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An ichthyological survey of the Sepik River, Papua New Guinea

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Abstract

A survey of the freshwater fishes of the Sepik River system of northern Papua New Guinea was undertaken by the authors between 1978 and 1985 with the use of gill nets and rotenone, and also by monitoring catches at local villages and markets. We also include records of past expeditions, namely that of the Dutch naturalist Gjellerup in 1910 and the yacht *Illyria* in 1929. The total known freshwater fauna as reported herein consists of 57 species in 35 genera and 23 families. The fauna is typical of other sections of New Guinea and northern Australia in that it is dominated by catfishes (Ariidae and Plotosidae), rainbowfishes (Melanotaeniidae), gudgeons (Eleotrididae) and gobies (Gobiidae) which collectively comprise 57 percent of the total species. With the exception of 22 widely distributed species that are frequently estuarine dwellers and are confined to the lower Sepik, the fishes are strongly endemic, either to the Sepik-Ramu drainages (which interconnect during floods), or the "intermontane trough" composed of the combined Markham, Ramu, Sepik, and Mamberamo systems. Individual accounts, including brief descriptions and information pertaining to habitat, distribution and biology are included for each species. In addition illustrations are provided for many of the endemic species.

Introduction

Considering its size, high rainfall and consequent abundance of fresh water habitats, the inland fishes of New Guinea (the term New Guinea is used in this paper to refer to the geographic unit composed of Papua New Guinea and Irian Jaya) are poorly documented except for scattered localities and a more or less comprehensive treatment of melanotaeniid rainbowfishes (Allen and Cross 1982). The lack of information is easily understood by anyone who has visited this intriguing island. The terrain is extremely difficult to negotiate, distances are vast, roads are few and far between, and air-travel extremely costly and often non-existent to remote destinations. Because of these obstacles relatively few collectors have ventured there. Surprisingly, considering the even greater difficulties at the time, Dutch naturalists made the first significant collections, mainly between 1903 and 1920. The majority of these collections which formed a foundation for our present knowledge of New Guinea freshwater fishes were

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reported by Weber (1908 and 1913). In 1929 the American Crane Pacific Expedition on the yacht *Illyria* made a two months cruise 650 km up the Sepik River and collected 30 species, nine which were described as new (reported by Herre 1935 and 1936). In addition, a collection containing 77 species was obtained in Irian Jaya during 1954-55 by personnel from the Rijksmuseum van Natuurlijke Histoire in Leiden (Allen and Boeseman 1982).

In recent years the only major collections were those from the Fly, Laloki and Purari rivers reported by Roberts (1978), Berra *et al.* (1975), and Haines (1979) respectively. In addition, the fauna of Lake Kutubu was documented by Allen and Hoese (1986). Robert's study of Fly River fishes is particularly notable due to its detail and comprehensiveness. The only recent summaries of the entire New Guinea freshwater fauna are those of Munro (1967) and Allen and Boeseman (1982).

The present study resulted from the collaborative efforts of David Coates, who conducted a gill-net and market survey at several localities, mainly around Angoram on the lower Sepik, and Gerald Allen, who made four visits to the Sepik (1978, 1979, 1982 and 1983) and collected mainly in tributary streams. Details of the gill-net survey conducted between 1981-1983 were given by Coates (1986). In addition, Coates has written a series of reports dealing with the biology of the species important to the local fishery (mainly ariids and large eleotrids) which are quoted later. The present paper reports 57 species belonging to 35 genera and 23 families that have been recorded from the Sepik River system (Table 1).

The only previous collections from the Sepik are those by the Dutchman Gjellerup in September-October 1910 and the already mentioned Crane Expedition of 1929. The species collected on these expeditions are summarised in Table 2. Of the 36 valid species obtained, all but six were recorded during our own survey. Two of the species included in Herre's report of the Crane Expedition, the ophichthid eel *Muraenichthys schultzei* and the carapid *Disparichthys fluviatilis* are normally marine or estuarine fishes. It is possible they were collected from one of the numerous marine locations visited during this trip and were subsequently mislabled. It is highly unlikely that a member of the genus *Carapus* (a senior synonym of *Disparichthys,* see Nelson, 1984) which is commensal with marine holothurians, echinoids, molluscs, and tunicates would occur in fresh water. We have therefore omitted coverage of these two species from the systematics section which follows.

Whitley (1938, 1939 and 1956) described a plotosid catfish (*Lambertichthys ater sepikensis*), a belonid (*Stenocaulis perornatus*), and a lobotid (*Datinoides campbelli*) from the Sepik River. In addition, the following species are among the collections of the Australian Museum and bear Sepik River labels: = *Arius leptaspis* (Bleeker), *Acanthoperca gigas* (= *Parambassis gulliveri* [Castelnau]), *Toxotes chatareus* (Hamilton-Buchanan), and *Oxyeleotris herwerdenii* (Weber). All of the above specimens, including Whitley's types were examined by us. We

Table 1: List of fish species recorded from the Sepik River.

Pristidae
Pristis microdon
Megalopidae
Megalops cyprinoides
Anguillidae
Anguilla marmorata
A. bicolor pacifica
Chanidae
Chanos chanos
Cyprinidae*
Cyprinus carpio
Ariidae
Arius (Brustiarius) nox
A. (B.) solidus
A. velutinus
A. utarus
A. coatesi
Plotosidae
Tandanus coatesi
T. gjellerupi
T. idenburgi
T. novaeguineae
Hemirhamphidae
Zenarchopterus kampeni
Poeciliidae*
Gambusia affinis
Melanotaeniidae
Chilatherina campsi
C. crassispinosa
C. fasciata
Glossolepis multisquamatus
Melanotaenia affinis
Syngnathidae
Microphis spinachoides
Ambassidae
Ambassis buruensis
A. interrupta
Parambassis confinis
Terapontidae
Hephaestus transmontanus
Mesopristes argenteus
Kuhlidae
Kuhlia rupestris
K. marginata
Apogonidae
Glossamia gjellerupi
Carangidae
Caranx sexfasciatus
Lutjanidae
Lutjanus goldiei
Sciaenidae
Pseudosciaena soldado
Cichlidae*
Oreochromis mossambicus
Mugilidae
Liza macrolepis
L. melinoptera
L. tade
Eleotrididae
Butis amboinensis
Eleotris aquadulcis
E. melanosoma
Hypseleotris guntheri
Morgurda bloodi
M. nesolepis
Ophieleotris aporos
Op. porocephala
Oxyeleotris fimbriata
Ox. heterodon
Gobiidae
Glossogobius bulmeri
G. coatesi
G. giurus
G. koragensis
G. torrentis
Mugilogobius fusculus
Redigobius bikolanus
Stenogobius laterisquamatus

Gobioididae
Brachyamblyopus urolepis

* — introduced

* — introduced

Table 2: List of Sepik fishes collected on previous expeditions (reported by: (1) Weber, 1913 and (2) Herre, 1936).

1. Gjellerup Collection (1910)	Present Allocation
Tandanus gjellerupi	*Tandanus gjellerupi*
Hemirhamphus kampeni	*Zenarchopterus kampeni*
Chilatherina fasciata	*Chilatherina fasciata*
Chilatherina crassispinosa	*Chilatherina crassispinosa*
Parambassis confinis	*Parambassis confinis*
Glossamia wichmanni	*Glossamia gjellerupi*
2. Crane Expedition (1929)	
Pristis perotteti	*Pristis microdon*
Anguilla pacifica	*Anguilla pacifica bicolor*
Anguilla spengeli	*Anguilla pacifica bicolor*
Muraenichthys schultzei	*Muraenichthys schultzei*
Disparichthys fluviatilis	*Carapus sp. ?*
Arius leptaspis	*Arius utarus*
Arius solidus	*Arius solidus*
Arius kanganamanensis	*Arius solidus*
Arius nox	*Arius (Brustarius) nox*
Hemipimelodus papillifer	*Arius velutinus*
Zenarchopterus sepikensis	*Zenarchopterus kampeni*
Melanotaenia kabia	*Glossolepis multisquamatus*
Melanotaenia rosacea	*Glossolepis multisquamatus*
Rhombosoma sepikensis	*Melanotaenia affinis*
Apogon abo	*Glossamia gjellerupi*
Parambassis confinis	*Parambassis confinis*
Priopsis buruensis	*Ambassis buruensis*
Kuhlia marginata	*Kuhlia marginata*
Hypseleotris guntheri	*Hypseleotris guntheri*
Eleotris macrolepis	*Eleotris aquadulcis*
Eleotris melanosoma	*Eleotris melanosoma*
Butis amboinensis	*Butis amboinensis*
Mogurnda mogurnda	*Mogurnda bloodi*
Boroda malua	*Oxyeleotris heterodon*
Ophiocara aporos	*Ophieleotris aporos*
Ophiocara porocephala	*Ophiocara porocephala*
Glossogobius celebius	*Glossogobius sp. ?*
Glossogobius giurus	*Glossogobius giurus ?*
Glossogobius koragensis	*Glossogobius koragensis*
Chaenophorus lachrymosus	*Stenogobius laterisquamatus*

were at once suspicious of their Sepik River origin because none of these species were encountered in our own collections, and all are relatively common in the Fly River system of southern Papua New Guinea. Examination of Whitley's types indicate that *Stenocaulis perornatus* = *Strongylura krefftii* (Günther), *Datnioides campbelli* = *D. quadrifasciatus* (Sevastionov) and *Lambertichthys ater*

sepikensis = *Tandanus ater* (Perugia). These three species have never been reported from northern New Guinea, but all were taken in the Fly River by Roberts (1978). All of the so called Sepik material was received from Flight-Lieutenant Stuart Campbell, who also donated a number of specimens from the Fly River (see Whitley, 1938). We are therefore certain that the specimens in the Campbell Sepik collection have been erroneously labeled and actually originated from the Fly River.

The Sepik River

The Sepik River (Figure 1), with a catchment of 78,000 km2 and a length of 1,100 km, is the largest river system in New Guinea. Discharge has been recorded as 10,963 m^3 s^{-1} in May, 1973, and 4,363 m^3 s^{-1} in July, 1973 (Mitchell *et al.* 1980). It rises among the lofty, forested peaks of the Central Dividing Range in the far west of Papua New Guinea. At this point it is separated by only a few kilometres from the Fly-Strickland drainage, the largest river system of southern New Guinea. The first 200 km or so of the Sepik mainstream consists of torrential flow through deep, rocky gorges. Near Telefomin (approximately 900 km upstream) the channel is constricted to a width of only 8-10 m in some places. The river leaves the mountains very close to the Irian Jaya border and is then characterised by strongly braiding channels flowing north for some 60-70 km, with sections on both the Irian Jaya and Papua New Guinea side of the border. The river then turns abruptly to the east and the braiding pattern gives way to a meandering course across the extensive alluvial plain. Since the river was mapped by the German Sepik Expedition in 1913 (see Behrmann 1917), it has dramatically altered its course. The shift of meanders has been particularly great above and below the entrances of major rivers such as the Leonhard Schulze, April, and Karawari (see map in Löffler 1977).

Although we include data from the entire river system, the main focus of the present study is the great alluvial basin in which the river flows some 700 km to the east before entering the Pacific Ocean on New Guinea's northern coast. The plain is sandwiched between the Torricelli Mountains to the north and the Bismarck and Central ranges to the south. In some places it is up to 70 km in width. Because of the constantly shifting river channel the meander belt varies in width between about 5-10 km and is characterized by a maze of oxbows, scroll complexes, backswamps, and lakes (locally called roundwaters). Trees and shrubs cover the higher parts of the bars and swamp grasses are present on the lower parts. The backswamp is covered by floating grass.

Löffler (1977) considers the Sepik to have a more active and immature floodplain than the lower course of the Fly as evidenced by its vigorously changing alluvial depositional system. The Sepik basin has probably been formed by down-warping due to compressional forces between the continental and Pacific plates. This, coupled with recent rises in sea-levels, has resulted only

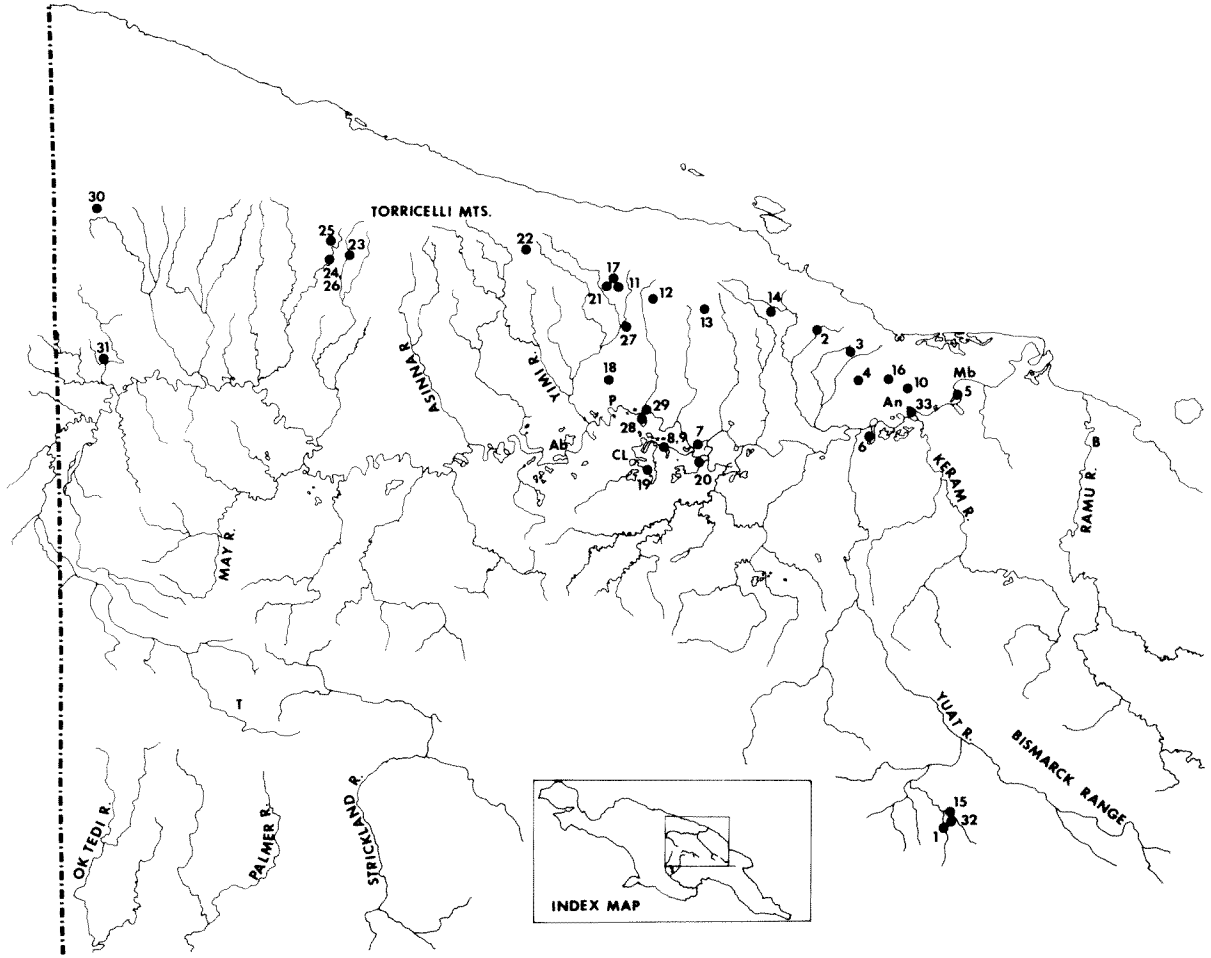

Figure 1: Map of the Sepik River system of northern Papua New Guinea. Numbers refer to collecting sites which are described in detail in the text. The Ok Tedi, Palmer, and Strickland rivers which appear at the lower left corner of the map are part of the Fly River system. Abbreviations are as follows Ab = Ambunti, An = Angoram, B = Bunapas, CL = Chambri Lakes, Mb = Marienberg, P = Pagwi, T = Telefomin.

recently in rapid alluvial deposition in the present basin and the recent development of the existing floodplain. The precise timing of these events is presently being investigated. It is known, however, that the present Sepik floodplains occupy an area that was, until recent geological time, an inland sea bordered by the Torricelli/Bewani mountains to the north and the central dividing range to the south. Recent archeological exacavations at sites presently 70 to 600 km inland on the existing floodplain suggest that some such areas were marine coastal regions as little as 5,000 to 20,000 years ago (Swadling, personal communication). For the present purposes it is sufficient to note that the Sepik floodplains are very much younger than those of the Fly.

The continental shelf along the northern New Guinea coast is much restricted, with very deep water close inshore. This contrasts markedly with the seabed along the southern coast which is shallow for greater distances offshore, particularly at the mouth of the Fly where shallow depths extend across to the Australian landmass. These geological features result in marked differences between northern and southern rivers, such as the Sepik and Fly. The Sepik discharges through a single channel (mouth), whereas the Fly is characterised by an extensive deltaic system with substantial inland estuarine and mangrove habitats. The latter habitats are absent from the Sepik River system, except for the Murik and Watam lakes to the west and east, respectively, of the river mouth. Such differences in river topography are important when comparing the Sepik and Fly ichthyofaunas, especially where those species dependent upon estuarine or mangrove habitats are concerned.

In subsequent discussion we refer to the upper, middle and lower sections of the main river. The upper section refers to the rapidly flowing headwater portion in hilly or mountainous terrain. The middle section includes the braided northerly flowing section as well as the upper meander plain to May River junction. The lower Sepik refers to the entire downstream section below May River junction.

Much of this study is based on the results of a gill-netting survey around Angoram on the lower Sepik (Coates 1986). The limnology of this region was described by Coates *et al.* (1983). At this point the main river channel is typical for the meander belt. During the dry season (roughly May-October) it is characterised by steep mud banks 2 to 5 m in height. The river is very turbid and approximately 400-500 m in width with depths up to 30 m. The water level rises for about six months during the wet season (November-April), usually with the maximum height in April, but occasionally March or May, after which time the level falls for about six months, usually with the minimum height in September, but occasionally August or October. Temperature and pH recordings in the lower Sepik ranged from 27.5-29.6°C and 7.0-7.4 respectively. Only slight temperature differences were noted between the surface and 15 m depth. The pH values recorded in lakes, oxbows, and on the floodplain were generally lower than the main river, ranging from 6.2-7.0. Water temperatures

in these areas ranged between 28.2-33.9°C at the surface with often a reduction of 3-6°C at 15 m depth in lakes. Water chemistry data are presented in Table 3.

Table 3: Water chemistry data for selected Sepik River sites.

Location		(1) Sepik River Angoram	(1) Upper Sepik near Telefomin	(2) Sepik River at Pagwi	(2) Sepik River at Tambali
Date		14.03.79	22.03.79	02.08.79	03.08.79
Time		—	—	10.30 a.m.	12.15 p.m.
Colour	Hazen Unit	35	10	—	—
Turbidity	J.T.U.	150	45	150	150
pH		7.0	7.9	7.05	7.18
Conductance	umho cm^{-1}	110	250	124	125
T.S.S.	mg l^{-1}	327	53	68	68
T. Hardness	mg $l^{-1}CaCO_3$	39	110	56	57
Alkalinity	mg $l^{-1}CaCO_3$	39	104	58	62
Ca	mg l^{-1}	11	42	15	16
Mg	mg l^{-1}	3	1	4	4
Na	mg l^{-1}	3	1	3	4
K	mg l^{-1}	0.6	0.1	0.4	0.4
Total Cations	mg l^{-1}	0.92	2.25	1.21	1.3
HCO3	mg l^{-1}	49	127	71	76
CO3	mg l^{-1}	nil	nil	—	—
Cl	mg l^{-1}	2	nil	nil	nil
SO4	mg l^{-1}	nil	5	5	4
F	mg l^{-1}	0.4	0.4	0.2	0.1
SiO2	mg l^{-1}	11	3	13	12
Total Anions	mg l^{-1}	0.84	2.18	1.26	1.33

(1) = data obtained from the Assay Laboratory of the Department of Minerals and Energy.
(2) = data from Mitchell et al. (1980). This reference also gives further data for Sepik Lakes.

The larger, lowland tributaries, particularly those flowing northward such as the Keram, Yuat, and May rivers, are similar in general characteristics to the Sepik mainstream. Tributaries in hilly or mountainous terrain are often clear during non-flood periods and frequently consist of rocky pools interspersed between more vigorously flowing sections. Although our data are restricted to only 10 stations from creeks in the Torricelli Mountains, pH values ranged from 7.2-8.0. Herre (1936) remarked that the lowland tributaries of the Sepik were either "white" (i.e. muddy) or "black". The blackwater streams have relatively clear, but very dark brown water and are richest in fish life. He noted that villages are usually situated next to blackwater streams.

Faunal Composition and Relationships

Whitley (1938) was among the first to note that the freshwater fish faunas of northern and southern New Guinea are quite distinct. Indeed, investigations

by Allen indicate that only a single melanotaeniid and a few gobioid fishes that occur in central highland streams are shared by both northern and southern watersheds. The central mountains thus provide a formidable barrier to dispersal. Allen (1987) noted that highland streams in the Sepik and Fly-Strickland systems had greatly impoverished fish faunas. He suggested this impoverishment could be attributed to a combination of features including relatively recent concurrent glaciation and volcanism, cool temperatures, steep gradients, and high rainfall.

There is a strong relationship between the freshwater faunas of northern Cape York Peninsula, Arnhem Land, and central- southern New Guinea. These same relationships are reflected in the geological origins of the region. Southern New Guinea is an integral part of the Australian plate, whereas northern New Guinea was formed in relatively recent geologic times, resulting from faulting, folding and upthrusting in the zone of collision between the Australian and Pacific plates (Löffler, 1977). The area and faunal relationships (based on analysis of Ariidae, Plotosidae, Atherinidae, Melanotaeniidae, Ambassidae, Apogonidae, Toxotidae, Gobiidae, and Eleotrididae) are summarised in Figure 2.

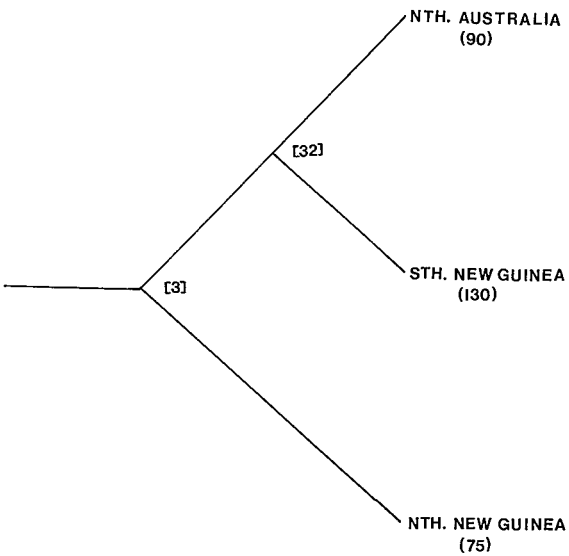

Figure 2: Cladogram indicating geological and faunal relationships within the Australia-New Guinea region. The approximate number of species for each major province is indicated in parentheses and the number of species shared by the provinces appears in brackets. Diadramous and partly estuarine species are excluded from this analysis. (Northern Australia Cape York Peninsula and Arnhem Land).

