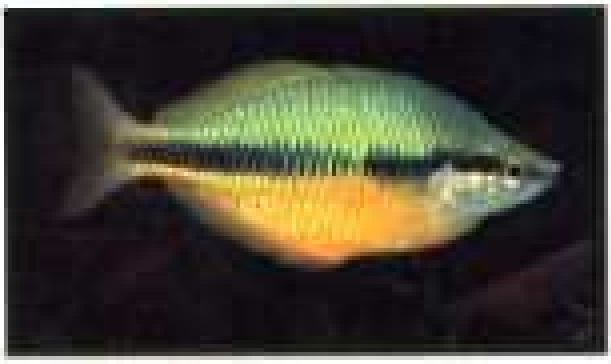
FIELD GUIDE TO THE

FRESHWATER FISHES OF NEW GUINEA



Dr. Gerald R. Allen

Publication No. 9 of the
Christensen Research Institute

Field Guide to The Freshwater Fishes of NEW GUINEA

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This book is dedicated to Connie J. Allen.
It could not have been completed without
her assistance and encouragement.

Cover photos : Popondetta Rainbowfish,
Pseudomugil connieae ,
(G. Schmida photo).

Lake Tebera Rainbowfish
Melanotaenia herbertaxelrodi
(G.Allen photo)

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Table of Contents

Fig 1 – Map of New Guinea and surrounding regions.

Preface

The idea of writing a comprehensive field guide to the freshwater fishes was conceived during my initial collecting trip to Papua New Guinea in 1978. The need for such a guide was obvious. I experienced difficulties when attempting to identify nearly every captured fish. At this time the only available book was Munro's "Fishes of New Guinea." Although extremely helpful it was too bulky for field use. Moreover, it was difficult to locate the freshwater species from among the hundreds of marine fishes that were treated. Also, the freshwater parts were based mainly on previous work that was now greatly outdated.

Since that first trip 12 years ago I have visited Papua New Guinea and Irian Jaya on ten separate occasions. The work has been usually difficult, but always rewarding. Access to remote areas was the major problem. Fortunately there is an excellent system of air transport operating in both Papua New Guinea and Irian Jaya, much of it provided by various missionary groups. In recent years there has also been an improvement in the road system. For example, one of my most exciting and successful trips was the 1982 journey from Kiunga to Tabubil in the Upper Fly system on a recently constructed road that crossed 160 km of previously virgin territory. Of course it is also possible to walk into remote locations, but this approach is not cost effective when trying to cover widely separated locations during visits of relatively short duration. However, walks were sometimes necessary. I will not soon forget the day-long 40-km trek through the Baliem Valley of Irian Jaya on which no native fishes were found.

I feel that the point of diminishing returns has been reached. I have collected most areas accessible by road and commercial aircraft plus numerous remote locations. Even so, many places remain unsampled, but the great expense of reaching these sites cannot be easily justified. My work in New Guinea has been rewarding to the extreme, exceeding even my own ambitious expectations at the onset of the project. Numerous new records, new species, and significant range expansions have resulted. The fauna as covered in this field guide, consists of 329 species. I believe it is now an appropriate time to summarise knowledge of this intriguing fauna. Habitat destruction due to timber cutting, mining, oil drilling, and dams is increasing at an alarming rate throughout New Guinea. Hopefully this book will also prove useful in helping formulate sound management and conservation policies in order to preserve freshwater habitats, especially those which are particularly vulnerable and require urgent protection such as Lake Kutubu.

Gerald R. Allen
Lumi, Papua New Guinea
24 October 1988

Acknowledgements

This book would not have been possible without the enthusiastic assistance of many individuals, various granting agencies, and particularly my home institution, the Western Australian Museum. I am most grateful to the Australia and Pacific Science Foundation (formerly the Papua New Guinea Biological Foundation) under the auspices of their Secretary, Professor Lindsay Pryor, for providing grants for three field expeditions to Papua New Guinea, and for funding the preparation of the painted plates and line drawings. Collections in Madang Province, including surveys of the Gogol and Ramu rivers, were facilitated by a grant from the Christensen Research Institute. The United Nations Sepik Fish Stock Assessment Project under the management of David Coates provided funds for a visit in 1988. Financial assistance for plane and helicopter charters was obtained from Herbert R. Axelrod and Hans Mayland.

I have enjoyed the continuing support of my work in New Guinea by the Western Australian Museum, in particular the Board of Trustees, the Director, John Bannister, and the Head of the Natural Sciences Division, Paddy Berry. Invaluable assistance was also rendered by J. Barry Hutchins and Kevin Smith of the Department of Ichthyology, and also by former employee Nick Haigh.

I was assisted on various expeditions by John Paska, Brian Parkinson, Roger Steene, Heiko Bleher, Wolfgang Tins, Barry Crockford, Lynne Parneti, and Douglass F. Hoese. The Papua New Guinea's Department of Primary Industry, Fisheries Research Branch, were particularly helpful, including past employees John Paska, Raymond Moore, and John Locke, as well as current Acting Chief Biologist, Andrew Richards. Assistance above and beyond the call of duty was given by David Coates formerly of D.P.I. Fisheries and now Project Manager of the U.N. Sepik Programme. Dr. Coates and project biologist, Paul van Zwieten, provided invaluable logistic support on two trips to the Sepik system. The Ramu and Gogol field work was greatly facilitated by assistance from the former and present staff of the Christensen Research Institute, including Diane Christensen, Terry Frohm, John Mizeu, Matthew Jebb, and Terry Reardon. My visits to Papua New Guinea were largely possible due to the cooperation of the Department of Environment and Conservation, especially Secretary Karol Kisakau and former First Assistant Secretary in the Wildlife Section, Navo Kwapena.

I am indebted to the curators or staff, past and present, of fish departments at various museums for allowing me to examine or borrow New Guinea material under their care. These include Douglass Hoese, John Paxton, and Mark McGrouther (Australian Museum, Sydney), Norma Feinberg, Gareth Nelson and C. Lavett Smith (American Museum of Natural History, New York), Lynne Parenti, William Eschmeyer and Tyson Roberts (California Academy of Sciences, San Francisco), Ike Rachmatika (Museum Zoologicum Bogoriense, Bogor, Indonesia), Victor Springer (Smithsonian Institution), Han Nijjsen and Issac Isbrucker (Institute of Taxonomic Zoology, Amsterdam), Martin Boeseman and Martin van Oijen

(Rijksmuseum van Natuurlijke Historie, Leiden), James Menzies and Matthew Kawei (University of Papua New Guinea), and Kasim Moosa (Indonesian Institute of Sciences). Valuable specimens were also examined at the Kanudi Fisheries Research Station in Port Moresby. The collection has variously been under the care of Patricia Kailola (now of the Bureau of Rural Resources, Canberra), John Paska, and Joe Makeu. Mrs. Kailola continues to maintain an active interest in this collection and has made periodic visits to advise on procedures for its maintenance and use. Assistance with the atherinid section was rendered by Walter Ivantsoff and Lucy Crowley. Basim Saeed helped to prepare the psedomugilid section. Similar assistance with the Gobiidae was given by Douglass Hoese, Helen Larson, and Ronald Watson. The ariid catfish section was greatly improved by the input of Patricia Kailola. John Beumer provided anguillid eel identifications.

The fish plates and line drawings were meticulously executed by talented Perth natural history artist Roger Swainston. Sharron Williams prepared the outline drawings for the families as well as the *Sicyopterus* and syngnathid drawings. Camera ready artwork was capably prepared by Greg Jackson of the Western Australian Museum's Publications Department. Desmond Doherty of the same department assisted with the layout.

Colour photographs were kindly provided by Neil Armstrong and Günther Schmida.

I am grateful for the assistance of the Asian Wetland Bureau and Perlindungan Hutan dan Pelestarian Alam (Indonesian Directorate General of Forest Protection and Nature Conservation) in supporting field work in Irian Jaya during 1989. In particular, thanks are due Marcel Silvius, Paul Erftemeijer, and Max Zeiren of the Indonesian office of AWB and Zuwendra and Sergius Kosamah of PHPA. Ian Craven, World Wildlife Fund Officer at Manokwari, Irian Jaya, kindly provided accomodation and collecting assistance.

The publication of this book would not have been possible without the support of the Christensen Research Institute, Madang, Papua New Guinea. The Director of CRI, Matthew Jebb, provided the necessary funds for publication.

I also thank Bernard Koh of Calendar Print, Singapore for his special interest in this book and his expertise in creating the layout and supervising the production stages.

Finally I thank my wife, Connie, for enthusiastic support of this work and her tolerance of my long periods of absence while away on field trips. Moreover, she has been a guiding light in so many ways, and is always willing to sacrifice her own priorities to help my research endeavours.

Introduction

Although New Guinea has one of the richest marine fish faunas on earth, only about 330 freshwater fishes have been recorded, including about 100 which are basically estuarine forms. By comparison the Kapus River system of Kalimantan (Indonesian part of Borneo) has nearly 300 and it is conservatively estimated there are 2000 species in the Amazon Basin. Nevertheless, New Guinea's fishes are deserving of special interest. It is easily forgotten that most are just as unique as the more heralded cassowaries, birds-of-paradise, and tree kangaroos.

This book represents the first truly comprehensive coverage of the island's freshwater fishes. It is largely based on the author's first hand collecting experiences during ten expeditions between 1978 and 1989, but also incorporates extensive study of museum specimens in Papua New Guinea, Indonesia, Australia, Europe and the United States of America. In addition, all previous literature dealing with the freshwater fishes of New Guinea was reviewed.

The book is intended to serve as a guide to the identification of every freshwater fish thus far known from Irian Jaya and Papua New Guinea. In addition, there is useful information concerning distribution, general biology and present or potential economic use.

The quality of higher education in both Papua New Guinea and Irian Jaya has greatly accelerated in the past ten years, resulting in a nucleus of well trained national biologists and less reliance on the recruitment of foreign educators. It is crucial for these people to have a good knowledge of their indigenous fauna and flora, especially since there is an increasing need to establish conservation measures. Hopefully, this book will help to fill this need.

Historical Background

Our current knowledge of the classification of New Guinea's fishes is based on preserved specimens lodged at various Australian, European, and American museums. There is also a relatively recent, but very important collection at the Kanudi Fisheries Research Laboratory in Port Moresby. New Guinea's fishes have attracted the attention of natural historians since the early 1800's. The French were the first Europeans to collect there followed later by the British. German and Italian expeditions also visited in the latter half of the century. Most of these early expeditions collected only marine fishes. Many were described by the French naturalists Cuvier and Valenciennes or later by Albert Günther, a curator, at the British Museum.

The first freshwater fishes were not described until the 1860's. The ariid catfish, *Arius leptaspis* was described by the famous Dutch surgeon-naturalist Pieter Bleeker in 1862 and Günther described the plotosid catfish,*Tandanus brevidorsalis* in 1867. Significant collections were also obtained by Australian expeditions and were described in a series of important works by Macleay, Ramsay and Ogilby between 1877 and 1898. The traditional Australian interest in New Guinea has continued into the 20th century, in a number of separate papers by Gilbert Whitley and Ian Munro's *The Fishes of the New Guinea Region* (1958) and *Fishes of New Guinea* (1964).

The most important early research devoted entirely to freshwater fishes was that of the Dutch who visited the interior on several expeditions between 1903 and 1920. Major collectors during this period included de Beaufort (1903 & 1910), Gjellerup (1910-11), Gooszen (1909), van Heurn (1920), van Kampen (1910-11), Koch (1904), and Lorentz (1907 & 1909). The

majority of these collections were summarised by Weber (1908 & 1913), who was the first author to comprehensively treat the freshwater fauna. Other New Guinea species were described in the monumental work *Fishes of the Indo-Australian Archipelago* by Weber and de Beaufort. The only major freshwater collections in recent times are those from the Fly, Sepik, Purari, and Laloki rivers of Papua New Guinea reported by Roberts (1978), Allen and Coates (1990), Berra et al. (1975), and Haines (1979) respectively. In addition, a large collection obtained by Dutch expeditions to Irian Jaya in the 1950's were reported by Allen and Boeseman (1982). My own collecting efforts between 1978 and 1989 has resulted in numerous publications which include descriptions of approximately 65 new species.

Faunal Composition

The freshwater fauna of New Guinea as reported in the present field guide consists of 329 species. Of this total 13 species are introduced forms, and about 102 species are fishes that are believed to have a marine larval stage and are relatively widespread outside of New Guinea. The remaining species are purely freshwater indigenous fishes. It is this latter group that gives New Guinea its unique "flavour" and which demonstrates a close relationship with the Australian fauna. The two areas have been connected by dry land in the region that is now Torres Strait and the Arafura Sea for much of their geological past. Nearly all families, most genera, and numerous species are shared between these two areas (see Table 1); two closely related families, Rainbowfishes (Melanotaeniidae) and Blue-eyes (Pseudomugilidae) are unique to the combined region.

The fish fauna of New Guinea-Australia is very different to that of other continental tropical regions such as south-east Asia, Africa, and South America, which tend to be dominated by cichlids and primary division Ostariophysan fishes (eg. carps, barbs, loaches, characins, and catfishes). The Ostariophysan assemblage is represented in New Guinea-Australia only by plotosid and ariid catfishes, but in contrast to the primary division forms that have evolved entirely in fresh water they are considered to be secondary division fishes of marine origin. In fact all of New Guinea-Australia's freshwater fishes except the lungfish (*Neoceratodus*), bony tongues (*Osteoglossus*), and possibly galaxiids (a southern Australian family) are considered to be derived from marine ancestors. The very different complexion of the fish fauna compared to other regions is a reflection of the long period of isolation (approximately 50 million years) since the Australian land mass broke away from Antarctica and began drifting northwards towards its present global position. Even though New Guinea now lies in close proximity to the island groups of eastern Indonesia there is marked difference between their respective freshwater fishes due to their very different geological origins. Indonesia (with the possible exception of Timor and western Sulawesi) is part of the Asian continental plate which until about 20 million years ago was well separated from New Guinea-Australia. Even today there remains a barrier of deep oceanic water which has effectively prevented faunal exchange of freshwater fishes. The Dutch ichthyologist, Max Weber delineated the boundary in 1919 and it is sometimes referred to as Weber's line. It lies between western New Guinea and the Molucca Islands, somewhat east of the much heralded "Wallace Line." There are a number of "freshwater" fishes, particularly gobiids and eleotridids, found on either side of this boundary, but they cannot be considered to be pure freshwater forms. Invariably they tend to be fishes that have a marine pelagic stage or are equally adept at living in fresh, brackish, or sea water. This capability accounts for their broad distribution throughout south-east Asia, Melanesia or beyond. In recent years a number of primary division fishes have reached New Guinea as a result of both intentional and accidental introductions by man (see page 209 for further discussion).

