm SL, from Port Jackson (Sydney). In addition, we have studied 1,877 specimens, 10-56 mm SL, from numerous localities in New South Wales, and from Moreton Bay, Queensland, in the AMS collection.

## *Ambassis macleayi* (Castelnau)

(Figures 5H and 15)

*Pseudoambassis macleayi* Castelnau 1878: 43 (Norman River, Gulf of Carpentaria).

### **Diagnosis**

A species of *Ambassis* with the following combination of characters: a single supraorbital spine; 2 transverse scale rows on cheek; lateral line either terminating on anterior part of body or interrupted in middle portion; gill rakers on lower limb of first gill arch 24 to 29. It is superficially similar to and sympatric with *A. agrammus*, but has more gill rakers on the first arch (16 to 20 in *A. agrammus*), usually 10 rather than 8 or 9 soft rays in the dorsal and anal fins, and a bar across the base of the pectoral fin.

### **Description**

(Proportional measurements based on 25 specimens, 41.7-74.5 mm SL). Dorsal rays VII,1.9 to 11; anal rays III,9 to 11; pectoral rays 14 or 15; lateral line with 5 to 14 + 0 to 6 scales, terminating below spinous dorsal fin or anterior to this point, or interrupted by series of tubeless scales then continued on caudal peduncle; vertical scale rows from upper edge of gill opening to caudal fin base 27 to 28; horizontal scale rows from anal fin origin to base of dorsal fin 12

or 13; transverse scale rows on cheek 2; predorsal scales 12 to 16; gill rakers on lower limb of first arch 24 to 29.

A single supraorbital spine; nasal spine absent; preorbital ridge with 3 to 8 small serrae; suborbital smooth, crenulate, or with 3 to 18 small serrae; preorbital edge with 5 to 10 serrae; preopercular ridge with 11 to 16 serrae on lower limb, vertical limb smooth or with 1 to 9 small serrae; lower edge of preoperculum with 13 to 21 serrae and hind margin crenulate or with additional series of 3 to 28 small serrae; interoperculum with 5 to 11 moderate serrae.

Body depth 47.2 to 49.3; head length 38.2 to 44.8; snout length 8.2 to 10.1; eye diameter 13.4 to 17.2; maxilla length 11.7 to 14.5; caudal peduncle depth 17.7 to 19.0; caudal peduncle length 16.1 to 19.5; height of first dorsal fin 32.2 to 40.3; second dorsal spine longer than third dorsal spine; third anal spine longer than second anal spine.

*Colour in alcohol:* generally yellowish tan with broad, dusky brown scale margins forming pronounced network pattern on side; dorsal and anal fins with dusky membranes between translucent spines and soft rays; caudal fin slightly dusky; pelvic fins translucent with membranes dusky on anterior half; pectoral fins translucent with base of fin frequently blackish.

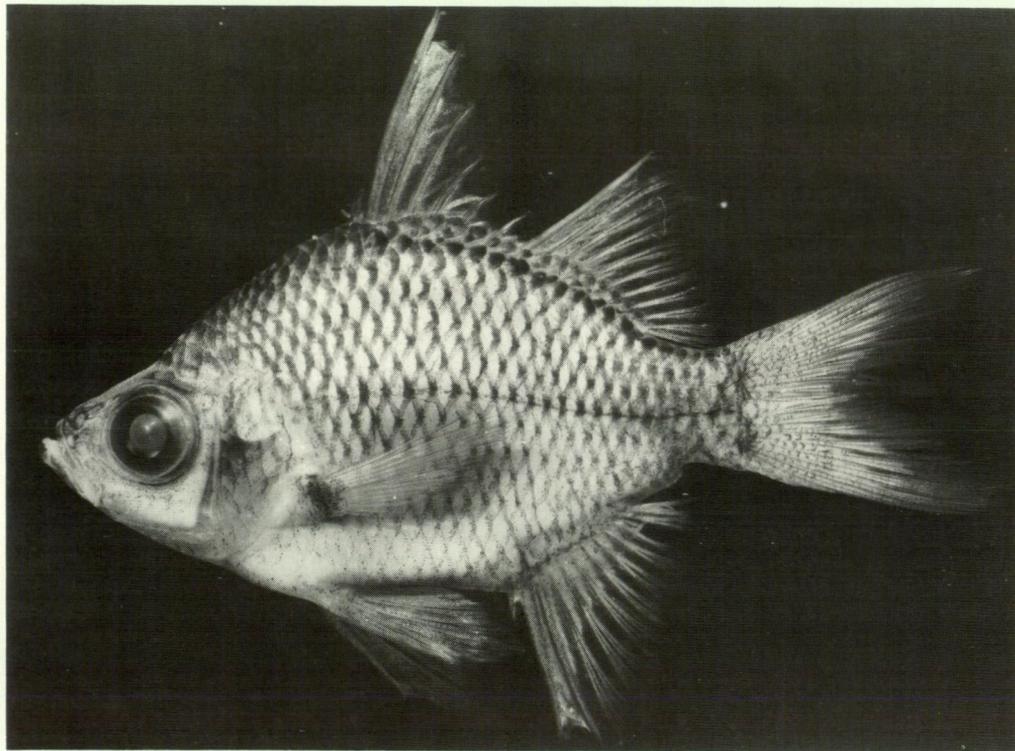


Figure 15. *Ambassis macleayi*, 51 mm SL, Archer River, Queensland.

### Distribution (Figure 2)

*Ambassis macleayi* is distributed across the northernmost portion of Australia and in south-central New Guinea. The Australian range extends from the Carson River of Western Australia to the Jardine River near the tip of Cape York Peninsula, Queensland. It has been collected in the following rivers (proceeding from west to east): Carson, Ord, Victoria, Daly, Finmiss, Mary, East Alligator, Roper, McArthur, Gregory, Gilbert, Norman, Mitchell, Archer, and Jardine. In New Guinea it is known from the Balimo area, Bensbach River, Middle Fly and lower Strickland rivers, including Lake Murray, and the Oriomo River.

### Habitat

Heavily vegetated margins of streams and swamps in fresh water.

### Material examined

We have examined 339 specimens, 22-77 mm SL, from Western Australia, Northern Territory, and Queensland in the AMS, NTM, QM, and WAM collections. We have also seen 33 specimens, 27.6-52.0 mm SL, from New Guinea at KFRS and WAM.

### Remarks

Whitley (1935) designated a specimen, 52 mm SL, from the Norman River as lectotype. It was part of the Macleay Museum collection that was eventually transferred to the Australian Museum. However, this specimen is apparently lost as it could not be located during the present study.

### *Ambassis macracanthus* Bleeker

(Figures 5I and 16)

*Ambassis macracanthus* Bleeker 1849: 30 (Batavia, Java).

*Ambassis batjanensis* Bleeker 1855: 196 (Batjan).

### Diagnosis

A species of *Ambassis* with the following combination of characters: a single supraorbital spine; 2 transverse scale rows on cheek; lateral line continuous from upper edge of gill opening to caudal fin base; pectoral rays 14 or 15; nasal spine present; body relatively deep, 40.0-44.7% of SL. It is most similar to *A. miops*. Both species have a continuous lateral line and similar colour patterns. They differ, however, in predorsal scalation (17-22 in *macracanthus* compared with 13-15 in *miops*) and the second dorsal spine is longer than the third in *macracanthus* and slightly shorter than the third in *miops*. In addition, *A. macracanthus* has a deeper body (40.0-44.7% of SL compared to 33.4-38.6%).

### Description

(Proportional measurements based on 8 specimens, 37-100 mm SL). Dorsal rays VII,1,9; anal rays III,9; pectoral rays 14 or 15; lateral line with 27 to 29

scales, continuous throughout its length; vertical scale rows from upper edge of gill opening to caudal fin base 27 to 29; horizontal scale rows from anal fin origin to base of dorsal fin 12 or 13; transverse scale rows on cheek 2; predorsal scales 17 to 22; gill rakers on lower limb of first arch 23 to 25. Fin ray and gill raker counts are summarised in Table 1.

A single supraorbital spine; nasal spine present; preorbital ridge smooth; suborbital smooth; preorbital edge with 5 to 7 serrae; preopercular ridge with 9 to 16 serrae on lower limb, vertical limb mainly smooth; lower edge of preoperculum with 13 to 21 serrae, hind margin smooth; interoperculum smooth except for flattened spine at posterior angle.

Body depth 40.0 to 44.7; head length 37.9 to 40.4; snout length 7.1 to 8.4; eye diameter 12.8 to 14.0; maxilla length 14.0 to 15.3; caudal peduncle depth 13.6 to 15.9; caudal peduncle length 18.2 to 20.8; height of first dorsal fin 24.0 to 31.9; second dorsal spine longer than third dorsal spine; third anal spine longer than second anal spine.

*Colour in alcohol:* generally uniform pale yellowish to tan or with scattered melanophores especially concentrated around scale margins and on snout, lips, and chin; scales darkly pigmented along base of dorsal fin and on dorsal surface of caudal peduncle; thin black stripe running along middle of side, sometimes not apparent on anterior part of body; fins mainly translucent with rays finely outlined with black; membrane between second and third dorsal spines blackish.

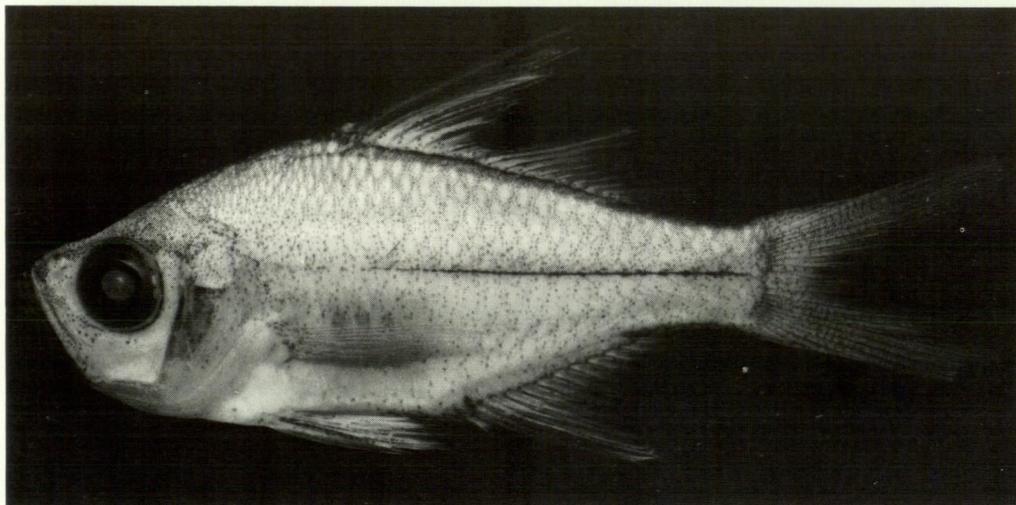


Figure 16. *Ambassis macracanthus*, 50 mm SL, Madang, Papua New Guinea.

#### Distribution (Figure 2)

Throughout Indonesia from Sumatera to Irian Jaya. Also found on the northern coast of Papua New Guinea.

### Habitat

Brackish mangrove estuaries and lower reaches of freshwater streams. Specimens collected near Madang, Papua New Guinea were in pure fresh water about 1-2 km from the sea in a tidal creek. They were sympatric in this habitat with *A. interruptus* and *A. buruensis*.

### Material examined

We have examined six specimens, 58-103 mm SL, from the Bleeker Indonesian collection (RMNH 5560) of *A. commersoni* (= *A. macracanthus*). This lot includes the probable syntypes of *A. macracanthus*. We have also studied 2 specimens, 37-50 mm SL, from Madang, Papua New Guinea at WAM and 5 specimens, 33-41 mm SL, from the Klipong River of Irian Jaya at ZMA.

### Remarks

This species was placed in the synonymy of *A. commersoni* Cuvier by Bleeker (1874) but our examination of Cuvier's syntypes and other specimens from Mauritius and Madagascar (type locality) at MNHN (see remarks under *A. urotaenia*) indicate that it differs from *A. macracanthus* in several features. It has 11-16 predorsal scales (versus 17-22) and serrations on the preorbital ridge and interopercular margin (versus smooth). Weber and de Beaufort (1929) also considered the Indonesian *A. batjanensis* Bleeker as junior synonym of *A. commersoni* (= *A. macracanthus*), but although we have not examined specimens (type reported lost by Weber and de Beaufort), we agree with their assessment.

## *Ambassis marianus* Günther

(Figures 6A and 17)

*Ambassis marianus* Günther 1880: 32 (Mary River, Queensland).

*Pseudoambassis ramsayi* Macleay 1881: 310 (Port Jackson, New South Wales).