The combined faunas (excluding fishes that are mainly estuarine) of southern New Guinea and far northern Australia include approximately 160 species of which 32 are shared by these regions (Figure 2). This is about twice the fauna

of northern New Guinea which has only about 75 known species, only three of which are shared with southern New Guinea. There is great similarity between the three major areas at the generic and familial level, although each region possesses several endemic genera and the Osteoglossidae, Belonidae, Engraulidae, Iriatherinidae, Centropomidae, Lobotidae and Toxotidae are not represented in fresh waters of northern New Guinea.

The Sepik River is part of the largest faunal province of northern New Guinea, both in terms of physical size and number of fish species. It extends from Huon Gulf in Papua New Guinea to Geelvink Bay in Irian Jaya encompassing the Markham, Ramu, Sepik, and Mamberamo river valleys. Geologists refer to this major structural element as the Sepik-Markham depression or the central intermontane trough (Löffler 1977). It has been a zone of relative subsidence since the later Tertiary and its margins are characterised by steep fault scarps. The valley floor is filled with terrestrial clastic sediments forming extensive alluvial plains and fans. The relief between the major river systems is relatively low and judging from the number of shared species, has not formed a significant barrier to fish dispersal.

A total of 57 species have thus far been recorded from the Sepik River and its tributaries including three introduced fishes (carp, mosquitofish, and tilapia) (Table 1). A recent survey in the adjacent Ramu drainage (Allen, Parenti, and Coates, unpublished) resulted in a similar total. Most of the 66 species found in the two systems are shared, which is predictable as a number of streams interconnect the lower reaches of the two rivers during the flood season. The following five species from the lower Ramu River near Bunapas (approximately 40 km upstream) were not collected by us in the Sepik, but can be expected to occur there: *Escualosa thoracata* (Valenciennes) — Clupeidae; *Microphis brachyurus* (Bleeker) — Syngnathidae; *Leiognathus equulus* (Forsskål) — Leiognathidae; *Scatophagus argus (Linnaeus)* — Scatophagidae; and *Pseudapocryptes lanceolatus* (Bloch and Schneider) — Gobiidae. In addition, we examined fins from a shark caught in the lower Ramu which is probably *Carcharhinus leucas* (Valenciennes), a circumtropical species reported to occur in New Guinea fresh water by Boeseman (1964).

A zoogeographic analysis is presented in Table 4. The largest category of Sepik fishes, containing approximately 38 percent of the total species, is that comprised of species with relatively widespread distributions throughout the Indo-Australian Archipelago or beyond this region. This group contains diadramous species such as anguillid eels and other fishes which commonly occur in brackish estuaries or marine conditions and are restricted to the lower parts of the river. The majority of purely freshwater species have relatively limited distributions that are restricted to parts of or the entire intermontane trough watersheds formed by the Markham, Ramu, Sepik, and Mamberamo rivers. The following ten species are considered to be Ramu-Sepik system endemics (see systematics section for further information): *Arius coatesi* and *A. utarus, A. (Brustarius) nox,*

Tandanus coatesi, Microphis spinachoides, Hephaestes transmontanus, Glossogobius bulmeri, G. koragensis, G. coatesi, G. torrentis and Eleotris aquadulcis.

Table 4: Zoogeographic Analysis of Sepik River Fishes.

	No. of species	% of total fishes
Widely distributed in Indo-Australian region or beyond (mainly in lower river)	23	40.3
Sepik-Ramu endemics	9	1.8
Sepik-Ramu-Mamberamo endemics	8	14.0
Widespread Nth. New Guinea	6	10.5
Nth. and Sth. New Guinea	3	5.3
Introduced species	3	5.3
Markham-Ramu-Sepik-Mamberamo	2	3.5
Sepik-Memberamo-Lake Sentani	1	1.8
Sepik-Ramu-Lake Sentani	1	1.8
Gogol-Ramu-Sepik-Mamberamo	1	1.8

The familial composition of the Sepik ichthyofauna is typical of that found in freshwater systems throughout the New Guinea-northern Australia region. The fauna is dominated by gobioids (Gobiidae and Eleotrididae), catfishes (Ariidae and Plotosidae), and rainbowfishes (Melanotaeniidae) which collectively comprise 57 percent of the fishes. It is worthwhile to further compare the ichthyofauna of the well studied Fly River (see Roberts, 1978) with that of the Sepik (Table 5). The Fly region is part of the older Australian plate and had a land connection with the Australian continent for much of its geologic history. Hence, the Fly represents an older, more mature stage of riverine evolution. Although highland tributaries in New Guinea are generally depauperate (Allen, 1987), there are far more fishes up-river in the Fly than in the Sepik. For example, Roberts (1978) recorded 16 species at distances between 901 and 966 km upstream from the mouth of the Fly, whereas a maximum of only four species was encountered in a mountain tributary of the Sepik about 450 km upstream (Allen, 1987). The Sepik mainstream is particularly impoverished in its upper section. Allen (1987) noted that in spite of suitable habitats fishes were unknown from both mainstream and tributaries in the vicinity of Telefomin, about 900 km upstream (Figure 3). Although our collections in the Sepik system were randomly scattered it is apparent there is an attenuation of species related to increased altitude and/or increased distance upstream. More methodical collections in the Ramu system (Allen, Parenti, and Coates, unpublished) indicate that the lower and middle reaches of the river are at least twice as speciose as the upper parts.

Another major difference concerns the catfish faunas of the two systems. The Sepik has nine species (5 ariids and 4 plotosids), all generalised omnivores (Coates unpublished). By contrast an impressive radiation has occurred in southern New

Table 5: Comparison of freshwater fish faunas of the Fly and Sepik river systems of Papua New Guinea, excluding introduced species. (* signifies members of that family are expected to occur but have not yet been recorded).

Family	Number of Species Fly	Sepik
Carcharhinidae	-*	-*
Pristidae	1	1
Osteoglossidae	1	-
Megalopidae	1	1
Anguillidae	-*	2
Chanidae	-	1
Moringuidae	1	-
Clupeidae	3	-*
Engraulidae	2	-
Ariidae	13	5
Plotosidae	7	4
Belonidae	1	-
Hemiramphidae	1	1
Melanotaeniidae	6	5
Iriatherinidae	1	-
Pseudomugilidae	2	-
Atherinidae	2	-
Syngnathidae	-*	1
Ambassidae	5	3
Centropomidae	1	-
Lobotidae	1	-
Terapontidae	5	2
Kuhliidae	-*	2
Apogonidae	4	1
Carangidae	-*	1
Lutjanidae	1	1
Sparidae	1	-
Sciaenidae	1	1
Toxotidae	2	-
Scatophagidae	1	-*
Mugilidae	2	3
Eleotrididae	8	10
Gobiidae	10	9
Periophthalmidae	2	-*
Gobioididae	1	1
Soleidae	2	-
Totals	89	55

Guinea, with 13 ariids and 7 plotosids native to the Fly-Strickland systems. At least two of the southern ariids exhibit specialized feeding habits: *Arius augustus* is primarily a fish eater and *Cinetodus froggatti* appears to feed exclusively on molluscs. Three ariid genera *Nedystoma, Cinetodus* and *Cochlefelis,* and the

plotosid genus *Oloplotosus* are endemic to central-southern New Guinea (Roberts 1978). The most specialised Sepik ariid is *A. (B.) nox* which filter-feeds extensively on dipteran and other small insect larvae (Coates unpublished). In this respect, its habits are similar to the Fly *Nedystoma dayi* and both species have a high number of modified gill-rakers. A review of the freshwater ariids of northern New Guinea by Kailola is provided elsewhere in the present volume.

Several major habitats, each with more or less distinctive fish communities, are represented in the Sepik and other large river systems of northern New Guinea; at least three are found on the alluvial floodplain. The main river channel (Figure 4) and large tributaries are characterised by relatively slow-flowing, muddy water, a soft silty substratum, grass covered banks, and frequent log snags. Fishes that are largely restricted to this habitat include *Glossogobius coatesi, Arius coatesi, A. velutinus,* partially marine or estuarine dwellers considered as vagrants into the lower river such as *Caranx sexfasciatus, Pseudosciaena soldado,* and *Ambassis interrupta* and the larger diadromous species such as *Pristis microdon* and *Lutjanus goldeii.* Another lowland habitat consists of still or very slow-flowing waters of roundwaters (isolated parts of former river channels), lakes (Figure 5) channels (locally referred to as barats, see Figure 6), and swamps. Common species in this environment include *Arius solidus, A. utarus, A. (Brustarius) nox, Glossolepis multisquamatus, Glossoglobus koragensis, Eleotris aquadulcis, Ophieleotris aporos,* and *Oxyeleotris heterodon,* as well as introduced carp and tilapia. The inundated floodplain is an extension of this habitat, which is typically well vegetated with submerged grasses and a variety of aquatic plants. Coates (1985), however, noted the apparent absence of species adapted to floodplain conditions and suggested that this was one factor resulting in the reduced yield of the fishery in this region. Although many of the lake dwellers may enter marginal floodplain, of the native species only *Ophieleotris aporos, Oxyeleotris heterodon* and *Glossolepis multisquamatus* exhibit any marked affinity for this environment. Another lowland habitat consists of "blackwater" tributaries, typically flowing through rainforest and characterised by relatively clear, "tea-stained" water. These streams are frequently populated by *Arius utarus, Tandanus novaeguineae, Zenarchopterus kampeni, Melanotaenia affinis, Parambassis confinis,* and *Glossamia gjellerupi. Megalops cyprinoides* appears to venture widely through all of the aforementioned habitats (Coates 1987a). Hillstream and mountain tributaries represent the last major habitat. Water clarity is generally good during the dry season, flow rates are highly variable, and the substratum consists of a mixture of solid rock, boulders, cobbles, and sand. Aquatic vegetation is generally minimal except in associated swamps, ponds and lakes. Common fish inhabitants include *Tandanus* spp. (often *T. coatesi*), *Chilatherina crassispinosa, Melanotaenia affinis, Glossamia gjellerupi, Hephaestus transmontanus, Glossogobius torrentis,* and *Mogurnda nesolepis.* Another gudgeon, *Mogurnda bloodi,* is sometimes found in these streams and associated swamps.

Figure 3: Highland tributary of the upper Sepik River near Telefomin.

Figure 4: Sepik River near Pagwi, approximately 390 km upstream from the sea.

Figure 5: Gill net fishing at Chambri Lake, situated on the floodplain of the lower Sepik.

Figure 6 Small tributary of the Sepik River near Pagwi.

Methods

The majority of sampling in the main river and associated floodplain habitats was achieved by gill-netting between 1981 and 1983 under the supervision of Coates (1986). Fleets of surface-set gill nets with mesh size ranging from 25-152 mm (stretched mesh) were set regularly (usually at least monthly) in three lakes and at one inundated floodplain site in the vicinity of Angoram. Nets were also set periodically at other widely scattered locations, including roundwaters (i.e. cut off channels in the meander belt), floodplain, lakes, and main river channels. Further detail of these locations and methods of gill-net setting are given in Coates (1986). Additional data were obtained during bi-weekly recordings of fish landings at Angoram market since 1981 and continuing. The market was an especially important source of information for larger species that are restricted to the main river channels as these areas were not regularly sampled. In addition, specimens, observations and catch reports were occasionally obtained from local fishermen. We also utilised rotenone powder, particularly for collections in small tributaries. The latter collections are deposited at the Western Australian Museum (WAM). A representative collection was also given to the Papua New Guinea Fisheries Research Station at Kanudi (KFRS). We also

examined Sepik material at the American Museum of Natural History, New York (AMNH) and the Australian Museum, Sydney (AMS).

In the following systematics section we provide coverage of each species known to inhabit fresh water in the Sepik system. Illustrations are provided for most of the species that are endemic to river systems of the northern "intermontane trough". Abbreviated literature citations which include the author, year of publication, page number, and locality are given for the original description, the first Sepik record, and in a few cases junior synonyms if the type locality is in the Sepik system. A brief diagnostic description (from our own investigations or from published accounts), and notes on habitat and distribution are also included. We also include a summary of biological data for many species based on published reports where possible. Reporting on the biology of many of the species is ongoing; Coates should be contacted for updates.

Collecting Stations

A list of the specimens examined by us is included in each species account. Fieldwork in the Sepik system between 1978 and 1983 resulted in rotenone and seine collections at 33 localities. Eleven of these stations were situated in the Sepik mainstream and other habitats on the lowland alluvial plain. The 22 remaining stations were in hill and mountain tributaries, primarily in the Torricelli Mountains on the northern edge of the Sepik Basin. Unfortunately, some of the fishes captured in the gill-net survey were not saved after biological data were recorded but most identifcations were confirmed by either Allen or other workers as mentioned. The idea to undertake a collaborative museum based taxonomic study was not formulated until after the 1981-1983 sampling program was completed. However, a representative sample of most species taken in the survey was deposited at WAM and are collectively included in station 33. All collection sites are indicated in Figure 1.

Station 1: Baiyer River near Baiyer River Village (5°34'S, 144°09'E), approximately 260 km from Sepik mainstream and 450 km from river mouth, elevation approximately 1200 m, 1 September 1978, seine net over gravel bottom, water clear with moderate flow through open section of rainforest; depth to 0.3 m.

Station 2: Small (approximately 3 m diameter) stagnant pool at side of Wewak-Angoram Road, 36 km east of Wewak (3°47'S, 143°44'E), approximately 80 km from Sepik mainstream and 230 km from river mouth, elevation approximately 150 m, 7 September 1979, seine net over mud and rock bottom, water moderately turbid and still in rainforest.

Station 3: Small creek on Wewak-Angoram Road, 43 km east of Wewak (3°52'S, 143°52'E), approximately 70 km from Sepik mainstream and 190 km from river mouth, elevation approximately 120 m, 7 September 1979, seine net over mud bottom, water clear and slow flowing through rainforest, depth to 0.4 m.

Station 4: Small creek on Wewak-Angoram Road, 73 km east of Wewak (3°58'S, 143°54'E), approximately 55 km from Sepik mainstream and 200 km from river mouth, elevation approximately 85 m, 7 September 1979, seine net over mud bottom, water clear and slow flowing through open section of rainforest, depth to 0.4 m.

Station 5: Mambel Creek, about 1 km north of Mambel Village (4°02'S, 144°14'E), approximately 1 km from Sepik mainstream and 100 km from river mouth, elevation approximately 15 m, 7 September 1979, seine net over mud and leaf litter bottom, water clear and very slow flowing through closed canopy rainforest, depth to 0.2 m.

Station 6: Tambali Lagoon (4°10'S, 143°55'E), oxbow lake near Sepik mainstream, approximately 160 km from river mouth, elevation approximately 18 m, 8 September 1979, seine net along heavily vegetated shore, water moderately turbid and still, depth to 2.0 m.

Station 7: Small creek, tributary of Chambri Barat near Chambri Village (4°12'S, 143°18'E), approximately 5 km from river mouth, elevation approximately 20 m, 8 September 1979, rotenone over mud bottom, water clear and slow flowing through open flood plain; depth to 1.0 m.

Station 8: Chambri Barat at Chambri Lakes Mission (4°12'S, 143°11'E), approximately 10 km from Sepik mainstream and 290 km from river mouth, elevation approximately 20 m, 9 September 1979, seine net over mud bottom, water slightly turbid and still, open shore with reeds, depth to 0.4 m.

Station 9: Tambali Lagoon (4°12'S, 143°11'E), oxbow lake near Sepik mainstream, approximately 160 km from river mouth, elevation approximately 18 m, 9 September 1979, seine net over mud bottom, water moderately turbid, along open, vegetated margin, depth to 2.0 m.

Station 10: Bagi Creek, about 10 km west of Salamandi Village (4°00'S, 144°03'E), approximately 15 km from Sepik mainstream and 130 km from river mouth, elevation approximately 30 m, 10 September 1979, seine net over mud bottom, water clear and slow flowing through open section of rainforest, depth to 0.4 m.

Station 11: Small creek on Maprik-Dreikikir Road, about 5 km from Maprik (3°38'S, 143°02'E), approximately 50 km from Sepik mainstream and 450 km from river mouth, elevation approximately 150 m, 11 September 1979, seine net over mud bottom, water clear and slow flowing through open section of rainforest, depth to 0.3 m.

Station 12: Small creek on Wewak-Maprik Road about 112 km west of Wewak (3°40'S, 143°09'E), approximately 60 km from Sepik mainstream and 460 km from river mouth, elevation approximately 170 m, 11 September 1986, seine net over sand bottom, water clear and slow flowing through open section of rainforest, depth to 0.4 m.

Station 13: Trubum Creek on Wewak-Maprik Road, about 79 km west of Wewak (3°43'S, 143°20'E), approximately 35 km from Sepik mainstream and 385 km from river mouth, elevation approximately 165 m, 11 September 1986, seine net over mud bottom, water clear and slow flowing through open section of rainforest, depth to 0.5 m.

Station 14: Nagam River Crossing on Wewak-Maprik Road (3°43'S, 143°34'E), approximately 70 km from Sepik mainstream and 270 km from river mouth, elevation approximately 80 m, 11 September 1979, seine net over mud bottom, water turbid and moderately flowing through open section of rainforest, depth to 1.5 m.

Station 15: Trauna River at Baiyer River Wildlife Sanctuary (5°31'S, 144°11'E), approximately 260 km from Sepik mainstream and 460 km from river mouth, elevation approximately 1200 m, 18 September 1979, seine net over sand and rock bottom, water clear and moderately flowing through open section of rain forest, depth to 0.6 m.

Station 16: Saramandi Creek about 8 km north of Gavien Village (3°58'S, 144°00'E), approximately 15 km upstream from Sepik mainstream and 150 km from river mouth elevation approximately 40 m, 15 October 1982, rotenone over sand bottom, water clear and slow flowing through open section of rainforest, depth to 1.5 m.

Station 17: Nimbrim Creek, bridge crossing on Maprik-Lumi Road (3°37'S, 143°01'E), approximately 50 km upstream from Sepik mainstream and 450 km from river mouth, elevation approximately 200 m, 19 October 1982, rotenone over sand and rock bottom, water clear and moderate to fast flowing through open section of rainforest, depth to 1.5 m.

Station 18: Huins Creek, bridge crossing on Pagwi-Maprik Road, about 10 km north of Pagwi (3°58'S, 143°00'E), approximately 10 km from Sepik mainstream and 400 km from river mouth, elevation approximately 30 m, 19 October 1982, rotenone over mud and rock bottom, water clear and slow flowing through closed canopy rainforest, depth to 1.8 m.

Station 19: Chambri Lake on east side about 1 km west of Chambri Village (4°17'S, 143°08'E), approximately 10 km from Sepik mainstream and 290 km from river mouth, elevation approximately 20 m, 21 October 1982, gill-net over mud bottom, water slightly turbid and still, depth to 2.0 m.

Station 20: Small rivulet draining into Chambri Barat about 4 km downstream from Chambri Lake (4°16'S, 143°11'E), approximately 10 km from Sepik mainstream and 290 km from river mouth, elevation approximately 20 m, 22 October 1982, rotenone over mud bottom, water clear and slow flowing through open floodplain, depth to 0.5 m.

Station 21: Nina River about 6 km west of Maprik (3°37'S, 143°00'E), approximately 70km from Sepik mainstream and 460 km from river mouth, elevation approximately 150 m, 23 October 1982, rotenone over mud, sand, and gravel bottom, water clear and moderately fast flowing through open section of rainforest, depth to 1.0 m.

Station 22: Wongol Creek, about 8 km east of Lumi village near Gweinif River (3°30'S, 142°07'E), approximately 70 km from Sepik mainstream and 680 km from river mouth, elevation approximately 460 m, 24 October 1982, rotenone over sand, gravel and rock bottom, water clear and slow flowing through open section of rainforest, depth to 1.2 m.

Station 23: Orutei Stream, crossing on Lumi-Maprik Road about 6 km east of Lumi (3°31'S, 142°04'E), approximately 75 km from Sepik mainstream and 685 km from river mouth, elevation approximately 470 m, 24 October 1982, seine net over mud and rock bottom, water clear and fast flowing through open gully, depth to 0.5 m.

Station 24: Yamkil Swamp, next to Lumi High School (3°32'S, 142°00'E), approximately 75 km from Sepik mainstream and 685 km from river mouth, elevation approximately 470 m, 25 October 1982, rotenone over muddy, densely vegetated bottom, water clear and still in open clearing surrounded by rainforest, depth to 0.5 m.

Station 25: Sibi River, road crossing about 3 km north of Lumi (3°28'S, 142°00'E), approximately 90 km from Sepik mainstream and 700 km from river mouth, elevation approximately 500 m, 25 October 1982, seine net over sand and gravel bottom, water clear and fast flowing through rainforest, depth to 0.3 m.

Station 26: Yamkil Creek near Lumi High School (3°32'S, 142°00'E), approximately 75 km from Sepik mainstream and 685 km from river mouth, elevation approximately 470 m, 25 October 1982, rotenone and seine net over mud bottom, water clear and very slow flowing through closed canopy rainforest, depth to 1.0 m.

Station 27: Small creek on Pagwi-Maprik Road about 25 km north of Pagwi (3°46'S, 143°03'E), approximately 35 km from Sepik mainstream and 435 km from river mouth, elevation approximately 35 m, 26 October 1982, rotenone over sand and mud bottom, water clear and slow flowing through closed canopy rainforest, depth to 0.5 m.

Station 28: Sepik River, mouth of small creek about 8 km downstream of Pagwi (4°06'S, 143°06'E), approximately 380 km from river mouth, elevation approximately 25 m, 27 October 1982, rotenone over mud bottom, water very turbid and slow flowing through open area of tall grass, depth to 3.0 m.

Station 29: Kwatit River, near mouth about 9 km down Sepik River from Pagwi (4°05'S, 143°06'E), approximately 0.5 km from Sepik mainstream and 380 km

from river mouth, elevation approximately 25 m, 28 October 1982, rotenone over mud bottom, water very turbid and slow flowing through open, grassy floodplain, depth to 2.0 m.

Station 30: Small creek near end of landing strip at Imonda (3°20'S, 141°10'E), approximately 160 km from Sepik mainstream and 870 km from river mouth, elevation approximately 300 m, 2 November 1982, rotenone and seine net over sand bottom, water very turbid and fast flowing (in flood) through closed canopy rainforest, depth to 1.6 m.

Station 31: Small creek about 700 m northwest of end of landing strip at Green River Village (3°53'S, 141°11'E), approximately 20 km from Sepik mainstream and 790 km from river mouth, elevation approximately 85 m, 27 October 1983, rotenone over sand and gravel bottom, water clear and slow flowing through closed canopy rainforest, depth to 1.0 m.

Station 32: Kwinkya Creek, crossing at Baiyer River Cattle Station (5°32'S, 144°11'E), approximately 260 km from Sepik mainstream and 450 km from river mouth, elevation approximately 1200 m, 5 October 1983, rotenone over sand and gravel bottom, water clear and moderately flowing through open section of rainforest, depth to 0.5 m.

Station 33: Sepik River, and adjacent lakes and floodplain in the vicinity of Angoram (4°05'S, 144°04'E), approximately 120 km from mouth, elevation approximately 16 m, gill-netting program between 1981-1983.

Systematics

Pristiidae (Sawfishes)

Pristis microdon

Pristis microdon Latham, 1794: 280 (no locality).
Pristis perotteti. — Herre, 1936: 434 (Sepik River).

Material examined:

No specimens were captured during the survey, but several "saws" in the possession of local fishermen were examined.

Diagnosis (from Munro 1967).