Origin of the New Guinean Fauna

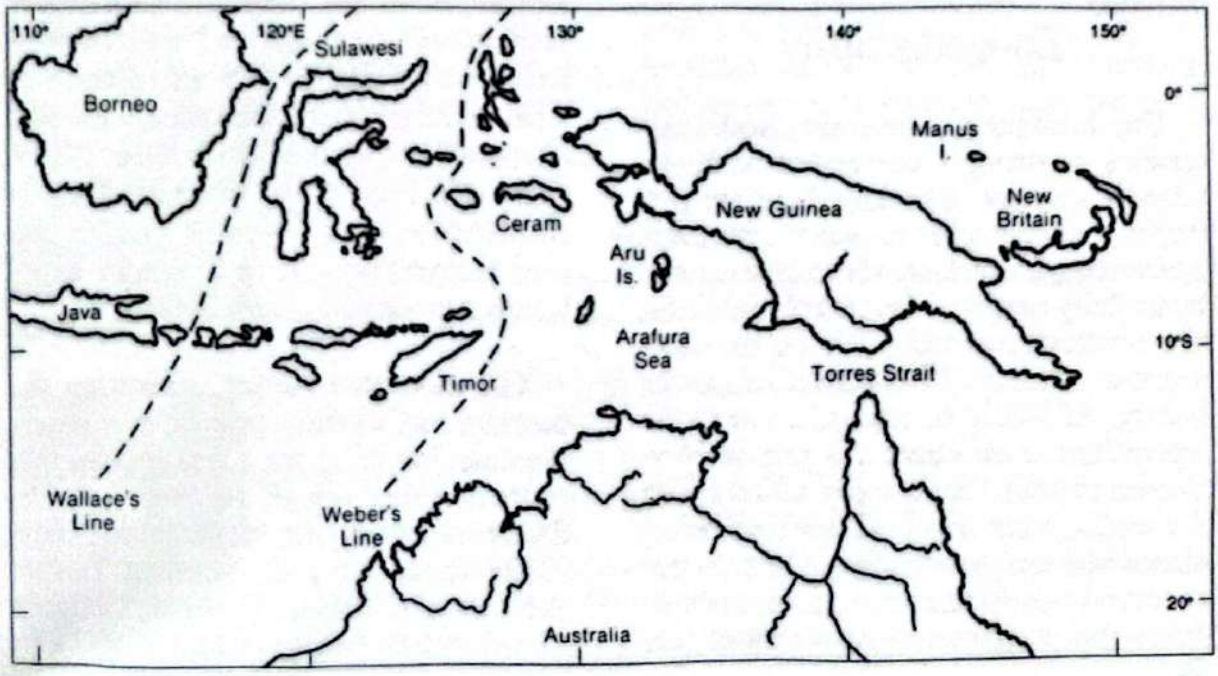
The close relationship between the New Guinean and Australian fish faunas is not surprising. These land masses have been connected throughout most of their history, up until about 6000-8000 years ago, when glacial melting caused a rise in sea levels, flooding the area (sometimes called the Sahul Shelf) that is now the Arafura Sea and Torres Strait.

When the Australia-New Guinea continental block finally reached its approximate present position some 20 million years ago the forces that molded the current New Guinean landscape gradually began to exert their influence. After separation with Antarctica there was a slow northward migration of about 30 degrees latitude until the advance was finally halted by a collision with the Pacific Plate. This collision and subsequent tectonic events have had a profound influence in transforming New Guinea from an ancient, rather featureless northern margin of Australia to the youthful, mainly mountainous island that exists today.

Although it is one of the most geologically complex areas on earth, New Guinea is basically composed of three main geological provinces: (1) the ancient southern continental platform; (2) the volcanically active northern margin containing both upthrusted oceanic crust (ophiolites) and volcanic formations; and (3) the central mountainous area formed by folding, deformation, and subsequent up-lifting of layered sedimentary and volcanic rock. It was not until the Pliocene, or about 5-6 million years ago that the present landscape became established. Vertical movements of several thousand metres occurred along major faultlines resulting in the mountainous relief of the central interior. Extensive volcanism also took place in the Highlands between about 1-2 million years ago, eventually ceasing at about 200,000 years ago.

Unfortunately far less is known about the evolutionary history of the present freshwater fish fauna. To date no fossils have been found that would elucidate its origins. Certainly for much of its history the Southern Platform portion of New Guinea must have been the haunt of various ceratodid lungfishes, which feature prominently in the fossil record of Australia. As many as 7 species once inhabited the island continent and the modern genus *Neoceratodus* of eastern Australia has remained virtually unchanged for over 100

Fig 1 – Map of New Guinea and surrounding regions.



million years. However, lungfishes did not survive in New Guinea. Perhaps the most ancient fish still represented there is the Saratoga (*Scleropages jardinii*), a member of the primitive bony tongue family (Osteoglossidae). The family apparently evolved in fresh waters of the Southern Hemisphere and although it is considerably older, fossil records date back as far as 38-55 million years ago. Besides New Guinea and Australia the family is represented today in south-eastern Asia, South America, and Africa.

Marine families such as the ariid and plotosid catfishes, atherinids, gudgeons, and gobies provided the evolutionary nucleus for the present fauna. They perhaps reached New Guinea and Australia after the northward drifting continent reached its present position proximal to the Indonesian Archipelago. Some ancestral colonizers probably reached New Guinea's shores in the form of drifting pelagic eggs and larvae, a mode of dispersal common among modern inshore fishes. It is not difficult to imagine that certain marine fishes, particularly euryhaline estuary dwellers, were able to gradually adapt to freshwater conditions. Once established in this habitat the stage was set for further evolution, which occurred when populations became fragmented due to the formation of natural barriers as a result of catastropic geological events.

Zoogeography

The distribution of the purely freshwater species is strongly correlated with the island's geology. Basically there are two major zoogeographic provinces, northern and southern, which are abruptly separated by the lofty ranges of the central highlands. The southern province is by far the most speciose, reflecting its long, relatively stable history. As would be expected, due to the recent land connection, this part of New Guinea exhibits the strongest affinity with Australia, with about 33 species being shared between the two areas. The presence of several closely allied species of rainbowfishes and gudgeons living on either side of the Arafura Sea-Torres Strait barrier indicate that their speciation was a relatively recent event, perhaps within the past 6000-8000 years.

Northern New Guinea was formed in relatively recent geological times, within the past 10 million years or so, as a result of faulting, folding, and upthrusting in the zone of collision between the Australian and Pacific Plates. It is evident from their close relationship that the somewhat impoverished northern fish fauna was derived from the older, southern fauna. It appears likely that the northern fauna evolved from ancestral species that became isolated as a result of the tremendous up-lifting of the central mountains which occurred 5-6 million years ago. It is interesting to note that the vast central mountainous region between the major provinces is largely devoid of fishes. No indigenous fishes have been found above an elevation of 1800 m. Highland fishes in general are restricted to broad low elevation valleys, the lower moderate-gradient sections of headwater streams, and montane lakes. In many upland areas where suitable aquatic habitats exist and fishes might be expected to occur they are conspicuously absent. Such is the case in the Baliem River Valley of Irian Jaya and in the Upper Sepik in the vicinity of Telefomin. The general lack of fishes in the highlands probably reflects the violent geological past of this region, which includes concurrent volcanism and glaciation as recently as 300,000 years ago. Moreover, widespread glaciation with greatly lowered temperatures persisted until about 15,000 years ago. Even today, steep gradients in combination with torrential rainfall and cool temperatures, tend to render many headwaters unsuitable for fishes.

The mountain barrier separating the northern and southern provinces is nearly absolute, but there are a few species that occur on either side of the central divide. Examples include the Mountain Rainbow (*Chilatherina campsi*), Northern Tandan (*Neosilurus gjellerupi*), Fimbriate Gudgeon (*Oxyeleotris fimbriata*), and Bulmer's Goby

(*Glossogobius bulmeri*). These fishes either have been able to cross the divide via their own locomotion or as a result of shifting barriers due to tectonic processes. With regards to the latter phenomena, there is a possibility the Wahgi River which flows through a broad valley near Mt. Hagen, Papua New Guinea and is a headwater stream of the southerly flowing Purari River, may have formerly been part of the northerly flowing Sepik system. It could have reversed its flow pattern as a result of blockage by eruptions from Mt. Hagen, which were as recent as 200,000 years ago. This may have provided the corridor which allowed the Mountain Rainbow access to the southern drainage. On the other hand, fishes such as the tandan, goby, and gudgeon belong to genera that are more proficient than most New Guinean fishes as far as penetrating mountainous terrain is concerned.

Zoogeographic Subprovinces

Although New Guinea is broadly divisible into major northern and southern faunal provinces, at least seven discrete subprovinces are evident. Their recognition is based on the presence of a substantial number of regional endemics. Although there are often relatively wide-ranging (within New Guinea) fishes that transcend these boundaries, being shared by one or more regions, each province harbours a significant number of species that are more or less restricted to it (i.e. endemic). The regional boundaries are closely related to those of major geographic barriers such as high mountain ranges and surrounding seas.

Western Islands - The province is composed of four heavily forested, mountainous islands, Waigeo, Batanta, Salawati, and Misool, which lie immediately to the west of the Vogelkop Peninsula. All were once connected to the New Guinea mainland, as recent as 10,000 years ago, when sea levels were as much as 100 m below present levels during pleistocene glacial periods. It is the least known region in New Guinea for freshwater fishes. For example, no collections have yet been made at Batanta or Salawati. Endemic *Melanotaenia* are known from Waigeo and Misool, but these islands have not been collected since Dutch expeditions in the first half of this century. The relatively few fishes that have been collected from this region indicate a relationship with the Great Southern Province.

Vogelkop Peninsula - The Vogelkop or Birdshead Peninsula comprises the extreme western end of the mainland and is essentially isolated by a narrow mountainous isthmus. It is divided into the main Vogelkop Peninsula and smaller Bomberai Peninsula that lie north and south respectively of the intervening Bintuni Bay (McCluer Gulf). The region consists mainly of lowland rainforest with large tracts of heavily corrugated Karst topography. There are also high mountains (>2,000 m) along the north coast of the Vogelkop Peninsula and northwestern corner of the Bomberai Peninsula. Ichthyologically, the area is poorly known, but it shows a definite affinity with the Great Southern Province. The only significant collecting expeditions are those of Boeseman (1954-55) and Allen (1982 & 1989), in which relatively few localities were visited. The level of endemism appears to be relatively high, however,

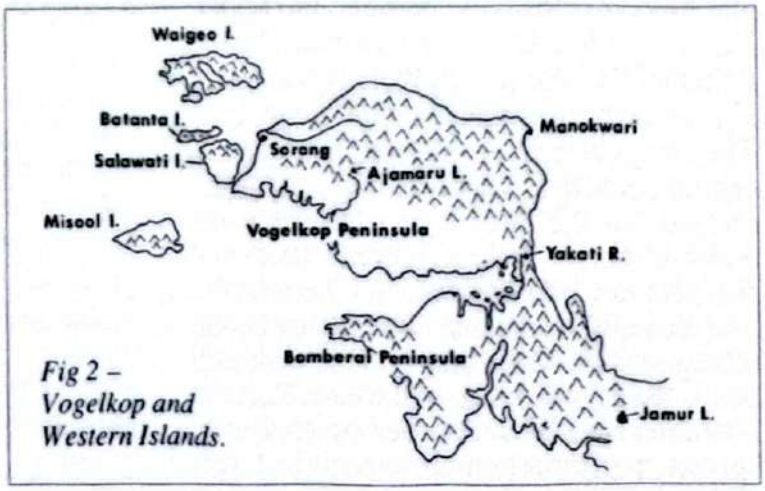


Fig 2 – Vogelkop and Western Islands.

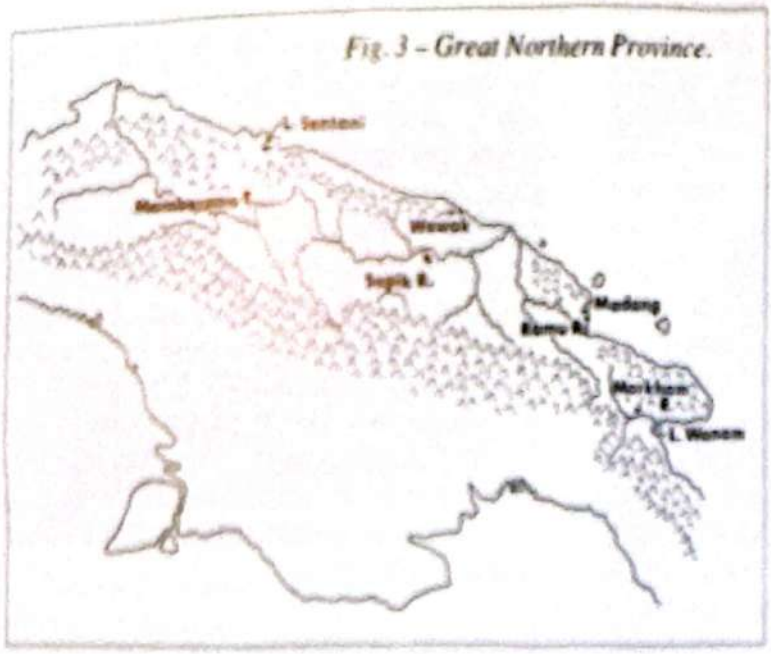


Fig. 3 – Great Northern Province.

and includes species of *Melanotaenia*, *Zenarchopterus*, *Glossogobius*, and *Hephaestus*.

Great Northern - This is the largest province and includes most of the northern half of central New Guinea. It contains several of New Guinea's largest rivers including the Mamberamo, Sepik, Ramu, and Markham. Associated with these river basins are extensive expanses of lowland alluvial plain with meandering and braided channels that undergo extensive periodic flooding. The Mamberamo and Sepik rivers in particular also have extensive foothill and low mountain tributaries in areas of rainforest. Barriers between the four major rivers are relatively insignificant. For example, during floods it is possible to travel by boat between the lower Ramu and Sepik rivers. Also, when traveling by road between Lae and Madang the divide between the upper Ramu and Markham system is scarcely detectable. Consequently there is considerable uniformity of fauna within the region. The area is effectively isolated by the high central cordillera. This isolation is demonstrated by the presence of numerous endemic species, and two endemic rainbowfish genera *Chilatherina* and *Glossolepis*. The area is divisible into two roughly equal subregions: the Mamberamo to the west and Sepik-Ramu-Markham to the east. Each is characterised by a number of endemic species, particularly melanotaeniids. Lake Sentani near the Irian Jaya-Papua New Guinea border harbours endemic species of *Glossolepis*, *Chilatherina*, and *Glossogobius*.

Eastern Papua : northern section - The northern portion of the eastern tip of New Guinea is effectively isolated from adjacent areas by the high central mountains, particularly the Owen Stanley Range. The region is extremely diverse containing low coastal plain, fijord-like coastal inlets, forest-covered foothills and low mountains. The region around Safia in the Musa River Valley greatly resembles parts of northern Australia with *Eucalyptus* woodland mixed with rainforest along water courses. Mt. Lamington, the mainland's most recent volcano is a prominent landmark near Popondetta. It last erupted in 1951, killing some 3,500 inhabitants. Although the freshwater fauna of this small region is relatively impoverished it contains an endemic genera, *Tateurndina*, and several endemic species of *Zenarchopterus*, *Pseudomugil*, *Craterocephalus*, *Tetracentrum*, and *Mogurnda*.