*Pseudambassis convexus* De Vis 1884: 394 (Queensland).

### Diagnosis

A species of *Ambassis* with the following combination of characters: 2 to 4 supraorbital spines; nasal spine present; rear margin of preoperculum smooth to slightly crenulate. It is sympatric with *A. jacksoniensis* in south-eastern Australia, but is easily separated from that species by its multi-serrate supraorbital (a single spine in *A. jacksoniensis*) and its greater body depth (about 37-44% of SL compared to 33-38% for *jacksoniensis*). In addition, it has an interrupted lateral line, whereas the lateral line is continuous in *A. jacksoniensis*.

### Description

(Proportional measurements based on 20 specimens, 46-75 mm SL). Dorsal rays VII,1,9 or 10; anal rays III,10 or 11; pectoral rays 13 to 15; lateral line with 11 to 13 + 9 to 13 scales, interrupted in middle portion by 3 to 8 tubeless scales; vertical scale rows from upper edge of gill opening to caudal fin base 27 to

29; horizontal scale rows from anal fin origin to base of dorsal fin 10 or 11; transverse scale rows on cheek 2 or 3; predorsal scales 16 to 18; gill rakers on lower limb of first arch 22 to 24. Fin ray and gill raker counts are summarised in Table 1.

Supraorbital spines 2 to 4; nasal spine present; preorbital ridge weakly crenulate or with 2 to 4 small serrae; suborbital smooth; preorbital edge with 5 to 7 serrae; preopercular ridge with 10 to 17 serrae on lower limb, vertical limb mainly smooth; lower edge of preoperculum with 12 to 30 serrae, hind margin smooth; interoperculum smooth except for flattened spine at posterior angle.

Body depth 37.3 to 44.1; head length 34.6 to 38.5; snout length 7.2 to 8.3; eye diameter 10.7 to 12.7; maxilla length 12.7 to 15.0; caudal peduncle depth 14.4 to 16.3; caudal peduncle length 16.1 to 20.8; height of first dorsal fin 23.1 to 28.7; third dorsal spine longer than second dorsal spine or these spines about equal in length; third anal spine longer than second anal spine.

*Colour in alcohol:* generally yellowish tan or whitish with scattered melanophores on scale margins, particularly on upper side; snout, lower jaw and interorbital dusky; dark pigmentation strongly concentrated at base of dorsal and anal fins, and on upper and lower edges of caudal peduncle; operculum silvery; fins mainly translucent except membrane between second and third dorsal spines blackish.

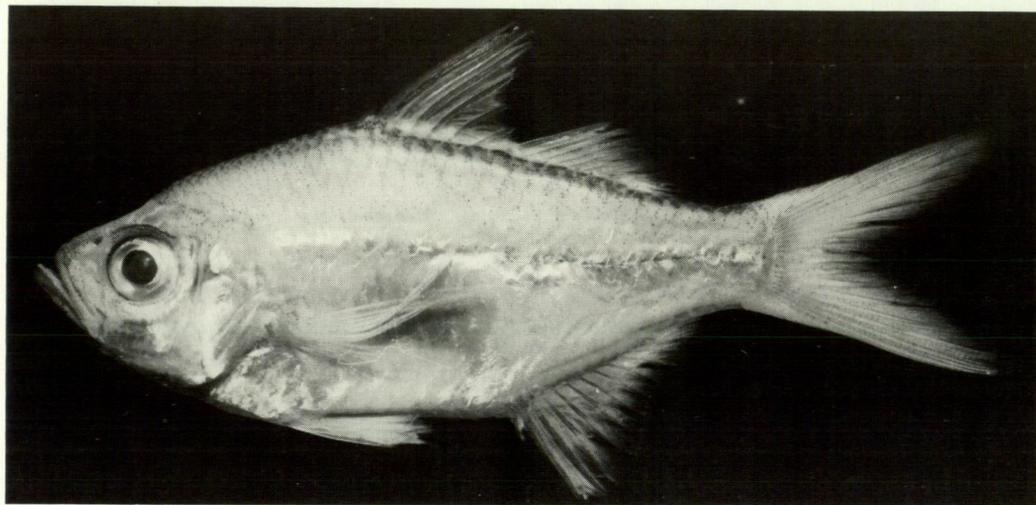


Figure 17. *Ambassis marianus*, 66 mm SL, Moreton Bay, Queensland.

#### Distribution (Figure 1)

*Ambassis marianus* is known only from the south-eastern coast of Australia. The known range extends from the vicinity of Narooma, southern New South Wales northward to at least Maryborough, Queensland.

### Habitat

Brackish mangrove estuaries, tidal creeks, and the lower reaches of freshwater streams.

### Material examined

We have examined three of Günther's syntypes (BMNH 1879.5.14.167-72), 57-63 mm SL, collected in the Mary River, southern Queensland by the Challenger Expedition. We have also seen the holotype (QM L85) of *Pseudambassis convexus*, a specimen 60 mm SL, from Queensland, and that of *Pseudoambassis ramsayi*, 76 mm SL (AMS L16316-001), from Port Jackson (Sydney), New South Wales. In addition, 195 specimens, 15-80 mm SL, mainly from the Sydney area and near Noosa, Queensland were studied at AMS, QM, and WAM.

### *Ambassis miops* Günther

(Figures 6B and 18)

*Ambassis miops* Günther 1871: 655 (Rarotonga, Cook Islands).

### Diagnosis

A species of *Ambassis* with the following combination of characters: a single supraorbital spine; 2 transverse scale rows on cheek; lateral line usually continuous from upper edge of gill opening to caudal fin base; pectoral rays usually 13 or 14 (rarely 15); nasal spine present; body relatively slender, greatest depth 33.4-38.6% of SL. It is most similar to *A. macracanthus*, but differs from it in having fewer predorsal scales (12-15 versus 17-22), a more slender body (greatest depth 33.4-38.6% of SL versus 40.0-44.7) and the second dorsal spine slightly shorter than the third spine (reverse situation in *A. macracanthus*).

### Description

(Proportional measurements based on 30 specimens, 35-63 mm SL). Dorsal rays VII,1,9 or 10; anal rays III,9 or 10; pectoral rays 13 to 15; lateral line with 28 to 30 scales, continuous throughout its length (except interrupted by one tubeless scale in one specimen examined); vertical scale rows from upper edge of gill opening to caudal fin base 28 to 30; horizontal scale rows from anal fin origin to base of dorsal fin 9 or 10; transverse scale rows on cheek 2; predorsal scales 12 to 15; gill rakers on lower limb of first arch 18 to 22. Fin ray and gill raker counts are summarised in Table 1.

A single supraorbital spine; nasal spine blunt, subcutaneous; preorbital ridge smooth to slightly crenulate or with 1 to 6 very small serrae; suborbital smooth; preorbital edge with 8 or 9 serrae; preopercular ridge with 7 to 9 serrae on lower limb, vertical limb smooth; lower edge of preoperculum with 12 to 19 serrae, hind margin smooth (except one individual with 12 small serrae); interoperculum smooth except for flattened spine at posterior angle.

Body depth 33.4 to 38.6; head length 35.5 to 38.6; snout length 6.7 to 9.1; eye diameter 12.9 to 15.0; maxilla length 13.4 to 16.8; caudal peduncle depth

12.9 to 14.8; caudal peduncle length 19.5 to 22.7; height of first dorsal fin 24.6 to 28.3; third dorsal spine slightly longer than second dorsal spine; third anal spine longer than second anal spine.

*Colour in alcohol:* generally pale tan or yellowish white with scattered melanophores on scale margins of upper side; similar pigmentation densely concentrated on predorsal scales, interorbital, snout, lower jaw, and along bases of dorsal and anal fins; a thin black stripe along middle of side, mostly evident on posterior half of body; fins mainly translucent except membrane between second and third spines blackish and basal half of caudal fin dusky.

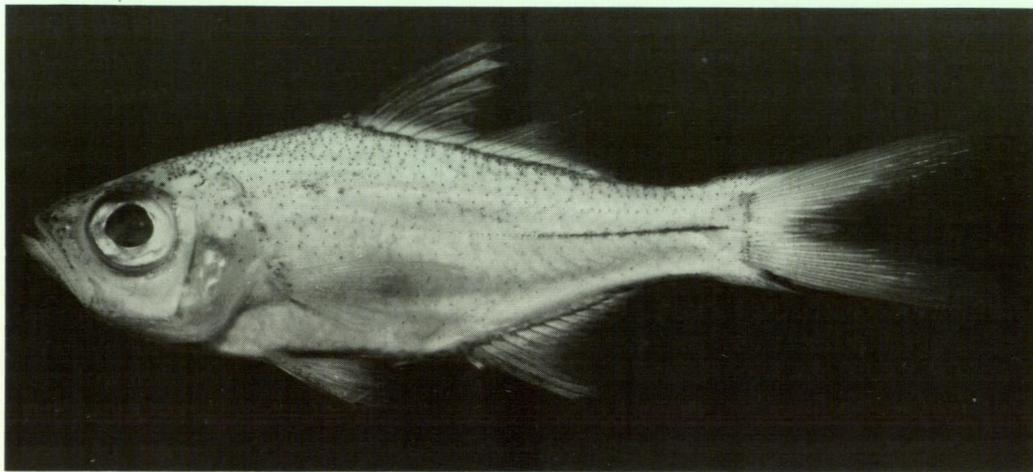


Figure 18. *Ambassis miops*, 58 mm SL, stream near Cape Tribulation, Queensland.

#### Distribution (Figure 2)

*Ambassis miops* is evidently widespread in the Indo-Pacific. Weber and de Beaufort (1929) reported it from India, the Indonesian islands of Flores, Ambon, and Goram, northern New Guinea, New Caledonia, and Rarotonga. We have examined Queensland specimens from the vicinity of Cairns and from the Endeavour and Starcke Rivers, near Cooktown, Cape York Peninsula. The species has not been recorded previously from Australia. We have also seen specimens from Vailala Creek near Port Moresby, streams near Bogia, the Lorengau River on Manus Island, and from Kavieng, New Ireland (all in Papua New Guinea).

#### Habitat

Clear, flowing freshwater streams usually within 20 km of the sea.

#### Material examined

We have examined the holotype (BMNH 1871.9.13.2177), a specimen 51 mm SL from Rarotonga. In addition, 67 specimens, 39-63 mm SL, from the Starcke River on Cape York Peninsula, and Freshwater Creek at Cairns, both in northern Queensland, and the localities in Papua New Guinea

mentioned above were studied at QM and WAM. We have also seen 39 specimens, 20-63 mm SL, from Wetar Island (near Timor) at WAM.

### Remarks

We provisionally identify a specimen, 65 mm SL (ZMA 112,349) from the Sermowai River, northern Irian Jaya as *A. miops*. It agrees well with this species in most respects although the forehead profile is slightly steeper. This specimen was reported by Weber and de Beaufort (1929) as *A. buton* Popta.

## *Ambassis mulleri* Klunzinger

(Figures 6C and 19)

*Ambassis mulleri* Klunzinger 1879: 346 (Port Darwin).

### Diagnosis

A species of *Ambassis* with the following combination of characters: a single supraorbital spine, 2 transverse scale rows on cheek; a weakly developed (sometimes absent) lateral line either terminating on anterior part of body or interrupted in middle portion; nasal spine absent; gill rakers on lower limb of first arch 16 to 19. It is most similar to *A. agrammus* and *A. agassizii*, but has fewer scales in a longitudinal series and a shorter first dorsal fin than *A. agrammus*, and more circumpeduncular scales and usually a taller first dorsal fin than *A. agassizii*. Details of these differences are presented in the key to *Ambassis* (couplets 13-14).

### Description

(Proportional measurements based on 30 specimens, 32-47 mm SL). Dorsal rays VII,1,8 or 9 (usually 8); anal rays III,8 or 9 (usually 8); pectoral rays 11 to 13; lateral line with 0 to 10 + 0 to 7 scales, terminating below spinous dorsal fin or anterior to this point, sometimes continued in the form of a few weakly tubed or pitted scales on middle of caudal peduncle; vertical scale rows from upper edge of gill opening to caudal fin base 25 or 26; horizontal scale rows from anal fin origin to base of dorsal fin usually 12; transverse scale rows on cheek 2; predorsal scales 13 or 14; gill rakers on lower limb of first arch 16 to 19. Fin ray and gill raker counts are summarised in Table 1.

A single supraorbital spine; nasal spine absent; preorbital ridge smooth or with 1 to 11 very small serrae; suborbital occasionally smooth, usually with 1 to 14 small serrae; preorbital edge with 4 to 7 serrae; preopercular ridge with 3 to 10 serrae on lower limb or concentrated around angle, vertical limb mainly smooth (at least on upper part); lower edge of preoperculum with 11 to 15 (one specimen with only 2) serrae and hindmargin with additional series of 1 to 10 (occasionally none) small serrae; interoperculum usually with 1 to 7 moderate to weakly developed serrae.