Elongated, flattened snout with 17-22 teeth along each side; first dorsal fin origin opposite or slightly behind posterior tips of pectorals, its base ending behind origin of pelvic fins; second dorsal fin origin midway between end of first dorsal base and tail base, its tip failing to reach tail base by a length equal to half its base; lower caudal lobe indistinct; colour grey to reddish-brown above and white below; maximum total length about 406 cm.

Habitat

Inhabits large turbid rivers and brackish estuaries.

Distribution

Widely distributed along the continental margin of the tropical Indian and western Pacific oceans.

Biology

There is little information on the biology of this species, but judging from the wide variety of "saw" sizes seen inland it is likely that breeding in this ovoviviparous species occurs in fresh water. Small juveniles are regularly netted far upstream in the Mitchell River on Cape York Peninsula, Australia.

Munro (1967) reported that sawfishes feed on small schooling fishes such as mullet and herring, and also consume bottom invertebrates. He further stated that the "saw" can be used to stun or kill fishes, but is primarily employed for uncovering prey items in soft mud.

Megalopidae (Tarpons)

Megalops cyprinoides

Clupea cyprinoides Broussonet, 1782: Pl. 9 (New Hebridies).

Material examined

A total of 278 specimens, 103-440 mm SL were captured during the gill-net survey of 1981-1983, but none were retained. However, we have examined a specimen, 170 mm SL, from the Laloki River near Port Moresby at WAM.

Diagnosis

(from Smith 1986). Dorsal rays 17 to 20; anal rays 24 to 31; pectoral rays 15 or 16; pelvic rays 10 or 11; gill rakers on first arch 15 to 17 + 30 to 35; lateral-line scales 36-40; branchiostegals 23-27; vertebrae 67 or 68; adipose tissue covering eye; mouth large, rear margin of upper jaw below rear part of pupil; elongate filamentous extension on last dorsal ray; colour mainly silvery in life, yellowish or tan with silvery sheen in preservative; maximum total length about 100 cm (44 cm SL in Sepik).

Habitat

Still waters of mangrove swamps and estuaries, frequently entering fresh water. In the Sepik system it is found in the main river, lakes, floodplain, and major tributaries. It has been found as far as 530 km upstream from the Sepik entrance. Roberts (1978) recorded it at 905 km upstream in the Fly River.

Distribution

Widespread in the tropical Indo-Pacific region from eastern Africa to the islands of Polynesia (excluding the Hawaiian Islands) and from Australia northward to southern Japan.

Biology

Adults spawn in sea and estuaries. The larvae, known as leptocephali, are transparent, elongate, and ribbon-like. After metamorphosis the young fish migrate upstream. Its biology in the Sepik was reported by Coates (1987a). Juveniles begin to migrate into fresh water at about 100 mm SL during April-July at the end of the flood season. During the present survey relatively low numbers were caught, usually only one or two individuals per fleet of gill nets. The species is reported to attain at least 100 cm, but the largest Sepik fish was only 440 mm SL (1.5 kg) and most were much smaller. All but one had very small, inactive gonads, thus supporting our contention that mainly juveniles ascend the river. The smallest fish (>150 mm SL) were caught from May to August with a pronounced disappearance of this class by September, perhaps an indication that these fish had continued their migration upstream. There was also a peak in the catch of 150-250 mm fish in April. Individuals larger than 250 mm SL showed no obvious seasonality in abundance.

Fat deposition was strongly correlated with fish length. Small individuals (<150 mm SL) had no intestinal fat and only fish exceeding 350 mm SL had significant amounts of stored fat. The stomachs of 142 specimens were examined of which 33 percent were empty. The dominant food items included small prawns (*Caridina* spp), aquatic insect larvae and nymphs, terrestrial insects, and small fish (including juveniles of *Ophieleotris aporos* and *Oxyeleotris heterodon, Ambassis interrupta,* and *Oreochromis mossambicus*) but it is not an important piscivore. Salvinia root fibres were conspicuous in the stomachs of many individuals and were presumably ingested accidentally while feeding on the infauna of the roots of this floating weed.

Anguillidae (Freshwater eels)

Anguilla marmorata

Anguilla marmorata Quoy & Gaimard 1824: 241 (Waigiu).

Material examined

A single specimen, 675 mm TL, was purchased from the Angoram market in June 1982, but was subsequently lost. However, we have examined 27 specimens, 56-225 mm TL from various localities in northern New Guinea at WAM.

Diagnosis

Typical eel shape; dorsal fin origin well in advance of anal fin origin; dorsal originates less than head length behind gill opening; pectoral rays 15 to 21; vertebrae 100 to 110 (prehaemal vertebrae 39 to 43); body depth about 14 to 21, head 7-7.5, both in total length; colour yellowish to brown with darker spots and markings which increase with age; maximum total length about 180 cm.

Habitat

Rarely seen during our Sepik survey. Is relatively common in small rocky creeks along the north coast of New Guinea, usually in close proximity to the sea.

Distribution

Widely distributed in the tropical Indo-Pacific region from East Africa to high islands of the central Pacific including the Fiji, Samoa, Society and Marquesas islands.

Biology

There is little information on biology. Limited data presented by Ege (1939) suggested that the ascent of juvenile elvers from the sea into fresh waters was not restricted to any definite time of year as in certain Atlantic species.

Anguilla bicolor pacifica

Anguilla bicolor pacifica Schmidt 1932 8: (Philippines and New Guinea).
Anguilla pacifica. — Herre 1936: 434 (Sepik River).
Anguilla spengeli. — Herre 1936: 435 (Sepik River).

Material examined

WAM P.27832-007, 6 specimens, 152-327 mm TL, station 16; WAM P.27835-001, 244 mm TL, station 17; WAM P.27845-001, 3 specimens, 191-245 mm TL, station 27; WAM P.27846-008, 240 mm TL, station 28.

Diagnosis

Typical eel shape; dorsal and anal fin origins about equal; dorsal-anal fins occupying posterior two-thirds of body; pectoral rays 14 to 20; vertebrae 103 to 111 (prehaemal vertebrae 41 to 45); body depth about 16 or 17, head 7-8.5, both in total length; colour grey to dark brown above and yellow or whitish ventrally; maximum total length about 100 cm.

Habitat

Specimens were captured from the main river channel, lowland tributaries, and in foothill creeks of variable flow rates to elevations of at least 400 m.

Distribution

A. bicolor pacifica is known from the Philippines, Borneo, Celebes, New Guinea and the Bismarck Archipelago. The nominal *A. bicolor bicolor* ranges widely in the tropical Indian Ocean from East Africa to Indonesia and north-western Australia.

Biology

This species is seasonally abundant in the Sepik mainstream. There appears to be an upstream migration of smaller eels (<300 mm TL). This phenomenon

occurred during February and March 1982. In 1983 the migration was first noted in late January and continued until mid March. Apparently little or no feeding takes place during these periods as the stomachs of 100 immature eels (<300 mm TL) were empty and scarcely any fat reserves were detected. Larger eels (>350 mm TL) were less common, but also showed an indication of seasonal "runs". These larger fish had substantial fat reserves and 29 of 100 dissected specimens had food items in the stomach. The contents consisted mainly of detritus and plant fragments. Interestingly the most common item was pieces of sago (*Metroxylum*), a pulpy plant from which an edible flour is extracted. Most of the larger eels were captured in the vicinity of sago-processing troughs. Eels were rarely caught in gill nets. The above information was mainly derived from market observations and catches obtained from hired fishermen using fine-mesh hand nets and in the case of larger eels hook and line or spears. All observations were made near Angoram. The size range of specimens was 134-789 mm TL.

Chanidae (Milkfishes)

Chanos chanos

Chanos chanos Forsskål, 1775: 74 (Red Sea).

Material examined

A single specimen, 190 mm SL, was caught in the Lower Sepik near Angoram in December 1982. However, it was not retained.

Diagnosis

(from Smith, 1986). Dorsal rays 13 to 17; anal rays 8 to 10; pectoral rays 15 to 17; pelvic rays 10 to 12; lateral line scales 78 to 90; gill rakers 147 to 160 + 107 to 165; body depth 3.1 to 4.7; eye diameter greater than snout length and interorbital width; torpedo-shaped body with cycloid scales; head naked; mouth small, maxilla not reaching past centre of eye; large auxiliary scales above pectoral and pelvic fins; no fin spines; caudal fin strongly forked; colour silvery; maximum total length about 180 cm.

Habitat

Occurs in a variety of marine habitats including offshore and inshore reefs, coastal embayments, and brackish estuaries. It is found occasionally in freshwater streams, although usually relatively close to the sea. The specimen taken in the present survey was from a roundwater. It is reported to be common in the Murik Lakes, a mangrove area at the mouth of the river.

Distribution

Widely distributed in the tropical Indo-West Pacific.

Biology

(from Van der Elst, 1981). The diet consists mainly of dead organic matter and microscopic organisms that live in or on muddy bottoms. Small crustaceans, worms, and fish are also eaten occasionally.

Gonadal development begins in females at about 500 mm TL and in males at about 900 mm. Both sexes are in spawning condition at an age of four years or about 1100 mm TL. Spawning occurs in the sea and the young undergo a ribbon (leptocephalus) larval stage that metamorphoses in estuaries.

Cyprinidae (Carps)

Cyprinus carpio

Cyprinus carpio Linnaeus 1758: 320 (Europe).
Cyprinus carpio. — Glucksman, West, and Berra 1976: 38 (East and West Sepik districts).

Material examined

Specimens not retained from gill-net survey of 1981-1983, but 2 specimens 140-185 mm SL from the adjacent Ramu River system were examined at WAM.

Diagnosis (from McDowell and Shearer 1980).

Dorsal rays III or IV, 15 to 24; anal rays III, 5 to 7; pectoral rays I, 15 or 16; lateral-line scales 33-40; scales large and cycloid, but absent on head; a small protrusible mouth with two barbels present at each corner; colour olive-green to golden on back shading to brassy yellow on sides and silvery yellow on belly; fins dark to reddish; preserved specimens tan to brown, often with silvery sheen. Maximum size to 120 cm TL and to at least 60 kg.

Habitat

Still and sluggish waters as well as the main Sepik Channel, tributaries, roundwaters, and oxbow lakes. Because of its tolerance of low oxygen concentrations it can survive in stagnant water.

Distribution

Native to Asia, but has been spread by man to Europe and North America and now occurs on all continents except Antarctica. It is the world's most widely distributed freshwater fish. Carp were introduced in Papua New Guinea in 1959 for aquaculture. It was first recorded at Angisi in the Sepik system in 1980 and has spread rapidly throughout the lowlands of the Sepik and Ramu systems since then.

Biology

Little is known of its reproductive habits in New Guinea, but judging from its rapid spread, reproduction probably occurs throughout most of the year rather

than on a seasonal basis as in temperate latitudes. The very small and numerous eggs are laid on the bottom among aquatic plants. They hatch within about 3-4 days and growth is rapid.

It feeds by sucking mud from the bottom, filtering out food items such as plant tissue, aquatic insects, crustaceans, annelids, and molluscs.

Ariidae (Fork-tailed Catfishes)

Arius coatesi

Arius coatesi Kailola 1990: 18 (Sepik River).

Material examined

WAM P.28221-001, 4 specimens, 282-380 mm SL; station 33. We have also seen a single specimen, 320 mm SL, from the adjacent Ramu River system at WAM.

Diagnosis

Fine teeth on palate in two distinct oval patches, arranged transversely; usually no rakers on posterior surface of first two gill arches; anal rays 19 to 21; pectoral rays 10 to 12; 48 to 49 vertebral centra posterior to complex centrum; rakers on first gill arch 13 to 17; eye small, 9.5% (mean) of head length; maxillary barbels thin, 9.5% (mean) of SL; mouth moderately broad, 43.1% (mean) head length; head height 17.4% (mean) of SL; dorsal head shield rugose, granular posteriorly and at margin; colour olive-bronzy, golden or bluish on upper half, silvery grey to white on lower sides and ventral parts; fins grey to bluish; preserved specimens generally grey, white or tan on lower sides and ventral parts; maximum size to about 750 mm SL.

Distribution

Lower and middle Sepik and Ramu river systems of northern Papua New Guinea.

Habitat

Restricted to rivers and not occurring in lakes or on the floodplain.

Biology

This is the largest of Sepik ariids, males and females reaching 750 and 740 mm SL respectively (173 specimens measured). During the 1981-1983 survey it represented approximately 35 percent of the total weight of ariid landings at the Angoram market.

Spawning occurs throughout the year as in other Sepik ariids. The smallest mature or maturing male and female were 370 and 360 mm SL respectively. Eggs range from 11.6-14.4 mm diameter (mean 13.1) and are orally incubated by the male (Coates in press). The number of ripe eggs in either ovaries or

male brood mass is about 20 to 173; the latter figure was from a 580 mm SL male and is the highest number recorded from any brooding ariid (Coates in press).

The stomach contents of 37 fish were examined. The main items included *Macrobrachium* (14 percent of volume) and smaller *Caridina* prawns (28 percent), detritus (24 percent), assorted plant material (12 percent), aquatic insects and nymphs (8 percent), and fishes (6 percent). Lesser amounts of worms, leeches, and unidentified eggs were also consumed.

Remarks

This species is described by Kailola in the present volume (p. 18). It is the largest known ariid from northern New Guinea. Juveniles are easily confused with *A. velutinus*. *Arius coatesi* is *Arius* species 3 of Coates (1987b, in press, and all internal reports prior to 1987).

Arius (Brustiarius) nox

(Figure 7)

Arius nox Herre 1935: 388 (Nyaurangai, Sepik River).

Material examined

WAM P.17837-003, 2 specimens, 212-226 mm SL, station 19; WAM P.27846-004, 131 mm SL, station 28; WAM P.28225-001, 15 specimens, 87-138 mm SL, station 33. We have also seen 8 specimens, 111-157 mm SL, from the adjacent Ramu River system at WAM.

Diagnosis

Palate always with conical teeth, arranged in four transverse patches or in a "butterfly"-shape, posterior surface of first two gill arches with 0 to 12 rakers; anal rays 18-21; pectoral rays 8-9; rakers on first gill arch 56-67; Fin spines thin; barbels rounded in cross-section, maxillary pair 22-30 (mean 26.6) %SL; adipose fin base 4.1-7.5 (mean 5.8) %SL; head rather low, height 13-36 (mean 14.5) %SL; snout short, 7.9-12 (mean 9.9) %SL; eye 4.3-6.3 (mean 5.1) %SL. Caudal fin deeply forked, lobes slender; colour generally grey (often with silvery sheen) to blackish, lighter on lower sides and ventral surface; preserved specimens similar, but generally lacking silvery sheen; maximum size to about 290-300 mm SL.

Distribution

Lower and middle Sepik and Ramu river systems of northern Papua New Guinea.

Habitat

Primarily the floodplain and permanent lakes; occasionally encountered in river channels, but in low numbers.

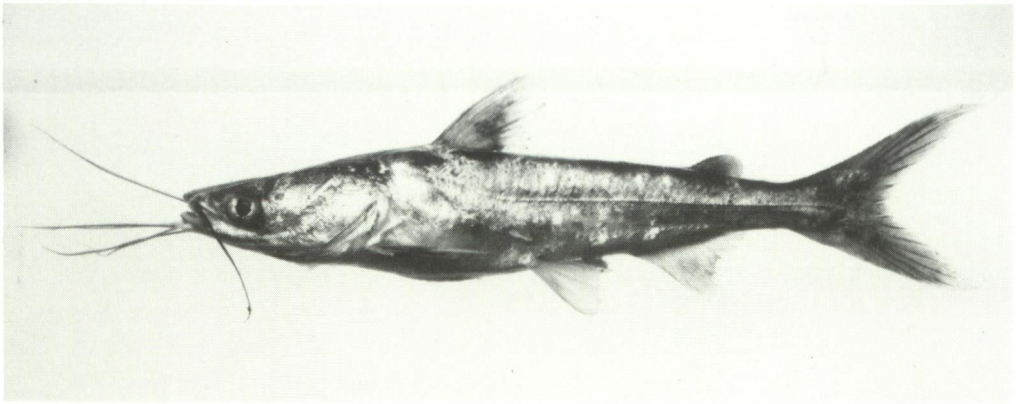

Figure 7: *Arius (Brustarius) nox*, 176 mm SL, lower Ramu River.

Biology

This is the smallest and most numerous of the Sepik ariids. A total of 758 specimens were obtained during the 1981-1983 survey. It made up approximately 18 percent of the weight of ariids caught in gill nets, but is not common in the market because of its small size. The largest female and male recorded were 285 and 280 mm SL respectively. Spawning occurs year round with a slight peak in activity during the flood season as reflected by higher values for visceral fat storage and gonosomatic index at this time. The smallest mature or maturing male and female were 160 and 170 mm SL respectively. Eggs range from 8.9-10.3 mm diameter (mean 9.5) and are orally incubated by the male (Coates in press). The number of ripe eggs in either the ovaries or male brood ranges from about 8 to 30 (Coates in press). It is not known how many broods are produced each year and there is no information on the early life history.

The stomachs of 481 specimens were examined of which 13 percent were empty. The main food items were small crustaceans (Ostracoda, Cladocerca, Chonchostraca) and small insect larvae and nymphs (eg. Diptera, Hemiptera) which comprised 46 and 36 percent respectively of the total volume. Other items consumed in relatively small amounts included assorted plant material, detritus, large crustaceans, gastropods, terrestrial insects, leeches, and worms. *A. nox* is primarily a filter feeder using its modified gill-rakers to feed on small invertebrates, many of which are thought to be disturbed from amongst aquatic vegetation by its forward pointing (when alive) barbels.

Arius (Brustiarius) solidus

(Figure 8)

Arius solidus Herre 1935: 385 (Timbunke, Sepik River)
Arius kanganamanensis Herre, 1935: 387 (Kanganaman, Sepik River)

Material examined

WAM P.27846-003, 4 specimens, 128-145 mm SL, station 28; WAM P.28220-001, 4 specimens, 221-277 mm SL, station 33. We have also seen 5 specimens, 158-234 mm SL, from the adjacent Ramu River system at WAM.

Diagnosis

Palate usually with fine conical teeth, rarely endentulous; palatine teeth either in a "butterfly"-shape, or in a large, single plate covering much of palate; posterior surface of first two gill arches smooth with 0-10 low rakers; anal rays 17-19; pectoral rays 8-10; rakers on first gill arch 19 to 30; adipose fin base 4.4 to 9.4 (mean 6) % SL; eye moderately large, 4-7.3 (mean 5.6)% SL; maxillary barbels thin, 23-36 (mean 30.1)% SL; dorsal head shield rugose; caudal fin lobes moderately long and tapered; colour olive-bronzy or golden on upper half, silvery grey grading to white on lower half; fins bluish to grey; narrow dusky bars on sides and 2-3 rows of small black spots on upper back sometimes present; preserved specimens generally grey, white or tan on lower sides and ventral parts; maximum size to about 600 mm.

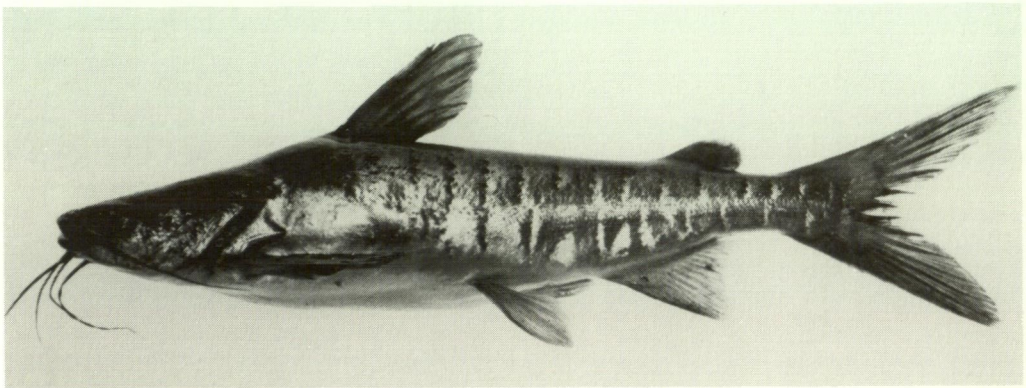

Figure 8: *Arius solidus*, 237 mm SL, Chambri Lake.

Distribution

Lower and middle Ramu, Sepik and Mamberamo river systems of northern New Guinea.

Habitat

Prefers lakes but also main river channels, occasionally entering the floodplain.

Biology

This was the most abundant (in terms of biomass) ariid during the 1981-1983 gill-net survey, representing 67 percent of the total weight of catfishes. It was also common at Angoram market, comprising about 20 percent of ariid landings. The largest female and male of 586 specimens obtained during the survey were 590 and 580 mm SL respectively.

Spawning occurs year round with some increase in activity during the dry season. The smallest mature or maturing male and female were 200 and 190 mm SL respectively. Eggs range from 9.5-13.8 mm diameter (mean 11.2) and are orally incubated by the male (Coates in press). The number of ripe eggs in either the ovaries or male brood mass ranges from about 8 to 85 (Coates in press). It is not known how many broods are produced each year and there is no information on early life history.

The stomachs of 444 fish were examined of which 20 percent were empty. The main items consumed were fine detritus (24 percent of volume), assorted plant material (20 percent), large crustaceans especially *Macrobrachium* (20 percent), and large insects and nymphs (13.4 percent) and fish, usually *Ophieleotris aporos* (12 percent). Other items found in small amounts included small crustaceans, small insect larvae and nymphs, leeches, earthworms, unidentified eggs, and fish scales.

Remarks

Kailola (1989) advises that *A. kanganamanensis*, a species recognized as valid by Munro (1967) and other authors, is a junior synonym. *Arius* species 1 and 2 of Coates (1987b, in press, and all internal reports prior to 1987) are now considered to be *A. solidus*.

Arius utarus

Arius utarus Kailola 1990:12 (Sepik River)
Arius leptaspis. — Herre 1936: 136 (Sepik River).

Material examined

WAM P.27846-001, 4 specimens, 97-133 mm SL, station 28; WAM P.28218-001, 3 specimens, 281-382 mm SL, station 33; WAM P.28224-001, 229 mm SL, station 33. We have also seen 32 specimens, 52-253 mm SL, from the adjacent Ramu River system at WAM.

Diagnosis

Fine teeth on palate in four distinct oval patches arranged transversely; usually no rakers on posterior surface of first two gill arches; anal rays 18 to 22; pectoral rays 9 to 10; 45 to 46 vertebral centra posterior to complex centrum, of which 10 to 12 are trunk vertebrae; rakers on first gill arch 13 to 22; maxillary barbel 35% (mean) of SL; mouth broad, jaws strong, gap 50.4% (mean) head length; dorsal head shield granular, extending forward along midline of head; body compressed and tapered distally, caudal peduncle shallow, depth 7.3% (mean) SL; colour dark blue, olive, or bronzy on back grading to silver-grey on sides and white on ventral parts; fins grey or bluish; sometimes with lighter transverse streaks or bars on sides and 2-3 rows of small blackish spots on back; preserved specimens generally grey, white or tan on lower sides and ventral parts; maximum size to about 550 mm SL.

Distribution

Lower and middle Ramu, Sepik, and Mamberamo river systems of northern New Guinea.

Habitat

Prefers main river channels but also lakes and entering the floodplain.

Biology

This species was more common in rivers than in other habitats. A total of 420 specimens were obtained during the 1981-1983 survey, representing 10 percent of the weight of ariids caught in gill nets and about 20 percent of the ariid landings at the Angoram market. The largest female and male specimens measured 550 and 530 mm SL respectively.