Eastern Papua : southern section - This province encompasses the relatively narrow strip of south-eastern New Guinea wedged

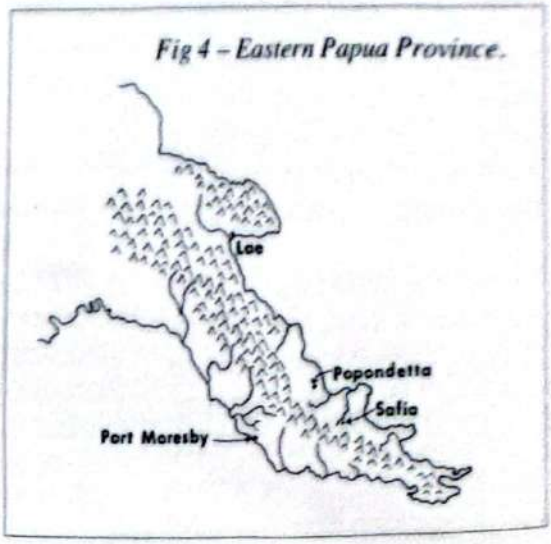


Fig 4 – Eastern Papua Province.

between the high central ranges, to the north and east and the swamplands of the Purari River Delta to the west. Because of the inclusion of Port Moresby and the presence of a road network (although not extensive) the area is relatively well collected. Habitat is similar to the northern section with areas of dry eucalypt woodland and lowland swamps near the coast and rainforested hills and mountains in the interior. Endemic fishes include species of *Melanotaenia*, *Tetracentrum*, and *Mogurnda*.

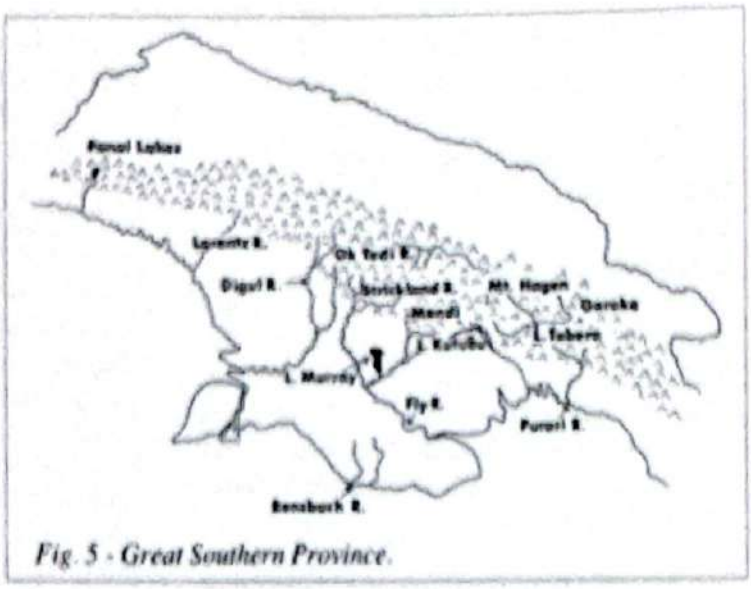


Fig. 5 - Great Southern Province.

Great Southern - Nearly equal in size to the Great Northern Province, this region includes most of the southern half of central New Guinea. It extends from the narrow isthmus at the base of the Vogelkop Peninsula in the west to the Purari Delta in the east and is separated from the Great Northern Province by the Central Cordillera. The area contains the most extensive alluvial lowland plains in New Guinea, largely composed of deposits from the Fly and Digul river systems. Most of the coast is fringed with mangroves with savannah and lowland swamps further inland. There is also extensive lowland rainforest. Geologically this is the oldest part of the mainland and was formerly connected to Australia. The savannah landscape in particular is very similar to parts of northern Australia and the great similarity in the general fauna serves to emphasize the relatively recent land connection. Besides a number of endemic fishes the region is characterised by 33 species that are shared with northern Australia. Genera contributing to the distinctiveness of this region include *Scleropages*, *Cochlefelis*, *Doiichthys*, *Nedystoma*, *Tetranesodon*, *Iriatherina*, and *Kiunga*. It is also home of the Barramundi (*Lates calcarifer*).

Upper Purari - Kikori - This inland province consists of moderately high rainforested mountains and deep valleys in headwater areas of the Fly, Strickland, Kikori, and Purari rivers. An exceedingly high annual rainfall (over 10 m in some areas!) and mountainous topography has resulted in a highly dendritic pattern of upland tributaries. Isolation of these areas has apparently enhanced the speciation process in several families, particularly the Melanotaeniidae, Eleotrididae, and Gobiidae. In addition, there are endemic plotosids, atherinids, and teraponids. The fauna of Lake Kutubu (upper Kikori System) is particularly noteworthy. Ten of 14 species occurring there are endemics, including five species of *Mogurnda*.

Aru Islands - This province is situated in the Arafura Sea approximately 120 km south of the isthmus that connects the Vogeklop Peninsula and central New Guinea. The group is of special interest to biologists as it was formerly part of the land connection between Australia and New Guinea. The freshwater fishes are poorly known, although Dutch expeditions collected there in the early part of the century. They are currently considered to be essentially the same species that occur in the Great Southern Province, but a modern survey is urgently required in order to reevaluate their status. There is an excellent possibility that a high level of endemism exists. If so, the islands could provide a "living laboratory" for the study of evolutionary processes in Australasian freshwater fishes.

The Environment

Physical Setting

New Guinea is the world's second largest island, stretching some 1600 km in length. It is Australia's nearest neighbour, separated from it by the 65-km wide Torres Strait. Politically the island is divided roughly down the middle, or along the longitudinal meridian of 141 degrees East. The Indonesian province of Irian Jaya occupies the western half of the island, and the independent nation of Papua New Guinea its western half.

New Guinea is an impressive land of contrasting scenic vistas. Seemingly endless tracts of virgin rainforest, lowland plains, snowclad alpine peaks, and coconut-fringed indigo seas provide a unique setting that has nurtured the development of a wealth of plant and animals. Although the landscape is dominated by rainforest, the massive central cordillera is equally impressive. The tallest peaks are found in Irian Jaya, rising to nearly 5000 m, and are capped with perennial snow and ice fields. Those of the Carstenz Pyramid near Mt. Jaya, are one of only three places in the world where glaciers are found in equatorial areas. The rugged mountain topography coupled with a huge annual rainfall forms an impressive catchment for the numerous drainage systems that flow primarily north and south.

Aquatic Habitats

Freshwater fishes, although relatively few in number of species compared to other tropical areas, are common throughout the island with the exception of high altitudes. The major habitats for fishes can be divided into the following seven categories .

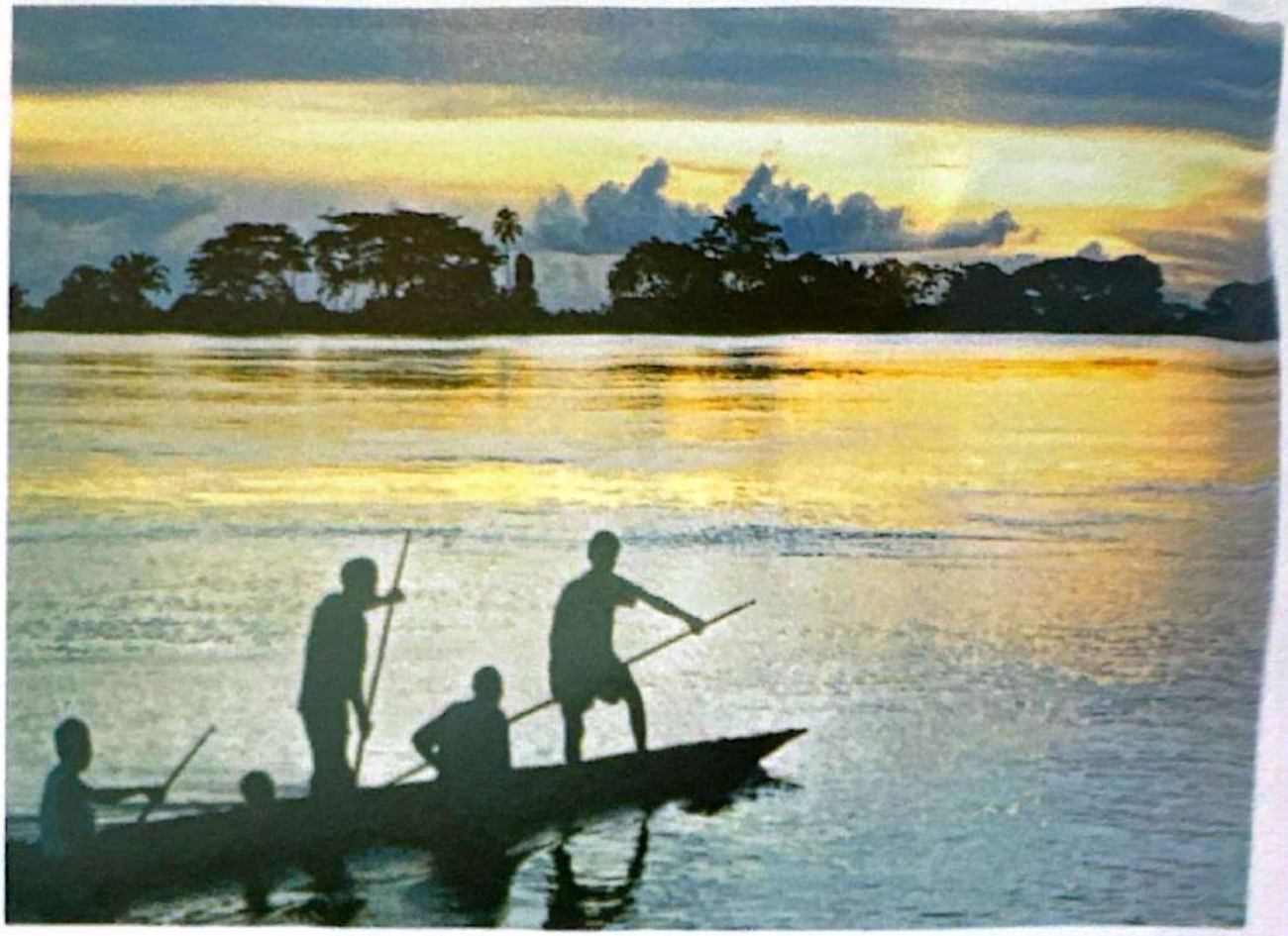
Lowland Rivers - The large lowland rivers of New Guinea represent a major habitat for fishes. They are generally slow flowing, but rates may be greatly accelerated during flood periods. There is generally an annual cycle of wet season flooding and low water during the dry season. For example, the Sepik River generally rises from about November to March or April and then gradually subsides. Water is highly turbid and the bottom is composed of soft silt or mud. Aquatic vegetation is generally poor, although there are extensive grasses and other terrestrial vegetation along the shore during the wet season. Ariid catfishes are common and there are a number of marine vagrants such as croakers, silver biddies, ponyfishes, and juvenile trevallies in the lower reaches. Large rivers in highland basins such as the Baliem in Irian Jaya and the Wahgi in Papua New Guinea are physically similar to their lowland counterparts but have few fishes.

Blackwater streams - These are small lowland tributaries of major rivers such as the Fly, Sepik, and Mamberamo. They are generally richer in fishes than the large muddy rivers and therefore villages are frequently located next to them. The name blackwater is derived from the dark tea-like colour which is due to the presence of tannin leached from rotting vegetation. Common fishes include ariid catfishes, rainbows, garfishes, glassfishes, gudgeons, and gobies. If the stream is located within about 50 km from the sea there may also be pipefishes, scats, ponyfishes, and other coastal stream fishes.

Floodplain Lakes, Swamps, and Backwaters - The floodplain waters of the major river systems are inhabited by a diversity of fishes, including species that are rare or absent in adjacent riverine habitats. This environment includes oxbow lakes, deadend branches (i.e. backwater) of former river channels, extensive swampland and huge floodplain lakes such as Lake Murray (Fly River), Chambri Lakes (Sepik River), and Danau Romberai (Mamberamo River). Water clarity is generally good, except when there is extensive flooding. This habitat is relatively rich in aquatic plants and offers ample hiding places for juvenile fishes. Common fishes include rainbows, gobies, gudgeons, and ariid catfishes.

Upland Tributaries - This category includes a wide range of rivers, creeks, and

Photo 1 - Braided channel of the Markham River near Lae.



▲ *Photo 2 - Sunset on the Sepik River near Angoram.*

▲ *Photo 3 - Blackwater Swamp near Lake Bosset, Middle Fly River.*

rivulets in hilly to mountainous terrain. The best studied ones are those in the Fly and Sepik systems which generally support about 6-12 species for a given site, depending on the size of the stream, its distance inland, and altitude. These streams usually flow through dense rainforest with occasional clearings. Aquatic plants are generally sparse or absent. For much of the year the water is very clear and flow rates are relatively slow except for occasional rapids. However, heavy rains may cause these streams to swell into muddy torrents many times the normal size. This may happen within only a few hours. Water levels subside just as rapidly when rains cease. Typically this habitat supports eel-tailed catfishes, rainbowfishes, hardyheads, mouth almighties, grunters, gudgeons (expecially *Oxyeleotris* and *Mogurnda*) and gobiids (particularly *Glossogobius*).

Upland Lakes - Lakes are well represented in New Guinea, although they are not extensive in either number or size. There are many mountain lakes above an altitude of 2000 m which are not inhabited by native fishes, although carp and trout have been stocked in some. Lake Tage in central Irian Jaya is the highest lake (1800 m) that supports native fishes, but only a single gudgeon (*Oxyeleotris wisselensis*) is found there. Lake Kutubu in the Southern Highlands of Papua New Guinea lies at an altitude of 800 m and has the richest lacustrine fauna in New Guinea, apart from floodplain lakes. A total of 13 species have been recorded there, including 11 which are endemics. The major upland lakes of New Guinea in order of size include Panai, Kutubu, Jamur, Tigi, Kamakawiar, Anggi, Gigi, Anggi Gita, Tage, Ajamaru, and Holmes (Danau Bira). Lake Sentani is acutally the second largest, but lying relatively close to the coast at an elevation of only 75 m, it can not be considered as a truly upland lake.

Torrential Mountain Streams - Very few fishes in New Guinea inhabit steep gradient mountain streams which are characterised by extensive white water rapids and waterfalls. The bottom consists mainly of boulders, cobbles, and gravel. This type of habitat is well represented in the Highlands and often forms an impenetrable barrier to the upstream movement of fishes. Few, if any, native species occur above an altitude of 1800 m. The current altitude record is 1750 m for *Oxyeleotris wisselensis*, a lake dwelling species of central Irian Jaya. However, introduced carp and trout may be found to at least 2700 m.

Coastal Streams - This habitat category includes small creeks to medium-sized rivers which rise in hilly or mountainous terrain within relatively close (about 100 km) proximity to the sea. Collectively they form a vast network of independent drainage systems around the coastal fringe of New Guinea. Water clarity is usually good except during floods. They generally occur in rainforest. Rates vary depending on terrain from fast, cascading brooks to slow meandering streams.