Body depth 36.4 to 45.0; head length 34.4 to 39.7; snout length 6.3 to 8.1; eye diameter 10.8 to 14.1; maxilla length 10.5 to 12.7; caudal peduncle depth 15.5 to 17.5; caudal peduncle length 20.3 to 23.8; height of first dorsal fin 24.0 to 36.8; second dorsal spine longer than third dorsal spine or these spines about equal; third anal spine longer than second anal spine.

*Colour in alcohol:* generally uniform pale tan to yellowish or with dusky scale margins, sometimes forming network pattern particularly on upper side; melanophores frequently concentrated on nape, along base of dorsal fin, and on upper and lower edge of caudal peduncle; a thin black line along middle of side, mostly evident on posterior half; fins mainly translucent except membrane between second and third dorsal spines frequently blackish and often a dusky, blackish blotch or vertical band on posterior portion of soft dorsal and anal fins and similar marking on anterior part of pelvic fins.

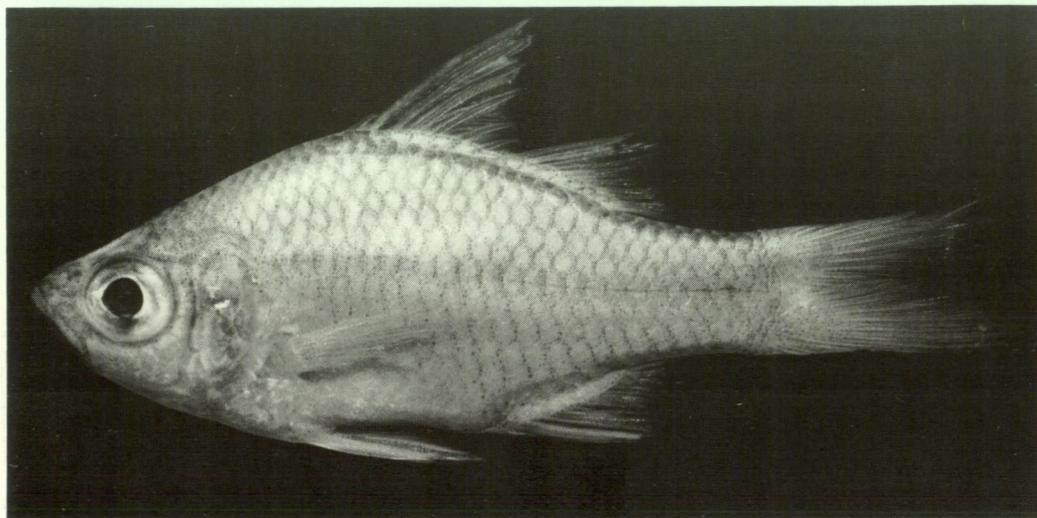


Figure 19. *Ambassis mulleri*, 42 mm SL, Fitzroy River, Western Australia.

#### **Distribution** (Figure 1)

Fitzroy River, Western Australia eastward to approximately the Roper River, Northern Territory (Gulf of Carpentaria drainage), but it is largely replaced by *A. agrammus* in coastal streams of the Northern Territory. It also occurs in drainages of central Australia including the Lake Eyre system. Further collecting is required to establish the distributional limits within this vast region.

#### **Habitat**

Rivers, creeks, and swamps, usually amongst aquatic vegetation.

#### **Material examined**

We have examined 1,304 specimens, 18-43 mm SL, at AMS, SAM, and WAM.

*Ambassis nalua* (Hamilton)

(Figures 6D and 20)

*Chanda nalua* Hamilton 1822: 107 (Ganges River, India).

**Diagnosis**

A species of *Ambassis* with the following combination of characters: a single supraorbital spine; 2 transverse scale rows on cheek; lateral line continuous from upper edge of gill opening to caudal fin base. It shares these features with *A. miops*, *A. macracanthus*, and *A. jacksoniensis*, but *nalua* generally has a greater body depth (45.3-50.6% of SL vs. less than 45%), a higher pectoral ray count (usually 16 or 17 vs. 13 to 15), and lacks a nasal spine (see couplets 6-8 in *Ambassis* key).

**Description**

(Proportional measurements based on 25 specimens, 49-87 mm SL). Dorsal rays VII,I,10 to 11; anal rays III,9; pectoral rays 15 to 17; lateral line with 27 to 29 scales, continuous throughout its length; vertical scale rows from upper edge of gill opening to caudal fin base 27 to 29; horizontal scale rows from anal fin origin to base of dorsal fin 11 or 12; transverse scale rows on cheek 2; predorsal scales 11 to 13; gill rakers on lower limb of first arch 18 to 22. Fin ray and gill raker counts are summarised in Table 1.

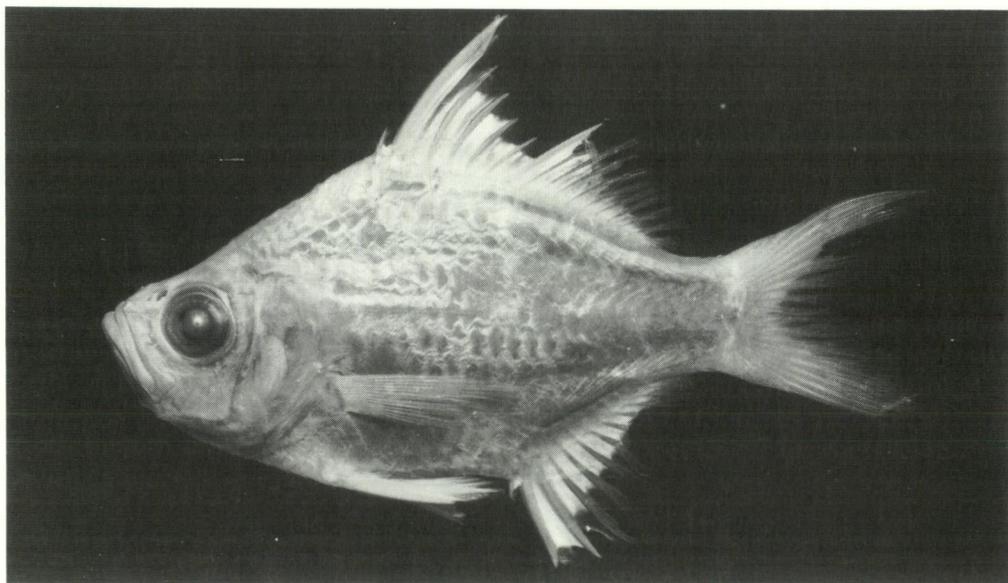


Figure 20. *Ambassis nalua*, 74 mm SL, Cape Bowling Green, Queensland.

A single supraorbital spine; nasal spine absent; preorbital ridge smooth, crenulate, or with a few weak serrae; suborbital smooth; preorbital edge with 7 to 9 serrae; preopercular ridge with 9 to 17 serrae on lower limb, vertical limb smooth; lower edge of preoperculum with 21 to 32 serrae, hind margin smooth; interoperculum smooth or with a few weakly developed serrae.

Body depth 45.3 to 50.6; head length 34.2 to 40.7; snout length 8.0 to 10.0; eye diameter 13.4 to 13.9; maxilla length 15.4 to 18.0; caudal peduncle depth 16.6 to 18.1; caudal peduncle length 17.7 to 20.6; height of first dorsal fin 27.4 to 32.0; second dorsal spine longer than third dorsal spine; third anal spine slightly longer than second anal spine.

*Colour in alcohol:* generally pale tan or yellowish white; scales on upper back with dusky margins; thin black stripe along middle of side, mostly evident on posterior half of body; fins translucent except membrane between second and third dorsal spines blackish.

#### **Distribution** (Figure 3)

*Ambassis nalua* is relatively widespread the tropical Indo-far west Pacific region. Weber and de Beaufort (1929) recorded it from India, Andaman Islands, Malay Peninsula, Indonesian Archipelago, and the Philippines. During the present study we have examined specimens from the following Australian localities: Proserpine and Cape Bowling Green (both lying just south of Townsville), Cairns, and Daintree River, all on the east coast of northern Queensland; and Port Warrender in Admiralty Gulf, northern Western Australia. Munro (1961) and Collette (1983) also recorded this species from the Northern Territory. Haines (1979) recorded it from the Purari River system of southern Papua New Guinea. Kailola (1975) listed material from various localities in Papua New Guinea, but some of the records are probably based on misidentifications judging from the distance inland.

#### **Habitat**

Brackish water of bays, estuaries, and mangrove-lined tidal creeks.

#### **Material examined**

We have examined two specimens (BMNH 1858.8.15.123) 39 and 41 mm SL, collected by Waterhouse in India that are labeled as "possible types." They agree well with Hamilton's original description of *nalua*. In addition, we have studied 73 specimens, 34-95 mm SL from Indonesia, northern Australia, and Bintuni Bay, Irian Jaya at AMS, RMNH, and WAM.

### ***Ambassis urotaenia* Bleeker**

(Figures 6E and 21)

*Ambassis urotaenia* Bleeker 1852a: 257 (Amboina; Waihai, Ceram).

*Ambassis papuensis* Alleyne and Macleay 1877: 266 (Hall Sound, Papua New Guinea).

### Diagnosis

A species of *Ambassis* with the following combination of characters: a single supraorbital spine; a single transverse scale row on cheek; lateral line continuous from upper edge of gill opening to caudal fin base; gill rakers on lower limb of first arch 23 or 24; nasal spine absent. It is most similar to *A. macracanthus* and *A. miops*, but has only a single row of scales on the cheek instead of two rows.

### Description

(Proportional measurements based on 8 specimens, 35.8-46.6 mm SL). Dorsal rays VII,I,10; anal rays III,9 or 10; pectoral rays 16; lateral line with 26 or 27 scales, with continuous throughout its length; vertical scale rows from upper edge of gill opening to caudal fin base 26 or 27; horizontal scale rows from anal fin origin to base of dorsal fin 10; a single transverse scale row on cheek; predorsal scales 9 to 11; gill rakers on lower limb of first arch 23 or 24.

A single supraorbital spine; nasal spine present; preorbital ridge smooth; suborbital smooth; preorbital edge with 7 to 9 serrae; preopercular ridge with 5 to 11 serrae on lower limb, vertical limb mainly smooth; lower edge of preoperculum with 11 to 19 serrae and hind margin with additional series of 2 to 8 small serrae or weak crenulations; interoperculum smooth or with 1 to 5 moderate to weakly developed serrae.

Body depth 35.8 to 36.9; head length 34.1 to 38.8; snout length 6.4 to 8.1; eye diameter 13.7 to 15.9; maxilla length 11.8 to 12.9; caudal peduncle depth 15.1 to 15.5; caudal peduncle length 20.5 to 22.3; height of first dorsal fin 26.0 to 28.0; second dorsal spine longer than third dorsal spine; third anal spine slightly longer than second anal spine.

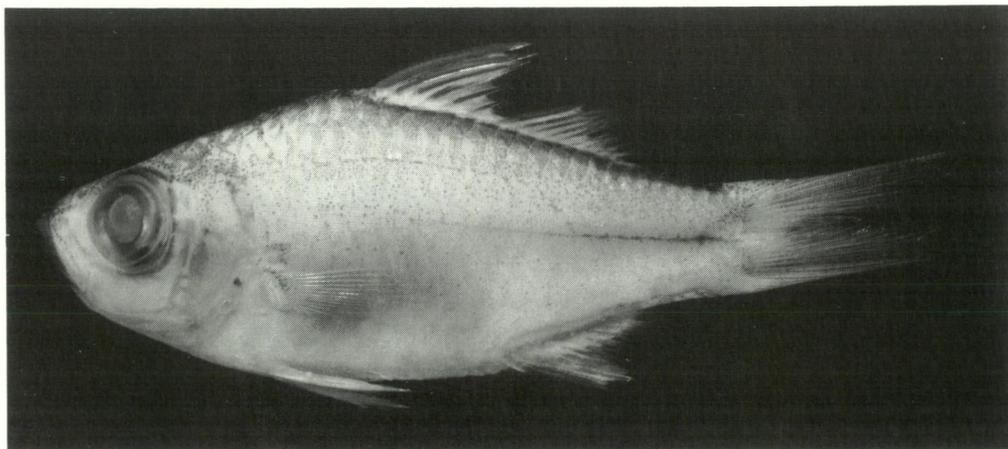


Figure 21. *Ambassis urotaenia*, 54 mm SL, Flores Island, Indonesia.