Spawning occurs year round with little evidence of obvious peak periods. The smallest mature or maturing male and female were 265 and 245 mm SL respectively. Eggs range from 9.4-13.4 mm diameter (mean 12.0) and are orally incubated by the male (Coates in press). The number of ripe eggs in either the ovaries or male brood mass is about 15 to 75 (Coates in press).

The stomach contents of 106 specimens were examined. Major dietary items included large crustaceans, particularly *Macrobrachium* and *Caridina* (43 percent of volume), fish scales (22 percent), detritus (17 percent), and large insect larvae and nymphs (9 percent). Small amounts of plant matter, leeches, worms, unidentified eggs, small crustaceans, terrestrial insects, and small aquatic insects and nymphs were also consumed. *A. utarus* is considered to be a particularly voracious species rasping at large prawns and fish, frequently eating only parts of these.

Remarks

This species is described by Kailola in the present volume (p. 9). It has usually been misidentified as *Arius leptaspis* (Bleeker) by previous authors. *Arius utarus* is the *A.* cf. *leptaspis* of Coates (1987b, in press, and all internal reports prior to 1987).

Arius velutinus

Hemipimelodus velutinus Weber 1908 (in part): 225, 551 (Lake Sentani, Tami River mouth, Tawarin River).

Hemipimelodus papillifer Herre 1935: 390 (Timbunke, Sepik River).

Material examined

WAM P.27847-009, 98 mm SL, station 29; WAM P.28216-001, 5 specimens, 182-415 mm SL, station 33. We have also seen 9 specimens, 50-265 mm SL, from the adjacent Ramu River system at WAM.

Diagnosis

Palate usually naked, rarely with one or two oval patches of fine teeth; lips moderately thick; posterior aspect of first two gill arches with up to 7 short rakers above, and many broad papilla below; anal rays 17-24; pectoral rays 10-12; 44-46 vertebral centra posterior to complex centrum; rakers on first gill arch 13-18; eye moderate, 10-21 (mean 15.5) % head length; mouth gape moderately small, 8.4-12.7 (mean 10.5) % SL; maxillary barbels 16-32 (mean 24.8) %SL; adipose fin base moderate, 7-14.5 (mean 10.3) % SL; maxillary tooth patch short and broad, its length 3-8.2 (mean 4.6) in its width; dorsal head shield smooth to rugose in larger fish; colour olive-bronzy to bluish or bluish grey on upper sides, silvery to white on lower half; frequently with narrow, whitish cross-bars on sides; lips pinkish; fins bluish to dusky brown with darker margins; preserved specimens generally grey to brownish, yellowish tan on lower parts; maximum size to about 600 mm SL.

Distribution

Ramu, Sepik, and Mamberamo river systems of central-northern New Guinea. It has also been reported by Weber (1908) from the Tami River, Lake Sentani, and the Tawarin River, all situated within 75 km of Jayapura, the capital of Irian Jaya.

Habitat

Rivers and lakes to elevations of at least 100 m above sea level. However in the Sepik and Ramu systems it is strictly confined to turbid river channels. It was never found in Sepik lakes or on the floodplain. Ascends rivers (in length and elevation) to a greater extent than any other Sepik ariid.

Biology

The only specimens available for study were obtained from the Angoram market where it accounted for about 19 percent of all ariid landings. The maximum SL of 74 male specimens was 600 mm and of 83 females was 580 mm. The smallest sexually mature individual (female) was 280 mm SL. Although our data are insufficient, spawning probably occurs year round as in other Sepik ariids. Oral incubation has not been noted in the Sepik but is expected to occur. Eggs range in diameter from 9.3-13.4 mm (mean 12.3 mm) (Coates in press). The number of ripe eggs present in the ovaries ranges from about 25 to 90 (Coates in press). It is not known how many batches are produced per year and there is no information on early life history.

The dominant items in 27 stomachs examined were detritus (38 percent of volume), large aquatic insect larvae and nymphs (32 percent), terrestrial insects (11 percent) and assorted plant material (11 percent). In addition small quantities of unidentified eggs and small insects (eg. Diptera and Hemiptera) were present. The insect larvae and terrestrial insects were mainly Mayflies (Ephemeroptera) that were emerging in huge quantities at the time most specimens were caught.

Remarks

Kailola (1989) advises that *H. papillifer*, a species recognised as valid by Munro (1967) and other authors, is a junior synonym. She also advises that *Hemipimelodus* is a synonym of *Arius*.

Plotosidae (Eel-Tailed Catfishes)

Tandanus coatesi

(Figure 9)

Tandanus coatesi Allen 1985: 252 (Ninar River, Tributary of Sepik River, Papua New Guinea.)

Material examined

WAM P.27839-007, 140 mm SL (holotype), station 21; WAM P.27839-005, 50 specimens, 36-130 mm SL (paratypes), station 21; WAM P.27840-005, 68 mm SL (paratype), station 22.

Diagnosis

Dorsal rays I,7 or 8 — 57 to 67; caudal rays 8 to 10; anal rays 65 to 88; total dorsal + caudal + anal fin rays 136 to 147; pelvic rays 12 or 13; gill rakers on anterior face of first gill arch 21 to 26; total free vertebrae posterior to Weberian apparatus 47 to 50; dorsal fin base occupying about one-half of standard length; tips of first dorsal and pelvic fins rounded; colour grey, ventral surface of head and abdomen whitish; nasal and maxillary barbels dark grey, outer mental barbels whitish; first dorsal fin dusky grey-brown, whitish distally; dorsal-caudal-anal fin whitish to slightly dusky grey; pectoral fins grey-brown; pelvic fins whitish to dusky grey; preserved specimens similar; maximum size to about 140 mm SL.

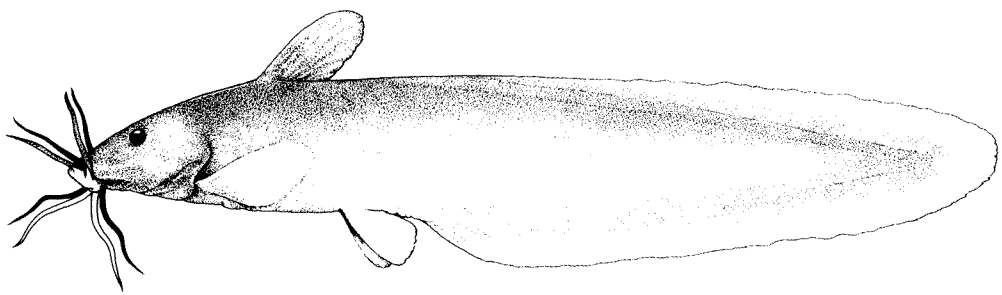

Figure 9: *Tandanus coatesi*, 139 mm SL, drawing of holotype (by R. Swainston).

Habitat

Moderate to swift flowing rainforest streams between 250-460 m elevation. The bottom consisted of gravel and cobbles.

Distribution

Known only from hillstream tributaries of the Sepik River in the northern or Torricelli mountains watershed.

Biology

The stomach contents of several specimens indicate a diet of mainly terrestrial and aquatic insects.

Remarks

The taxonomic status of *T. coatesi* is problematical and is being investigated by G. Allen and N. Feinberg. The species may be conspecific with *T. gjellerupi*.

Tandanus gjellerupi

Copidoglanis gjellerupi Weber 1913: 528 (Sepik River).

Material examined

WAM P.28205-002, 2 specimens, 133-241 mm SL, station 32. We have also seen 3 specimens 100-165 mm SL from other northern New Guinea localities at WAM.

Diagnosis

Dorsal rays I,6 or 7 — 70 to 77; caudal rays 8 or 9; anal rays 77 to 86; total dorsal + caudal + anal fin rays 160 to 169; pectoral rays I,11 or 12; pelvic rays 12; gill rakers on anterior face of first gill arch 25 to 27; total free vertebrae posterior to Weberian apparatus 51 to 53; dorso-caudal fin base occupying about one-half of standard length; tips of first dorsal and pelvic fins pointed; dorsal snout profile slightly concave; colour grey sometimes with obscure darker blotching, cream or whitish on ventral surface; fins grey to pale tan; barbels pale tan; preserved specimens similar; maximum size to about 300 mm SL.

Habitat

Generally clear, relatively rapid flowing tributary streams, often in hilly terrain between about 300 and 1,600 m elevation. The bottom usually consists of gravel and cobbles.

Distribution

Known from tributaries of the Ramu and Sepik rivers of northern New Guinea.

Biology

The diet consists mainly of terrestrial and aquatic insects. Maturity occurs at about 150-170 mm SL.

Tandanus idenburgi

(Figure 10)

Copidoglanis idenburgi Nichols, 1940: 1 (Idenburg River, W. New Guinea).

Material examined

WAM P.27835-003, 109 mm SL, station 17. We have also seen 2 specimens, both 45 mm SL from the adjacent Ramu River system at WAM.

Diagnosis

Dorsal rays I,5 to 7 — 66 to 80, caudal rays 8 to 10; anal rays 79 to 89; total dorsal + caudal + anal fin rays 158 to 178; pectoral rays I,11 to 13; pelvic rays 12 to 14; gill rakers on first arch 27 to 31; total free vertebrae posterior to Weberian apparatus 51 to 53; dorso-caudal fin base occupying about 32 to 40 percent of standard length; colour ranges from dark grey to blackish, fins sometimes paler than body, particularly in juvenile specimens; barbels dark grey to blackish; preserved specimens similar; maximum size to about 280 mm SL.

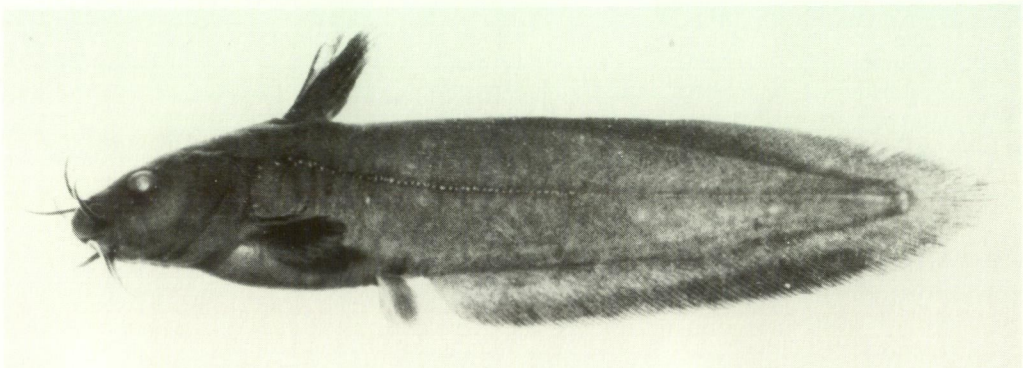

Figure 10: *Tandanus idenburgi*, 75 mm SL, tributary of middle Ramu River.

Habitat

Generally clear, relatively rapid-flowing creeks, in hilly terrain between about 200-500 m elevation. The bottom usually consists of gravel and cobbles.

Distribution

Known from the Markham, Ramu, Sepik, and Mamberamo river systems of northern New Guinea.

Biology

The gut contents of several specimens indicate a diet of mainly insects (aquatic and terrestrial) and prawns. Sexual maturity occurs between about 100-130 mm SL.

Tandanus novaeguineae

Copidoglanis novaeguineae Weber 1908: 226 (Sentani Lake, W. New Guinea).

Material examined

WAM P.27832-006, 10 specimens, 114-151 m SL, station 16; WAM P.27836-004, 3 specimens, 100-210 mm SL, station 18; WAM P.28192-002, 2 specimens, 80-82 mm SL, station 31.

Diagnosis

Dorsal rays I,4 or 5 — 50 to 53; caudal rays 8; anal rays 80 to 93; total dorsal + caudal + anal fin rays 140 to 152; pectoral rays 11; pelvic rays 12 or 13; gill rakers on first arch 17 to 19; free vertebrae posterior to Weberian apparatus 7 or 8 + 39 or 40 = 47 or 48; dorso-caudal fin base occupying about 25-40% of standard length; colour primarily dark brown to black including barbels, lighter ventrally; preserved specimens similar; maximum size to about 220 mm SL.

Habitat

Main river and lakes of the floodplain. Also found in clear to moderately turbid rainforest creeks on the edge of the floodplain or in lower foothills at about 100-300 m elevation. It generally occurs in deeper pools that have a soft bottom and are littered with log debris.

Distribution

Sepik and Mamberamo river systems and Lake Sentani, all in northern New Guinea.

Biology

A total of 167 specimens, 90-187 mm SL, were captured during the 1981-83 sampling programme. Specimens were caught all year round with a slight increase in catch rate during June and July.

Stomach contents indicate a diet of various small invertebrates. The major components were small insect larvae (37%), crustaceans (26%), larger insects larvae such as Odonata (10%), terrestrial insects (7%), fine detritus (14%), and unrecognizable material (6%). The mean percentage of stomach fullness was 17.5% during the dry season (May-November) compared to 43.2% during the wet season (December-April), thus indicating increased feeding activity during the flood periods.

Ripe females were not observed below 150 mm SL. Nearly all fish greater than this size were ripe females with little or no obvious fat reserves. Mature males were rarely caught.

Hemirhamphidae (Garfishes)

Zenarchopterus kampeni
(Figure 11)

Hemiramphus (Zenarchopterus) kampeni Weber 1913: 554 (Sepik River).
Zenarchopterus sepikensis. — Herre 1935: 391 (Sepik River).

Material examined

USNM 266411, 4 specimens, 113-144 mm SL, station 29; WAM P.27847-007, 13 specimens, 29-125 mm SL, station 29.

Diagnosis

Dorsal rays 11-13; anal rays 11-13; pectoral rays 10; mid-lateral scales 48-50; predorsal scales 33-47; vertebrae 43-46; sixth anal fin ray of males enlarged and paddle-shaped; left and right supraorbital lateral-line canals completely separated; colour in life olive dorsally and whitish below with broad silvery stripe along middle of side; colour in preservative tan with silvery mid-lateral stripe; maximum size to about 200 mm SL.

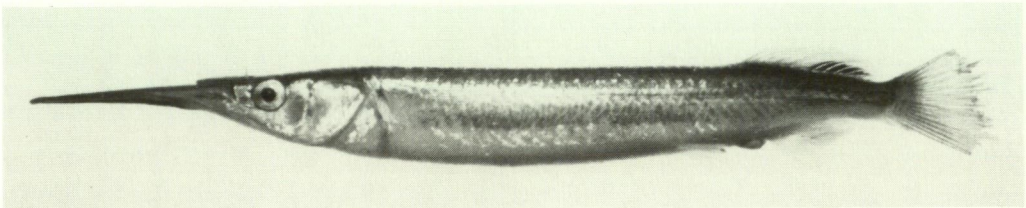

Figure 11: *Zenarchopterus kampeni*, 149 mm SL, tributary of middle Ramu River.

Habitat

Occurs in higher order rivers, floodplain lakes and occasionally enters marginal areas of the floodplain. Also ascends tributary rivers where it prefers quiet pools.

Distribution

Lower and middle Sepik, also the Ramu River in Papua New Guinea and the Mamberamo River in Irian Jaya.

Biology

During the 1981-83 sampling period 149 individuals were caught with gill nets. The smallest individual was a 156 mm SL female with ripe ovaries and the largest fish was 195 mm. The sex ratio was approximately 1:1 and almost all individuals that were caught had ripe gonads. Numerous running-ripe females were recorded during May, June, and July. Spent females were also occasionally caught during the same period. It appears that spawning occurs in fresh waters of the lower Sepik. It has relatively large eggs (2-3 mm diameter), thus indicative of low fecundity.

Z. kampeni has omnivorous feeding habits. Stomach content analysis revealed that approximately 35% of specimens had fed exclusively on filamentous algae and 60% on small invertebrates with the remainder feeding on a combination of these items. Invertebrate items included insect larvae (45%), terrestrial insects (33%), crustacea (17%), and miscellaneous items (5%) such as tiny gastropods, oligochaetes, leeches, and spiders. Some individuals fed almost exclusively on terrestrial insects, mainly flies, ants, and beetles, taken from the surface.

This species appears to be relatively common, at least in the lower part of the river. It was present at the sample sites throughout the year. There was a definite increase in abundance at all sites towards the end of the flood season (March-May). Most individuals were caught in 1-inch nets. It was also caught at Chambri Lake and numerous individuals were observed at Angisi (4°35'S, 144°20'E) in small channels or barats, but not on the floodplain proper.

Poeciliidae (Livebearers)

Gambusia affinis

Heterandria affinis Baird and Girard, 1855: 390 (Rio Medina and Rio Salado, Texas).

Material examined

Often observed in large numbers in small channels and barats during the flood season. No specimens were retained, but we have seen 5 specimens, 12-25 mm SL, from the adjacent Ramu River system at WAM.

Diagnosis

(From McDowall 1980) Dorsal rays 7 to 9; anal rays 9 or 10; scales in lateral series 29 to 32, no lateral line; gill rakers on first arch 13 to 15; a tiny (males to 35 mm TL and females to about 60 cm TL) stout fish with a deep, rounded belly (especially in females), and flattened upper surface, especially the head; mouth small, upturned and protrusible, eyes large; colour greenish-olive to brownish on back, sides grey to silvery with bluish sheen; belly silvery-white; fins clear, the dorsal and caudal often with fine spotting; preserved specimens pale grey to tan; maximum size to about 60 mm TL (males to about 35 mm).

Sexual dimorphism

Females are much larger than males and have a rounder belly. Males have the anterior rays of the anal fin thickened and elongated with very small hooks at the tip. This structure forms the gonopodium used for internal fertilisation.

Habitat

Barats and small creeks of the lower and middle Sepik floodplain. Also amongst vegetation on the edges of the main river channel.

Distribution

Rivers of North America draining into the Gulf of Mexico. It has been introduced to tropical localities around the world because it eats mosquito larvae. It is widespread in New Guinea and Australia. The Fisheries Department introduced it into the territory of Papua New Guinea in 1930 (Glucksman *et al.*1976).

Biology

It feeds on a wide variety of small aquatic invertebrates. Eggs are fertilised within the female with development requiring 3-4 weeks. The young are ovoviviparous, averaging about 50 fry per batch. They grow quickly and reach maturity in less than two months. Breeding occurs several times per year and the size of populations may increase dramatically.

Melanotaeniidae (Rainbowfishes)

Chilatherina campsi

Anisocentrus campsi Whitley 1956: 26 (tributary of Jimmi River, 53 km, 60 E of NE of Mount Hagen airstrip).

Material examined

AMS IB.3337 (holotype), 56 mm SL, tributary of middle Jimmi River, Papua New Guinea; AMS IB.3342 (paratype), 50 mm SL, collected with holotype. We have also seen 17 specimens, 33-83 mm SL, from the adjacent Ramu River system at WAM.

Diagnosis

Dorsal rays V to VII-I,12 to 16; anal rays I,21 to 26; pectoral rays 13 to 15; horizontal scale rows between bases of anal and first dorsal fins 11 or 12; vertical scale rows between upper corner of gill cover and base of caudal fin 39 to 42; predorsal scales 17 to 23; preopercle — suborbital scales 12 to 21; greatest body depth of adult (>50 mm SL) males 28.0-32.3 percent of SL; colour in life pale bluish white with silver sheen, pale yellow to whitish longitudinal stripes frequently bordering scale rows and a broad blue mid-lateral stripe (most prominent on posterior part of body); fins white, sometimes with yellow suffusion; preserved specimens brownish on upper half and whitish on lower half with black mid-lateral stripe from rear edge of gill cover to base of caudal fin (sometimes faint in females), fins pale; maximum size to about 85 mm SL.

Sexual dimorphism

Males are deeper bodied than females and their overall colour pattern is more intense, particularly the mid-lateral stripe. In addition the vertical fins of females are mainly translucent in contrast to the whitish fins of males.

Habitat

Inhabits relatively slow-flowing tributary streams in hilly or mountainous terrain. Small schools are often seen over mud, sand or rock bottoms exposed to sunlight. Allen (1981) recorded temperature and pH values ranging from 21.0°-25.5°C and 7.6-7.8 respectively.

Distribution

Known in the Sepik system only from the type locality, a small creek flowing into the middle Jimmi River, situated approximately 420 km from the mouth of the Sepik via the Yuat River and at an altitude of about 1000 m. Allen (1981) also recorded it from the Wahgi and Pima rivers, both highland tributaries of the Purari River, and from the Omsis River near Lae. It is the only melanotaeniid known to occur on both sides of the central dividing range.

Biology

Stomach contents indicate a diet consisting mainly of terrestrial and aquatic insects. Sexual maturity occurs at between 32-40 mm SL. Gravid females deposit several eggs each day that adhere to aquatic vegetation. Hatching occurs in about 15 days at 22°-24°C. Sexual maturity is attained before the end of the first year.

Chilatherina crassispinosa

Rhombatractus crassispinosus Weber 1913: 567 (Tawarin and Upper Sermowai rivers, Irian Jaya). *Chilatherina crassispinosa*. — Allen 1981: 292 (Tributary of Sepik River).

Material examined

WAM P.26734-002, 4 specimens, 67-72 mm SL, station 11; WAM P.27835-004, 50 specimens, 19-92 mm SL, station 17; WAM P.27839-001, 28 specimens, 35-95 mm SL, station 21; WAM P.27840-001, 113 specimens, 21-76 mm SL, station 22.

Diagnosis

Dorsal rays IV to VII-I,11 to 16; anal rays I,21 to 28; pectoral rays 14 to 16; horizontal scale rows between anal and first dorsal fins 11 to 13; vertical scale rows between upper corner of gill cover and base of caudal fin 39 to 44; predorsal scales 18 to 23; preopercle — suborbital scales 14 to 24; greatest body depth of males (>50 mm SL) 26.1-38.8 percent of SL; colour in life overall silvery shading to olive dorsally and white ventrally, sides with narrow orange stripes, fins translucent except anal and pelvic fins and base of second dorsal fin often yellowish in males, dorsal and ventral edges of caudal fin with narrow black margin; preserved specimens tan or brownish sometimes with thin black longitudinal stripe from upper edge of opercle to middle of caudal fin base; maximum size of males to about 100 mm SL, females to about 80 mm SL.

Sexual dimorphism

Males are generally deeper bodied than females and have more intense coloration, particularly with regards to the orange stripes on the side and yellow colour of the vertical fins.

Habitat

Relatively slow-flowing streams, sometimes quiet pools, in open sections of rainforest exposed to sunlight. These streams are usually situated in hilly terrain. Temperature and pH values generally range between 24°-28°C and 7.5-8.0 respectively.

Distribution

Known in the Sepik system from foothill tributaries of the Torricelli Range on the northern side of the Sepik Basin. Also occurs in the upper Ramu system and streams in the Bewani Mountains flowing into the Neumayer River, both in Papua New Guinea north of the Sepik. The range extends into northern Irian Jaya where it is known from several coastal streams just to the west of Jayapura and from a few scattered locations in the Mamberamo system.

Biology

The diet includes a variety of terrestrial and aquatic insects and their larvae, crustaceans, and filamentous green algae. It spawns readily in captivity all year round. Several eggs are deposited daily in weed by each female during pair or group spawning. These hatch in about two weeks. Sexual maturity is attained by the end of the first year.

Remarks

This species was previously recorded from the Markham system of Papua New Guinea by Allen and Cross (1982), but in a subsequent paper by Allen (1983) the Markham population was shown to be a distinct species, *C. bulolo* (Whitley).

Chilatherina fasciata

Rhombatractus fasciata Weber 1913: 565 (Boearin River, tributary of Upper Sermowai River (Irian Jaya)).