Conservation

There is an urgent need to conduct floral and faunal surveys throughout much of New Guinea in order to identify areas of special conservation significance. Many freshwater fishes, particularly the rainbowfishes (Melanotaeniidae) appear to be restricted to an isolated lake or small part of a single river system. Species such as this are highly vulnerable to environmental disturbances, for example clear-cut logging or dam construction. Until just a few years ago threats from these activities were minimal, but this situation is changing rapidly. Both Irian Jaya and Papua New Guinea have government conservation agencies staffed by skilled personnel, but they are frequently frustrated when economic concerns are given a higher priority than protection of native flora and fauna. The opening of a mining or logging operation usually injects much needed capital into the local economy and therefore conservation issues are often ignored. Hopefully, through education and publicity campaigns local people can be made aware

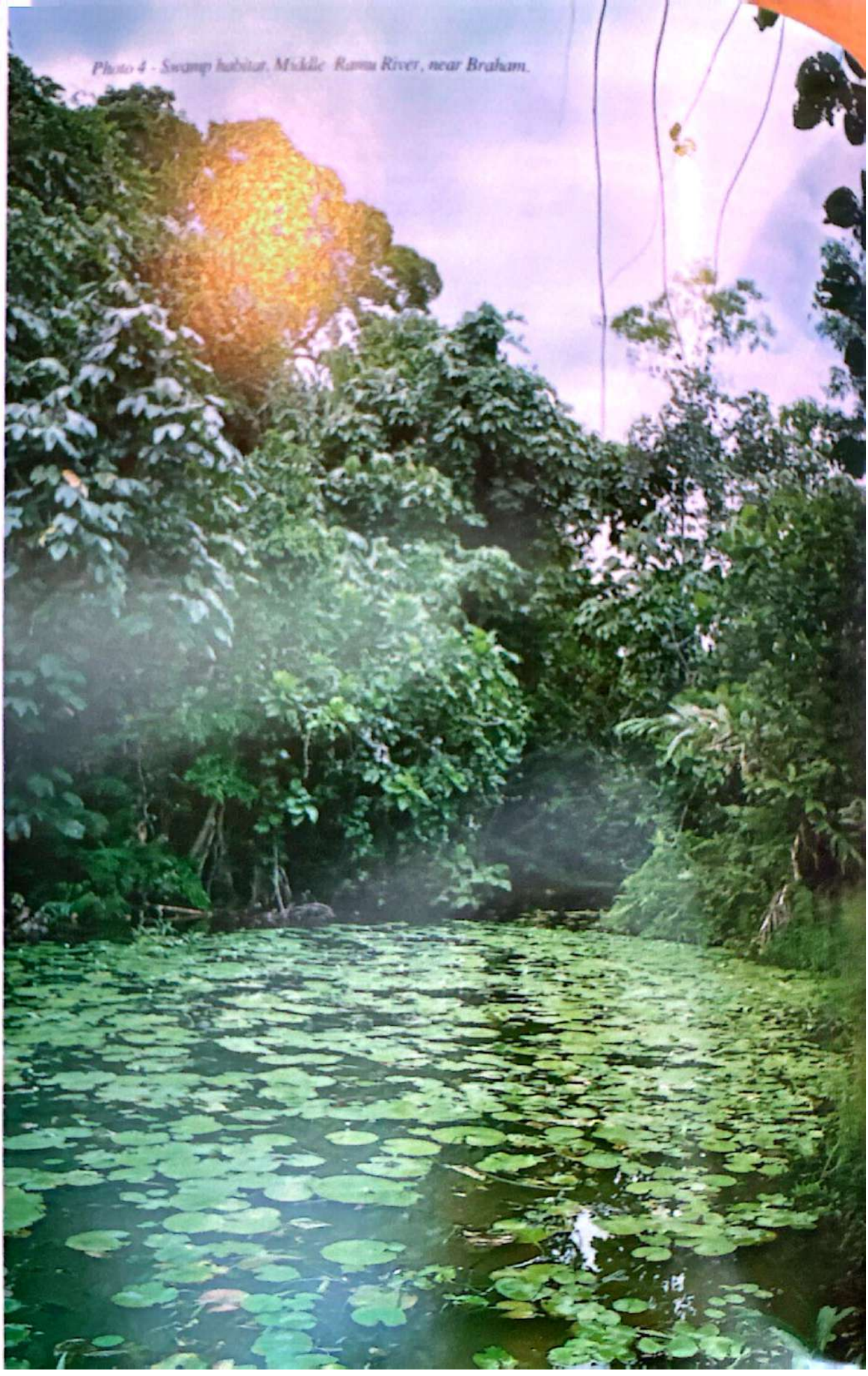


Photo 4 - Swamp habitat, Middle Rumu River, near Braham.

of the uniqueness of their plants and animals and the need to protect them.

Lake Sentani in Irian Jaya and Lake Kutubu in Papua New Guinea are two areas that have highly unique fish faunas, but are extremely vulnerable. In the case of Lake Sentani, it may be too late. A rapidly increasing population has caused considerable pollution, and introduced fishes such as the walking catfish and carp have no doubt had an adverse effect on the indigenous fish community. Also the lake is fished rather heavily and nearly all species are utilised for food, even small rainbowfishes, gobies, and gudgeons. Lake Kutubu is the home of 11 endemic fishes. There is no other mountain lake in New Guinea with such a wealth of species. At present the lake remains in a pristine condition, but its future is clouded. Oil deposits were discovered nearby and now the exotic calls of birds of paradise, parrots, and hornbills compete with the drone of helicopters. There are no roads in the area, therefore these aircraft are used to ferry personnel and supplies to the drilling site. A proposal to link Lake Kutubu by road with Mendi and the Highlands Highway network is presently being considered. There is also a proposition to establish a township of 2,000 people on the shores of the lake to provide manpower and support facilities for the drilling operation. This development would be disastrous to the lake's delicate ecosystem. Hopefully the Papua New Guinea Government will take steps to protect this important wildlife refuge.

Logging is another major threat to fishes and other animals. It results in drastic alteration of stream habitats, eliminating shade and causing siltation as a result of erosion. The threat of habitat destruction from logging is particularly acute in Irian Jaya where most of the forest lands have already been carved up into numerous logging concessions.

Mining is another detrimental force. The Ok Tedi copper and gold mine in western Papua New Guinea is a good example. It is situated on a major headwater stream of the Fly River and therefore has a profound influence for hundreds of kilometres downstream. It was deemed to costly to construct a tailings reservoir at the mine site. Instead the resultant silt and tailings effluents are dumped directly into the river. This activity involves the release of toxic heavy metals into the Fly including cooper, zinc, lead, arsenic, mercury, cadmium, and molybdenum. In addition, significant amounts of free cyanide, particularly toxic to aquatic organisms, are being discharged. There appears to be little that can be done to save the already devastated Ok Tedi River. Hopefully, fishes and other aquatic organisms in the area can survive in major tributary systems. Fortunately, the huge runoff in the Fly system results in a large dilution effect downstream, thus providing at least some measure of protection against the effects of chemical pollution.

Classification of Fishes

Although the fundamentals of biological nomenclature and classification are common knowledge to many, it is my experience that the average non-biologist frequently has little idea of the basis of scientific names or how fishes are classified. It therefore seems worthwhile to include a brief section on the rudiments of this subject.

Every described organism, be it a single celled amoeba, crab, bird, fish or mammal has a scientific or Latin name. It is composed of two parts and is generally italicised. The first part is the genus or generic name and the second is the species or specific name. For example the Three-barred Mouth Almighty is *Glossamia trifasciata*. The generic name *Glossamia* pertains to a group of closely related species which share a number of common features related to general shape, scalation, type of teeth, fin-ray counts, etc. The specific name *trifasciata* applies only to a single entity that is distinguished from its relatives by a unique set of characteristics, often including colour pattern. Related genera (plural of genus) are grouped together in a family, whose spelling always ends in - idae. Worldwide there are

▲ *Photo 5 - Fisheries research team on Chambri Lake, Middle Sepik.*

▲ *Photo 6 - Bulolo River, a mountainous tributary of the Markham River.*

▲ *Photo 7 - Coastal creek near Rabaul, New Britain.*

▲ *Photo 8 - Torrential mountain stream near Mendi.*

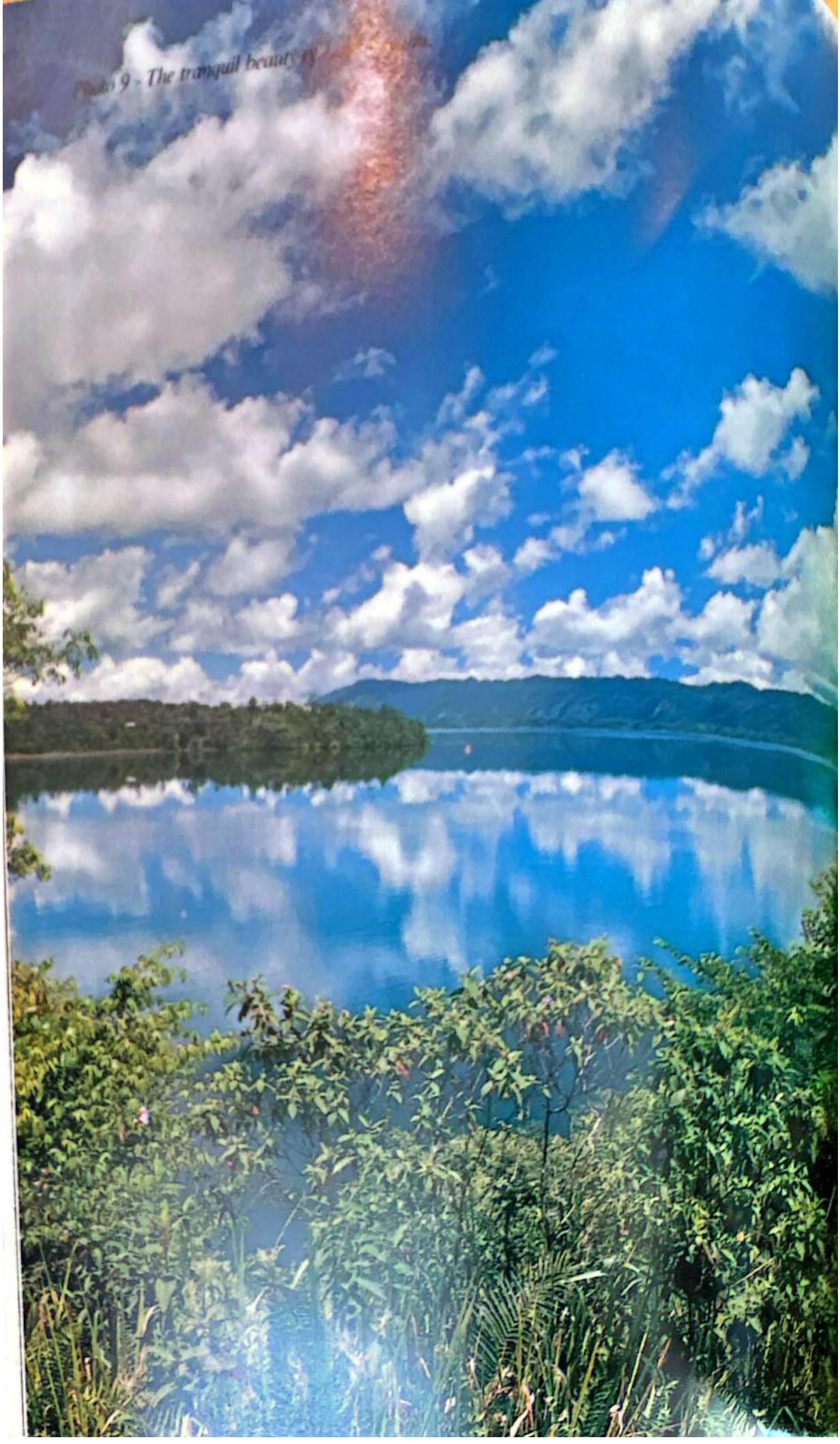
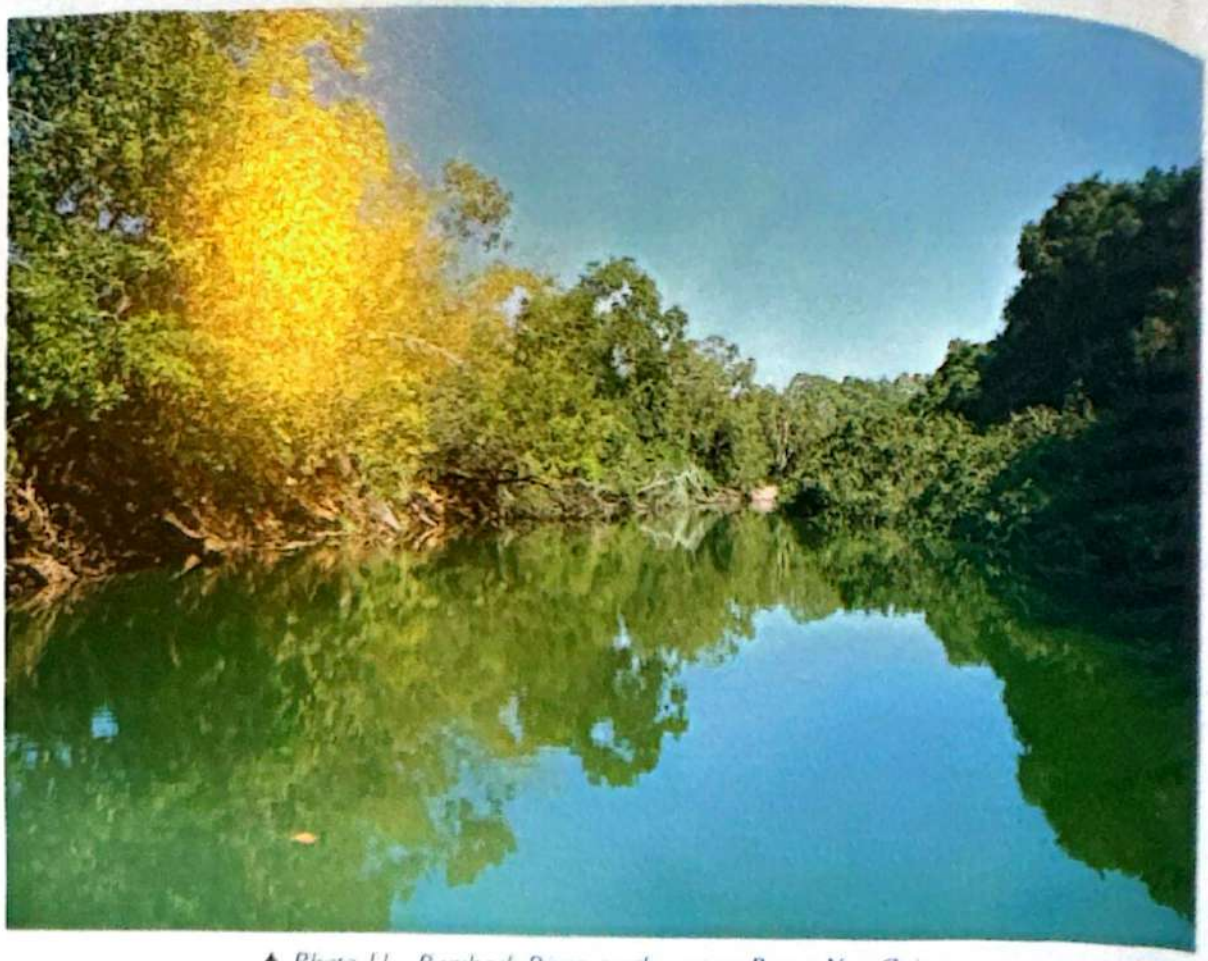


Photo 10 - Rainforest stream



▲ *Photo 11 - Bensbach River, south-western Papua New Guinea.*

▲ *Photo 12 - The author is surrounded by curious onlookers, Bomberai Peninsula, Irian Jaya.*

445 families; 55 are represented in freshwaters of New Guinea. A group of similar families is placed in one of the 35 orders of fishes whose spelling always ends in -iformes. The highest rungs on the 'ladder' of classification pertain to class and phylum. The class Myxini contains the jawless marine hagfishes and lampreys (no species included in this book); Chondrichthyes contains sharks and rays; and the third class, Osteichthyes, contains the majority of fishes. All fishes, as do other higher animals including amphibians, reptiles, birds and mammals, belong to the phylum Chordata. Therefore, in summary the classification of the Three-barred Mouth Almighty can be represented as follows:

Phylum – Chordata (all animals with notochord)

Class – Osteichthyes (all bony fishes)

Order – Perciformes (most marine reef fishes and many freshwater fishes)

Family – Apogonidae (Mouth Almighties and relatives)

Genus – *Glossamia* (all Mouth Almighties)

Species – *trifasciata* (Three-barred Mouth Almighty)

Characters that are most often used to separate species, and often genera, include external features such as the number of fin rays, size and number of scales, ratio of various body proportions, and colour pattern. For higher classification at levels above genus internal structure, particularly those pertaining to skeletal elements, are often indicative of relationships.