*Colour in alcohol*: generally pale tan or yellowish white; a thin black stripe along middle of side, mostly evident on posterior half of body; fins translucent except membrane between second and third dorsal spines blackish.

#### **Distribution** (Figure 2)

The only Australian record is that of Munro (1961, as *A. commersoni*) from the Northern Territory. However, we have not seen Australian specimens. The species has frequently been misidentified and therefore the distributional limits are vague. We have seen specimens from India, Indonesia, and New Guinea.

#### **Habitat**

Mainly marine environments including mangrove embayments, brackish estuaries, and tidal creeks.

#### **Material examined**

We have examined 73 specimens, 12.0-46.6 mm SL from New Guinea (Port Moresby, Umboi Island, and Semai Island) at WAM and the U.S. National Museum of Natural History. However, most of these were juveniles under 25 mm SL. Therefore relatively few specimens were utilised for proportional data.

#### **Remarks**

Fraser-Brunner (1954) and Munro (1961) referred to this species, characterised by a single row of scales on the cheek, as *A. commersoni*. However, we have examined Cuvier's syntypes of *A. commersoni* (MNHN A.5470, 3 specimens, 86-88 mm SL), which consist of dried half-skins in poor condition. Two of the specimens do not have the cheek intact, but the third clearly reveals two scale rows on the cheek. Two non-type specimens of *A. commersoni* from Mauritius (type locality) at MNHN (reg. no. 2956) collected by Desjardins also have two scale rows on the cheek. The oldest name for the species treated here is *A. Ambassis urotaenia* Bleeker. We have not examined the type (presumably at RMNH) but Weber and de Beaufort, who based their description of *A. urotaenia* on Bleeker's material, stated there is a single row of scales on the cheek. We have examined the lectotype and paralectotype (designated by Whitley 1935) of *Ambassis papuensis*, 43-46 mm SL (AMS I.16317-001), and find them identical to *A. urotaenia*.

### *Ambassis vachellii* Richardson

(Figures 6F and 22)

*Ambassis vachellii* Richardson 1846: 221 (Canton, China).

*Ambassis telkara* Whitley 1935: 349 (Bathurst Head, N. Queensland).

#### **Diagnosis**

A species of *Ambassis* with the following combination of characters: 4 or 5 supraorbital spines; nasal spine present; rear margin of preoperculum serrate.

It is morphologically similar to *A. gymnocephalus*, a sympatric species. The presence of small serrae or crenulations on the hind margin of the preoperculum of *A. vachellii* and absence of this feature in *A. gymnocephalus* provide the best means of separation. These serrations are also evident in the juveniles, although they are weakly developed.

### Description

(Proportional measurements based on 18 specimens, 35-54 mm SL). Dorsal rays VII,I,9; anal rays III,9; pectoral rays 14 to 16; lateral line with 10 to 13 + 12 to 14 scales, interrupted in middle portion by 1 to 3 tubeless scales; vertical scale rows from upper edge of gill opening to caudal fin base 27 to 28; horizontal scale rows from anal fin origin to base of dorsal fin 10; transverse scale rows on cheek 2; predorsal scales 13 to 16; gill rakers on lower limb of first arch 22 to 25. Fin ray and gill raker counts are summarised in Table 1.

Supraorbital spines 4 or 5; nasal spine well developed; preorbital ridge with 3 to 8 small serrae; suborbital smooth or with 1 or 2 minute serrae; preorbital edge with 6 or 7 serrae; preopercular ridge with 10 to 13 serrae on lower limb, vertical limb smooth; lower edge of preoperculum with 16 to 19 serrae, hind margin with additional series of 6 to 13 small serrae or crenulations; interoperculum smooth except flattened spine present at posterior angle.

Body depth 34.6 to 37.6; head length 31.6 to 36.8; snout length 6.8 to 7.6; eye diameter 12.0 to 13.6; maxilla length 11.9 to 14.0; caudal peduncle depth 13.0 to 14.5; caudal peduncle length 20.9 to 23.6; height of first dorsal fin 24.3 to 26.3; second dorsal spine slightly longer than third dorsal spine; third anal spine longer than second anal spine.

*Colour in alcohol*: generally pale yellowish or light tan with melanophores concentrated on scale margins, particularly on upper side; snout, lower jaw, and

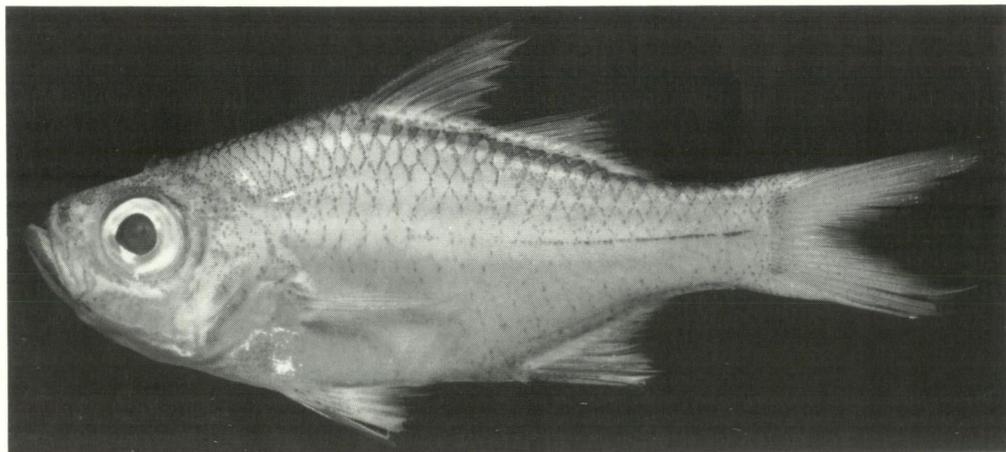


Figure 22. *Ambassis vachellii*, 47 mm SL, Fly River, Papua New Guinea.

interorbital dusky; thin black stripe along middle of side frequently present; fins mainly translucent except membrane between second and third dorsal spines blackish and caudal fin lobes slightly dusky.

### **Distribution** (Figure 1)

*Ambassis vachellii* is probably widespread in the tropical Indo-far western Pacific region. Accurate locality information is obscured by the fact that previous authors (for example, Weber and de Beaufort, 1929; Fowler and Bean, 1930) have placed this species in the synonymy of *A. gymnocephalus* or *A. dussumieri*. We have examined specimens from Indonesia (Ambon), Carnarvon and the Kimberley coast of Western Australia, and the east coast of far northern Queensland. The species has also been recorded (as *dussumieri*) from the Northern Territory by Munro (1961) and Taylor (1964). We have not seen specimens from New Guinea, but it certainly must occur there.

### **Habitat**

Brackish water of bays, estuaries, and mangrove-lined tidal creeks.

### **Material examined**

We have examined six paratypes of *A. telkara* (AMS IA.6046), 22-45 mm SL, from Bathurst Head, northern Queensland. In addition, 41 specimens, 21-54 mm SL, from Lizard Island and Cape York in Queensland and the Admiralty Gulf and Carnarvon in Western Australia were studied at AMS and WAM.

### **Remarks**

The identity of this species has been greatly confused by previous authors. Bleeker (1874), Weber and de Beaufort (1929), and Fowler and Bean (1930) wrongly included it, which they referred to as *A. dussumieri* Cuvier, in the synonymy of *A. gymnocephalus* (Lacepède). The senior author made an unsuccessful effort to locate Cuvier's type of *A. dussumieri* during a recent visit to the Museum National d'Histoire Naturelle, Paris. Three specimens, 47-48 mm SL collected at Ambon, East Indies by Quoy and Gaimard are indicated as types (MNHN 582), but the only locality given in the original description was Malabar (India). Thus, they cannot be regarded as the true types, although these specimens were most likely identified and studied by Cuvier, as were three additional specimens (MNHN 2953), 56-58 mm, also located at Paris. All six specimens agree with the original description of *A. dussumieri*, in which Cuvier stated that this species is very similar in detail to *A. commersoni* Cuvier except for its more elongate shape. The description of *A. commersoni*, which appeared in the same publication, stated that there was a single spine above the eye (i.e., supraorbital spine) and a lack of serrae or denticulations on the rear edge of the preoperculum. The three syntypes, 86-88 mm SL, of *A. commersoni* were examined at Paris (MNHN A.5470) and they agree with the original description. Because of Cuvier's mention of the great similarity in morphology between *A. dussumieri* and *A.*

*commersoni*, and his failure to mention both the presence of more than one supraorbital spine and serrations on the rear edge of the preoperculum, it is our belief that *A. dussumieri* of most previous authors is not the same fish as that described by Cuvier. The next available name for this species is therefore *A. vachellii* Richardson 1846. The original description is brief, but Richardson mentions two diagnostic characters for this species: "in having four teeth reclining backwards on the hinder part of the orbit and the posterior edge of the upper limb of the preopercle rather openly and slenderly toothed" (i.e., serrated). According to Fraser-Brunner (1954) the type specimen, originally deposited at the Philosophical Institution of Cambridge, England, is apparently lost.

### Genus *Denariusa* Whitley

*Denariusa* Whitley 1948: 92 (type species: *Denariusa bandata* Whitley 1948, by original designation).

#### Diagnosis

Mouth relatively small, the maxillary length 7.0 to 8.0% of SL; gill rakers rudimentary, about 6 to 9 on lower limb of first gill arch; pectoral rays 9 or 10; lateral line weakly developed or absent, represented by 0 to 4 tubed scales; supraorbital spine absent; hindmargin of preopercle strongly serrate; scales relatively large, 24 to 26 in longitudinal series from upper edge of gill opening to caudal fin base; horizontal scale rows from anal fin origin to base of dorsal fin 11; transverse scale rows on cheek 2; a series of six narrow dark vertical bars often present on side of body; maximum size to about 35 mm SL; freshwater habitat.

### *Denariusa bandata* Whitley

(Figures 6G and 23)

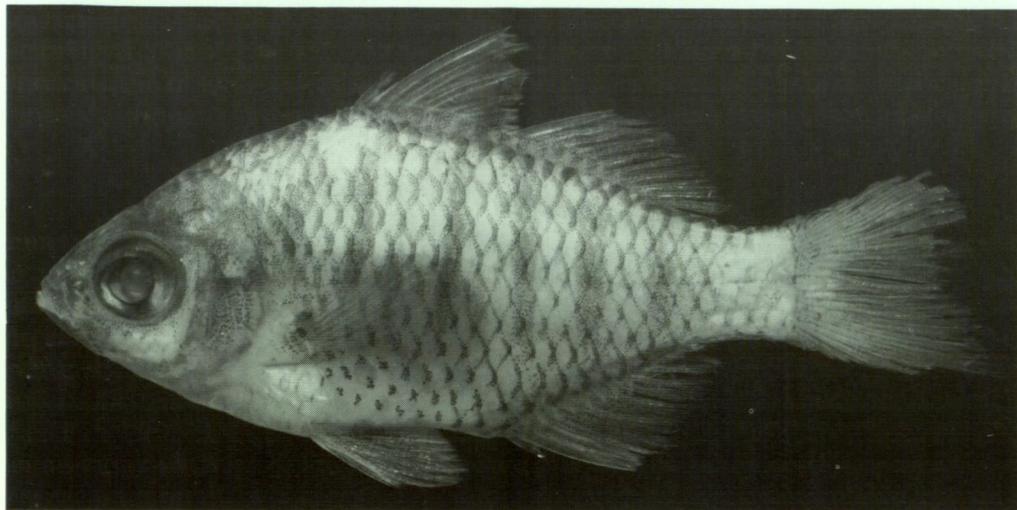
*Denariusa bandata* Whitley 1948: 92 (Amhem Land, Northern Territory).

#### Diagnosis

The monotypic *Denariusa* is easily distinguished from other members of the family on the basis of its small size, robust shape, barred pattern, lower pectoral ray and gill raker counts, and absence of a supraorbital spine. Other characters are indicated in the generic diagnosis.

#### Description

(Proportional measurements based on 15 specimens, 24-30 mm SL). Dorsal rays VII,1,9 or 10; anal rays III,7 to 9; pectoral rays 9 or 10; lateral line scales weakly developed or absent, tubed scales 0 to 4; vertical scale rows from upper



**Figure 23.** *Denariusa bandata*, 26 mm SL, Flying Fox Creek, Northern Territory.

edge of gill opening to caudal fin base 24 to 26; horizontal scale rows from anal fin origin to base of dorsal fin 11; transverse scale rows on cheek 2; predorsal scales 12 to 16; gill rakers on lower limb of first arch 7 to 9. Fin ray and gill raker counts are summarised in Table 2. Supraorbital spine absent; nasal spine absent; preorbital ridge smooth; suborbital smooth; preorbital edge with 9 to 12 serrae; preopercular ridge usually smooth, occasionally with 1 to 3 weak serrae concentrated around angle, vertical limb mainly smooth; lower edge of preoperculum with 18 to 23 serrae and hind margin with additional series of 24 to 30 well developed serrae; interoperculum with 3 to 14 small serrae.