Chilatherina fasciata — Allen 1981: 295 (Tributary of Sepik River).

Material examined

WAM P.26727-001, 48 specimens, 23-99 mm SL, station 4; WAM P.26733-001, 21 specimens, 44-90 mm SL, station 10; WAM P.26734-001, 10 specimens, 33-105 mm SL, station 11; WAM P.26735-001, 81 mm SL, station 12; WAM P.26736-002; 7 specimens, 66-89 mm SL, station 13; WAM P.27832-001, 19 specimens, 26-88 mm SL, station 16; WAM P.27836-006, 29 specimens, 21-68 mm SL, station 18; WAM P.27840-006, 80 mm SL, station 22; WAM P.27841-003, 7 specimens, 70-91 mm SL, station

23; WAM P.27845-002, 60 specimens, 20-90 mm SL, station 27; WAM P.27851-002, 2 specimens, 55-63 mm SL, station 30.

Diagnosis

Dorsal rays IV to VII-I,11 to 16; anal rays I,21 to 28; pectoral rays 14 to 16; horizontal scale rows between anal and first dorsal fins 10 to 12; vertical scale rows between upper corner of gill cover and base of caudal fin 39 to 44; predorsal scales 18 to 23; preopercle — suborbital scales 14 to 24; greatest body depth of males (>50 mm SL) 26.1-38.8 percent of SL; colour in life brown to blue-green on upper half, white on lower half with scales of this region often bordered with pale yellow, 6-8 faint dusky bars sometimes present on middle of lower sides of males, fins dusky grey to yellow white; preserved specimens brownish on upper half grading to yellow white or yellowish below, frequently with dusky to black mid-lateral stripe and faint bars on side as described above, fins translucent or dusky; maximum size of males to about 110 mm SL, females to about 100 mm SL.

Sexual dimorphism

Males are generally deeper bodied than females, this feature becoming more obvious with increased growth. In addition, the posterior profile of the dorsal and anal fins is more pointed and elongate in males. In contrast to males, which have longer posterior dorsal rays, females have the longest rays at the anterior part of the fin. Finally, mature males are more colourful than females often exhibiting reddish or yellowish dorsal and anal fins. Also they sometimes have a series of faint blackish bars on the side. Females are basically silver to olive overall with clear fins.

Habitat

Absent from the main river and floodplain. Usually encountered in clear rainforest creeks with slow to moderate flow on the edge of the flood plain or in hilly terrain to an elevation of about 500 m. The bottom consists of leaf litter, sand, gravel, and cobbles.

Distribution

Markham, Ramu, Sepik, Neumeyer, and Mamberamo river systems of northern New Guinea.

Biology

The diet includes filamentous algae, small crustaceans, terrestrial insects (particularly ants and tiny beetles), and aquatic insect larvae. Sexual maturity occurs at about 35-40 mm SL in females and 45-55 mm SL in males. During spawning periods, which occur throughout the year, females deposit several eggs each day amongst aquatic vegetation. Hatching occurs in about 15 days at 22°-24°C. The young develop rapidly and sexual maturity is attained before the end of their first year. *Chilatherina fasciata* is sometimes hermaphroditic.

Glossolepis multisquamatus

(Figure 12)

Melanotaenia multisquamata Weber and de Beaufort 1922: 290 (Idenburg River (Irian Jaya)).
Melanotaenia kabia Herre 1935: 397 (Sepik River).
Melanotaenia rosacea Herre 1935: 398 (Sepik River).

Material examined

WAM P.26729-001, 81 mm SL, station 6; WAM P.26730-001, 40 mm SL, station 7; WAM P.26732-001, 53 specimens, 36-43 mm SL, station 9; WAM P.27634, 2 specimens, 65-66 mm SL, station 33; WAM P.27837-001, 11 specimens, 67-95 mm SL, station 19; WAM P.27838-002, 223 specimens, 22-48 mm SL, station 20; WAM P.2819-005, 30 mm SL, station 31; WAM P.28206-001, 21 specimens, 66-91 mm SL, station 33.

Diagnosis

Dorsal rays IV to VI-I,9 or 10; anal rays I,19 to 22; pectoral rays 14 to 17; scales on side of body arranged in parallel horizontal rows, 13 to 15 rows between bases of anal and first dorsal fins; vertical scale rows between upper corner of gill cover and base of caudal fin 38-43; predorsal scales 24-31; preopercle-suborbital scales 20-26; greatest body depth of adult (>50 mm SL) males 33.1-43.5 percent of SL; colour in life greenish or olive to silvery with series of narrow orange stripes on sides; preserved specimens brownish on upper half of body, whitish below, operculum silvery, fins pale to dusky; maximum size to about 135mm SL, usually smaller.

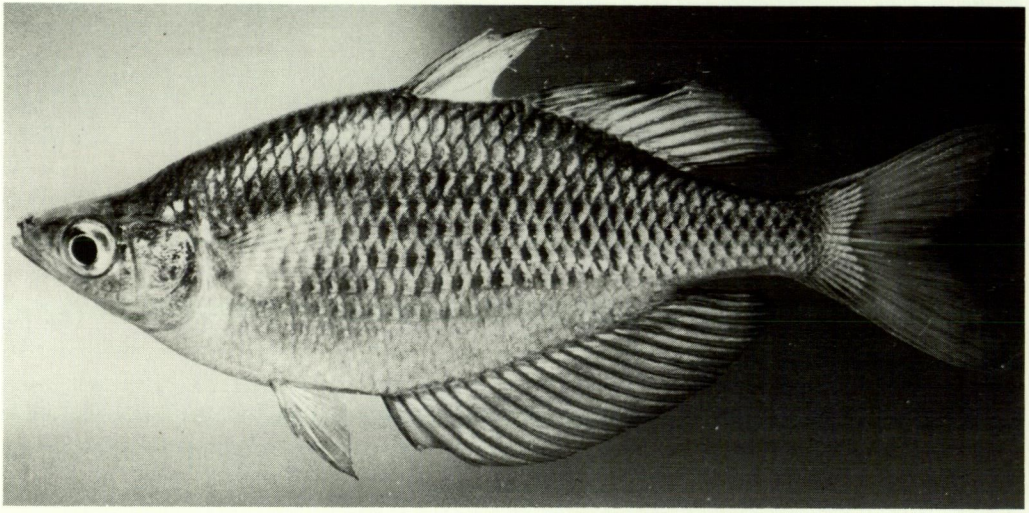

Figure 12: *Glossolepis multisquamatus*, male, 83 mm SL, Chambri Lake.

Sexual Dimorphism

Males are deeper bodied than females, although this differences in not obvious in young adults (< about 60 mm SL). The orange stripes on the sides are brighter

in mature males and their dorsal and anal fin membranes often have a silvery to yellow sheen. During courtship and spawning males frequently "flash" an instantaneous stripe of bright yellow on the dorsal midline between the snout and dorsal fin origin.

Habitat

Floodplain and swampy lagoons, lakes, and channels (barats). Usually found where there is an abundance of aquatic vegetation in moderately turbid to clear, still to slow-flowing water. Young fish form aggregations around submerged logs and branches or in dense vegetation.

Distribution

Floodplain portions of the Sepik River in Papua New Guinea, the Taritatu River (formerly Idenburg River) in Irian Jaya, and Doorman River, a major tributary of the Taritatu.

Biology

This species is incredibly abundant over the floodplain. Virtually thousands of young, 20-40 mm SL, individuals were observed in a 50 m section of a shallow (10-30 cm) and narrow (about 1.5 m) side channel of Chambri Barat during October 1982. Coates (1983) reported daily catches of 263-962 individuals from a standard fleet of gill nets between July and November 1982. In nearly all gill-net samples males predominate with the overall sex ratio approximately 2.7:1. However, this difference is possibly due to the deeper body shape of males, thus making them more vulnerable to netting. The mean standard length of fish caught in 1-inch monofilament nets was 69 mm, in 1.5-inch nets 93 mm, and in 1-inch multifilament nets 77. The largest individual collected was 110 mm SL (135 mm TL).

Population movements of *G. multisquamatus* appear to be determined primarily by fluctuations in river height. This species exhibits a preference for shallow areas which are greatly increased and support large populations during flood periods. It is the only native species, besides *Ophieleotris aporos* and *Oxyeleotris heterodon*, that shows a marked affinity for the floodplain during the wet season.

Males and females generally become sexually mature at about 75 mm SL. Individuals with either ripe, running ripe or spent gonads were rarely found below this size which is relatively large compared with most rainbowfishes. Males and females in spawning condition were found throughout the dry season. Fish with active gonads were also caught during the wet season, but due to small sample sizes at that time it is difficult to draw conclusions about time of spawning peaks or seasonality.

G. multisquamatus is carnivorous, feeding on a wide variety of small invertebrates taken mainly from mid-water or from the surface. Feeding habits

varied greatly between individuals as indicated by stomach contents. The overall percentage composition based on 200 individuals was as follows: crustaceans — 39%; insect larvae — 27%; terrestrial insects, especially ants, beetles, and flies — 21%, organic detritus — 7%; miscellaneous items including spiders, oligochaetes, and tiny planospiral gastropods — 6%.

Melanotaenia affinis

Rhombatractus affinis Weber 1908: 234 (Timena Stream and Lake Sentani, Irian Jaya).
Rhombatractus sepikensis Herre 1935: 400 (Sepik River).

Material examined

WAM P.26434-001, 4 specimens, 37-44 mm SL, station 1; WAM P.26725-001, 20 specimens, 19-67 mm SL, station 2; WAM P.26726-001, 3 specimens, 42-54 mm SL, station 3; WAM P.26728-001, 36 specimens, 23-100 mm SL, station 5; WAM P.26733-002, 41 specimens, 33-76 mm SL, station 10; WAM P.26736-001, 55 mm SL, station 13; WAM P.26746-001, 22 specimens, 32-67 mm SL, station 15; WAM P.27832-002, 9 specimens, 40-98 mm SL, station 16; WAM P.27836-001, 24 specimens, 38-105 mm SL, station 18; WAM P.27839-002, 4 specimens, 64-81 mm SL, station 21; WAM P.27841-002, 2 specimens, 57-97 mm SL, station 23; WAM P.27842-001, 153 specimens, 19-70 mm SL, station 24; WAM P.27843-001, 27 specimens, 12-53 mm SL, station 25; WAM P.27844-001, 2 specimens, 30-53 mm SL, station 26; WAM P.27845-001, 31 specimens, 25-115 mm SL, station 27; WAM P.27851-001, 3 specimens, 55-59 mm SL, station 30; WAM P.28192-001, 47 specimens, 12-97 mm SL, station 31; WAM P.28205-001, 81 specimens, 14-87 mm SL, station 32.

Diagnosis

Dorsal rays IV to VI-I,13 to 20; anal rays I,18 to 14; pectoral rays 12 to 15; horizontal scale rows between bases of anal and first dorsal fins 10 or 11; vertical scale rows between upper corner of gill cover and base of caudal fin 38-43; predorsal scales 14-16; preopercle — suborbital scales 13-25; greatest body depth of adult (>59 mm SL) males 30.0-37.5 percent of SL; colour in life olive or greenish-brown dorsally grading to white on belly; a blue to blackish stripe from snout to caudal fin base, often faint or absent in pectoral fin region and becoming more intense and broader on caudal peduncle where it is bordered by orange or reddish stripes (at least in males); sides often with series of narrow orange stripes between each scale row; fins whitish-translucent to yellowish; anal fin and frequently soft dorsal fin of mature males bright yellow orange; preserved specimens brownish dorsally and whitish or silvery below; black mid-lateral stripe faint anteriorly but distinct and relatively broad posteriorly; fins pale to dusky; maximum size to about 110 mm SL.

Sexual dimorphism

Males are deeper bodied than females and have pointed posterior tips of the dorsal and anal fins, these features becoming more obvious with increased growth. The overall colour pattern of males is more intense, particularly the orange stripes and dark mid-lateral stripe. The vertical fins of females are either

translucent or only faintly yellow compared to the bright yellow-orange colour of males.

Habitats

Rarely encountered on the floodplain. Mainly occurs in smaller tributary streams, frequently in hilly or mountainous terrain to an elevation of at least 1500 m. Common in rainforest creeks which are well shaded, but also found in some ponds, lakes, and reservoirs; usually in clear water, but sometimes in turbid conditions.

Distribution

Widely distributed in northern Papua New Guinea and Irian Jaya (i.e. north of the central dividing range). The range extends from the vicinity of Lae, Papua New Guinea westward into Irian Jaya to at least the vicinity of Nabire (3°23'S, 135°30'E). It is the most common melanotaeniid in tributary streams of the Sepik, Ramu, and Markham rivers of Papua New Guinea and the Taritatu River of Irian Jaya.

Biology

Males and females generally mature before the end of their first year or a standard length of 50-60 mm. During spawning periods approximately 10-20 eggs are deposited daily amongst dense vegetation by each female. The hatching period is about 7 days at temperatures between 26-28°C. Juveniles form large aggregations in the shoreline vegetation. According to aquarium observations spawning occurs throughout the year.

M. affinis is carnivorous, feeding on a variety of small invertebrates taken from mid-water or from the surface. Gut contents included crustaceans, insect larvae, and terrestrial insects such as ants and small beetles.

Remarks

This species often exhibits geographic colour pattern variation. Generally this is related to the amount or intensity of orange or reddish striping on the sides, width and intensity of the dark mid-lateral stripe and intensity of yellow or orange coloration in the vertical fins. There may also be morphological variation, for example in relation to body depth and shape of the snout. Two populations in particular are noteworthy because of these features; one from the highland tributaries in the vicinity of Baiyer River and the other from lowland tributaries near Pagwi. The Baiyer River population is characterised by a relatively slender body and tends to have a higher soft dorsal ray count than specimens from other localities (17-20 vs 13-16). The fish from streams near Pagwi differs by having a more pointed snout and a mid-lateral stripe that is more uniform in width (i.e. not broadly expanded posteriorly) and bordered by brilliant reddish stripes.

Syngnathidae (Pipefishes)

Microphis spinachioides
(Figure 13)

Doryichthys spinachioides Duncker 1915: 52 (Kaiserin Augusta River (= Sepik River), New Guinea).

Material Examined
KFRS F.5347-01, 81 mm SL, from main Sepik River at Angoram.

Diagnosis (from Dawson, 1985)
Caudal fin well developed; distal part of tail not clearly prehensile (i.e. not coiled ventrally in preservative); inferior trunk and tail ridges discontinuous, the lateral trunk ridge confluent with inferior tail ridge; dorsal fin rays 57-63; pectoral rays 19-20; caudal fin rays typically 9; trunk and tail rings 16 + 26-27; subdorsal rings 11.0-12.5, usually with some keeled scutella in subadults and adults; no supplemental ridges below longitudinal opercular ridge; live colours unknown but from memory (Coates) believed to be brown dorsally lighter below with scattered dark brown to black small spots — no bright colours, preserved specimens brown with dark lateral stripe on head and silvery iridescence on operculum; trunk with indication of an irregular dark stripe above lateral ridge; distal half of caudal fin mainly dark brown; maximum size to about 150 mm SL.

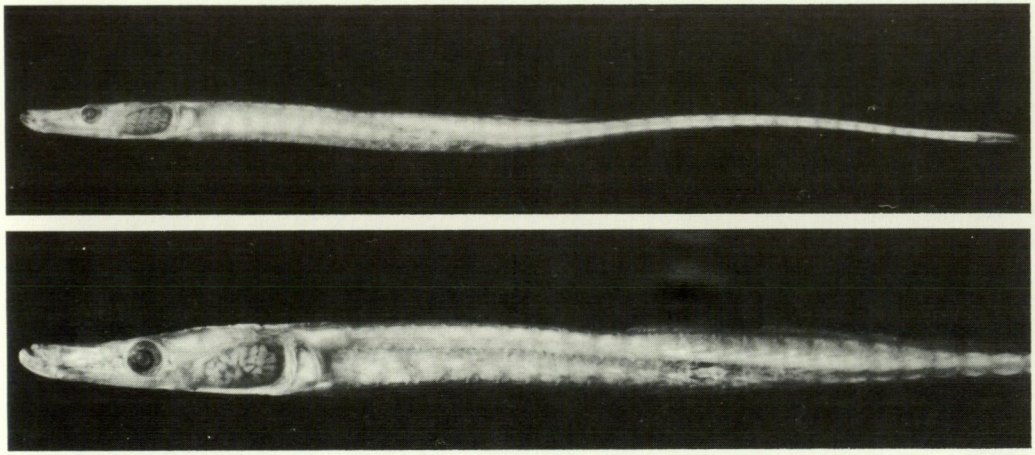

Figure 13: *Microphis spinachoides*, 75 mm SL, lower Sepik River.

Habitat
The few specimens so far collected have been taken from dense vegetation along the shallow river margin in the Lower Sepik at Marienberg and Angoram.

Distribution

Known only from the Sepik River.

Biology

There is no information on biology other than the fact it exhibits the usual pipefish habit of male brood pouch incubation. The male brood area is located under the trunk.

Remarks

The holotype was deposited in the Hamburg Museum, but destroyed in World War II (Dawson 1985). Dawson (1984) gave further taxonomic data and references to four additional specimens collected by Coates at Angoram.

Ambassidae (Glassfishes)

Ambassis buruensis

Ambassis buruensis Bleeker 1856: 396 (Buru, Indonesia).
Priopis buruensis. — Herre 1936: 449 (Sepik River).

Material examined

Not collected during the present survey, but 28 specimens, 18-42 mm SL, from rivers near Madang were examined at WAM.

Diagnosis

Dorsal rays VII,I,9; anal rays III,8 or 9; pectoral rays 15; lateral-line scales 8 to 13 + 11 to 14 (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; suborbital margin smooth; ridges of small serrae on preorbital and preoperculum; edge of interoperculum smooth; height of spinous dorsal fin 27.6 to 32.7 percent of SL; second dorsal spine longer than third dorsal spine; colour semi-transparent, scales on back with narrow blackish margins and numerous pepper-like spots on dorsal half; operculum and breast silvery; silvery stripe often present on middle of side; fins clear except membrane between second and third dorsal spines blackish; preserved specimens tan or yellowish with darker markings as described above; maximum size to about 50 mm SL.

Habitat

Brackish mangrove estuaries and freshwater streams. Herre (1936) reported it from a brook at Marienberg on the lower Sepik.

Distribution

Philippine Islands, Indonesia (Sumatra to Timor), and New Guinea.

Ambassis interrupta

Ambassis interrupta Bleeker 1852: 696 (Ceram).

Material examined

WAM P.27847-004, 33 specimens, 42-82 mm SL, station 29.

Diagnosis

Dorsal rays VII, I,9 or 10; anal rays III,9 or 10; pectoral rays 14 to 16; lateral-line scales 11 to 13 + 9 to 13 (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. Suborbital margin smooth; ridges of small serrae on preorbital, preoperculum, and interoperculum; height of spinous dorsal fin 28.4 to 40.5 (usually 34-38) percent of SL; second dorsal spine longer than third dorsal spine; third anal spine slightly longer than second anal spine or spines about equal. Colour semi-transparent, often olive or tan on back; head and breast silvery and silvery stripe often present along middle of side; fins clear to yellowish except anterior edge of dorsal, anal, and pelvic fins dusky; maximum size to about 115 mm SL.

Habitat

Brackish mangrove estuaries and freshwater streams. In the Sepik system it is primarily confined to the main channel and is rarely encountered on the floodplain. It forms aggregations amongst aquatic plants and log snags. Large schools frequently enter ox-bow lakes.

Distribution

Indo-Australian Archipelago including Indonesia, Philippines, New Guinea, Vanuatu, New Caledonia, and northern Australia. Also recorded from the Andaman Sea by Weber and de Beaufort (1929).

Biology

Specimens ranged in size from 43-115 mm SL. However, most were under 80 mm SL. The smallest individual with ripe gonads was 83 mm SL and usually fish above 85 mm SL had ripe or ripening gonads. Insufficient numbers of mature fish were caught to enable any firm conclusions to be drawn on the seasonality of spawning. It is believed that *A. interrupta* spawns in estuaries and juveniles migrate upstream, primarily into the lower sections of the river, but occasionally further upstream. There was an apparent migration of juveniles into the lower Sepik in March 1982 suggesting seasonal spawning activity.

The stomach contents of 724 specimens examined between 1981 and 1983 revealed that *A. interrupta* feeds chiefly on insect larvae, predominantly smaller

varieties such as haliplids and chironomids. These items accounted for 67% of the overall volume. Other items included crustaceans (9%), oligochaetes (6%), terrestrial insects (8%) and miscellaneous items including plant fragments, detritus, spiders, and Hirudinea (10%). A lowered intensity of feeding, as indicated by a lower percentage of stomach fullness, was evident during low water periods (May to November), perhaps due to reduced food availability.

Parambassis confinis

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

Material examined

WAM P.27817-003, 6 specimens, 23-53 mm SL, station 29. We have also examined 27 specimens, 24-96 mm SL, from the Gogol, Ramu, and Mamberamo river systems at WAM.

Diagnosis

Dorsal rays VII, I,10; anal rays III,9 or 10; pectoral rays 16 or 17; lateral-line scales 36 to 48 (usually 44 to 48 in Sepik specimens); 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; ridges of small serrae present on preorbital, posterior circumorbitals, preoperculum, and interoperculum; height of spinous dorsal fin 25.3 to 27.6 percent of SL; second dorsal spine longer than third dorsal spine; second and third anal spines about equal; colour brownish on back, white or silvery on lower half with broad blackish stripe between these regions 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 clear except outer portion of soft dorsal and anal fins may be faintly dusky; preserved specimens similar except tan to yellowish on lower half of body; maximum size to about 100 mm SL.

Habitat

The main river channel, tributaries from Marienberg to at least as far upstream as Pagwi. In the Sepik we have taken it only from turbid waters of the main river and large tributaries, but in the Gogol system near Madang aggregations were encountered in clear rocky pools below rapids.

Distribution

Northern New Guinea in the Gogol, Ramu, Sepik, Musa, and Mamberamo river systems.

Biology

The stomach contents of three specimens contained mainly small insect larvae and crustaceans. It is possible that small fishes also form part of the diet.

Terapontidae (Grunters)

Hephaestus transmontanus
(Figure 14)

Therapon transmontanus Mees and Kailola 1977: 58 (Ramu and Sepik systems, Papua New Guinea).

Material examined

WAM P.27835-005, 47 specimens, 51-93 mm SL, station 17; WAM P.27836-003, 4 specimens, 74-76 mm SL, station 18; WAM P.27839-006, 6 specimens, 57-74 mm SL, station 21; WAM P.27840-002, 7 specimens, 54-75 mm SL, station 22; WAM P.27845-008, 3 specimens, 74-78 mm SL, station 27.

Diagnosis

Dorsal rays XI or XII,10 or 11; anal rays III,10 or 11; pectoral rays 14 to 16; gill rakers on first arch 13 to 16; scales in lateral series above lateral line 46-68, below lateral line 46-58; head length 3.2 to 3.5, body depth 2.7 to 3.6, both in standard length; yellow-brown on upper two-thirds of head and body with series of 4 or 5 black longitudinal stripes; area below stripes white; fins mainly clear to slightly dusky, sometimes a few spots at base of caudal fin; freshly dead specimens may develop a series of transverse bars that overlay the stripes thus forming a series of pale "windows"; preserved specimens largely tan with dark markings as described above; maximum size to about 100 mm SL.