Many species previously unknown to science have been found in fresh and marine waters of New Guinea over the past few decades. When a new fish is discovered it is given a scientific name by the researcher who formally publishes a detailed description in a recognised scientific journal. Scientific names are frequently descriptive. For example *trifasciata* is Latin for three bars and is therefore appropriate for the Three-barred Mouth Almighty. New fishes are sometimes named after the locality where they are collected, for example *japonicus* (Japan) or *novaeguineae* (New Guinea). A third category of specific names are based on the names of people, often the person who first discovers the fish (respectable researchers never name fishes after themselves). Fishes named after a male end in -i, those after females in -ae.

Preserving Fishes

It is sometimes desirable to preserve specimens, particularly if a positive identification by museum authorities is required. Also small, unusual or rare fishes can be kept as curios or as teaching aids. The recommended method of preservation in any case is exactly the same one that is employed by biologists in museums. The basic ingredient is full strength formalin which can be obtained from a pharmacy, university laboratory, or fisheries station. The preserving solution is made by diluting one part of formalin with nine parts of water. The fish should be fully immersed in the solution. If larger than about 15 - 20 cm a slit along the side of the belly will facilitate preservation of the internal organs. For long term storage it is desirable to transfer the specimen to a 70% ethyl alcohol solution (70% ethanol, 30% water) after the fish is fully fixed in formalin (i.e. after several weeks). However, the fish may be held in the initial formalin for several years without deleterious effects.

Unfortunately colours fade rapidly in preservative. Therefore photography (see below) is a valuable method of accurately recording the colour pattern.

Fish Photography

Nearly everyone carries a camera on fishing and camping expeditions these days. Good photographs can be valuable in

determining the identification of a questionable fish, particularly if the catch has already been eaten. The following steps will ensure the photos are of good diagnostic quality: (1) the specimen should be photographed when fresh as live colours fade rapidly after death; (2) an attempt should be made to spread out the fins. With small fishes you can hold the fins erect with sewing pins on a piece of flat styrofoam or cardboard. If full strength formalin is then applied to the fins with a small paintbrush or eye dropper and allowed to set for a few minutes they will remain erect when the pins are removed; (3) wet fish should be blotted dry with a cloth or paper to prevent harsh glare when photographed; (4) the specimen should be placed on a suitable contrasting background and photographed as close as the lens will allow for sharp focus, attempting to fill the frame; (5) it is helpful if a ruler or some other object of known length can be placed besides the fish when it is photographed in order to determine its length later on.

Photography of live captive specimens is a rewarding hobby, particularly for aquarists. Excellent results can be achieved with many of the autofocus SLR cameras now on the market. The main item required is a good lens such as a 55-Macro that allows close-up focus on small objects. The best results are achieved with a flash, but it must be used with an extension lead at some distance from the camera and angled at the subject to avoid reflection from the aquarium glass.

Dangerous Fishes

Although freshwater fishes in general are usually safe to handle or eat, there are a few exceptions. Potentially harmful fishes can be divided into several broad categories including species that can bite, species which can sting, and those which can cause poisoning if consumed.

Biters. - The only species in this category posing a serious threat is the Bull Shark (*Carcharhinus leucas*), which is found in some lakes and rivers, well upstream from the sea.

Stingers. - Virtually any fish with rigid fin spines is capable of inflicting wounds if handled carelessly. Most are non-venomous and can be treated in the same manner as any puncture wound. The most dangerous category of stingers include fishes that have venomous spines. The main group of concern in New Guinea fresh waters is the catfishes, both eel-tailed (Plotosidae) and fork-tailed (Ariidae). They have a venomous spine at the front of the first dorsal and pectoral fins that can cause excruciating pain and may even result in hospitalization in extreme cases. Another dangerous stinger is the Vermiculated Spinefoot (*Siganus vermiculatus*) which has venomous spines on the dorsal, anal, and pelvic fins. For both spinefoot and catfishes the recommended first-aid procedure is to immerse the injured area in hot water (as hot as bearable), repeating until the pain subsides. The protein base of the toxin is denatured by heat and relief is sometimes immediate. In cases when the victim is stung by several spines, or if the wound is deep, medical assistance should be obtained.

Poisonous fishes. - The only threat in this category is the pufferfishes (Tetraodontidae) which often have poisonous internal organs, frequently the viscera and gonads. Although these fishes are eaten by the Japanese when specially prepared by licensed chefs, they are considered extremely dangerous and specimens from local waters should never be eaten.

Colour Patterns

One shortcoming of all field guides is that it is virtually impossible to illustrate all of the variations in colour that commonly occur within a single species. With a few exceptions the colours shown here are the 'normal' or average ones displayed by live fish in their natural habitat. Anglers especially will be well aware that many fishes can drastically alter their coloration after being caught. Variation in colour

pattern within individual species may also be related to age, sex, environmental conditions, or geography.

How to use this Book

The main purpose of this volume is to serve as an illustrated identification guide and to present a summary of general information concerning distribution, habitat, and biology. When attempting to identify an unfamiliar fish the user is urged to first scan the colour plate section, as most species are included there. Also the illustrated guide to families in the following section will prove useful. It consists of outline drawings which show basic body shapes and the presence or absence of fin spines. When the fish is matched with one of the illustrations, additional information can be obtained by consulting the page number given in the caption for the colour plate. Another alternative, and the preferred method for scientific users, is to use the various keys to genera and species that are included. The keys are relatively easy to use. Each couplet (e.g. 1a and 1b) offers two choices and it is simply a matter of following the option which agrees with the fish in question, proceeding through the key until the correct species is obtained. Admittedly, the keys are mainly designed for use by trained ichthyologists and university students, but amateur naturalists need not despair as the technical terms are defined in the glossary appearing at the end of the book.

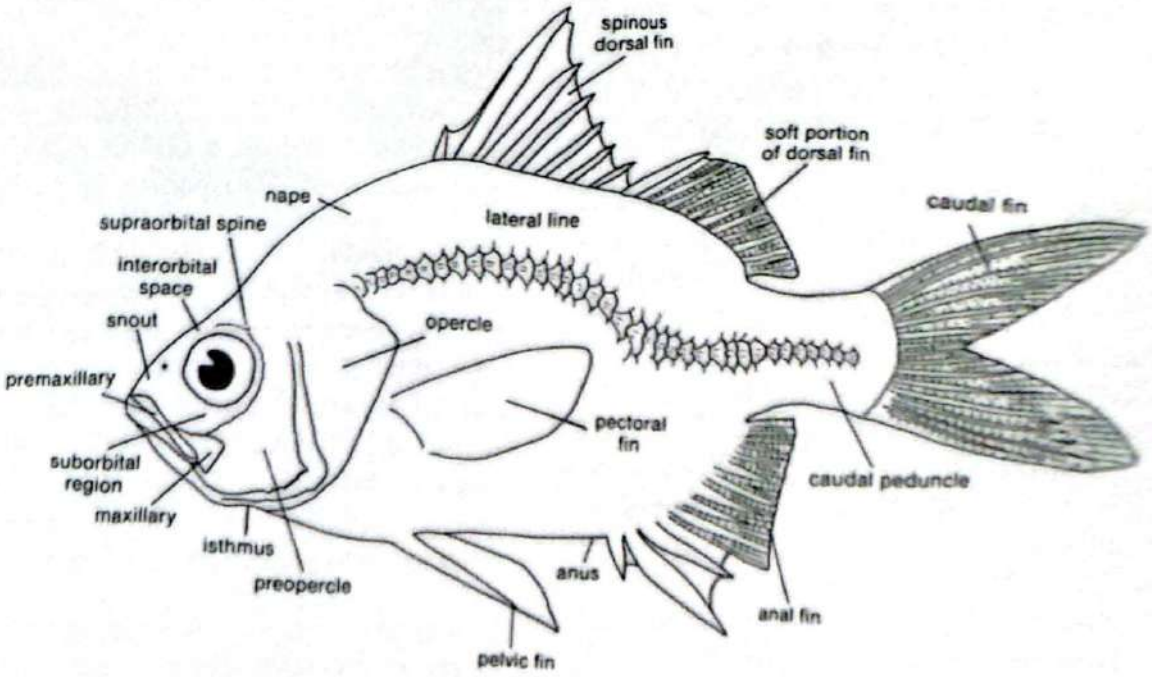
Species section Introduced species are treated in a separate section near the end of the book. All other fishes are covered in the main species section. Families are presented in order of their generally accepted phylogenetic position. Primitive groups such as sharks, sawfishes, herrings and eels appear first followed by more advanced bony fishes. Family sections include a general introduction followed by an identification key to genera if there is more than one genus. A very brief generic introduction containing the total number of species and distribution is followed by a key to species. The species texts are arranged alphabetically within each generic section. The common and Latin names are given at the beginning of each species account. The scientific name is followed by the name of the person who described the fish and the year of publication. If the name appears in parentheses this signifies that the species was first assigned to a genus different from the present one. Individual species texts contain a brief account of diagnostic features, a colour description, maximum size, distribution, and habitat.

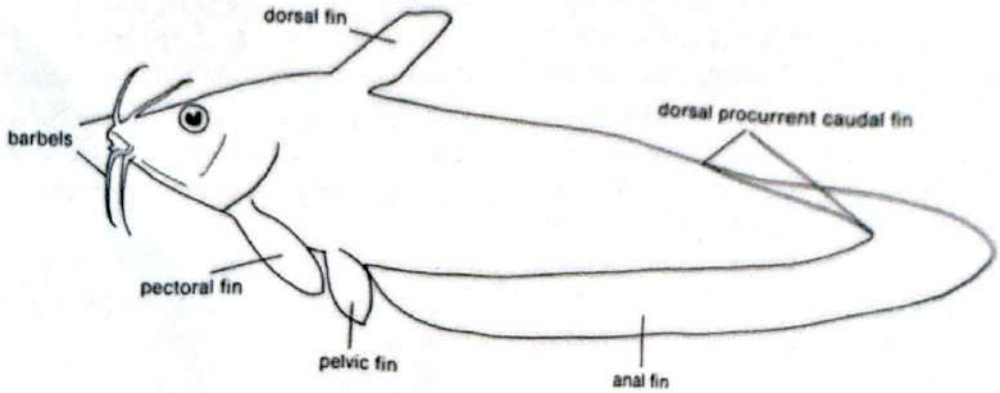
Common names - The common names used in this book are the English language names that are generally used in Australia. Readers should be aware that fishes are an integral part of New Guinean culture, hence local names exist for most, if not all species. Because of the tremendous diversity (there are an estimated 700 languages), no attempt has been made to include the indigenous names.

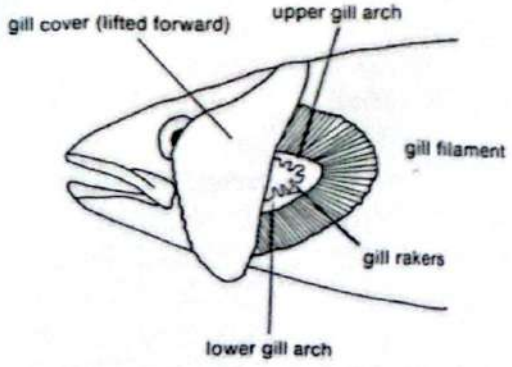
Distribution maps - A small distribution map is included for species that are restricted to the New Guinea-Australia region and nearby islands. Maps are not given for fishes that have distributional ranges extending well beyond the New Guinea-Australia region. Most of the fishes in this category, apart from anguillid eels, are coastal stream and estuarine dwellers.

Fin-ray counts and fish lengths - The standard ichthyological notation is used for fin-ray counts, with stiff spines represented by Roman numerals and soft rays by Arabic numbers. If the dorsal fin count is given as two sets of figures separated by a hyphen, this indicates there are two completely separate fins. For example, V-I,6 refers to the condition in which the first dorsal fin contains five spines followed by a separate second dorsal fin with a single spine and six soft rays. The count X,16 indicates a single dorsal fin composed of 10 spines and 16 soft rays. The maximum size or length is given at the end of the diagnosis section. The lengths refer to either standard length (abbreviated SL), which is the distance from the snout tip to the base of the tail, or total length (TL), the distance from the snout tip to the farthest projection of the tail.

Fig. 6 - External anatomy of typical freshwater fishes.

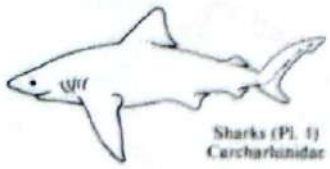






Illustrated Guide to Families

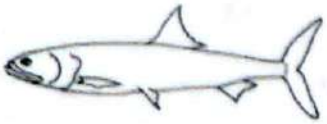
The following pages contain outline drawings of typical members of the families contained in the book. Scientific and common family names are indicated below each drawing as well as the appropriate colour plate number.