Body depth 41.7 to 44.0; head length 34.8 to 40.0; snout length 7.5 to 8.3; eye diameter 12.3 to 14.6; maxilla length 7.0 to 8.0; caudal peduncle depth 13.2 to 15.8; caudal peduncle length 19.6 to 24.4; height of first dorsal fin 25.8 to 29.3; second and third dorsal spines about equal in length; second and third anal spines about equal in length.

*Colour in alcohol:* mainly yellowish to whitish; most of body scales with dusky margins forming network pattern on side; a series of about six narrow dark bars (sometimes faint or absent) on side; first dorsal fin translucent except rear edge blackish; basal two-thirds of second dorsal and anal fins dusky black, remaining portions pale or translucent; caudal fin pale tan to slightly dusky; pelvic fins mainly dusky; pectoral fins pale with intense black spot on upper portion of axil.

#### **Distribution** (Figure 3)

*Denariusa bandata* is known from the northern portion of the Northern Territory between the Daly River and East Alligator River systems and in

Queensland from the Jardine River system at the northern extremity of Cape York Peninsula and the Murray Swamps area near Cardwell. It also occurs in the Fly River system and Bensbach River of central-southern New Guinea.

### Habitat

This species is restricted to small, slow-flowing streams and swamps. It frequents areas with dense growth of aquatic vegetation.

### Material examined

We have examined the holotype (AMS IB.2035), 23 mm SL, and three paratypes (AMS IB.2037), 17-20 mm SL, from Arnhem Land. In addition, 755 specimens, 10-31 mm SL from Northern Territory, Queensland, and southern New Guinea (Fly and Bensbach rivers) were studied at AMS, KFRS, and WAM.

### Remarks

*Denariusa bandata*, with a maximum standard length of about 35 mm, is the smallest member of the family inhabiting the Australia-New Guinea region. The only chandid that is possibly smaller is *Gymnochanda filamentosa* Fraser-Brunner (1954) described from nine specimens, 15-20 mm SL from southern Malaya.

## Genus *Parambassis* Bleeker

*Parambassis* Bleeker 1874: 86 (type species: *Ambassis apogonoides* Bleeker 1851, by original designation).

*Acanthoperca* Castelnau 1878: 44 (type species: *Acanthoperca gulliveri* Castelnau 1878, by monotypy).

*Whitleyina* Fowler and Bean 1930: 163 (type species: *Ambassis wolffi* Bleeker 1850, by original designation).

### Diagnosis

Mouth relatively large, the maxillary length 10.9 to 16.1% of SL; gill rakers well developed, 11 to 22 on lower limb of first gill arch; pectoral rays 15 to 17; lateral line well developed, represented by 36 to 52 tubed scales, usually in a continuous series; usually 1 or 2 supraorbital spines; vertical limb of preopercle edge smooth or serrate; scales relatively small, 36 to 52 in longitudinal series from upper edge of gill opening to caudal fin base; horizontal scale rows from anal fin origin to base of dorsal fin 16 to 20; transverse scale rows on cheek 3 or 4; maximum size from about 100 mm to at least 250 mm SL; freshwater habitat.

### Remarks

Fraser-Brunner (1954) included *Parambassis* as a subgenus of *Chanda* Hamilton. However, Opinion 1121 published in the Bulletin of Zoological Nomenclature (1979: 223) specified that *Chanda nama* Hamilton is the valid

type species for *Chanda*. This species was placed in the monotypic genus, *Hamiltonia* Swainson, in Fraser-Brunner's revision, based on several distinctive features including much reduced serration of the head bones and a projecting lower jaw bearing a group of massive teeth at the symphysis. Thus, it is our interpretation that *Chanda* is a valid genus that applies only to *C. nama* and that *Parambassis* is the oldest available name for the remainder of the species of the genus referred to as *Chanda* by Fraser-Brunner. The limits and relationships of this group remain poorly defined, but are outside the scope of the present study. The genus (i.e. *Chanda*) as recognised by Fraser-Brunner contains 11 species distributed from India eastward to the Malaysian Peninsula, Indonesia, New Guinea, and northern Australia.

### Key to the species of *Parambassis* from Australia and New Guinea

- 1a. Gill rakers on first gill arch 11 to 14; height of first dorsal fin 25.3 to 27.6% of SL; broad mid-lateral band on each side of body and dark streak on each caudal fin lobe (northern New Guinea) ..... *P. confinis* (Weber)
- 1b. Gill rakers on first gill arch 17 to 22; height of first dorsal fin 31.5 to 37.7% of SL; colour pattern not as above ..... 2
- 2a. Lateral line scales 47 to 52; predorsal scales 23 to 29; hindmargin of preoperculum with 18 to 25 serrae; body depth 34.8 to 37.5% of SL; head length 32.0 to 34.5% of SL; maxilla length 11.0 to 12.6% of SL; uniformly coloured (specimens preserved for long time)(Mamberamo River, northern Irian Jaya) ..... *P. altipinnis* Allen
- 2b. Lateral line scales 37 to 42; predorsal scales 17 to 22; hindmargin of preoperculum smooth; body depth 42.0 to 47.5% of SL; head length 37.9 to 39.3% of SL; maxilla length 14.4 to 16.1% of SL; series of narrow dark stripes present on side (Australia and New Guinea) ..... *P. gulliveri* (Castelnau)

### *Parambassis altipinnis* Allen

(Figures 7A and 24)

*Parambassis altipinnis* Allen 1982: 166 (Mamberamo River, Irian Jaya).

#### Diagnosis

*Parambassis altipinnis* is most similar to *P. confinis* (Weber) from northern New Guinea between the Gogol and Mamberamo rivers. The two species are

easily separated on the basis of dorsal fin height, lateral-line scale counts, gill raker counts, and coloration. The dorsal fin height of *P. altipinnis* exceeds or is equal to the head length, whereas in *P. confinis* the height of this fin is always significantly less than the head length (0.8 to 1.0 in head for *altipinnis* vs. 1.1 to 1.3 for *confinis*). Lateral-line scale counts for *P. altipinnis* generally exceed 47, while in *P. confinis* the range is about 36 to 48. Lower limb gill raker counts for *P. altipinnis* usually range from 17 to 19 compared with the very low count of 11 to 14 for *P. confinis*. *P. confinis* is also distinguished by the presence of a distinct, broad horizontal black band long the middle of the sides and a dark streak on each caudal fin lobe. Moreover, the body is generally brownish above and abruptly silvery-white below the mid-lateral band, and the outer half of the spinous dorsal fin is blackish. *Parambassis altipinnis* in contrast is uniformly coloured without dark markings, at least in preservative.

### Description

(Proportional measurements based on 12 specimens, 74-113 mm SL). Dorsal rays VII,I,10 or 11; anal rays III,9 or 10; pectoral rays 15 or 16 (usually 15); lateral line with 47 to 52 scales; vertical scale rows from upper edge of gill opening to caudal fin base 47 or 52; horizontal scale rows from anal fin origin to base of dorsal fin 16 to 19; transverse scale rows on cheek 3 or 4; predorsal scales 23 to 29; gill rakers on lower limb of first arch 17 to 19 (usually 18). Fin ray and gill raker counts are summarised in Table 2.

Supraorbital spines 1 or 2; nasal spine absent; preorbital ridge smooth or with a few weak serrae; suborbital with 16 to 22 small serrae; preorbital edge with 11 or 12 serrae; preopercular ridge with 2 to 12 serrae; lower edge of preoperculum with 15 to 22 serrae, hindmargin with 18 to 25 serrae; interoperculum with 5 to 10 serrae; opercular margin smooth.



Figure 24. *Parambassis altipinnis*, 88 mm SL, Mamberamo River, Irian Jaya.

Body depth 34.8 to 37.5; head length 32.0 to 34.5; snout length 6.5 to 7.8; eye diameter 8.9 to 10.9; maxilla length 11.0 to 12.6; caudal peduncle depth 11.8 to 13.8; caudal peduncle length 20.2 to 24.1; height of first dorsal fin 34.0 to 37.5; second dorsal spine longer than third dorsal spine; third anal spine slightly shorter than second anal spine.

*Colour in alcohol:* after 61 years in preservative the body is dark brown and the fins are tan. The live coloration of living individuals is unknown.

#### **Distribution** (Figure 3)

Known only from the Mamberamo River in northern Irian Jaya. The type specimens were collected in 1920 at Prauwenbivak. It has not been reported since then.

#### **Habitat**

Exact habitat conditions are unknown, but the Mamberamo is a large, turbid river with steep banks and subject to annual flooding (senior author's personal observations).

#### **Material examined**

We have examined 20 specimens, 74-113 mm SL, all part of the type series (including holotype, ZMA 116.452, 94.2 mm SL) at USNM, WAM, and ZMA.

### ***Parambassis confinis* (Weber)**

(*Figures 7B and 25*)

*Ambassis confinis* Weber 1913: 577 (Sepik River, Njao, and Sermowai River, all in northern New Guinea).

*Ambassis confinis occidentalis* Weber and de Beaufort 1929: 420 (Njao, Sermowai River, and Mamberamo River).

#### **Diagnosis**

*Parambassis confinis* is distinguished from other sympatric chandids except *P. altipinnis* by a vertical scale row and lateral-line scale count in excess of 35 and the presence of many small serrae on the circumorbital bones. It is separable from *Parambassis altipinnis* and all other sympatric chandids as well as from *P. gulliveri* by a low gill raker count of 11 to 14. It is further distinguished from *P. altipinnis* by its lower spinous dorsal fin (1.1 to 1.3 in head vs. 0.8 to 1.0 for *altipinnis*) and both *P. altipinnis* and *P. gulliveri* by the presence of a broad black stripe along the middle of the sides.

#### **Description**

(Proportional measurements based on 15 specimens, 63-96 mm SL). Dorsal rays VII,1,10; anal rays III,9 or 10; pectoral rays 16 or 17 (usually 16); lateral

line with 36 to 48 scales, continuous throughout its length; vertical scale rows from upper edge of gill opening to caudal fin base 36 to 48; horizontal scale rows from anal fin origin to base of dorsal fin 17 or 18; transverse scale rows on cheek 3 or 4; predorsal scales 20 or 21; gill rakers on lower limb of first arch 11 to 14. Fin ray and gill raker counts are summarised in Table 2.

Supraorbital spines 2 or 3, more or less merging with circumorbital serrae; nasal spine absent; serrae of preorbital ridge continuous with those of circumorbitals, 20 to 34 in number; preorbital edge with 7 to 13 serrae; preopercular ridge with 6 or 7 serrae in vicinity of angle, vertical limb mainly smooth; lower edge of preoperculum with 8 to 10 serrae, hind margin with 18 to 24 serrae; interoperculum with 5 to 9 small serrae.

Body depth 38.1 to 42.3; head length 33.3 to 37.2; snout length 7.9 to 9.3; eye diameter 11.5 to 12.8; maxilla length 10.9 to 12.8; caudal peduncle depth 12.3 to 14.1; caudal peduncle length 19.2 to 23.0; height of first dorsal fin 25.3 to 27.6; second dorsal spine longer than third dorsal spine; second and third anal spines about equal.

*Colour in alcohol:* brown on upper back (scale centres often lighter), whitish to tan below with broad, blackish stripe separating the two areas along middle of side; snout and lips dusky brown; spinous dorsal fin with blackish area on outer half; caudal fin with prominent, broad, blackish streak on each lobe; remainder of fins mainly pale tan to white except outer portion of soft dorsal and anal fins may be faintly dusky.

*Colour in life:* similar to preserved colouration except side of head and belly often silvery.