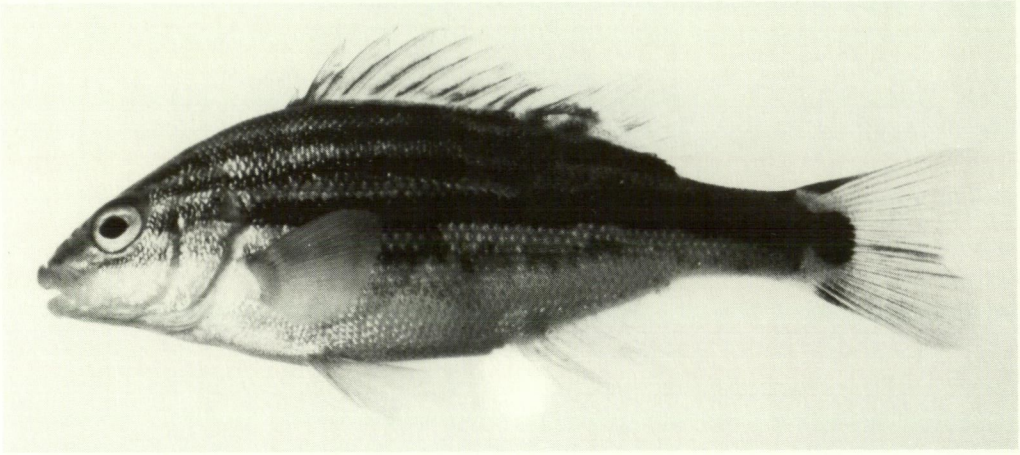

Figure 14: *Hephaestus transmontanus*, 76 mm SL, Sepik tributary near Pagwi.

Habitat

Moderately fast to slow-flowing rainforest creeks, usually in hilly or mountainous terrain at between about 300-1600 m elevation. The bottom usually consists of gravel and cobbles. Particularly common around submerged logs in pools below rapids.

Distribution

Ramu and Sepik river systems of northern New Guinea.

Biology

Stomach contents of several specimens indicate a diet consisting of mainly terrestrial insects, prawns, and small fishes (eleotrids). Sexual maturity is reached at a size of about 60-70 mm SL.

Mesopristes argenteus

Datnia argentea Cuvier (in Cuvier and Valenciennes) 1829: 139 (Java).

Material examined

A single specimen, 160 mm SL, was caught at Magendo (near Angoram) in June 1982, but was not kept. We have examined 2 specimens 32-45 mm SL, from Madang at WAM.

Diagnosis (From Vari, 1978)

Dorsal rays XII,10-11; anal rays III,8-9; pectoral rays 12-14; lateral-line scales 52-58; predorsal scales 13-16; gill rakers on first arch 7-9 + 1 + 15-17; vertebrae 10 + 15; body depth 2.4-2.8, head length 2.4-3.1, both in SL; colour of young in life silvery white to pale grey with 4 black longitudinal stripes on sides, dorsal and caudal fins often yellowish; adults grey with silvery sheen, white on ventral part of head and body. Preserved specimens brown to tan, whitish ventrally, young with black stripes on sides; maximum size to about 280 mm SL.

Habitat

Adults are most often found in brackish estuaries. The young occur in freshwater creeks, usually within 2-3 kilometres of the sea, but occasionally well inland.

Distribution

Indo-Australian Archipelago including Sumatra, Java, Sulawesi, Molucca Islands, Philippines, southern China, Queensland, New Guinea, and New Hebrides.

Kuhliidae (Flagtails)

Kuhlia marginata

Dules marginata Cuvier (in Cuvier and Valenciennes) 1829: 116 (Java).
Kuhlia marginata. — Herre 1936: 450 (Sepik River).

Material examined

Not collected during the present survey, but 16 specimens, 30-89 mm SL, from various New Guinean freshwater localities were examined at WAM.

Diagnosis

Dorsal rays X,10 to 12; anal rays III,11 to 13; pectoral rays 13 to 15; lateral-line scales 40 to 45; scales in transverse series 14 or 15; predorsal scales 9 to 12; rakers on first gill arch 9 + 16 to 18; greatest body depth 2.5 to 2.9 in SL; head length 2.8 to 3.6 in SL; eye 2.6 to 3.3 in head length; maxillary reaching below front half of eye; preorbital and preopercular margins serrated; caudal fin emarginate; colour silvery, greenish-brown on back; upper sides with large dark brown spots, sometimes extending on to bases of dorsal, anal and caudal fins; blackish band submarginally on second dorsal and anal fins; preserved specimens similar, but often overall yellowish or tan; maximum size to about 180 mm SL.

Habitat

Brackish estuaries and lower reaches of streams. Herre (1936) reported it from a brook at Marienberg on the lower Sepik. All specimens collected from scattered New Guinea localities by Allen were from within about 15-20 km of the sea.

Distribution

Widely distributed throughout the Indo-Malayan Archipelago and northwards to Japan; also at high islands of Oceania eastward to the Society Islands.

Kuhlia rupestris

Centropomus rupestris Lacepède 1802: 252, 273 (Reunion).

Material examined

A single specimen, 172 mm SL, caught at Angoram with hook and line on 23 September 1982 was taken during the survey, but subsequently lost. However, 41 specimens, 45-100 mm SL, from New Guinean localities were examined at WAM.

Diagnosis

Dorsal rays X,11; anal rays III,9 or 10; pectoral rays 13 or 14; lateral-line scales 41-44; longitudinal scale rows below lateral line 11 or 12; predorsal scales 14-16; gill rakers on lower limb of first arch 16-19; body depth 1.4-3.0 in SL; head length 2.8-3.0 in SL; colour in life brown or olive on upper back grading to silvery on side and whitish on belly, sides covered with numerous dusky or red-brown spots; fins clear to dusky with prominent black blotch across each caudal lobe; preserved specimens brown to tan with silvery sheen, dark markings on side and caudal fin as described above; maximum size to about 350 mm SL.

Habitat

Usually clear, fast-flowing streams in rainforest. The Sepik specimen is unusual in this regard, having been taken from a turbid, slow-flowing section of the main river.

Distribution

Widely distributed in the tropical Indo-Pacific region. It has been recorded from east Africa, Madagascar, Mauritius, Seychelles, India, Indonesia, Philippines, Palau Islands, Caroline Islands, Solomon Islands, New Guinea, and eastern Queensland, Australia.

Biology

There is scant information on biology, but judging from the broad distribution it apparently has a marine larval stage. Adults probably migrate downstream to spawn in brackish estuaries. The diet includes prawns, insects, and fishes.

Apogonidae (Cardinalfishes)

Glossamia gjellerupi

Apogon gjellerupi Weber and de Beaufort 1929: 285 (Sepik River; Idenburg River; Mamberamo River; and Otker River).
Apogon abo Herre 1936: 447 (Sepik River system).

Material examined

WAM P.26733-003, 47 mm SL, station 10; WAM P.26737-001, 2 specimens, 60-85 mm SL, station 14; WAM P.27832-003, 52 specimens, 20-136 mm SL, station 16; WAM P.27835-002, 36 specimens, 35-115 mm SL, station 17; WAM P.27836-002, 25 specimens, 50-108 mm SL, station 18; WAM P.27839-003, 14 specimens, 44-107 mm SL, station 21; WAM P.27840-004, 14 specimens, 42-83 mm SL, station 22; WAM P.27845-003, 7 specimens, 21-152 mm SL, station 27; WAM P.27846-007, 66 mm SL, station 28; WAM P.27847-001, 7 specimens, 41-101 mm SL, station 29.

Diagnosis

Dorsal rays VI-I,9 or 10; anal rays II,9 or 10; pectoral rays 14 or 15; lateral-line scales 32 to 47; mouth large, maxilla reaches hind margin of eye; lower part of preopercular margin serrate; body depth 2.4 to 2.8 in SL; colour extremely variable, sometimes uniformly pale brown to dark brown, but usually with series of about 10 to 20 oblique dark brown bands on brown to bronzy background; an oblique dark brown bar across cheek below eye; fins clear, brown, or dusky, pelvic sometimes blackish; preserved specimens similar; maximum size to about 160 mm SL.

Habitat

Occurs in a wide variety of habitats including large rivers and small tributary creeks in rainforest. In the latter situation it is most abundant in deeper pools around log debris. In the Sepik mainstream it is found close to shore amongst vegetation or log snags. It was not found in roundwaters or on the floodplain.

Distribution

Markham, Ramu, Gogol, Sepik, and Mamberamo river systems of northern New Guinea. Also occurs in many small independent coastal drainages along the north coast.

Biology

Feeds on small prawns, crabs, insect larvae, and possibly fishes. Females mature at about 70 mm SL, but most at over 90 mm SL. The nuptial colouration of males is considerably more vivid than that of females. Ripe individuals have been collected between August and November.

Remarks

There is a considerable range in the number of lateral-line scales which exhibits random variation amongst populations. The following counts were recorded from specimens examined at WAM: Markham R. system (30-38); Gogol R. system (32-35); Sepik R. system near Pagwi (32-38), Sepik system near Lumi (35-41); Ramu R. system (32-36); Mamberamo R. system (40-47). The closely related *G. wichmanni* from Lake Sentani and streams in the vicinity of Jayapura on the central north coast is characterised by a lower, but overlapping scale count (24-35) and generally has fewer oblique bands on the body (5-10).

Carangidae (Trevallies)

Caranx sexfasciatus Quoy and Gaimard 1825: 358 (Iles des Papous).

Material examined

Twenty-three specimens, 83-175 mm SL were captured during the 1982-83 sampling programme, but none of these were saved. We have examined 3 specimens, 67-83 mm SL, from the adjacent Ramu River drainage at WAM.

Diagnosis

Dorsal rays I (procumbent) — VII or VIII — I,19 to 21; anal rays II-I,15 to 17; pectoral rays 19-21; breast completely scaled; juveniles are silvery, sometimes with 5-6 coppery brown bars on side (although this feature not evident in Sepik specimens); dorsal, anal, and caudal fins yellowish, often a blackish or dusky area near tips of caudal and second dorsal fin lobes; elevated tips of second dorsal and anal fin lobes white; adults reaching 800 mm SL and mainly silvery, darker on back, but not occurring in freshwater habitats.

Habitat

The lower section of the main river and adjacent roundwaters. It also enters tributaries that traverse the floodplain. Common along the northern coast of New Guinea and in the brackish Murik and Watam lakes adjacent to the Sepik River mouth.

Distribution

Widespread in the tropical Indo-Pacific region.

Biology

Adults live in the sea, often forming schools in the vicinity of coral reefs. Juveniles and subadults are common in brackish mangrove estuaries and lower parts of freshwater streams. Our limited survey data indicate that juveniles probably enter the river at the beginning of the flood season and generally occur in small schools. Specimens of about 500 mm TL were reported by villagers in the main river as far as Pagwi (about 390 km upstream).

Half of 18 dissected specimens had empty stomachs, four individuals had fed mainly on insect larvae and five mainly on small prawns (*Cardinia* spp.). No fish remains were evident.

Lutjanidae (Snappers)

Lutjanus goldiei

Mesoprion goldiei Macleay 1882: 233 (Hood Bay, New Guinea).

Material examined

A single specimen, 450 mm SL, from the vicinity of Angoram was examined and photographed, but not retained. However, we have seen 5 specimens, 136-613 SL at WAM from the adjacent Ramu system and southern Papua New Guinea.

Diagnosis (From Allen and Talbot, 1985)

Dorsal rays X,13 or 14; anal rays III,8; pectoral rays 16 or 17; lateral-line scales 45-47; horizontal scale rows above lateral line 5 or 6; scale rows on cheek 6-8; total gill rakers on first arch 5 or 6 + 9 = 14 or 15; body depth 2.2-2.8, head length 2.2-2.8, both in SL; snout 2.8-3.4, eye 5.4-7.0, interorbital 4.9-6.5, maxilla 2.3-2.6, and preorbital depth 4.7-6.1, all in head length; colour metallic golden brown or olive brown to charcoal grey or blackish, paler ventrally; margins of scales darker; fins dark brown to blackish, often yellowish in juveniles; preserved specimens generally overall dark brown; maximum size to about 100 cm TL.

Habitat

Freshwater streams and creeks. It has not been reliably reported from marine habitats, but may occur in brackish estuaries.

Distribution

Fresh water of Papua New Guinea including the Sepik and Ramu river systems in the north and streams draining into the Gulf of Papua in the south.

Biology

Although only one specimen, 200 mm SL, was caught during the gill-net survey, it is occasionally taken by local hand-line fishermen or with nets set in the main river channel. Between August 1981 and February 1983, *Lutjanus*

goldiei was recorded in the market during August, November, December 1981, and January, July, August, September and November 1982. The maximum number seen in any one survey was five individuals and usually only an occasional specimen was present. The size range varied from 400 to 950 mm TL. Ten fish were purchased from the market, all with empty stomachs. However, like other members of the family, they may feed mainly on fishes and crustaceans. The fish entering the market were caught from the main river channels, deeper tributaries, or from the entrances to roundwaters, but never from shallow areas inside roundwaters or the floodplain. It is reported by fishermen at least as far upstream as Ambunti.

According to R. Moore (in Allen and Talbot, 1985) it does not enter coastal waters for spawning off southern Papua New Guinea. He suggested that it might spawn in the upper reaches of tidal inundation in the lower Fly. In the Fly River it has been taken 828 km upstream from the sea.

Remarks

This species is closely related to and frequently confused with *Lutjanus argentimaculatus*. The two species were compared in detail by Allen and Talbot (1985). The most distinctive differences are the greater body and caudal peduncle depths of *L. goldiei* (2.2-2.6 and 2.5-3.0 in head length vs 2.5-3.1 and 3.0-3.5). The two species also differ in colouration. *L. goldiei* lacks the reddish hue often characteristic of *L. argentimaculatus* and its juveniles are uniform dark brown with yellowish fins compared with the narrow pale bars on the body and 1 or 2 horizontal blue lines on the cheek that are typical in young *L. argentimactus*

There is also a substantial difference in general ecology. *L. goldiei* is mainly, if not solely confined to pure fresh water, although they may frequent brackish areas. *L. argentimaculatus* , by contrast is basically marine, although juveniles and subadults are common in brackish mangrove estuaries and lower reaches of freshwater streams. *L. goldiei* was incorrectly referred to as *L. argentimaculatus* by Coates (1987b).

Sciaenidae (Jewfishes)

Pseudosciaena soldado

Holocentrus soldado Lacepède 1802: 344 and 389 (no locality).

Material examined

Four specimens, 150-160 mm SL, were captured in the main river at Angoram in August 1982, one was identified by Trewavas (BMNH), but they were not retained. However, we have seen 5 specimens, 80-116 mm SL, from the adjacent Ramu River at WAM.

Diagnosis (from Munro, 1967)

Dorsal rays X,I,28 to 31; anal rays II,7; lateral-line scales 50 to 55; transverse scale rows above lateral line 8 or 9, below lateral line 17 or 18; predorsal scales

about 14; gill raker on first arch 6 or 7 + 8 to 13; body depth 3.0-4.1 in SL; colour silvery, white on ventral surface; fins often yellowish; preserved specimens tan to brown, fins tan or yellowish; maximum size to about 750 mm TL.

Habitat

Brackish mangrove estuaries and lower sections of rivers, usually over muddy bottoms in very turbid conditions.

Distribution

Widespread along the southeast Asian coast from India to China and throughout the Indo-Malayan Archipelago. Also recorded from Queensland, Australia.

Biology

Apparently feeds partly on fishes. One fish had a large (75% of its own length) blind goby (*Brachyamblyopus urolepis*) in its mouth. There is no published information on the biology, but it appears that spawning occurs in estuaries and young fish migrate upstream.

Cichlidae (Cichlids)

Oreochromis mossambicus

Chromis (Tilapia) mossambica Peters 1852: 681 (Mozambique).
Tilapia mossambica.— Glucksman, West, and Berra 1976: 39 (East and West Sepik Districts).

Material examined

WAM P.27838-004, 10 specimens, 23-29 mm SL, station 20.

Diagnosis

Dorsal rays XV to XVII,10 to 13; anal rays III,7 to 10; pectoral rays 14 or 15; lateral-line scales 29 to 33; gill rakers on lower limb of first arch 17 to 19; colour greenish above with silvery flanks and belly greyish-white; three blackish spots usually visible on sides; breeding males black with white breast, edges of unpaired fins scarlet; juveniles silvery with black spot on dorsal fin; preserved specimens tan to brown, often with silvery sheen and dark marks as described above; maximum size 360 mm TL and 3.3 kg but Sepik specimens rarely above 1.0 kg.

Habitat

Turbid waters of the main river and large tributaries, as well as floodplain lakes. Also found in faster, clearwater creeks of the foothills to at least 1500 m elevation. It tolerates a wide variety of temperatures and may enter low to medium salinities. The predominant habitat is the Sepik floodplain where it is abundant

during flood periods. It enters lakes when river levels fall. Fish in tributary streams attain a much smaller size and are less abundant unless near adjacent swamps. Similarly, there is a general decrease in fish size and abundance with altitude.

Distribution

Freshwaters of eastern Africa, but it has been widely introduced in tropical areas throughout the world as a food fish. It was first brought to Papua New Guinea in 1954 for aquaculture but is now well established in natural waters, particularly north of the dividing range.

Biology

Oreochromis mossambicus is very abundant in Sepik floodplain regions and accounted for about 50% of the weight of catches from fleets of gillnets and 65% of the weight of total landings at Angoram market. Coates (1985) noted the importance of this species to the Sepik floodplain fishery. It is the only freshwater fish ever to form the basis of a commercial fishery (a fillet salting and drying project in Papua New Guinea, based at Angoram).

The biology of this species is well studied in other regions. During reproductive periods the male establishes a territory, excavates a volcano-shaped nest, attracts and courts a female which takes the fertilized eggs into her mouth where they are brooded until the fry are 20-30 mm TL. In the Sepik, such nests are built at the edges of the floodplain. There is no evidence of stunting in floodplain regions. Growth and maturation are rapid. Fish probably begin to breed in their first flood season. Most growth occurs on the floodplain and feeding and growth are reduced in lakes which are regarded more as refuge areas in the dry season.

Adults feed mainly on benthic algae, especially diatoms. Juveniles consume insects and crustaceans. Coates (1987b) noted that the success of *O. mossambicus* was probably due to its ability to exploit the productive alluvial plain. Few native species are able to do this. Thus its niche requirements appear to be quite different to the native species and there is no evidence that it has caused an ecological imbalance in floodplain areas. This, however, is difficult to quantify since no biological studies were undertaken before its introduction. Despite this species being regarded as a "pest" in some regions, in the Sepik it is the singularly most important fish to the local population and its contribution to nutrition greater than all other species combined.

Remarks

Members of the genus *Oreochromis* are well known to interbreed, especially *O. mossambicus* and *O. niloticus* (Linnaeus). Due to the widespread use of both these species, and others, in aquaculture, much interbreeding of stocks has previously occurred. Sepik *O. mossambicus* have been examined by Lowe-McConnell and Trewavas (British Museum [Natural History]) who confirmed

our identification. Similary, Pullin (International Centre for Living Aquactic Resources Management, Manila) has examined Sepik *O. mossambicus* electrophoretically and regards the stock as reasonably pure. T. A. Redding (Institute of Aquaculture, University of Stirling, England) is currently completing a three year study of its biology in the Sepik.

Mugilidae (Mullets)

Liza macrolepis

Mugil macrolepis Smith 1849: plate 28 (South Africa).
Mugil troschelii. — Weber and de Beaufort 1922: 248 (Mimika and Sepik rivers).

Material examined

A single specimen, approximately 300 mm TL was collected by villagers at a small lake near Angoram, identified by Kailola, but was not retained.

Diagnosis (From Thomson and Luther, 1984)

Dorsal rays IV-I,8 or 9; scales in transverse series from first dorsal fin origin to pelvic fin origin 12; head length 23-28 percent of SL; pectoral fin 81-84 percent of head length; fatty (adipose) tissue forming a rim around eye; first dorsal fin origin usually nearer to caudal fin base than to snout tip; second dorsal fin origin on vertical through middle of anal fin base; pectoral axiliary scale absent; colour greenish-grey on back, silvery on sides and belly; fins dusky along margin; preserved specimens tan or brownish, often with silvery sheen, fins tan to dusky brown; maximum size to about 600 mm TL.

Habitat

Shallow coastal seas, brackish estuaries, and fresh water.

Distribution

Widely distributed along continental margins from eastern Africa across the northern Indian Ocean to the Indo-Australian Archipelago and north to Japan; also occurs at the islands of Oceania eastward to the Tuamotus.

Biology

According to Thomson and Luther (1984) it forms aggregations which spawn in the sea. It feeds on small algae, diatoms, foraminifera, and other organic matter, both living and detrital, taken in with sand and mud.

Liza melinoptera

Mugil melinopterus Valenciennes (in Cuvier and Valenciennes), 1836: 146 (Vanicolo).

Material examined

Although several specimens were captured during the 1981-1983 gill-net survey none were retained. However, we have examined 2 specimens at WAM, 136-150 mm SL, from the Ramu and Gogol systems.

Description (From Thomson and Luther, 1984)

Dorsal rays IV-I,8 or 9; anal rays III,9; scales in longitudinal series 26 to 31; scales in transverse series from first dorsal fin origin to pelvic fin origin 9 or 10; head length 26-29 percent of SL; pectoral fin 73-77 percent of SL; fatty (adipose) tissue partially covering iris; first dorsal fin origin nearer to caudal fin base than to snout tip; pectoral axiliary scale absent; colour greenish-brown on back, white to silvery below; fins dusky; preserved specimens tan or brownish, sometimes with silvery sheen, fins tan to dusky brown; maximum size to about 220 mm TL.

Habitat

Shallow coastal seas, brackish estuaries, and fresh water. In the Sepik and Ramu rivers we have taken it only in roundwaters within about 120 km of the sea.

Distribution

Widely distributed along continental margins from eastern Africa across the northern Indian Ocean to the Indo-Australian Archipelago and South China Sea.

Biology

Only a few stomachs were examined and most were empty. The remainder contained fine detritus. Thomson and Luther (1984) reported it feeds on minute bottom-living organisms and on organic material contained in mud and sand.

Remarks

This species was recorded by Hardenberg (1941) from the Merauke River of southern Irian Jaya as *Mugil ceramensis* Bleeker which is currently recognized as a junior synonym of *Liza melinoptera* (Thomson and Luther 1984).

Liza tade

Mugil crenilabis tade Forsskål 1775: 74 (Red Sea).

Material examined

Although several specimens were captured during the 1981-1983 gill-net survey none were retained.

Diagnosis (From Thomson and Luther, 1984)

Dorsal rays IV-I,8 or 9; anal rays III,9; scales in longitudinal series 30 to 35; scales in transverse series from first dorsal fin origin to pelvic fin origin 10 or 11; head length 19-25 percent of SL; pectoral fin 75-79 percent of head length; fatty (adipose) tissue covers most of iris; first dorsal fin origin nearer to snout tip than to caudal fin base; second dorsal fin origin at vertical through posterior

half of anal fin base; pectoral axillary scale absent; caudal fin forked; colour greenish-brown above, silvery below, often with 5-7 indistinct longitudinal dark lines on upper half of body; preserved specimens tan or brownish, sometimes with silvery sheen, fins tan to dusky; maximum size to about 700 mm TL.

Habitat

Shallow coastal seas, brackish estuaries, and fresh water. In the Sepik River we have taken it only in roundwaters near Angoram (about 120 km upstream).