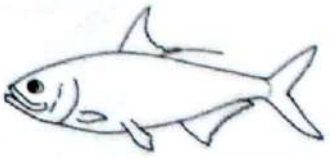
Sharks (Pl. 1)
Carcharhinidae

Sawfishes (Pl. 1)
Pristidae

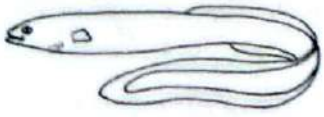
Bony Tongues (Pl. 12)
Osteoglossidae



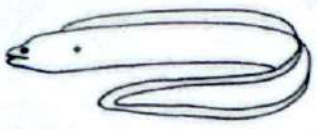
Tenpounders (Pl. 17)
Elopidae



Tarpons (Pl. 17)
Megalopidae

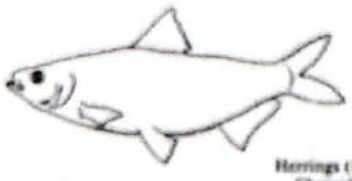


Freshwater Eels (Pl. 1)
Anguillidae

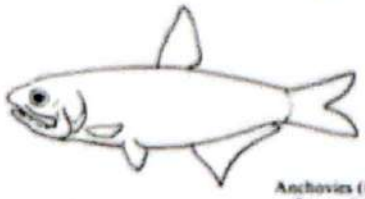


Moray Eels (Pl. 1)
Muraenidae

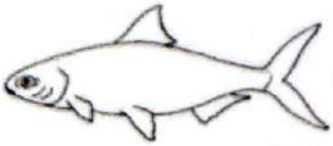
Snake Eels
Ophichthidae



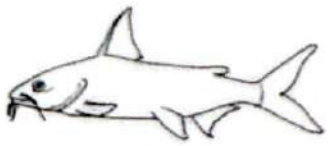
Herrings (Pl. 1)
Clupeidae



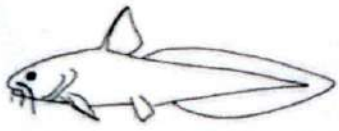
Anchovies (Pl. 1)
Engraulidae



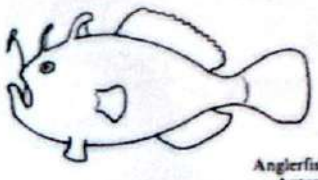
Milkfishes (Pl. 17)
Chanidae



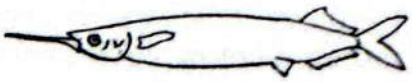
Fork-tailed Catfishes (Pl. 2, 3)
Ariidae



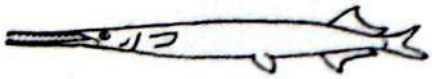
Eel-tailed Catfishes (Pl. 4)
Plotosidae



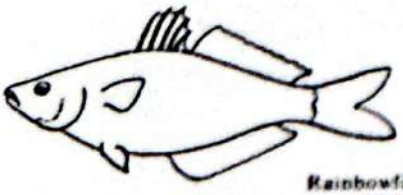
Anglerfishes (Pl. 17)
Antennariidae



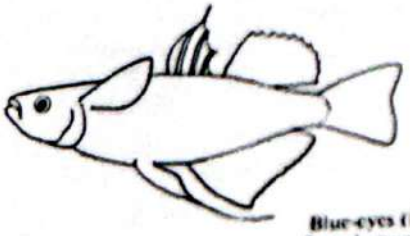
Garfishes (Pl. 1)
Hemirhamphidae



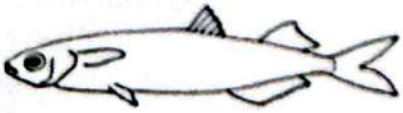
Longtoms (Pl. 1)
Belonidae



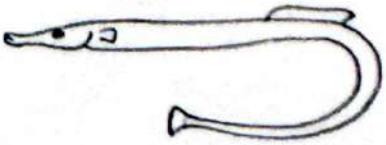
Rainbowfishes (Pl. 5, 6, 7, 8)
Melanotaeniidae



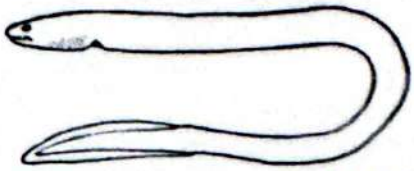
Blue-eyes (Pl. 9)
Pseudomugilidae



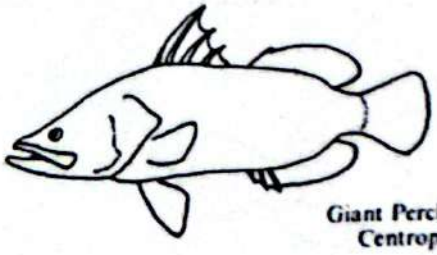
Hardyheads (Pl. 18)
Atherinidae



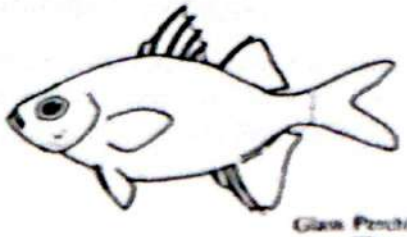
Pipefishes (Pl. 1)
Syngnathidae



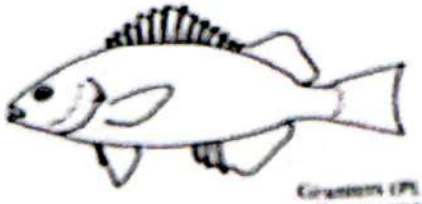
Swamp Eels
Synbranchidae



Giant Perches (Pl. 12)
Centropomidae

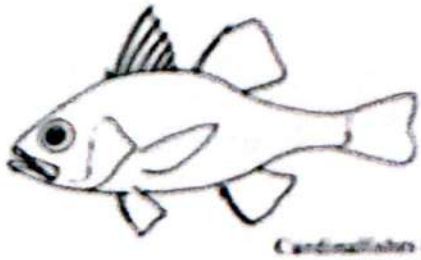


Glass Perchlets (Pl. 10)
Chandidae

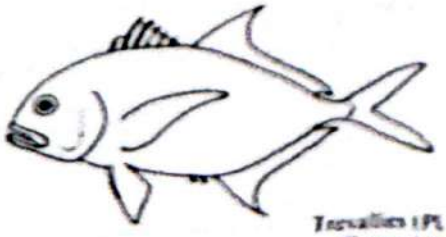


Grunters (Pl. 11)
Terapontidae

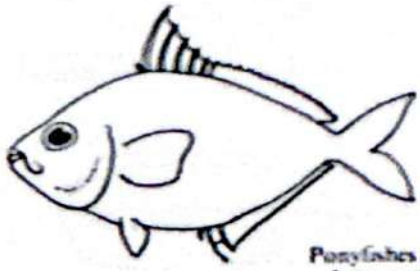
Flagtails (Pl. 1)
Kuhliidae



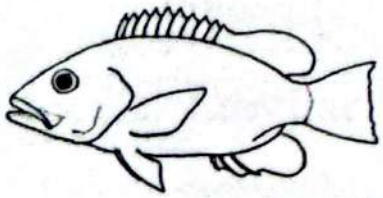
Cardinalfishes (Pl. 12, 13)
Apogonidae



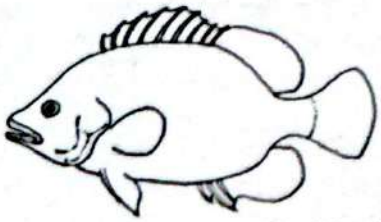
Trevallies (Pl. 17)
Carangidae



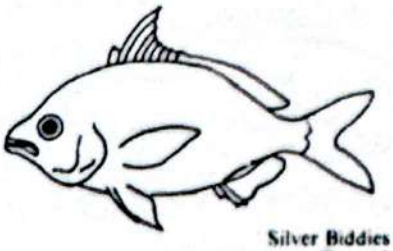
Ponyfishes (Pl. 17)
Leiognathidae



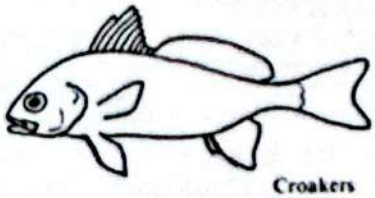
Snappers (Pl. 12)
Lutjanidae



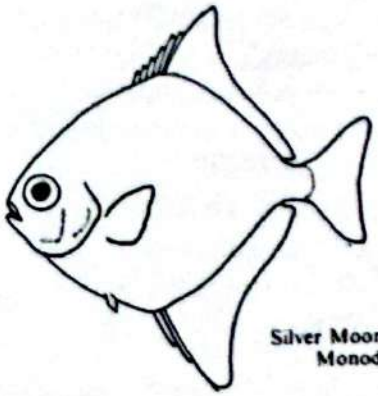
Tigerfishes (Pl. 1)
Datnioididae



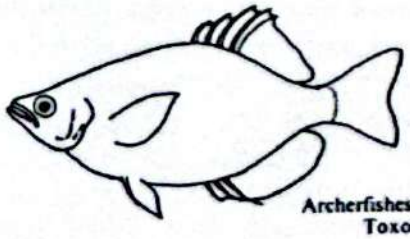
Silver Biddies (Pl. 17)
Gerreidae



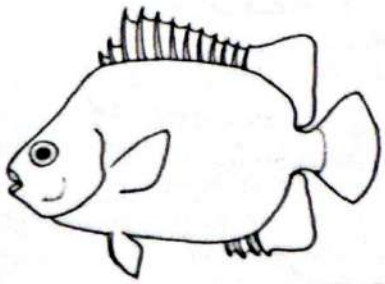
Croakers
Sciaenidae



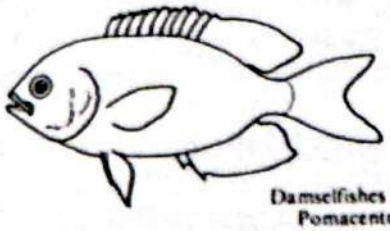
Silver Moonfishes (Pl. 17)
Monodactylidae



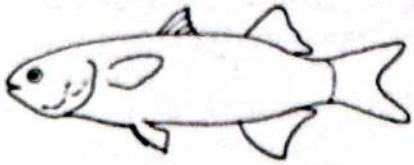
Archerfishes (Pl. 12, 17)
Toxotidae



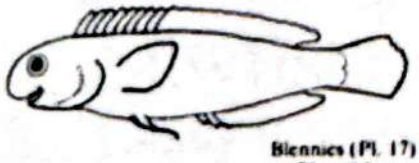
Scats (Pl. 17)
Scatophagidae



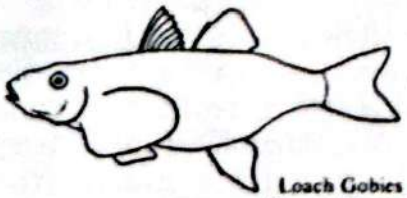
Damselfishes (Pl. 17)
Pomacentridae



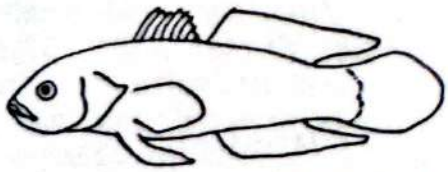
Mullets (Pl. 17)
Mugilidae



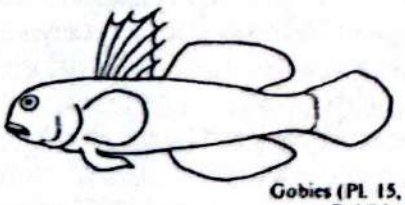
Blennies (Pl. 17)
Blenniidae



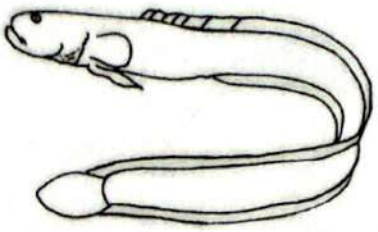
Loach Gobies
Rhyacichthyidae



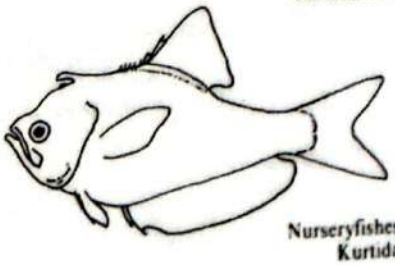
Gudgeons (Pl. 13, 14, 17)
Eleotrididae



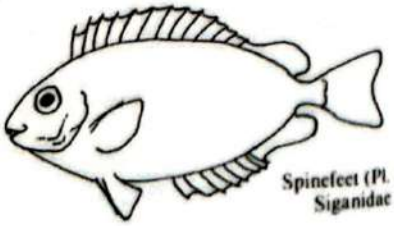
Gobies (Pl. 15, 16, 17)
Gobiidae



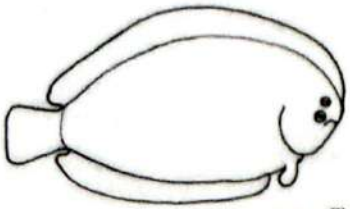
Worm Gobies
Gobioididae



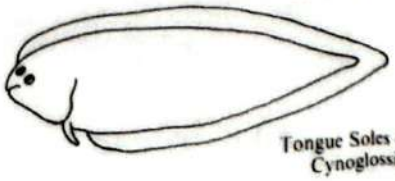
Nurseryfishes (Pl. 1)
Kurtidae



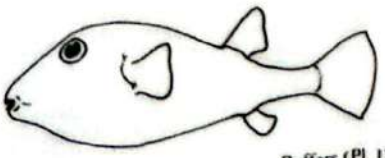
Spinefeet (Pl. 17)
Siganidae



Soles (Pl. 12)
Solcidae

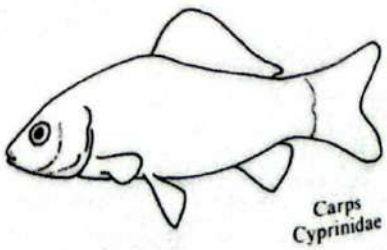


Tongue Soles (Pl. 12)
Cynoglossidae

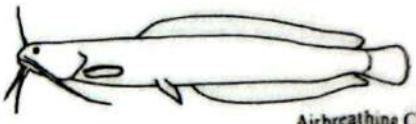


Puffers (Pl. 17)
Tetraodontidae

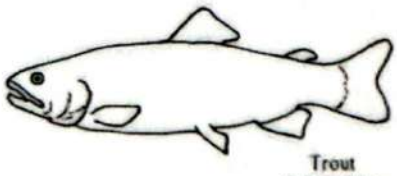
INTRODUCED FISHES



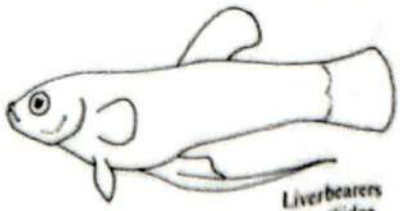
Carps
Cyprinidae



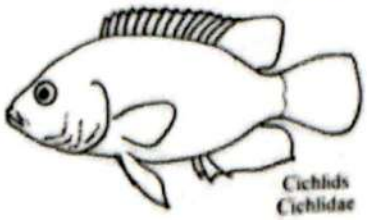
Airbreathing Catfishes
Clariidae



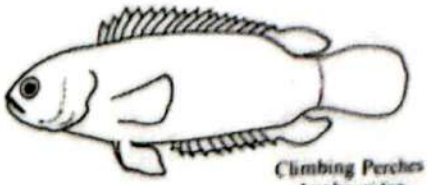
Trout
Salmonidae



Liverbearers
Poeciliidae

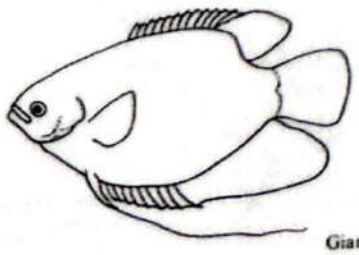


Cichlids
Cichlidae

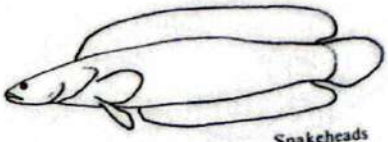


Climbing Perches
Anabantidae

Gouramies
Belontiidae



Giant Gouramies
Osphronemidae



Snakeheads
Channidae

Sharks

Family Carcharhinidae

The carcharhinid sharks are well known marine inhabitants, but at least one species, *Carcharhinus leucas* is encountered in freshwater streams and lakes which are linked to the sea by rivers. The family contains several species which are considered dangerous and may attack, especially if provoked. Carcharhinids exhibit internal fertilisation and are ovoviviparous. An average litter contains eight pups, but as many as 135 have been recorded for certain species. Fishes, turtles, and large crustaceans are common food items. The Tiger Shark (*Galeocerdo cuvier*) reaches a length of about 7 m, but most species seldom exceed 3 m.