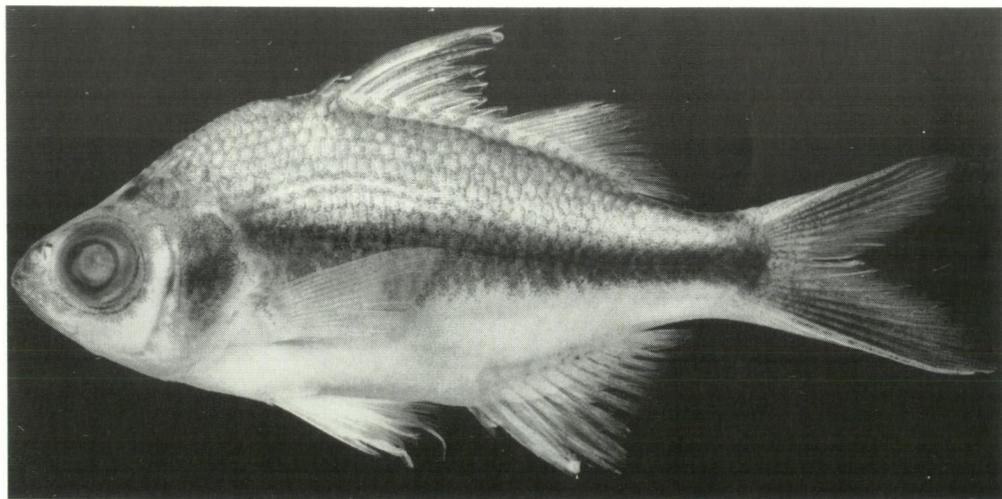


Figure 25. *Parambassis confinis*, 68 mm SL, Gogol River, Papua New Guinea.

**Distribution** (Figure 3)

Known from the following river systems in central-northern New Guinea (proceeding westward): Gogol, Ramu, Sepik, Mosso, Sermowai, and Mamberamo.

**Habitat**

Occurs in a variety of purely freshwater habitats including large turbid rivers, clear, gravel-bottom creeks, and lakes. It often forms aggregations.

**Material examined**

We have examined syntypes of *Ambassis confinis* (ZMA 112.396-97, 52 and 91 mm SL) and *A. confinis occidentalis* (ZMA 109.469 and 112.399, 7: 39-71 mm SL). We have also studied 27 specimens, 24-96 mm SL from the Gogol, Ramu, Sepik, and Mamberamo river systems at WAM.

**Remarks**

Weber and de Beaufort (1929) described *P. confinis occidentalis* as a new subspecies for the western population based on a lower lateral-line scale count of 37 to 39 and a more marked concavity at the nape. However, we believe these features are not sufficiently different for the recognition of either specific or subspecific status. We have detected a great deal of variability in both features. There is apparent random variation in lateral line scale counts according to river systems. For example, specimens from the Gogol system usually have 39-42 scales, those from the Sepik 44-48 scales, and those from the Mamberamo 40-44 scales. In the absence of other differences we prefer to recognize these populations as belonging to a single species.

***Parambassis gulliveri* (Castelnau)**

(Figures 7C and 26)

*Acanthoperca gulliveri* Castelnau 1878: 45 (Norman River, Queensland).

*Ambassis gigas* Ramsay and Ogilby 1887: 9 (Strickland River, New Guinea).

**Diagnosis**

*Parambassis gulliveri* is distinguished from all other sympatric chandids by the possession of four scale rows on the cheek and a vertical scale row count in excess of 37. The other species have two scale rows (rarely one or three) on the cheek and less than 35 vertical scale rows. Moreover, the striped colour pattern and large size (to at least 250 mm SL) attained by adults of *P. gulliveri* are also distinctive. It differs from the other two species of *Parambassis* from northern New Guinea, *P. altipinnis* and *P. confinis*, by its higher gill raker count (20-22 vs. 11-19), greater body depth (42.0-47.5 vs. 34.8-42.3% of SL), and its greater size (maximum SL of about 115 mm SL in other species).

### Description

(Proportional measurements based on 15 specimens, 44-151 mm SL). Dorsal rays VII,I,10 or 11; anal rays III,9 or 10; pectoral rays 15 to 17 (usually 17); lateral line with 37 to 42 scales, usually continuous throughout its length or occasionally interrupted in middle portion by a few tubeless scales; vertical scale rows from upper edge of gill opening to caudal fin base 37 to 42; horizontal scale rows from anal fin origin to base of dorsal fin 18 to 20; transverse scale rows on cheek 4; predorsal scales 17 to 22; gill rakers on lower limb of first arch 20 to 22 (usually 21). Fin ray and gill raker counts are summarised in Table 2.

Supraorbital spines 1 or 2 (rarely none); nasal spine absent; preorbital ridge usually smooth, rarely with 1 or 2 small serrae; suborbital smooth; preorbital edge with 7 to 15 serrae; preopercular ridge with 3 to 13 serrae on lower limb, vertical limb mainly smooth; lower edge of preoperculum with 7 to 28 serrae, hind margin smooth; interoperculum with 4 to 14 minute serrae.

Body depth 42.0 to 47.5; head length 37.9 to 39.3; snout length 8.1 to 8.7; eye diameter 10.3 to 13.3; maxilla length 14.4 to 16.1; caudal peduncle depth 13.5 to 15.2; caudal peduncle length 17.7 to 20.3; height of first dorsal fin 31.5 to 37.7; second dorsal spine longer than third dorsal spine; second anal spine longer than third anal spine.

*Colour in alcohol:* generally yellowish tan with series of eight or nine brown stripes on side, those above lateral line and the stripe immediately below lateral line more or less parallel to curved path of lateral line, the four to six lowermost stripes horizontal; a brown blotch on upper, anterior portion of operculum; axil

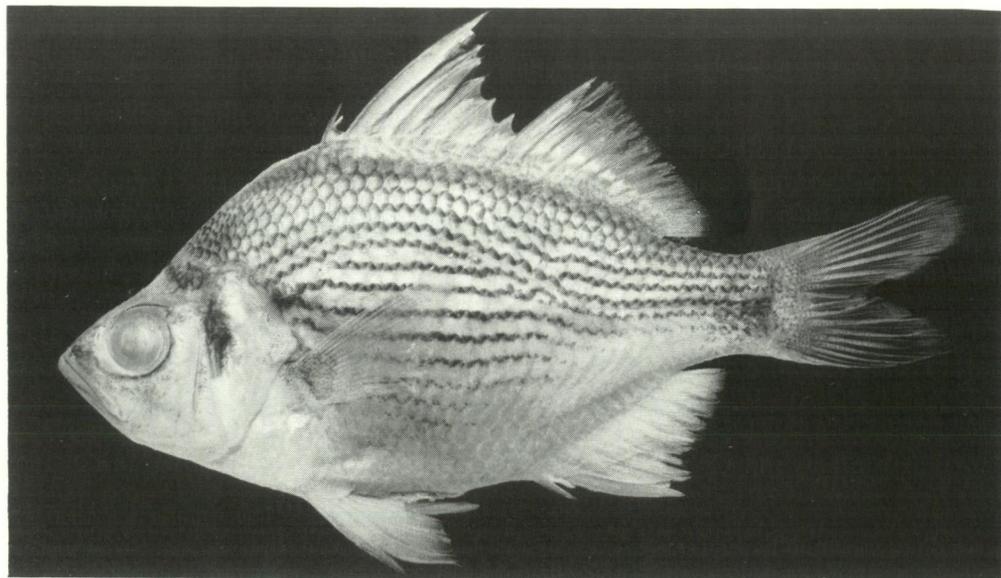


Figure 26. *Parambassis gulliveri*, 101 mm SL, Victoria River, Northern Territory.

and base of pectoral fin dusky brown; nape, snout, and area around eye dusky brown; dorsal fin dusky; caudal fin dark brown; anal fin mainly yellowish tan with some duskiness on membranes between rays; pelvic fins yellowish tan; pectoral fins slightly dusky. Juveniles under 80 mm SL are mainly plain yellowish tan, frequently with dusky scale margins on upper part of back.

### Distribution (Figure 3)

*Parambassis gulliveri* is known in Australia from the following river systems: Western Australia — Ord; Northern Territory — Victoria; Queensland — Flinders and Norman. The species also occurs in the Lorentz, Digul, Oriomo, Fly, Strickland, Alice, Pie, and Purari rivers of south-central New Guinea.

### Habitat

Relatively large freshwater rivers that are characterised by high turbidity levels.

### Material examined

McCulloch (1929) indicated that the type of *P. gulliveri* was at the Museum National d'Histoire Naturelle (Paris). However, the specimen could not be located by the senior author during a visit to Paris in 1981 and therefore it must be presumed lost. We have examined the holotype of *Ambassis gigas* (AMS B.9958), a specimen 165 mm SL from New Guinea. In addition, 44 specimens, 26-180 mm SL, from the Ord River and Gulf of Carpentaria drainage were studied at AMS and WAM.

## Genus *Tetracentrum* Macleay

*Tetracentrum* Macleay 1884: 256 (type species: *Tetracentrum apogonides* Macleay 1884 by original designation).

*Synechopterus* Norman 1935: 61 (type species: *Synechopterus caudovittatus* Norman 1935 by original designation).

*Negambassis* Whitley 1935: 360 (substitute name for *Tetracentrum* believed preoccupied and therefore takes the same type species).

*Xenambassis* Schultz 1945: 115 (type species: *Xenambassis honessi* Schultz 1945 by original designation).

### Diagnosis

Spinous dorsal fin continuous, the last dorsal spine not much longer than penultimate one; dorsal rays VIII to X (usually VIII or IX), 9 to 11; anal rays III or IV, 8 to 11; mouth relatively large, the maxillary length 13.0 to 17.4% of SL; gill rakers well developed, 12 to 14 on lower limb of first gill arch; pectoral rays 14 to 16; lateral line complete, usually with 31 or 32 scales plus 1 or 2 scales on base of caudal fin; supraorbital spines 0 to 4; vertical limb and lower margin of preoperculum serrated; interoperculum usually with well defined serrae; horizontal scale rows from anal fin origin to base of dorsal fin 12; transverse scale rows on cheek 2 or 3; colour brown dorsally and yellow or tan (silvery to whitish in life) on ventral half, usually with broad, black, mid-lateral stripe,

wider and most vivid on caudal peduncle, and a prominent black blotch or streak immediately above anterior part of anal fin base; maximum size ranging from about 75-110 mm SL; Papua New Guinea freshwater habitats only.

### Remarks

Norman (1935) described the genus *Synechopterus* separating it from the closely allied *Tetracentrum* on the basis of the third rather than the second dorsal spine being the longest and the presence of three anal spines instead of four. Ten years later Schultz described *Xenambassis* to accommodate two new species, one of which (*X. simoni*) we consider as a junior synonym of *Tetracentrum caudovittatus* (see remarks section for this species). The main feature used to distinguish *Xenambassis* from *Synechopterus* were the orbital rim (smooth in *Synechopterus*, serrated in *Xenambassis*), head profile over the orbits (convex versus slightly concave), and position of the pelvic and anal fin origins (behind versus under pectoral fin base, and under penultimate dorsal spine versus under last dorsal spine or first dorsal ray respectively). Fraser-Brunner (1951) relegated *Xenambassis* to subgeneric status under *Synechopterus*. The two were further differentiated by him on the basis of preopercular ridge serration (only two small spines at angle in *Synechopterus* versus many serrae in *Xenambassis*), and 13 gill rakers on the lower limb of the first branchial arch of *Synechopterus* (versus 14 in *Xenambassis*).

We have examined all of the type material of the species of *Synechopterus*, *Tetracentrum*, and *Xenambassis*. The species in these genera were invariably described on the basis of few specimens which resulted in a lack of understanding of the variation in characters such as head bone serration, head shape, position of fin insertions and gill raker counts. After examining 290 specimens collected by the senior author in recent years from areas very close to the various type localities we consider that the characters traditionally used to separate the three groups are insufficient, hence their generic status cannot be maintained. Of far greater importance is the great similarity of the species involved when compared to all other chandids, in particular their overall shape, dorsal fin profile, presence of serrae on the interoperculum, and their distinctive colour pattern.

### Key to the species of *Tetracentrum*

- 1a. Supraorbital spines usually 3 or 4 (rarely 2); anal fin spines usually 4 (about 5% of specimens with 3 spines) ..... *T. apogonides* Macleay
- 1b. Supraorbital spines usually 0 or 1 (often embedded); anal fin spine 3 ..... 2
- 2a. Dorsal-fin spines 9 (very rarely 8); penultimate dorsal-fin spine 85-98% of last dorsal-fin spine ..... *T. caudovittatus* (Norman)

- 2b. Dorsal-fin spines 8; penultimate dorsal-fin spine  
71-82% of last dorsal-fin spine ..... *T. honessi* (Schultz)

*Tetracentrum apogonides* Macleay

(Figures 7D and 27)

*Tetracentrum apogonides* Macleay 1884: 256 (Goldie River, Papua New Guinea).

*Xenambassis lalokiensis* Munro 1964: 172 (Laloki River, Papua New Guinea).

**Diagnosis**

*Tetracentrum apogonides* is readily separated from other members of the genus by its unusual anal spine count of four (rarely three) and the high number of supraorbital serrae (usually 3 or 4 versus 0 or 1).