Distribution

Widely distributed along continental margins from the Arabian Peninsula across the northern Indian Ocean to the Indo-Australian Archipelago and China Sea; also occurs in the western Pacific to the Mariana Islands.

Biology

Only a few stomachs were examined and most were empty. The remainder contained fine detritus. Thomson and Luther (1984) reported it feeds on small algae, diatoms, and other organic matter, both living and detrital, taken in with sand and mud. The largest Sepik specimen was 400 mm SL.

Remarks

This species was previously recorded by Weber and de Beaufort (1922) from the Mosso, Tawarin, and Sermowai rivers of northern New Guinea and the Lorentz and Merauke rivers in the south.

Eleotrididae (Gudgeons)

Butis amboinensis

Eleotris amboinensis Bleeker 1853: 343 (Ambon).
Butis amboinensis. — Herre 1936: 453 (Sepik River).

Material examined

WAM P.28206-008, 68 mm SL, station 33. We have also examined 31 specimens, 24-84 mm SL, from New Guinean localities at WAM.

Diagnosis (Partly from Munro, 1967)

Dorsal rays VI-I,8; anal rays I,8; pectoral rays 18 or 19; scales in lateral series about 30; scales in transverse series 9 or 10; predorsal scales about 20; depth of body 5.0-5.5; teeth in outer rows of both jaws not enlarged; area between eye and interorbital crest usually scaled; no small auxiliary scales on body or sometimes a few scattered auxiliary scales; colour variable depending on ecological conditions, specimens from turbid water often lighter brown than those from clear conditions which may be nearly black or very dark brown with scale

centres tan forming longitudinal rows of spots; a broad dark brown stripe from snout through eye and continued across operculum; first dorsal with brown spotting on basal portion and clear or whitish distally; caudal fin mostly dark brown with white spotting except upper lobe abruptly pale; anal fin dark brown with pale spots on basal part; pelvic fins dark brown; both anal and pelvic fins and sometimes second dorsal fin with red margin; pectoral fin mainly clear with black blotch anteriorly edged with red; preserved specimens similar, except red colouration is absent; maximum size to about 100 mm SL.

Habitat

Brackish estuaries, mangrove creeks, and freshwater streams. Occurs amongst mangrove roots or aquatic vegetation. It was rarely collected during the survey period but penetrates upstream about 390 km to the vicinity of Pagwi. Most specimens were captured by villagers at Imbuando roundwater near Angoram in January, March and May of 1982.

Distribution

Indo-Australian Archipelago including Indonesia, Philippines, New Guinea, and the Solomon Islands. It was also reported from India by Koumans (1953).

Biology

The stomach contents of several specimens examined at WAM included insects, crabs, and prawns.

Remarks

Koumans (1953) noted a lack of scales between the eye and orbital crest of *B. amboinensis*. Our specimens, however usually possess a few scales in this area. Otherwise they agree well with his description.

Eleotris aquadulcis

Eleotris aquadulcis Allen and Coates, 1990: 133 (near Bunapas, Ramu River, Papua New Guinea; paratypes from Sepik River).

Material examined

WAM P.28206-007, 9 specimens (paratypes), 61-183 mm SL, station 33; AMS I. 24301-002, 5 specimens, 160-215 mm SL, station 33. We have also seen the holotypes, 305 mm SL, and 11 paratypes 61-226 mm SL, from the adjacent Ramu River at CAS and WAM.

Diagnosis

Dorsal rays VI-I,7 or 8; anal rays I,9; pectoral rays 16 or 17; scales in longitudinal series 36-40; scales in transverse series 13; predorsal scales 35-42; gill rakers on first arch 2 + 10 = 12; vertebrae 25; greatest body depth 3.6-4.4 in SL; head length 2.4-2.7 in SL; maxillary length 2.7-3.0 in head length; a downward projecting

blunt spine at lower corner of preopercle margin (revealed by dissecting overlaying skin). Colour mainly dark brown to blackish with 1-2 diagonal white stripes across cheek; fins mainly dark brown except pelvic and pectoral fins lighter with faint brown spotting; juveniles with pattern of irregular light brown to whitish bars and blotches on darker brown ground colour; preserved specimens similar; maximum size to about 250 mm SL.

Habitat

Most specimens have been collected from oxbow lakes. It has been recorded as far upstream as Chambri Lakes, about 300 km from the river mouth.

Distribution

Known only from the Sepik and Ramu rivers of northern Papua New Guinea.

Biology

A total of 124 specimens were caught during the gill-net survey of 1981-1983. Although taken from roundwaters throughout the year it was more abundant from November to April during the flood season. It is far less common than the other large eleotridids *Oxyeleotris heterodon* and *Ophieleotris aporos*. Most adult individuals (>100 mm SL) caught in gill nets were mature or maturing. The smallest mature male was 117 mm SL and the smallest female was 123 mm SL. The maximum SL was 246 mm (weight 396 g) and 217 mm (weight 307 g) for females and males respectively. Fish with running-ripe or spent gonads were encountered from December to May (the flood season), but relatively few individuals were sampled during the dry season.

The majority of ripe eggs observed were in the same stage of development. The mean diameter of 10 eggs each from a total of 10 individuals with ripe ovaries was 0.27 mm. Mean GSI for females with ripe or running-ripe gonads was 6.58 (N=41) and 1.97 for males (N=21). *E. aquadulcis* did not appear to be storing much visceral fat. Many specimens had no visible fat deposits and the overall impression was that there was far less fat than in the other large Sepik eleotridids.

Most stomachs examined were empty, but of 19 fish containing food items, larger insect larvae (e.g. Odonata, Isoptera) comprised the majority of the contents. Snails had been consumed by seven individuals and one fish had eaten a juvenile *Oxyeleotris heterodon*.

Remarks

This species was erroneously referred to as *Eleotris macrolepis* (Bleeker) by Herre (1936) and Munro (1958 and 1967).

Eleotris melanosoma

Eleotris melanosoma Bleeker 1852: 705 (Ceram).
Eleotris melanosoma. — Herre 1936: 453 (Sepik River).

Material examined

None collected during the present survey, but 11 specimens, 25-117 mm SL, from the Fly River and Madang were examined at WAM.

Diagnosis

Dorsal rays VI-I,8; anal rays I,8; pectoral rays 17 to 20; rakers on first gill arch 2 or 3 + 8 or 9; scales in longitudinal series 46 to 58; scales in transverse series 11 to 18 (usually 13 to 16); predorsal scales 37 to 53; greatest body depth 4.5 to 5.5 in SL; head length 2.7 to 3.5 in SL; eye 4.5 to 5.5 in head length; maxilla reaches to below rear part of eye; a downward projecting spine at lower corner of preoperculum (sometimes hidden by skin and muscle tissue); cheek, operculum, and top of head usually scaled; colour dark brown to black, sometimes with paler longitudinal lines on scale rows; fins spotted in young, but blackish in adults; preserved specimens similar; maximum size to about 120 mm SL.

Habitat

Brackish estuaries and lower reaches of streams, usually within 10-20 km of the sea. Herre (1936) reported it from a brook at Marienberg on the lower Sepik about 70 km upstream.

Distribution

Widely distributed along continental margins from eastern Africa across the northern Indian Ocean to the Indo-Australian Archipelago; also found at high islands of Oceania eastward to the Society Islands.

Biology

The stomach contents of several specimens examined at WAM included terrestrial insects, prawns, and prosobranch molluscs (Neritidae).

Hypseleotris cyprinoides

Eleotris cyprinoides Valenciennes (in Cuvier and Valenciennes) 1836: 248 (Réunion).
Hypseleotris guntheri. — Herre 1936: 450 (Sepik River).

Material examined

WAM P.28206-003, 35 specimens, 40-60 mm SL, station 33.

Diagnosis

Dorsal rays VI-I,8; anal rays I,10; pectoral rays 13 to 15; scales in longitudinal series 28 to 30; scales in transverse series 7 or 8; predorsal scales 23 to 26; extending

nearly to snout tip; rakers on first gill arch 4 + 11 to 13; segmented caudal rays 15; greatest body depth 3.5 to 4.5 in SL; head length 3.5 to 4.1 in SL; body slender and laterally compressed; snout short, somewhat pointed; mouth nearly terminal, lower jaw protruding slightly; head and body covered with ctenoid scales; colour overall brown with lighter scale centres; black spot about size of eye at base of lower half of caudal fin; dorsal and anal fins dusky brown to blackish with 2-3 rows of large pale spots; caudal fin clear with vertical rows of small blackish spots; pelvic and pectoral fins pale with narrow blackish bar across base of latter; preserved specimens similar; maximum size to about 70 mm SL.

Habitat

Well vegetated margins of streams and lakes. It was not collected in the main river during the survey, but probably occurs there.

Distribution

Apparently widespread in the Indo-West Pacific. New Guinea localities other than the Sepik River where the species has been collected by Allen include Manus Island, Gogol River system, and Nabire (Irian Jaya), all on the northern coast.

Biology

There is little information on biology. It was commonly caught by village fishermen in roundwaters and lakes between November and March during the survey period. Sexual maturity is attained by at least 35-40 mm SL in both sexes. Young (1987a) described an aquarium spawning of the closely related *Hypseleotris compressa* from northern Australia. Hundreds of tiny (0.2-0.3 mm diameter) eggs were laid in random "trails" on a hard substrate (aquarium glass in this case, but probably rock in nature). Hatching occurred within about 24 hours. The stomach contents of several specimens of *H. guntheri* examined at WAM included filamentous algae and small crustaceans (mainly copepods).

Remarks

According to Hoese (pers. comm.) the northern New Guinea species treated here may represent an undescribed species. There is a need for revision of *Hypseleotris*.

Mogurnda bloodi

(Figure 15)

Mogurnda bloodi Whitley 1956: 28 (Jimmi River, a tributary of the Sepik River, Papua New Guinea).

Material examined

WAM P.27841-001, 11 specimens, 38-96 mm SL, station 23; WAM P.27842-002, 29 specimens, 18-73 mm SL, station 24; WAM P.27844-002, 11 specimens, 23-39 mm SL, station 26; WAM P.28192-004, 53 mm SL, station 31.

Diagnosis

Dorsal rays VIII or IX - I,11 to 14 (usually 13); anal rays I,11 to 13; pectoral rays 15 or 16; segmented caudal rays 15; lateral scale series 37 to 51; transverse scales 12 to 16; predorsal scales 20 to 27; upper portion of head and back dark brown; 8 or 9 brown bars on upper half of side with yellow or tan colour between that extends onto ventral part of body; breast, pectoral base and lower half of head bluish; 3 reddish stripes radiating from rear part of eye across cheek and opercle, the uppermost continued across middle of pectoral fin base; scattered red spots on body and basal half of caudal fin; dorsal and anal fins mainly reddish to dusky purple, dorsal fins with pale yellowish margin, anal fin with yellowish mid-lateral band and red stripe adjacent to base; caudal fin pale yellow with whitish margin; pectoral and pelvic fins purplish, a dark mark at base of upper pectoral rays and a thin dark bar across base of all rays; preserved specimens yellowish or tan, brown dorsally with 8-9 brown bars on upper half of side; stripes on cheek and opercle sometimes evident; fins tan to brown; maximum size to about 100 mm SL.

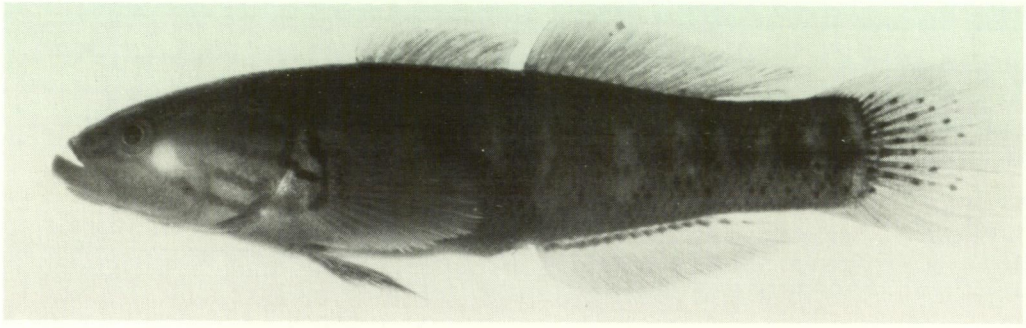

Figure 15: *Mogurnda bloodi*, 78 mm SL, Sepik tributary near Lumi.

Habitat

Inhabits deeper pools in relatively shallow fast-flowing creeks and also swamps. Known mainly from tributaries in hilly terrain at elevations between 300-1500 m.

Distribution

Ramu, Sepik, and Mamberamo river systems of northern New Guinea.

Biology

The stomach contents of several specimens indicate that terrestrial and aquatic insects are the main food items. Young (1987b) gave an account of the spawning behaviour of the closely related *Mogurnda mogurnda* from northern Australia. A patch of relatively large (3 mm-long), elongate eggs is deposited on a rock surface. These are guarded by the male until hatching which occurs in about six days at 24°C.

Mogurnda nesolepis

Eleotris (Odonteleotris) nesolepis Weber 1908: 256 (Tawarin River and Timena Brook, New Guinea).

Material examined

WAM P.27832-005, 76 specimens, 12-27 mm SL, station 16; WAM P.27845-005, 8 specimens, 25-35 mm SL, station 27; WAM P.28192-003, 21 specimens, 15-39 mm SL, station 31.

Diagnosis

Dorsal rays VII-I,10 or 11; anal rays I,8 to 10; pectoral rays 13 to 15; branched caudal rays 14 or 15 (usually 15); predorsal scales 13 to 20; scales in lateral series 26 to 38; scales in transverse series from base of second dorsal fin origin to anal fin origin 9 to 12; precaudal vertebrae 12 or 13; colour light tan, females with black mid-lateral stripe, also present in males, but usually broken or diffuse, often forming a series of large black spots on middle of caudal peduncle; head with broad dark stripe behind eye across opercle and thinner oblique stripe across cheek; dorsal fins and caudal fin yellowish with red to dusky brown spotting; anal fin yellowish or orange, except blackish distally; pectoral and anal fins clear to dusky; fins of mature males more vividly marked than those of females; preserved specimens tan to light brown with darker markings as described above; maximum size to about 40 mm SL.

Habitat

Slow-flowing tributaries on the edge of the floodplain and faster flowing rainforest creeks in hilly terrain at altitudes between about 100 and 400 m.

Distribution

Gogol, Ramu, Sepik and Mamberamo river systems of northern New Guinea. Also occurs in many smaller independent drainages along the northern coast.

Remarks

This species is provisionally placed in *Mogurnda*. A revision of *Mogurnda* and allied genera currently in progress by Allen and Hoese indicates that *nesolepis* possibly deserves separate generic status.

Ophieleotris aporos

Eleotris aporos Bleeker 1854: 59 (Sindagole, Halmahera).
Ophiocara aporos. — Herre 1936: 456 (Sepik River).

Material examined

WAM P.26730-002, 21 specimens, 25-101 mm SL, station 7; WAM P.27832-004, 135 mm SL, station 16; WAM P.27836-005, 108 mm SL, station 18; WAM P.27838-003, 234 specimens, 14-137

mm SL, station 20; WAM P.27846-009, 2 specimens, 98-105 mm SL, station 28; WAM P.27847-005, 50 mm SL, station 29.

Diagnosis

Dorsal rays VI-I,8 or 9; anal rays I,9; pectoral rays 14 or 15; scales in longitudinal series about 30-32; scales in transverse series 8 or 9; predorsal scales 17-19; gill rakers 2-4+10-12; greatest body depth 4.0-4.8 in SL; head length 3.2-3.5 in SL; head completely scaled; maxilla reaches below front of eye; caudal fin rounded, about length of head; colour generally greenish to brown, sometimes with bronzy sheen; series of 8-10 faint brownish bars across sides; lower part of head and belly tan or yellowish; 3-4 dark brown to reddish stripes radiating from lower and rear margin of eye across cheek and opercle; red spots sometimes present on body; dorsal fins weakly spotted with yellow and brown on basal part; caudal fin dusky brown with yellow spots; pectoral fins clear with pale-edged black mark covering most of base; preserved specimens generally brown and lacking bronzy sheen and red marks; maximum size to about 200 mm SL.

Distribution

Reported by Koumans (1953) from widely scattered localities in the tropical Indo-Pacific including Madagascar, India, Andaman Sea, Indo-Malayan Archipelago, Philippines, islands of Melanesia, and northern Australia. The possibility that more than a single species may be represented is currently being investigated by Akihito and Meguro (pers. comm.).

Habitat

Occurs in a variety of habitats including the main river, swamps, lakes, and turbid or clear tributary streams to elevations of at least 400 m above sea level. It is perhaps the most widely distributed of all fishes in the Sepik system and is particularly common throughout the floodplain of the lower and middle parts of the river.

Biology

This species was caught throughout the gill-net survey of 1981-1983, representing 16 percent of the total catch weight. It was also commonly encountered at the Angoram market where it made up approximately 3 percent of the landings. There was a marked increase in catches as the river level decreased at the beginning of the dry season. Our survey data confirm it inhabits the floodplain during the wet season and enters permanent lakes when the river level is dropping.

Approximately 2000 specimens were captured with gill nets: the largest male was 196 mm SL (171 g) and the largest female 194 mm (165 g). No significant difference was found in the average size of the two sexes. However, during most of the year there was a pronounced difference in male to female ratio, generally ranging from about 1-4 : 1.

Sexual maturity occurs by at least 53 mm SL in males and 50 mm SL in females or at about 25 percent of maximum length. It possibly occurs slightly smaller, but few fishes in this size class were sampled. Spawning takes place year round with a peak in January and February or just after the start of the flood season. The eggs are very small compared to most other Sepik fishes, with a mean diameter of .297 mm (N = 100)). Smaller fish are relatively more fecund (i.e. eggs per unit weight) than are larger ones. Fish under about 80 mm SL generally have in the region of 100,000 eggs, whereas those above 140 mm SL may have only about 220,000.

It is generally omnivorous. The stomach contents of 1,282 individuals were examined of which 47 percent were empty. Aquatic insects and nymphs (e.g. Odonata and Isoptera) were the dominant item consumed representing 41.8 percent of the volume of stomachs containing food. Other major items included green filamentous algae (13.1 percent), other plant material (11.1 percent), and fine detritus (19.9 percent). Small crustaceans (e.g. Ostracoda, Cladocerca, etc) represented 3.2 percent of the volume. In spite of their availability no larger crustaceans such as *Caridina* and *Macrobrachium* were consumed. Lesser items which each constituted less than 1 percent of the volume included terrestrial insects, spiders, gastropods, leeches, worms, unidentified eggs and fish scales. The stomachs of some individuals frequently contained only a single item, in many cases an unidentified species of filamentous algae. There appeared to be little or no correlation between size and dietary preference except filamentous algae was largely avoided by fish under 100 mm SL. Feeding activity or food availability as reflected by percent fullness of stomachs was reduced during the dry season (July-October).

Ophieleotris aporos is abundant on the floodplain and swampy areas near lower altitude streams. Its ecology is influenced greatly by the river flood regime. Feeding, reproduction, body condition and fat storage all increase in the flood season and decrease in the dry season. It is an important subsistence food fish and frequently caught by villagers with hand nets or in basket traps. It also forms the primary food source of the larger *Oxyeleotris heterodon*.

Ophiocara porocephala

Eleotris porocephalus Valenciennes (in Cuvier and Valenciennes) 1837: 178 (Seychelles and New Ireland).

Ophiocara porocephala. — Herre 1936: 457 (Sepik River).

Material examined

None collected during the present survey, but 12 specimens, 27-109 mm SL, from eastern New Britain and Madang were examined at WAM.

Diagnosis

Dorsal rays VI-I, 8 or 9; anal rays I, 6 or 7; pectoral rays 15; scales in longitudinal series 38 to 40; scales in transverse series 11 to 13; predorsal scales 24 to 26; greatest

body depth 4.0 to 4.5 in SL; head length 2.6 to 3.1 in SL; maxillary reaching below rear part of eye; head completely scaled; body scales ctenoid posteriorly becoming cycloid anteriorly and on head; caudal fin rounded, somewhat lanceolate in large specimens, about equal to head in length or slightly shorter; colour dark green to blackish or dark brown with darker longitudinal lines along scale rows; lighter brown on ventral half; fins dusky brown or blackish with orange rays; second dorsal, anal, and caudal fins bordered with reddish-orange; second dorsal and caudal fins also with small dark spots; juveniles with 2-5 white or silvery bars across sides which fade with growth; preserved specimens brown to blackish with darker longitudinal lines along scale rows; juveniles with 2-5 white to yellow tan cross bars; maximum size to about 260 mm SL.

Habitat

Primarily brackish estuaries, but also enters fresh water. In the latter habitat it is usually found within about 10 km of the sea. Herre (1936) reported it from Marienberg on the lower Sepik, about 60 km upstream.

Distribution

Widely distributed from India eastward to the Indo-Australian Archipelago and China Sea; also reported from high islands of Oceania.

Biology

The stomachs of several specimens examined at WAM were packed with shells of prosobranch molluscs (Thiaridae).

Oxyeleotris fimbriata

Eleotris fimbriatus Weber 1908: 254 (Etna Bay, New Guinea).

Material examined

WAM P.26726-002, 92 mm SL, station 3; WAM P.27845-006, 4 specimens, 16-48 mm SL, station 27; WAM P.27846-006, 62 mm SL, station 28. We have also examined 2 lots (AMNH 48614 and 48608) collected in the Torricelli Mountains (North Sepik drainage) in 1966 by J. Diamond.

Diagnosis

Dorsal rays VI-I,11 or 12; anal rays I,9 or 10; pectoral rays 15 or 16; scales in lateral series about 65 to 83; scales in transverse series about 19 to 24; predorsal scales about 37 to 45; gill rakers on first arch 1 or 2 + 7 or 8 = 8 to 10; greatest body depth 5.1-5.8 in SL; head dorsally flattened; lower jaw prominent; caudal fin rounded, less than head length; colour mainly brown lighter on ventral parts; 2 or 3 broad dark brown stripes radiating from lower and rear margin of eye across preopercle; frequently with dark brown spot partly bordered with white or tan at base of upper caudal fin rays; juveniles (under about 50 mm SL) with

irregular dark brown bar at base of caudal fin; dorsal and caudal fins with brown spotting; pectoral, pelvic, and anal fins dusky grey to brown; preserved specimens similar; maximum size to about 20 cm SL.

Habitat

Most common in deeper pools of creeks situated in hilly terrain to at least 500 m elevation, but also found in lowland areas in the main river, tributaries, and lakes.

Distribution

New Guinea and Cape York Peninsula, Australia. The various populations in northern and southern New Guinea and in Australia most likely represent several distinct taxa.

Biology

Insect remains are the only recognizable stomach contents in the specimens we examined. Sexual maturity, at least in females, occurs at a SL of about 60-70 mm. The ripe eggs are very large, measuring about 2 mm in diameter in a 76 mm SL specimen.

Oxyeleotris heterodon

(Figure 16)

Eleotris heterodon Weber 1908: 255 (Lake Sentani).
Boroda malua Herre 1935: 111 (Sepik River).

Material examined

WAM P.26730-003, 2 specimens, 52-137 mm SL, station 7; WAM P.26731-001, 2 specimens, 102-262 mm SL, station 8. We have also seen 5 specimens, 170-213 mm SL from the adjacent Ramu River system.