Genus *Carcharhinus*
Blainville, 1816

This is the largest genus of sharks, containing 29 species. They occur worldwide mainly in tropical and subtropical seas, although some species penetrate cooler temperate regions. They are generally streamlined in shape with a more or less pointed snout (when viewed laterally), many rows of sharp triangular teeth, and an asymmetrical caudal fin. The genus contains small, harmless sharks, as well as several feared maneaters including the Bull Shark.

Bull Shark
Carcharhinus leucas
(Valenciennes, 1839)
(Plate 1, no. 1)

Diagnosis. - Heavy-bodied; snout short and broadly rounded, the preoral length 4.6-6.7% of total length; no interdorsal ridge; origin of first dorsal fin usually over or just posterior to pectoral axil; first dorsal fin moderately large, its height 7.0-11.3% of total length; apex of first dorsal fairly pointed; origin of second dorsal distinctly in front of anal origin; grey, becoming white ventrally, often with faint pale grey horizontal band extending into the white of the upper abdomen; fins of small individuals with dusky tips or edges, adults plain. Maximum size to 300 cm TL.

Distribution and Habitat. - Continental coasts of all tropical and subtropical seas; often travels far up rivers. It has been captured 3700 km from the sea in the Peruvian Amazon system. New Guinea localities include the Sepik and Ramu rivers and Lake Jamur. It was reported to be very common at Lake Jamur, some 130 km inland from the Arafura Sea, during the 1950's.

Remarks. - This is a dangerous shark responsible for many attacks on humans, some fatal. The normal habitat is shallow coastal waters and estuaries, but it frequently ascends rivers and may sometimes breed in fresh water. It feeds on just about anything edible. Females have litters of 3-13 young.

Sawfishes

Family Pristidae

Sawfishes are primarily confined to marine and estuarine habitats in tropical regions, but at least one species regularly occurs in fresh water and is believed to reproduce there. Currently, two genera and seven species are recognised from the tropical Atlantic, Indian and western Pacific oceans. They are shark-like in many respects, particularly the shape of the fins, but are actually related to rays, as indicated by the ventrally situated gill slits. The elongate snout, which is equipped with two rows of laterally projecting teeth, is their most distinctive feature. This saw apparatus is used to dig for food which largely consists of molluscs and other benthic invertebrates. It has also been reported that it is used to kill fish, but there is insufficient documentation. Sawfishes are ovoviviparous, females give birth to about 3-5 pups at a time. In the Mitchell River on western Cape York Peninsula, Queensland spawning generally occurs in *Pristis microdon* at the beginning

of the wet season in November or December. The largest species in the family is reported to attain lengths up to 6 m.

Genus *Pristis*
Linck, 1790

The genus contains four species and is distributed in all tropical continental seas. The shape (relatively broad or slender) of the saw and the number of teeth it contains are important for differentiating the species.

Sawfish
Pristis microdon
Latham, 1794
(Plate 1, no. 2)

Diagnosis. - Body shark-like with two nearly equal-sized dorsal fins, broad triangular pectoral fins, and ventral gill slits; saw relatively broad with 17-22 teeth on each side; grey or olive green above, whitish ventrally. Maximum size to at least 460 cm TL.

Distribution and Habitat. - Widespread in the tropical Indo-West Pacific. It occurs in shallow, near-shore marine environments, often in estuaries or ascending rivers. It is possible that this species may sometimes breed in fresh water. Common in the Digul River, Middle Fly River, Middle and Lower Sepik and Ramu rivers. Usually found in turbid channels of large rivers over soft mud bottoms, but also recorded from Lake Sentani. This species is protected by law in Irian Jaya.

Bony Tongues
Family Osteoglossidae

Bony tongues are a small group of primitive freshwater fishes that are mainly distributed in the Southern Hemisphere. Two species are found in South America, one in Africa, and three in the Indo-Australian region. They are characterised by a relatively elongate and laterally compressed body, large bony scales, a scaleless bony head, no fin spines, small to relatively elongate pectoral fins placed low on the sides, a small abdominal pelvic fin, and dorsal and anal fins set far back on the body immediately in front of the caudal fin. The Arapaima, a South American osteoglossid is one of the two largest strictly freshwater fishes in the world (the other is a South American Catfish), reported to attain a length of more than 4 m. The genus *Scleropages* of the New Guinea-Australian region has a maximum size of nearly 100 cm. It feeds near the surface mainly on insects and small fishes, but crustaceans are also consumed. Australian populations of *S. jardinii* generally spawn prior to the wet season, or from about September to early November. The timing apparently depends on water temperature and takes place when daytime surface temperatures approach 30 degrees C. The fertilised eggs are carried in the mouth of the female and number between about 30-130, depending on the size of the fish. These hatch in 1-2 weeks and the larvae, with their enlarged yolk sacs, are kept in or close to the mouth for another 4 or 5 weeks. The young begin feeding, primarily on microcrustaceans, at a size of 2-3 cm, well before the yolk sac is entirely resorbed. They eventually become independent of the female parent at a length of 3.5-4.0 cm. They grow to about 10 cm SL in the first three months. Adults are esteemed angling fish, famous for their fighting ability and tasty flesh. Large specimens may weigh as much as 27 kg, but 1-2 kg fish are the most common.

Genus *Scleropages*
Günther, 1864

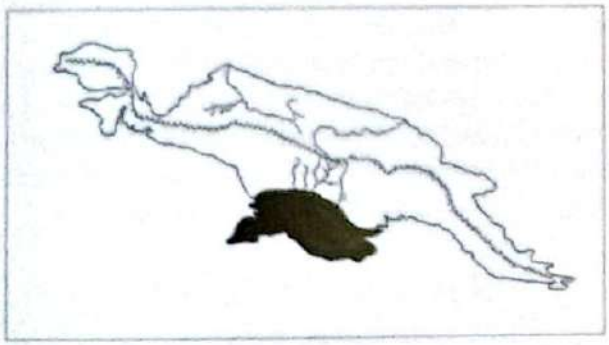
The genus contains two species: *S. jardinii* of southern New Guinea and northern Australia, and *S. leichardti* from the Fitzroy system of south-eastern Queensland. They are strictly freshwater inhabitants.

Saratoga or Bony Tongue

Scleropages jardinii
(Saville-Kent, 1892)
(Plate 12, no. 2)

Diagnosis. - Dorsal rays 20 to 24; anal rays 28 to 32; greatest body depth of adults 25 to 28% of SL; head length of adults 28 to 31% of SL; angle of mouth in relation to horizontal axis of body 41-45 degrees; rear edge of jaws extending well beyond level of eye; dorsal profile curved, nape arched; pair of barbels on chin; overall grey with silvery sheen, pink to red margins on scales of body and scattered small spots of these same colours on head and body. Maximum size to about 90 cm SL, but common to 30-50 cm.

Distribution and Habitat. - Known from the Digul, Bensbach, and Fly rivers. In northern Australia it ranges eastward from the Adelaide River, Northern Territory to the Jardine River, Queensland. This species is protected by law in Irian Jaya. It inhabits relatively still waters of streams and swamps. It is frequently seen near the surface or near shore among aquatic vegetation.



Tenpounders

Family Elopidae

The family contains a single genus, *Elops* with five species. It occurs in all tropical and warm temperate seas. They are elongate, silvery fishes closely related to the tarpons (Megalopidae). Both families have a characteristic leptocephalus larval stage. The larva is transparent, ribbon-like, with a small head and forked tail. Tenpounders spawn in the sea and the eggs and larvae are pelagic. The young use shallow coastal areas and estuaries as nursery grounds and may sometimes penetrate fresh water. *Elops* form large schools that prey on smaller fishes and crustaceans. They are an excellent angling fish, but because of their numerous small bones are not very palatable.

Genus *Elops*
Linnaeus, 1758

The genus contains five species and occurs circumglobally in tropical and warm temperate seas.

Giant Herring

Elops hawaiensis
Regan, 1909
(Plate 17, no. 2)

Diagnosis. - Dorsal rays 23 to 27; anal rays 15 to 18; pelvic rays 14 or 15; lateral-line scales 92-103; transverse scales 12-14 above lateral line and 9-10 below lateral line; predorsal scales 38-46; gill rakers on first arch 7-8 + 13-14; olive above and silvery on sides and ventral parts. Maximum size to 700 mm SL.

Distribution and Habitat. - Widely distributed in the eastern Indian Ocean and western and central Pacific. It occurs in coastal seas, sometimes entering brackish estuaries and freshwater streams, but does not penetrate very far inland.

Tarpons

Family Megalopidae

Tarpons are large silvery fishes, easily recognisable by their big eyes and mouth, single dorsal fin with a backward projecting filament, and deeply forked caudal fin. The family contains a single genus, *Megalops*, with one species each from the

tropical Indo-West Pacific and tropical Atlantic regions. Some researchers place the tarpons in the family Elopidae (Giant Herrings) due to anatomical similarities. These groups also share a leaf-like leptocephalus larval stage, similar to that of eels except they have a forked tail. Tarpons are swift, solitary predators of small fishes and crustaceans. They readily take lures and baits and have a reputation as fine angling fishes, although their flesh is considered poor eating. Spawning occurs near shore, sometimes in estuaries. The young migrate into fresh water and are often common in coastal streams or in floodplain lakes of larger rivers.

Genus *Megalops*
Lacepède, 1803

The genus contains only two species, *M. atlanticus* from the Atlantic Ocean and *M. cyprinoides* from the Indo-West Pacific.

Oxeye Herring
Megalops cyprinoides
(Broussonet, 1782)
(Plate 17, no. 1)

Diagnosis. - Dorsal rays 17 to 20, the last ray forming a prolonged filament; anal rays 24 to 31; pectoral rays 15 or 16; pelvic rays 10 or 11; gill rakers on first arch 15-17 + 30-35; lateral-line scales 36-40; adipose tissue covering eyes; no teeth in jaws; overall silvery. Maximum size to about 130 cm SL, but common to 50 cm SL.

Distribution and Habitat. - Widespread in the tropical Indo-West Pacific from East Africa to the Society Islands. It inhabits estuaries, particularly amongst mangroves and freshwater habitats. It is usually present in the tidal, mangrove-lined portion of coastal streams, but may also be seen well inland, occurring in the main channel of rivers or in lagoons, lakes, and swampy backwaters. In the Fly system it penetrates at least 900 km upstream.

Freshwater Eels
Family Anguillidae

The family contains a single genus, *Anguilla*, with about 15 species. These eels are easily recognized by their slender snake-like body, lack of pelvic fins, and presence of small, fan-shaped pectoral fins. They occur in lands bordering the North Atlantic, western Pacific, and Indian oceans. The life history of several species that have been studied is similar. Eels migrate downstream to the sea when sexual maturity is reached. Spawning often occurs in a centralised location well out to sea, for example, in the Sargasso Sea for Atlantic species. The tiny, leaf-shaped larvae, known as leptocephali, are carried by ocean currents to coastal areas where metamorphosis occurs. The young semi-transparent eels gradually assume the appearance of adults and begin their upstream migration. The migrating eels are extremely adaptable in their ability to reach remote headwater streams, sometimes high in the mountains. They use their muscular bodies to slither up rapids, waterfalls, and spillways of dams. Eels may require 10-20 years to attain sexual maturity before beginning their migration back to the sea. Anguillids feed mainly on fishes, crustaceans, and molluscs.

Genus *Anguilla*
Schank, 1798

The genus contains about 15 species distributed in the Atlantic and Indo-West Pacific oceans. Published reviews include those of Schmidt (1928), Ege (1939), and Tesch (1977).