**Description**

(Proportional measurements based on 15 specimens, 46-74 mm SL). Dorsal rays IX,10; anal rays III or IV (usually IV),9; pectoral rays 15 to 17 (usually 16); lateral line with 29 to 31 (usually 31) scales; vertical scale rows from upper edge of gill opening to caudal fin base usually 31; horizontal scale rows from anal fin origin to base of dorsal fin 12, transverse scale rows on cheek 2 or 3; predorsal scales 15 to 16; gill rakers on lower limb of first arch 13 or 14. Fin ray and gill raker counts are summarised in Table 2.

Supraorbital spines 2 to 4 (usually 3); nasal spine absent; serrae of preorbital ridge continuous with those of circumorbitals, 9 to 35 in number; preorbital edge with 6 to 11 serrae; preopercular ridge with 5 to 18 serrae; lower edge of

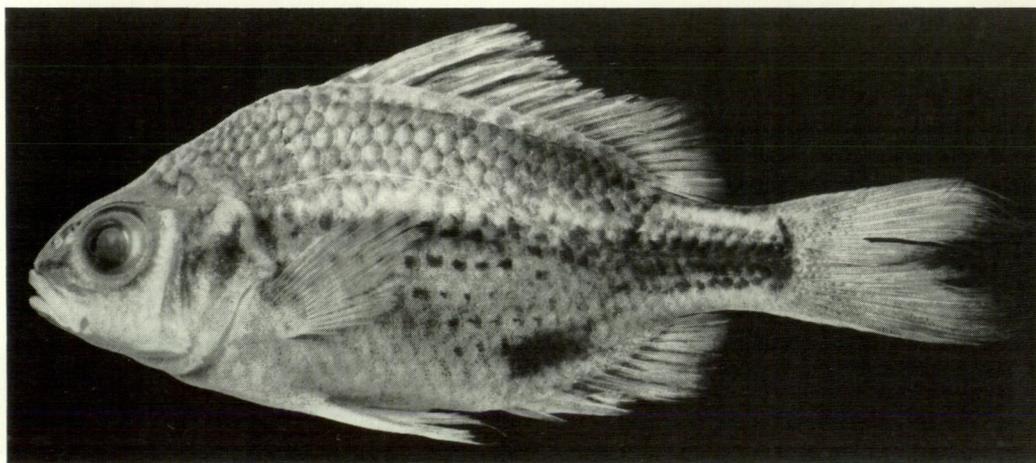


Figure 27. *Tetracentrum apogonides*, 73 mm SL, Kemp Welsh River, Papua New Guinea.

preoperculum with 7 to 13 serrae, hind margin with 15 to 23 serrae; interoperculum with 4 to 8 serrae; lower edge of operculum with a few weak serrae in specimens over about 60 mm SL.

Body depth 39.3 to 44.6; head length 36.7 to 39.3; snout length 8.5 to 11.8; eye diameter 12.2 to 15.2; maxilla length 13.0 to 14.9; caudal peduncle depth 12.2 to 14.3; caudal peduncle length 17.0 to 21.8; height of first dorsal fin 19.1 to 28.3; second and third dorsal spines about equal; second and third anal spines about equal.

*Colour in alcohol:* generally brown on upper half of head and body, tan or yellowish on lower half; scales of back with light (tan) spot at centre; those on lower sides and all scales of juveniles often with narrow brown margin; a blackish, mid-lateral stripe on side, broader and more vivid on caudal peduncle, terminating at base of caudal fin, where it is often expanded into an enlarged spot or blotch; a pronounced dark blotch or streak immediately above anterior part of anal fin base; a number of small scattered black spots on lower half of side; a narrow, black, slightly diagonal stripe on upper part of operculum often present; a pale (yellowish or tan) bar behind eye merging with light colour of cheek; a silvery patch often present on lower half of opercle; dorsal, caudal, and anal fins dusky grey; pelvic fins whitish with slight duskiness; pectoral fins translucent.

### **Distribution** (Figure 3)

This species has a very limited distribution, being confined to streams in the vicinity of Port Moresby, Papua New Guinea. It has thus far been collected from the Brown, Goldie, Laloki and Kemp Welsh rivers. It is also common in Sirinumu Reservoir (Laloki River) on the Sogeri Plateau at an elevation of 540 m.

### **Habitat**

Restricted to freshwater rivers and creeks, usually in deeper rocky pools where it is found amongst vegetation and log snags. It often occurs in large aggregations, particularly the juveniles.

### **Material examined**

We have examined 131 specimens, 21-75 mm SL at WAM. We have also seen the holotype of *Xenambassis lalokiensis* (CSIRO C2126, 60 mm SL) and lectotype (see Whitley 1935) of *Tetracentrum apogonides* (AMS I.9205-8, 125 mm SL).

### **Remarks**

Munro (1964) described *Xenambassis lalokiensis* from a single specimen, 80 mm TL, collected in a tributary of the Laloki River. He distinguished it on the basis of its anal spine count of three compared with four in other species of *Xenambassis* and *Synechopterus* (synonyms of *Tetracentrum*). However, we have examined this specimen and find no differences between it and typical

*T. apogonides* other than the anal spine anomaly. We disregard the significance of this feature as approximately 5% of the specimens of *T. apogonides* from our collections possess only three anal spines.

***Tetracentrum caudovittatus* (Norman)**

(Figs. 7E and 28)

*Synechopterus caudovittatus* Norman 1935: 61 (Kokoda, Papua New Guinea).  
*Xenambassis simoni* Schultz 1945: 120 (Buna, Papua New Guinea).

**Diagnosis**

*Tetracentrum caudovittatus* is most similar in general appearance to *T. honessi*, but differs from it by usually having nine rather than eight dorsal spines. In addition, the dorsal fin is less deeply notched than in *T. honessi*. This feature is reflected in the relative heights of the penultimate and last dorsal spines. The penultimate spine of *T. caudovittatus* is consistently taller than the equivalent spine of *T. honessi* (85-98% of last spine versus 71-82%). Finally, there is a slight difference in the position of the anal fin origin. It is usually level with the base of the penultimate dorsal spine or between it and the last spine in *T. caudovittatus* compared with between the last spine and first soft ray in *T. honessi*.

**Description**

(Proportional measurements based on 8 specimens, 46-106 mm SL). Dorsal rays IX (one with X), 9 or 10 (usually 10); anal rays III, 8 to 11 (usually 10); pectoral rays 15 or 16; lateral line with 30 to 32 (usually 32) scales; vertical scale rows from upper edge of gill opening to caudal fin base 30 to 32; horizontal scale rows from anal fin origin to base of dorsal fin 14; transverse scale rows on cheek 3 or 4; predorsal scales 13 to 16; gill rakers on lower limb of first arch 12 to 15. Fin ray and gill raker counts are summarised in Table 2.

Supraorbital spines usually absent (single small spine in 106 mm SL specimen); nasal spine absent; serrae of preorbital ridge continuous with those of circumorbitals, 12 to 21 in number; preorbital edge with 8 to 13 serrae; preopercular ridge with 4 to 14 serrae on lower limb and lower part of vertical limb; lower edge of preoperculum with 7 to 16 serrae, hind margin with 14 to 22 serrae; interoperculum with 2 to 8 serrae, poorly developed in specimens less than about 70 mm SL; opercular edge usually smooth, but with 5 serrae in 106 mm SL specimen.

Body depth 37.0 to 41.5; head length 38.2 to 42.3; snout length 8.5 to 9.9; eye diameter 10.8 to 15.4; maxilla length 13.2 to 17.4; caudal peduncle depth 11.2 to 14.3; caudal peduncle length 17.9 to 21.8; height of first dorsal fin 17.9 to 25.2; second and third dorsal spines about equal or third spine slightly longer; second and third anal spines about equal.

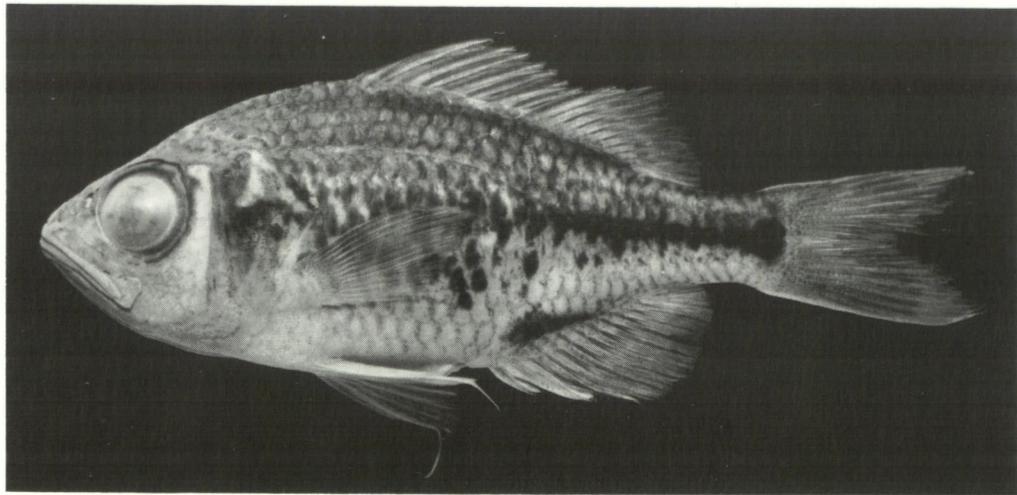


Figure 28. *Tetracentrum caudovittatus*, 75 mm SL, near Kokoda, Papua New Guinea.

*Colour in alcohol:* mainly dark brown on upper part of head and body, tan or yellowish on lower portion; 4-5 lateral scale rows under pectoral fin, and sometimes posterior to it, with black blotch covering most of each scale, immediately posterior to this area a concentration of black pigment forming a relatively broad stripe running along middle of caudal peduncle to base of caudal fin; a black blotch, about pupil size or smaller, immediately above anterior part of anal fin base; a black blotch or stripe, level with centre of eye, across operculum; upper margin of operculum often blackish; dorsal, caudal, and anal fins dusky grey; pelvic fins whitish; pectoral fins pale whitish or tan; juveniles (under about 50 mm SL) are overall much lighter (tan or yellowish) with the mid-lateral black stripe well contrasted on the posterior half of the body and ending in an enlarged black spot at the caudal fin base; juveniles also show the dark markings described above on the operculum and above the anal-fin base; fins of juveniles only slightly dusky.

#### **Distribution** (Figure 3)

The senior author has collected this species only from a creek near Kokoda (type locality) at an elevation of 365 m. Schultz (1945) reported the type locality of *Xenambassis simoni* (a synonym) as either the Samboga or Girua rivers on the coastal lowlands near Buna, the same locality given for *Tetracentrum honessi*. Collecting in this same area by the senior author yielded only *T. honessi*, therefore we are doubtful regarding the validity of the lowland distribution record.

#### **Habitat**

Creeks in hilly terrain at elevations to at least 365 m. Specimens were collected by the senior author from quiet, rocky pools in a rainforest stream.

**Material examined**

We have examined 15 specimens, 34-106 mm SL, collected near Kokoda, Papua New Guinea at WAM. We have also seen the holotypes of *Synechopterus caudovittatus* (BMNH 1934.4.7.16, 73 mm SL) and *Xenambassis simoni* (USNM 122828, 80 mm SL).

**Remarks**

Schultz (1945) differentiated *Xenambassis simoni* from *Synechopterus caudovittatus* on the basis of slight differences in head serration and position of the pelvic and anal fin origins relative to the pectoral base and last dorsal spine respectively. We consider these differences to be very slight and well within the range of variation for individual species in *Tetracentrum*. We therefore place *X. simoni* in the synonymy of *T. caudovittatus*.

***Tetracentrum honessi* (Schultz)**

(Figures 7F and 29)

*Xenambassis honessi* Schultz 1945: 118 (Buna, Papua New Guinea).

**Diagnosis**

*Tetracentrum honessi* is most similar to *T. caudovittatus*, but differs from it by usually having eight instead of nine dorsal spines. In addition, the dorsal fin is more deeply notched than in *T. caudovittatus*. This feature is reflected in the relative heights of the penultimate and last dorsal spines (see key to *Tetracentrum*, couplet 2, for details of difference). There is also a slight difference in the position of the anal fin origin. It is usually at a level between the last dorsal spine and the first soft dorsal ray in *T. honessi* and either level with the base of the penultimate dorsal spine or between it and the last dorsal spine in *T. caudovittatus*.

**Description**

(Proportional measurements based on 20 specimens, 67-91 mm SL). Dorsal rays VIII, 10 or 11; anal rays III, 9 to 11 (usually 10); pectoral rays 14 or 15; lateral line with 31 to 35 (usually 32) scales; vertical scale rows from upper edge of gill opening to caudal fin base 31 to 35 (usually 31 to 33); horizontal scale rows from anal fin origin to base of dorsal fin 11 to 15 (usually 11 or 12); transverse scale rows on cheek 3 or 4; predorsal scales 13 to 16; gill rakers on lower limb of first arch 12 to 14. Fin ray and gill raker counts are summarised in Table 2.