Diagnosis

Dorsal rays VI-I,9; anal rays I,8; pectoral rays 18; scales in longitudinal series 62 to 68; scales in transverse series 19 to 22; predorsal scales about 50 to 60; gill rakers 3 or 4 + 9 or 10; vertebrae 26; greatest body depth 4.0-5.0 in SL; head length 2.5 to 2.7 in SL; body thick, wedge-shaped, robust; head broad, depressed, cheeks becoming swollen with age; upper profile concave between nape and snout; outer row of teeth in each jaw enlarged; caudal fin rounded; colour overall dark brown, lighter brown on breast and abdomen; fins of fish under about 150 mm SL often nearly clear or slightly dusky brown, becoming darker with increased growth; dorsal fins with dark brown spotting; preserved specimens similar; maximum size to about 410 mm SL.

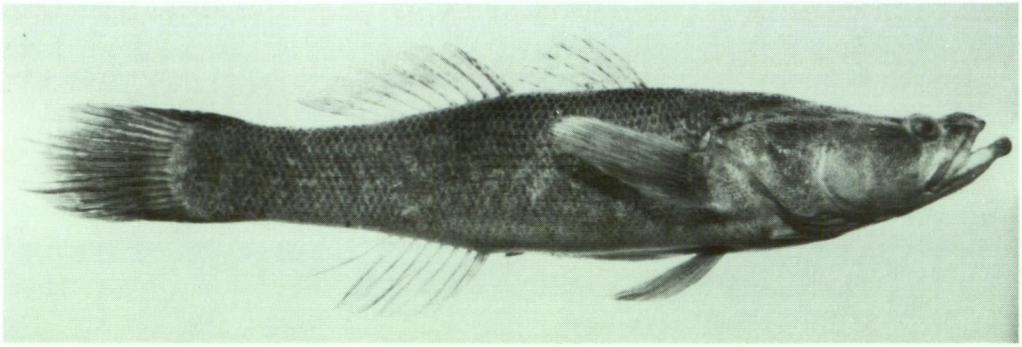

Figure 16: *Oxyeleotris heterodon*, 200 mm SL, lower Ramu River.

Distribution

Known with certainty only from the Sepik and Ramu river systems, and Lake Sentani, all in the central portion of northern New Guinea.

Habitat

Widespread throughout the floodplain of the lower and middle Sepik, with a preference for deeper, still waters of lakes. It is rarely encountered in the main river channel.

Biology

This species was caught throughout the 1981-1983 gill net survey, but in much lower numbers than the other major eleotridid *Ophieleotris aporos*. Approximately 500 specimens were obtained from the nets and at the Angoram market representing 13 and 12 percent of the total catch weight and market landings respectively. It is similar to *Ophieleotris aporos* in that it inhabits the floodplain during the wet season and then enters permanent lakes as the river level drops at the beginning of the dry season.

Sex ratios were approximately 1:1. The largest male was 404 mm SL (1.83 kg) and largest female 396 mm SL (1.86 kg), with specimens in excess of 350 mm SL frequently encountered. Relatively little visceral fat is stored compared to *Op. aporos*, although larger fish and mature males generally showed an increase in deposits. It was difficult to determine the minimum size at maturation because few small fish were obtained. The smallest mature male seen during the survey was 185 mm SL and all males above 230 mm SL were mature or at least maturing. Females tend to mature at a significantly smaller size; the smallest was 100 mm SL and all those above 175 mm SL were mature or maturing.

Spawning occurs all year round with a slight increase in activity during May-August (dry season). The eggs have a mean diameter of .46 mm (N = 100). The gonads of individual females were found to contain between about 15,000-250,000 eggs. Fecundity is low (on a number of eggs per unit body weight basis) compared to that in *Op. aporos*.

Ox. heterodon has strictly carnivorous feeding habits, exhibiting a marked preference for its fellow eleotridid, *Ophieleotris aporos*. Of 268 stomachs containing food this item represented 63 percent of the volume and 76 percent of all fish had consumed it. This prey item is specifically targeted as only 3 of 187 fish examined had eaten fishes other than *Op. aporos*. The other major food category was large crustaceans, primarily *Macrobrachium* which constituted 34 percent of the volume and was found in 42 percent of individuals. Other items found in small quantities included detritus, gastropods, and larger insect larvae and nymphs. All food items, including larger fish and prawns, are ingested whole.

Oxyeleotris heterodon is important to the local fishery (Coates 1985). It is also interesting to note that it is the only piscivore in the Sepik known to feed almost exclusively on *Op. aporos*. Its ecology is influenced greatly by the behaviour of *Op. aporos* and it follows this prey onto and off the floodplain according to flood conditions. Therefore its food source is constantly available. Feeding, condition and reproduction increase only slightly at the beginning of the dry season, as *Op. aporos* become more available as prey.

Gobiidae (Gobies)

Glossogobius bulmeri

(Figure 17)

Glossogobius ? bulmeri Whitley 1959: 318 (Kwan Stream, flowing into the lower Lanim River, a tributary of the Lai River, Sepik system).

Material examined

WAM P.27839-004, 79 specimens, 36-76 mm SL, station 21; WAM P.27840-007, 17 specimens, 21-50 mm SL, station 22; WAM P.27845-004, 4 specimens, 18-35 mm SL, station 27.

Diagnosis

Dorsal rays VI-I,10; anal rays I,7 or 8, pectoral rays 17 to 19; scales in longitudinal series 32 to 36; scales in transverse series 9 $^{1}/_{2}$ or 10 $^{1}/_{2}$; predorsal scales 15 to 18; rakers on first gill arch 0 + 6 or 7; vertebrae 28 or 29; greatest body depth 5.2 to 5.8 in SL; head length 3.4 to 3.7 in SL; eye 3.7 to 5.6 in head length; interorbital 5.7 to 7.8 in head length; body elongate, laterally compressed posteriorly; head short with rounded snout; lower jaw projects slightly; head mostly naked except nape; colour light brown with darker scale margins forming network pattern; four irregular, large, blackish blotches along middle of side with similar, but slightly smaller blotches on back above spaces between mid-lateral blotches; blackish spot, about eye size, at base of caudal fin; dorsal half of head with numerous brown streaks and blotches; fins clear to whitish; males with black spot on posterior part of first dorsal fin; first dorsal fin with pair of oblique blackish stripes and pair of similar stripes on basal

part of second dorsal fin; central portion of caudal fin with prominent brown spotting; a curved brownish stripe on upper part of pectoral fin base; preserved specimens similar; maximum size to about 100 mm SL.

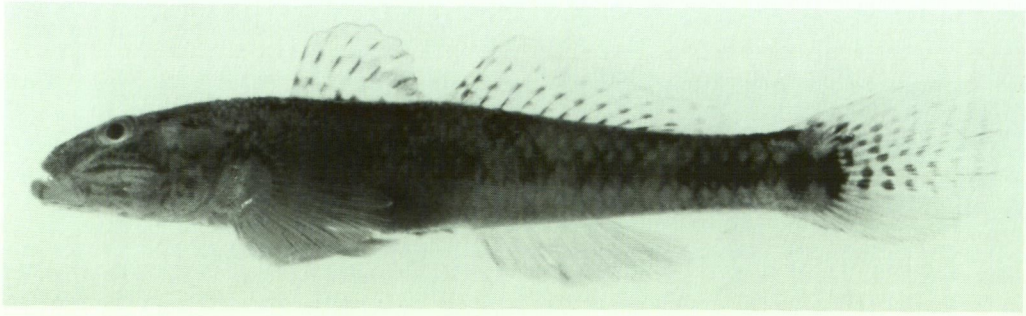

Figure 17: *Glossogobius bulmeri*, 74 mm SL, Sepik tributary near Maprik.

Habitat

Rainforest tributaries with boulder, gravel, or sand bottoms in hilly terrain. It has been taken at elevations ranging from about 35 to 1,070 m.

Distribution

Known from the Sepik and Mamberemo systems. Also found in the Bewani Mountains between the two systems.

Glossogobius giurus

Gobius giurus Hamilton - Buchanan 1822: 51, 366 (Ganges River System).
Glossogobius giurus. — Herre 1936: 458 (Sepik River).

Material examined

No specimens were taken during our survey activities. However, we have examined a specimen, 91 mm SL, from the adjacent Ramu River and several Australian specimens at WAM.

Diagnosis

Dorsal rays VI-I,9; anal rays I,8; pectoral rays 19 or 20; scales in longitudinal series 30 to 32; scales in transverse series 9 ½ to 10 ½; predorsal scales 20 to 24; rakers on first arch 2 + 1 + 6; vertebrae 27; greatest body depth 5.3 to 6.2 in SL; head length 2.9 to 3.1 in SL; eye 4.9 to 7.3 in head length; body elongate, laterally compressed posteriorly; head relatively elongate, depressed in anterior part; lower jaw projects strongly; head largely naked, but scales on nape and upper part of operculum; some pit organ lines on cheek in multiserial rows; colour tan or light brown with row of five enlarged dark brown blotches along middle of side including one at caudal fin base; similar but smaller and often less distinct blotches on back above spaces between mid-lateral blotches; irregular

dark brown spots, blotches and lines on head; fins clear or whitish, a double row of brown spots on basal half of both dorsal fins; caudal fin with relatively large brown spots forming transverse rows; preserved colouration is similar; maximum size to about 350 mm SL, but New Guinea specimens usually under 180 mm SL.

Habitat

Occurs in a variety of freshwater and brackish habitats. Usually confined to the lower and middle reaches of rivers, not penetrating to significant elevations. The Ramu specimen was collected from very turbid water on a soft mud bottom, approximately 40 km upstream from the sea.

Distribution

This is the widest ranging member of the genus occurring from eastern Africa and Madagascar, along the coast of Asia to the Indo-Australian Archipelago, and northward to Japan.

Remarks

The identity of the species identified from the Sepik as *G. guirus* by Herre (1936) is uncertain as we now know there are several similar *Glossogobius* in this region. However, *G. giurus* must certainly occur in the lower Sepik since we have confirmed its presence in the nearby and sometimes confluent Ramu system. Herre also recorded *G. celebius* (Valenciennes) from the Sepik, but confirmation of this record is likewise not possible on the basis of the information he provided.

Glossogobius koragensis

(Figure 18)

Glossogobius koragensis Herre 1935: 419 (Koragu, Sepik River).

Material examined

WAM P.27846-005, 8 specimens, 51-126 mm SL, station 28; WAM P.27847-002, 14 specimens, 46-102 mm SL, station 29.

Diagnosis

Dorsal rays VI-I,9; anal rays I,8; pectoral rays 17 to 19; scales in longitudinal series 31 to 36; scales in transverse series 11; predorsal scales 30; rakers on first arch 1 + 7 or 8; vertebrae 27; greatest body depth 5.0 to 6.5 in SL; head length 2.8 to 3.0 in SL; eye 6.1 to 7.1 in SL; head length 2.8 to 3.0 in SL; eye 6.1 to 7.1 in head length; body elongate, laterally compressed posteriorly; head relatively elongate, depressed in anterior part; lower jaw projects strongly; head naked except nape and a few small scales on upper part of operculum; interorbital

relatively wide (4.8 to 6.0 in head length), usually with paired anterior and posterior interorbital pores; colour light brown sometimes with 5 or 6 faint dusky blotches on side; small black spot about pupil size sometimes at base of caudal fin; head darker brown, operculum with bronzy sheen; fins clear to slightly yellow, except caudal fin dusky yellowish-brown; faint spotting on pectoral, second dorsal and caudal fins; preserved specimens brown to yellowish brown with darker scale margins; dusky on back, fins tan with dark markings described above; maximum size to at least 170 mm SL.

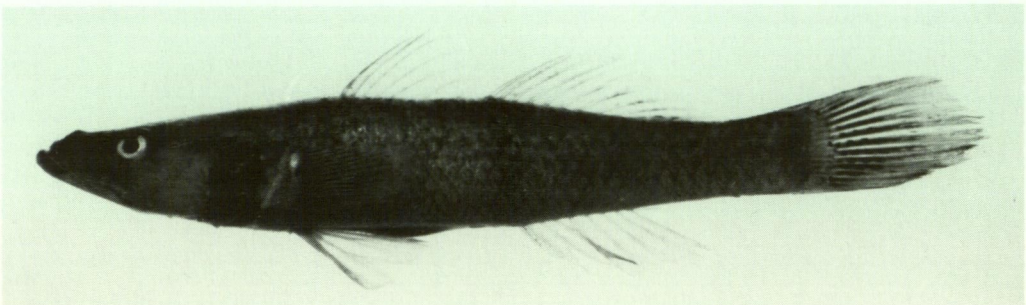

Figure 18: *Glossogobius koragensis*, 142 mm SL, lower Ramu River.

Habitat

Mainly found in lakes or roundwaters of the lowland plain, but also occasionally encountered in main river channels.

Distribution

Sepik and Ramu river systems of northern New Guinea.

Biology

Twenty specimens, nearly all exceeding 110 mm SL, were captured from roundwaters near Angoram during the 1981-1983 gill-net survey. Most specimens were either sexually mature or maturing. The presence of two running ripe females and one spent female in a February 1982 collection suggests breeding occurs in the lakes. The largest specimen collected was 160 mm SL. The stomachs of 15 fish examined were mainly empty, but two contained whole large snails and three had large insect larvae (mainly *Odonata*).

Glossogobius coatesi

Glossogobius coatesi Hoese and Allen 1990: 118 (Ramu River near Usema Village, Papua New Guinea).

Material examined

WAM P.27847-009, 5 paratypes, 24-79 mm SL, station 29. We have also seen 21 type specimens, 15-96 mm SL, from the adjacent Ramu system at CAS and WAM.

Diagnosis

Dorsal rays VI-I,8; anal rays I,8; pectoral rays 19 or 20; scales in longitudinal series 29 to 31; scales in transverse series 9½ or 10½; predorsal scales 14 to 16; rakers on first arch 2 + 7 or 8; vertebrae 27; greatest body depth 5.2 to 5.9 in SL; head length 3.3 to 3.4 in SL; eye 3.6 to 4.6 in head length; interorbital 4.9 to 5.6 in head length; body elongate, laterally compressed posteriorly; head depressed, snout relatively short; lower jaw projecting; head naked except nape and a few small scales on upper part of operculum; colour tan, brown on back; scale margins dark brown; five large diffuse brown blotches on middle of side; head with irregular brown spots and blotches; fins mainly pale, fine spotting on dorsals and caudal; male slightly darker overall and may have small black spot at rear of first dorsal fin; maximum size to about 100 mm SL.

Habitat

Most specimens have been collected from relatively slow-flowing, turbid water, except three were taken from a clear, fast-flowing tributary of the Ramu River.

Distribution

Known from the Sepik system in a tributary near Pagwi and from the Ramu mainstream (approximately 380 up upstream from mouth) and a rainforest tributary of this system (450 km upstream).

Remarks

This species is described by Hoese and Allen in the present volume (p. 118).

Glossogobius torrentis

Glossogobius torrentis Hoese and Allen, 1990 : 122 (tributary of Ramu River near Dumpu, Papua New Guinea).

Material examined

WAM P.27835-005, 2 paratypes, 20-31 mm SL, station 17; WAM P.27840-003, 51 specimens, 20-65 mm SL, station 22. We have also seen 122 specimens, 15-71 mm SL, from the upper Ramu Valley at AMS, CAS, and WAM.

Diagnosis

Dorsal rays VI-I,9 or 10 (usually 9); anal rays I,7 or 8 (usually 7); pectoral rays 15 to 18 (usually 16 or 17); scales in longitudinal series 28 to 33; scales in transverse series 8 ½; predorsal scales 8 to 15; rakers on first gill arch 1 or 2 + 5 to 7; vertebrae 27 or 28; greatest body depth 6.0 to 6.3 in SL; head length 3.3 to 3.4 in SL; eye 3.4 to 3.6 in head length; interorbital 4.3 to 4.5 in head length; body elongate, laterally compressed posteriorly; head depressed with relatively short snout; jaws about even or lower jaw projecting slightly; head

mostly naked except nape; colour generally tan; with complex pattern of irregular-shaped, dark brown spots and blotches on head and sides; about 8 diffuse, large, dark brown blotches along middle of side including one at base of caudal fin, usually with 1-3 thin vertical brown lines extending from blotches; dorsal and caudal fins with rows of small dark brown spots, those on caudal fin forming vertical bands; a black ocellus sometimes surrounded by yellow-orange on rear part of first dorsal fin; anal, pelvic and pectoral fins mainly pale tan or cream coloured; brown spot on upper base of pectoral fins; maximum size to about 75 mm SL.

Habitat

Clear to moderately turbid, fast-flowing streams with gravel and rock bottoms. Elevations of the known collecting sites range from 140 to 1800 m.

Distribution

Known from mountain tributaries of the Sepik River near Lumi and from the Ganz River near its junction with the Jimmi River (approximately 5°27'S, 14428'E). Also known from the upper Ramu Valley.

Remarks

This new species is described by Hoese and Allen in the present volume (p. 122).

Mugilogobius fusculus

Gobius (Tamanka) fusculus Nichols 1951: 5 (New Guinea).

Material examined

WAM P.28206-009, 21 mm SL, station 33. We have also seen the holotype, 31 mm SL (AMNH 16887).

Diagnosis

Dorsal rays VI-I,8 or 9; anal rays I,8 or 9; pectoral rays 16; branched caudal rays 15; scales in lateral series 32-38; scales in transverse series 8 or 9; predorsal scales 13-15; pelvic fins fused with well-developed basal membrane; head depressed with swollen cheeks; predorsal scales reaching rear edge of interorbital; snout and interorbital papillose; cheeks scaleless; caudal fin rounded about equal to head length; larger specimens (males?) reported to have a filamentous extension of the first dorsal spine; preserved specimens light brown with fine pepper-like spotting on body and fins; a blackish spot at rear of first dorsal fin and pelvic fins dusky brown; other fins mainly pale. Live colouration unknown; maximum size to about 35 mm SL.

Habitat

Precise habitat data is unavailable. It is not known if our single specimen was taken from the main river or from nearby lakes or roundwaters.

Distribution

Known only from New Guinea fresh waters. Our specimen is only the second that has been collected. The exact type locality was unknown to Nichols (1951).

Redigobius bikolanus

Vaimosa bikolana Herre 1927: 151 (Luzon, Philippines).

Material examined

WAM P.28206-005, 16 specimens, 17-27 mm SL, station 33.

Diagnosis

Dorsal rays VI-I,6 or 7; anal rays I,6 or 7; pectoral rays 15 to 17; vertical scale rows 26 to 28; horizontal scale rows 7; predorsal scales 6 to 8; gill rakers short, 7 or 8 on lower limb of first gill arch; body depth 26-31 percent of SL; head length 33-38 percent of SL; snout blunt, rounded; maxillary reaching to about middle of eye or slightly beyond; colour light brown or tan with irregular darker brown spots and blotches; faint brown bars on head; dorsal and caudal fin spotted; anal fin dusky with 4-5 short brown bars immediately above base; pectoral and pelvic fins clear or slightly dusky; preserved specimens similar; maximum size to about 35 mm SL.

Habitat

The main river channel and roundwaters of the Lower Sepik. It is also a common inhabitant of brackish estuaries throughout its range.

Distribution

Widely distributed along the western margin of the tropical Pacific Ocean from Japan southward to the Philippines, Indonesia, New Guinea, and northern Australia, south to Fraser Island.

Stenogobius laterisquamatus

Oxyurichthys laterisquamatus Weber 1908: 261 (Tami Basin, northern New Guinea).
Chonophorus lachrymosus. — Herre 1936: 459 (Sepik River).

Material examined

WAM P.27846-010, 57 mm SL, station 28; WAM P.27847-006, 3 specimens, 44-76 mm SL, station 29; WAM P.28206-002, 156 mm SL, station 33. We have also seen 8 lots at WAM containing 115 specimens, 17-131 mm SL, from the Ramu and Gogol rivers.

Diagnosis

Dorsal rays VI-I,10; anal rays I,10; pectoral rays 16; scales in longitudinal series 52 to 61; scales in transverse series 14 to 16; predorsal scales 22 to 32; rakers on first gill arch poorly developed (3 or 4 rudiments on lower limb) or absent; greatest body depth 3.9 to 4.9 in SL; head length 4.0 to 4.2 in SL; eye 5.2 to 7.2 in head length; caudal relatively elongate, somewhat pointed, much longer than head in adults; body elongate and compressed; snout blunt and rounded; scales ctenoid except cycloid on head; cheek and operculum scaled; snout and interorbital naked; gill opening somewhat restricted, extending forward to below rear part of operculum; colour pale grey to slightly yellowish on back grading to white or silvery on sides; small brown spots (approximately one per scale) on upper half of body; 8-10 broad, curved, brown bars sometimes present on side, their concave side forward; a broad blackish bar below eye; dorsal fins pale with faint wavy blackish stripes; caudal fin pale, faintly spotted on upper half; anal, pelvic and pectoral fins mainly whitish or translucent; a short black bar on upper base of pectoral fin; preserved specimens similar; maximum size to about 220 mm SL.

Habitat

Main river channels, tributaries, lakes, and roundwaters of the lowland floodplains with mud bottoms.

Distribution

Mosso, Sepik, Ramu, and Gogol rivers of north-western Papua New Guinea.

Biology

A total of 67 specimens were caught during the survey of 1981-1983. These ranged in size from 95 mm (a maturing female) to 215 mm SL. Forty-three stomachs were examined of which 26 were empty. Those with food generally contained detritus.

Gobioididae (Eelgobies)

Brachyamblyopus urolepis

Amblyopus urolepis Bleeker 1852: 581 (Sumatra).

Material examined

WAM P.29664-001, 84 mm SL, station 33.

Diagnosis

Dorsal rays VI,31 or 32; anal rays I,32 or 33; pectoral rays 18; body elongate, head rounded; eyes very small; small scales restricted to rear part of body; dorsal

and anal fins with elongate bases; caudal fin pointed, longer than head; no barbels or flaps on head; colour pinkish-red; preserved specimens tan or brown; reaches at least 85 mm SL.

Habitat

Rivers and brackish estuaries. In the Sepik and adjacent Ramu systems it has been collected from the main river channel. Apparently it burrows in soft mud.

Distribution

India, Andaman Islands, Malay Peninsula, Indonesia, Philippines, and New Guinea.

Biology

The single specimen collected during the present survey was taken from the mouth of *Pseudosciaena soldado*.

Acknowledgements

We thank the Papua New Guinea Department of Fisheries and Marine Resources, who sponsored the gill-netting survey of 1981-1983. We are also grateful to the Papua New Guinea Biological Foundation under the auspices of Dr L. Pryor, for providing funds for Allen's visit to the Sepik River in 1982. The United Nations Development Programme and the Food and Agriculture Organisation of the United Nations sponsored Coates's investigations on Sepik and Ramu fishes from 1987.

Much valuable comparative material utilised in this study was obtained on a recent survey of the Ramu River. Allen's involvement in this expedition was made possible by a grant from the Christensen Research Institute in Madang, Papua New Guinea. We were capably assisted in this work by Mr T. Frohm, Mr J. Mizu, and Dr L. Parenti.

The following specialists provided assistance with species identification: Dr B. Collette (Hemirhamphidae), Dr C. Dawson (Syngnathidae), Dr D. Hoese (Gobiidae and Eleotrididae), Mrs P. Kailola (Ariidae) and Mr R. Watson (*Stenogobius*). Dr S. Poss supplied photographs of *Microphis spinachoides*. We are especially grateful to Mrs P. Kailola for providing species diagnoses for the ariid catfishes. Mrs S. Slack-Smith provided identifications of molluscs found in the stomachs of eleotrids.

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