A single supraorbital spine, often embedded; nasal spine absent; serrae of preorbital ridge continuous with those of circumorbitals, usually 8 to 27, but occasionally absent; preorbital edge with 8 to 13 serrae; preopercular ridge with 3 to 9 (usually 3-5) serrae clustered around angle; lower edge of preoperculum

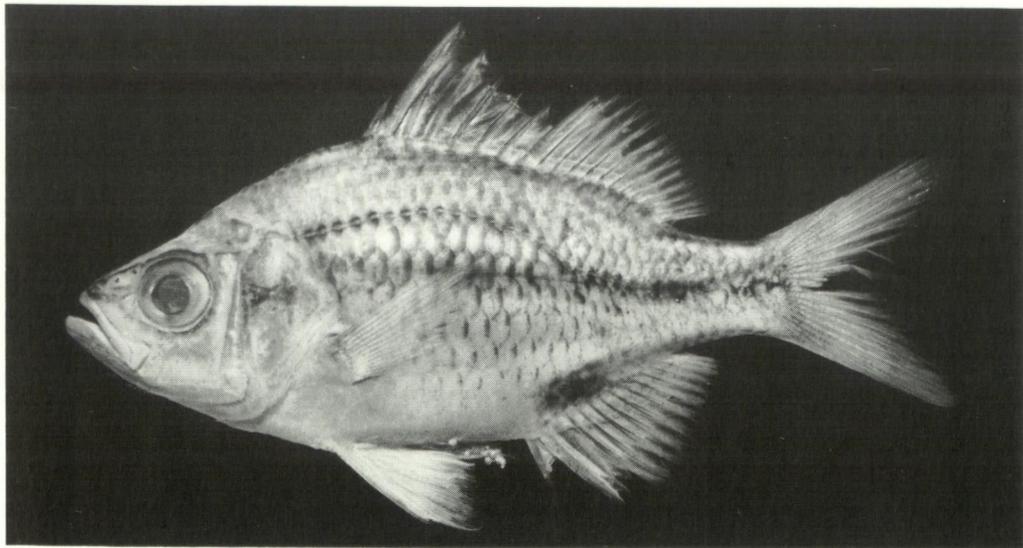


Figure 29. *Tetracentrum honessi*, 70 mm SL, Safia, Papua New Guinea.

with 12 to 15 serrae, hind margin with 18 to 24 serrae; interoperculum usually with 0 to 8 poorly developed serrae; opercular edge usually smooth; lower margin of operculum with 0 to 5 weak serrae. Body depth 40.6 to 46.8; head length 38.5 to 41.5; snout length 9.0 to 10.5; eye diameter 11.0 to 13.2; maxilla length 13.2 to 15.9; caudal peduncle depth 12.3 to 14.5; caudal peduncle length 16.9 to 21.0; height of first dorsal fin 17.1 to 23.2; third dorsal spine slightly longer than second; second and third anal spines about equal.

*Colour in alcohol:* generally brown on upper half of head and body, tan or yellowish on lower half; scales of back with light (tan) spot at centre, those on lower sides with brown margins; a diffuse, relatively broad blackish stripe along middle of side, usually more pronounced on posterior part of body and expanded into a large blackish spot at caudal fin base; a large black blotch immediately above anterior part of anal fin base; a narrow, black, slightly diagonal stripe on upper part of operculum often present; upper edge of operculum with dusky brown to blackish margin; dorsal, caudal, and anal fins dusky grey, darker basally, anterior portion of dorsal fin frequently darker than posterior or soft portion of fin; pelvic fins whitish or tan with dusky outer portion; pectoral fins pale; a few individuals are very dark brown overall except for tan scale centres and the black mid-lateral stripe; juveniles (under about 40-50 mm SL) mainly tan with brown scale margins, a narrow black mid-lateral stripe, black blotch above the anal fin, and a large black blotch covering most of the spinous dorsal fin. Colour of living individuals is similar except black areas have a bluish tinge and the tan to yellowish areas on the lower half of

the body are whitish to silvery. Courting males observed by the senior author near Safia underwater were overall blackish.

**Distribution** (Figure 3)

Known only from a small area north of the Owen Stanley Range at the eastern end of Papua New Guinea. Thus far it has been collected from the Moni River and its tributaries near Safia and in streams around Popondetta, lying 105 km to the north.

**Habitat**

Restricted to freshwater rivers and creeks. Specimens collected or observed underwater near Safia were in clear streams with slow to moderate flow. This species was most common around submerged logs on gravel or sandy bottoms.

**Material examined**

We have examined 144 specimens, 15-115 mm SL from Safia and Popondetta, Papua New Guinea at WAM. We have also seen the holotype (USNM 122830, 87 mm SL).

**Acknowledgements**

We are indebted to the following museum curators who kindly allowed us access to specimens in their care: M. Bauchot (MNHN); M. Boeseman and M. Van Oijen (RMNH); J. Glover (SAM); M. Gomon (MV); D. Hoese (AMS); R. McKay (QM); H. Nijssen (ZMA); J. Paxton (AMS); A. Wheeler and P. Whitehead (BMNH). Special thanks are due D. Hoese (AMS), B. Hutchins (WAM), H. Larson (NTM); W. Starck (Daintree, Queensland), and R. Steene (Cairns, Queensland) for their invaluable collecting assistance. N. Cross assisted with head drawings. Finally we thank C. Allen for her careful preparation of the typescript.

**Appendix I** Gazetteer of localities mentioned in text (abbreviations: I.J. Irian Jaya; N.S.W. New South Wales; N.T. Northern Territory; P.N.G. Papua New Guinea; Qld. Queensland; S.A. South Australia; W.A. Western Australia).

Locality	Lat. & Long.	Locality	Lat. & Long.
Alice River, P.N.G.	6°10'S, 141°08'E	Lizard Island, Qld.	14°40'S, 145°28'E
Archer River, Qld.	13°35'S, 142°09'E	Lorengau River, P.N.G.	2°05'S, 147°00'E
Arnhem Land, N.T.	13°00'S, 134°00'E	Lorentz River, I.J.	5°00'S, 138°40'E
Balimo, P.N.G.	8°01'S, 142°57'E	Madang, P.N.G.	5°12'S, 145°50'E
Bathurst Head, Qld.	14°16'S, 144°12'E	Mamberamo River, I.J.	2°24'S, 137°58'E
Bensbach River, P.N.G.	8°57'S, 141°15'E	Manus Island, P.N.G.	2°05'S, 147°00'E
Bintuni Bay, I.J.	2°10'S, 133°30'E	Mary River, N.T.	12°41'S, 131°39'E
Bogia, P.N.G.	4°16'S, 144°59'E	Mary River, Qld.	25°40'E, 152°35'S
Brisbane, Qld.	27°28'S, 153°01'E	Maryborough, Qld.	25°32'S, 152°42'E
Brisbane River, Qld.	27°28'S, 153°02'E	McArthur River, N.T.	16°40'S, 135°51'E
Brown River, P.N.G.	9° 11'S, 147°14'E	Merauke River, I.J.	8°20'S, 140°10'E
Buna, P.N.G.	8°40'S, 148°25'E	Mitchell River, Qld.	15°25'S, 141°58'E
Caims, Qld.	16°55'S, 145°46'E	Moni River, P.N.G.	9°36'S, 148°37'E
Cape Bowling Green, Qld.	19°17'S, 147°24'E	Moreton Bay, Qld.	27°25'S, 153°20'E
Cape Tribulation, Qld.	16°05'S, 145°28'E	Mosso River, I.J.	2°40'S, 141°00'E
Cardwell, Qld.	18°16'S, 146°01'E	Mowbray River, Qld.	16°34'S, 145°29'E
Camaron, W.A.	24°53'S, 113°40'E	Murray River, S.A.	35°34'S, 138°53'E
Carson River, W.A.	14°29'S, 126°46'E	Murray Swamps, Qld.	18°02'S, 145°56'E
Cooktown, Qld.	15°28'S, 145°15'E	Murrumbidgee River, N.S.W.	34°31'S, 144°22'E
Croker Island, N.T.	11°07'S, 132°33'E	Narooma, N.S.W.	36°13'S, 150°09'E
Daintree River, Qld.	16°16'S, 145°24'E	Niao, P.N.G.	2°48'S, 141°02'E
Daly River, N.T.	13°15'S, 130°41'E	Noosa, Qld.	26°23'S, 153°07'E
Darling River, N.S.W.	31°52'S, 143°05'E	Norman River, Qld.	17°37'S, 141°00'E
Daru, P.N.G.	9°05'S, 143°12'E	Ord River, W.A.	15°35'S, 128°35'E
Darwin, N.T.	12°27'S, 130°50'E	Oriomo River, P.N.G.	9°02'S, 143°12'E
Digul River, I.J.	7°00'S, 140°05'E	O'Shannessy River, Qld.	19°01'S, 138°45'E
East Alligator River, N.T.	12°09'S, 132°13'E	Pie River, P.N.G.	7°30'S, 144°50'E
Endeavour River, Qld.	15°28'S, 145°15'E	Popondetta, P.N.G.	8°45'S, 148°15'E
Finniss River, N.T.	12°51'S, 130°37'E	Port Jackson (Sydney), N.S.W.	33°53'S, 151°13'E
Fitzroy River, Qld.	23°30'S, 150°40'E	Port Moresby, P.N.G.	9°29'S, 147°09'E
Fitzroy River, W.A.	17°29'S, 126°48'E	Port Warrender, W.A.	14°35'S, 125°53'E
Flinders River, Qld.	17°52'S, 140°46'E	Prauwenvivak, I.J.	2°18'S, 138°33'E
Fly River, P.N.G.	8°22'S, 142°40'E	Prince Regent River, W.A.	15°48'S, 125°35'E
Freshwater Creek, Qld.	16°55'S, 145°46'E	Proserpine, Qld.	20°24'S, 148°35'E
Gilbert River, Qld.	16°48'S, 141°20'E	Purari River, P.N.G.	7°46'S, 145°10'E
Girua River, P.N.G.	8°45'S, 148°20'E	Ramu River, P.N.G.	4°02'S, 144°41'E
Gogol River, P.N.G.	5°19'S, 145°47'E	Roper River, N.T.	14°42'S, 134°05'E
Goldie River, P.N.G.	9°21'S, 147°16'E	Safia, P.N.G.	9°36'S, 148°37'E
Gregory River, Qld.	19°39'S, 144°20'E	Samboga River, P.N.G.	8°41'S, 148°20'E
Hall Sound, P.N.G.	8°50'S, 146°33'E	Semai Island, I.J.	3°05'S, 132°30'E
Hartley's Creek, Qld.	16°42'S, 145°40'E	Sepik River, P.N.G.	3°0'S, 143°45'E
Jamur Lake, I.J.	3°40'S, 134°55'E	Sermowai River, I.J.	2°47'S, 140°00'E
Jardine River, Qld.	11°08'S, 142°19'E	Setakwa River, I.J.	4°42'S, 137°25'E
Kavieng, P.N.G.	2°35'S, 150°48'E	Sirinumu Reservoir, P.N.G.	9°30'S, 147°27'E
Kemp Welsh River, P.N.G.	9°17'S, 147°43'E	Starcke River, Qld.	14°19'S, 144°58'E
Kimberley Coast, W.A.	15°00'S, 125°00'E	Strickland River, P.N.G.	6°19'S, 142°04'E

## Review of glassfishes

<b>Locality</b>	<b>Lat. &amp; Long.</b>	<b>Locality</b>	<b>Lat. &amp; Long.</b>
King Sound, W.A.	17°00'S, 123°30'E	Swan River, W.A.	34°34'S, 139°36'E
Klipong River, I.J.	2°30'S, 140°20'E	Sydney, N.S.W.	33°53'S, 151°13'E
Kokoda, P.N.G.	8°58'S, 147°45'E	Townsville, Qld.	19°16'S, 146°49'E
Lake Eyre, S.A.	28°30'S, 137°00'E	Umboi Island, P.N.G.	5°50'S, 147°40'E
Lake Hiawatha, N.S.W.	29°48'S, 153°17'E	Vailala Creek, P.N.G.	9°39'S, 147°25'E
Lake Murray, P.N.G.	7°00'S, 141°30'E	Victoria River, N.T.	15°27'S, 129°57'E
Laloki River, P.N.G.	9°23'E, 147°14'E	Wetar Island, Indonesia	8°00'S, 126°30'E
Leichhardt River, Qld.	18°00'S, 139°49'E	Wewak, P.N.G.	3°33'S, 143°37'E

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