Key to the New Guinean Species of *Anguilla*

1a. Skin uniform in colouration; dorsal fin originating only slightly in front, in line with, or slightly behind vertical through anus 2

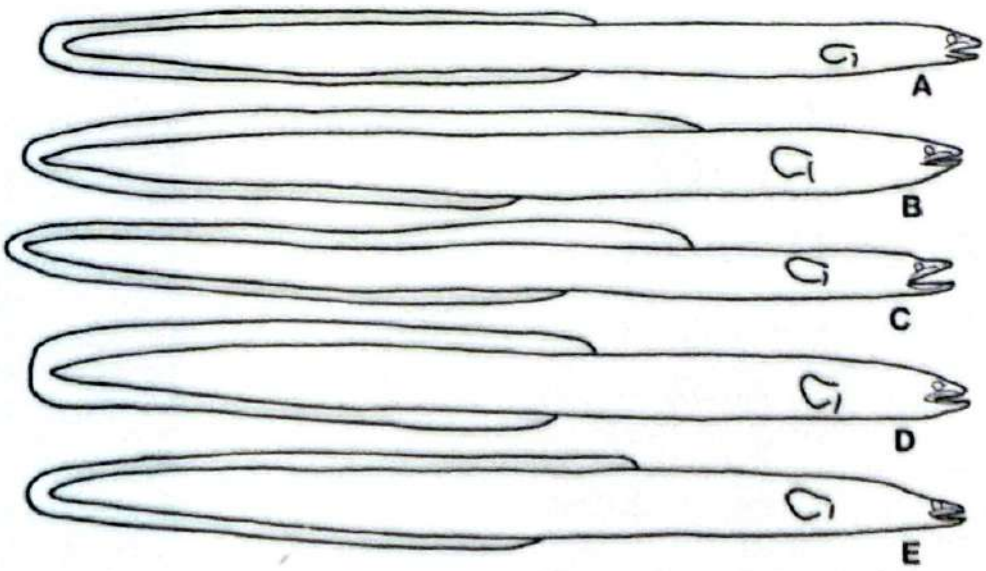


Fig. 7 - Body shapes of New Guinean ***Anguilla****: A)* ***A. bicolor****; B)* ***A. maramorata****; C)* ***A. megastoma****; D)* ***A. obscura****; E)* ***A. reinhardti*** *(from Ege, 1939).*

1b. Skin mottled or blotched; dorsal fin originating well in advance of vertical through anus 3

2a. Dorsal fin originates above, very slightly before, or very slightly behind the vertical through the anus (by distance of 1% or less of total length); length of median band of teeth in upper jaw (vomer and intermaxilla) 0.75 or greater of that of maxillary band .....*A. bicolor*

2b. Dorsal fin originates approximately one eye diameter or more in advance of vertical through anus (distance of 1.1% or more of total length); length of median band of teeth in upper jaw (vomer and intermaxilla) less than 0.75 of that of maxillary band..*A. obscura*

3a. Width of middle part of vomerine band of teeth about equal to that of maxillary band; maxillary band composed of three regular longitudinal rows of teeth separated by toothless grooves ....*A. marmorata*

3b. Width of middle part of vomerine band of teeth about half that of the maxillary band; maxillary band composed of more than three irregular longitudinal rows of teeth not separated by toothless grooves 4

4a. Length of gape (measured from tip of lower jaw to rear corner of mouth) 33-45% of head length ...*A. megastoma*

4b. Length of gape 20-31% of head length .....*A. reinhardtii*

Indian Short-finned Eel

Anguilla bicolor
McClelland, 1844
(Plate 1, no. 7; Fig. 7A)

Diagnosis. - Pectoral rays 14 to 20 (usually 16 to 18); total vertebrae 103-114; head length 12-17, preanal length 37-45, both as % of total length; length of mouth gape 20-32% of head length; maxillary tooth band relatively broad with teeth arranged in dense irregular rows without toothless grooves between them (Fig. 8A); generally dark brown, including fins; tan or whitish on belly. Maximum size to 600 mm TL.

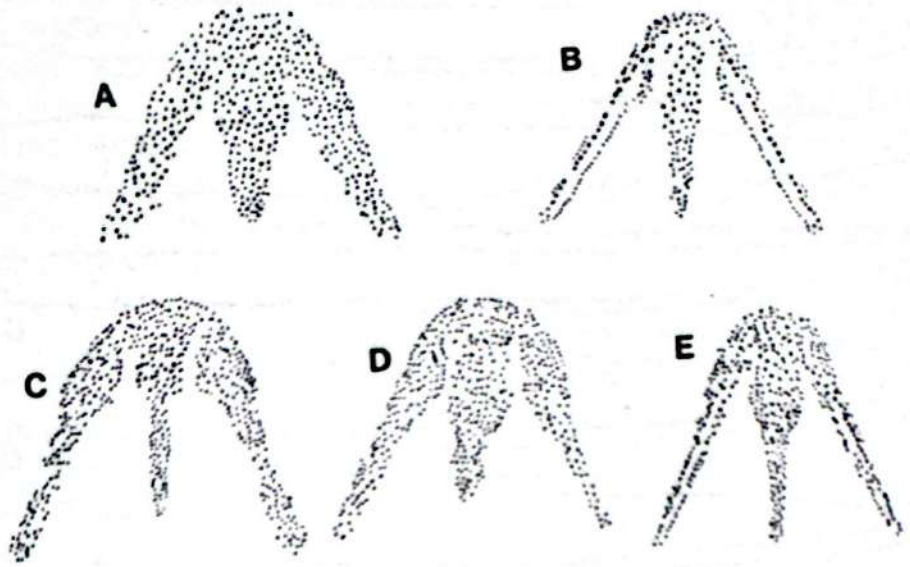


Fig. 8 - Upper jaw dentition patterns of New Guinean ***Anguilla****: A)* ***A. bicolor****; B)* ***A. maramorata****; C)* ***A. megastoma****; D)* ***A.obscura****; E)* ***A. reinhardti*** *(from Ege, 1939).*

Distribution and Habitat. - Widespread in regions bordering the Indian Ocean and western Pacific; also on high islands in this region. All records from New Guinea are from northern river systems, particularly the Sepik and Ramu. It occurs in large lowland rivers as well as mountain tributaries.

Giant Long-Finned Eel

Anguilla marmorata
Quoy & Gaimard, 1824
(Fig. 7B)

Diagnosis. - Pectoral rays 15 to 21 (usually 17 to 19); total vertebrae 100-110; head length 12-18, preanal length 39-47, both as % of total length; length of mouth gape 27-38% of head length; maxillary tooth band relatively narrow, consisting of three longitudinal rows of teeth with toothless groove between each row (Fig. 8B); generally brown with darker spots and mottling which increases with age. Maximum size to at least 900 mm TL.

Distribution and Habitat. - Widespread in the Indo-West Pacific region from East Africa to the Society and Marquesas islands. New Guinea records include the region near Jayapura, Irian Jaya and streams of south-eastern Papua New Guinea near Port Moresby. It occurs in lowland rivers as well as upland tributaries.

Pacific Long-Finned Eel

Anguilla megastoma
Kaup, 1856
(Fig. 7C)

Diagnosis. - Pectoral rays 14 to 19 (usually 16 to 18); total vertebrae 108-115; head length 11-16, preanal length 36-42, both as % of total length; length of mouth gape 33-45% of head length; maxillary tooth band relatively broad with teeth arranged in dense irregular rows without toothless grooves between them (Fig. 8C); brownish yellow above and pale yellow below, with darker marbling or mottling. Maximum size to 900 mm TL.

Distribution and Habitat. - Widespread in the western and central Pacific region from Sulawesi to the Society Islands. New Guinea specimens have been collected from streams inland from Popondetta, and from Kairiru Island, just northwest of Wewak. It occurs in rocky pools, often in coastal streams.

Pacific Short-Finned Eel

Anguilla obscura
Günther, 1871
(Fig. 7D)

Diagnosis. - Pectoral rays 14 to 20 (usually 16 to 19); total vertebrae 101-107; head length 12-18, preanal length 39-47, both as % of total length; length of mouth gape 25-38% of head length; maxillary tooth band moderately broad with teeth arranged in dense irregular rows without toothless grooves between them (Fig. 8D); uniform dark brown, lighter on belly. Maximum size to about 100 cm TL.

Distribution and Habitat. - Widespread in the South Pacific region from New Guinea to the Society Islands and Rapa. New Guinea records include the Port Moresby region, Embi Lakes near Popondetta, Madang area, Sepik River, and streams near Jayapura. It occurs in both large turbid rivers and small creeks, as well as swamps and lacustrine habitats.

Marbled Eel

Anguilla reinhardti
Steindachner, 1867
(Fig. 7E)

Diagnosis. - Pectoral rays 16 to 20 (usually 17 to 19); total vertebrae 103-114; head length 13-18, preanal length 39-49, both as % of total length; length of mouth gape 20-31% of head length; maxillary tooth band relatively narrow, consisting of three longitudinal rows of teeth with toothless groove between each row Fig. 8E); olive green to brownish with distinct darker blotching on back and sides; pale grey or whitish ventrally; median fins dark brown, pectorals yellowish. Maximum size to 100 mm TL.

Distribution and Habitat. - New Guinea, eastern Australia, Lord Howe Island, and New Caledonia. In New Guinea it is known from relatively few localities including Dinawa, (Upper Saint Joseph River, Gulf of Papua drainage) and near Jayapura. It inhabits streams, lakes, and swamps, but is most common in flowing water. *Anguilla interioris* Whitley is here considered to be a synonym.

Moray Eels

Family Muraenidae

Moray eels are marine fishes that are common on coral reefs. However, one species, *Gymnothorax polyuranodon*, is regularly encountered in fresh water. Morays have a characteristic eel-like body, sharp teeth, and lack pectoral fins. Other features include: scales absent; dorsal fin origin usually in front of level of gill opening; median fins continuous around tail; posterior nostrils either a slit or a tube in front or above eye; teeth variable, either conical and pointed, sometimes as long depressible fangs, or molariform in a pavement structure; teeth of jaws and usually those on vomer frequently multiserial; lateral line composed of 1-3 pores before gill opening; head pores obvious; gill opening a conspicuous midlateral hole just behind head.

Morays have a largely undeserved reputation of being vicious and aggressive. They very seldom attack divers and usually only if provoked. None of the species have venomous bites, but morays sometimes cause ciguatera poisoning if eaten. Moray eels live in rocky crevices and amongst coral heads. They are predators of fishes and invertebrates, particularly crustaceans. Worldwide the family contains about 200 species in 13 genera. The largest species reach approximately 3 m.

Genus *Gymnothorax*

Bloch, 1795

This large genus of mainly reef-dwelling eels occurs worldwide in tropical and warm temperate seas. In the Indo-West Pacific region there are more than 50 species.

Freshwater Moray

Gymnothorax polyuranodon
(Bleeker, 1853)
(Plate 1, no. 6)

Diagnosis. - Greatest body depth divided into total length 19-28; head length divided into total length 9-11; origin of dorsal fin above gill opening; teeth sharp and conical, inclined backwards; 2-3 series of teeth on upper jaw, 1-3 series on lower jaw; intermaxilla with 2 series of teeth around 1-2 recurved depressible fangs; vomer with single series of 5-10 teeth; colour generally yellowish to light brown with large, irregular round black blotches, joined to form longitudinal dark bands on head. Maximum size to about 800 mm.

Distribution and Habitat. - Distributed throughout Indonesia from Sumatera to Irian Jaya and eastward to northern Papua New Guinea. Also reported from Fiji and Cape York Peninsula, Australia. It is usually found within 20-30 km of the sea at a maximum elevation of about 30-40 m.

Snake Eels
Family Ophichthidae

Snake eels are generally associated with sandy marine habitats, but a few species occur in fresh or brackish waters. The family has a worldwide, mainly tropical, distribution and includes about 200 species in 38 genera. Most species are adapted for burrowing in soft bottoms and exhibit a relatively long slender body and pointed snout. Many species lack fins and the body tapers to a sharp, bony tip that is useful when burrowing backwards. Other features include: scales absent; pectoral fins present or absent; a supratemporal pore and a supraorbital pore along the dorsal midline of the head; posterior nostril usually on the upper lip and opening into the mouth; teeth uniserial or multiserial, either small and conical, fang-like, or molariform.

They are mainly predators of benthic invertebrates, but fishes are also consumed. The largest snake eels attain a length of about 1.5 m.

Genus *Achirophichthys*
Bleeker, 1865

This genus is poorly known. It apparently contains two species from Indonesia and New Guinea, but few specimens have been collected.

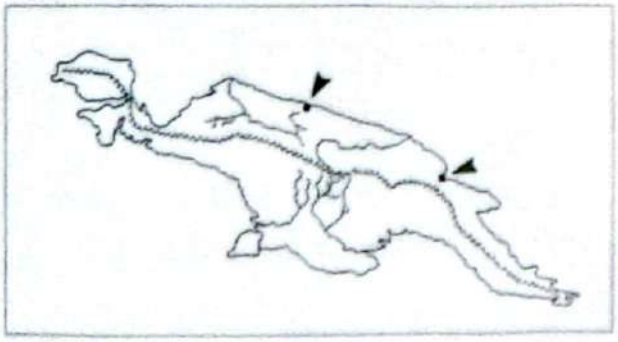
Freshwater Snake-Eel

Achirophichthys kampeni
(Weber and de Beaufort, 1916)
(Photo 13)

Diagnosis. - Greatest body depth divided into total length 33-41; head length divided into total length 7.6-8.7; head and trunk somewhat longer than tail; snout pointed, projecting over inferior mouth; cleft of mouth wide, about 1/3 the head length; jaws with single series of compressed recurved teeth, also a few enlarged canines on upper jaw; intermaxillary with a curved series of about 5 teeth, mainly enlarged canines; eye relatively large, situated above anterior 1/3 of mouth cleft; origin of dorsal fin slightly behind gill openings; dorsal and anal fins relatively low, terminating just before the pointed end of the tail; colour dark grey on dorsal half and whitish ventrally; lateral-line pores white. Maximum size to about 410 mm TL.

Photo 13 -
Freshwater Snake-eel,
***Achirophichthys kampeni** , 340mm TL.*

Distribution and Habitat. - Known thus far from only two localities, both in northern New Guinea: (1) near a river mouth at Humboldt Bay, site of the present day city of Jayapura and (2) in small tributaries of the Gogol River, near Madang. At the latter locality specimens were collected from a clear, flowing rainforest stream about 45 km upstream from the sea and at an elevation of about 35m. The eels were collected from very fine sand with the use of rotenone.



Herrings
Family Clupeidae

Clupeids are small to moderate sized, silvery, schooling fishes. They are primarily coastal marine inhabitants, although there are a considerable number of estuarine and freshwater species. Diagnostic characters include the presence in most species of specialised scales on the belly called scutes, that have a bony median ridge; no fin spines; cycloid scales that are easily shed; no lateral line; mouth more or less terminal, often small; teeth either very small or absent; gill rakers often numerous, long and slender in most species.

Herrings and their close relatives, the anchovies, are perhaps the single most important group of commercial fishes that are harvested by man. They surpass all other groups both in weight and in numbers, representing nearly 20% of the world's total catch. In 1982, for example, 18,897,731 tons were caught compared to 2,593,212 tons of tunas. Most of the impressive herring catch comes from cool seas, including a massive contribution from Peru. The clupeid catch is utilised in a number of ways including fresh, frozen, and tinned food products for humans and pets, as live bait that is used to catch other fishes such as tunas, as fish meal that is used for animal feeds, as a component of fertilisers, and for the extraction of oil products.

Herrings generally occur in schools hence they are usually caught in large numbers. However, the freshwater species of New Guinea are largely ignored as a food source. In fact they are scarce or absent in most areas except the Great Southern region (particulary Fly and Digul rivers). Clupeids feed primarily on small planktonic animals, especially crustaceans. Algae may also be consumed. Members of the family exhibit a wide size range, from about 2 cm to 60 cm. The largest species from New Guinean freshwaters is about 22 cm.

Key to the Freshwater Genera of Clupeidae from New Guinea

1a. Upper jaw rounded when seen from front; last dorsal finray not elongate and filamentous 2

1b. Upper jaw with a distinct median notch or cleft when seen from front; last dorsal finray elongate and filamentous ..... *Nematalosa*

2a. Posterior supra-maxilla enlarged, more or less rectangular (Fig. 10A); anterior supra-maxilla present ..... *Escualosa*

2b. Posterior supra-maxilla relatively narrow, elongate, and rounded (Fig. 10B); anterior supra-maxilla absent .. .. *Clupeoides*

Genus *Clupeoides*
Bleeker, 1851

This genus contains four species that inhabit rivers of south-east Asia, Indonesia, and New Guinea.

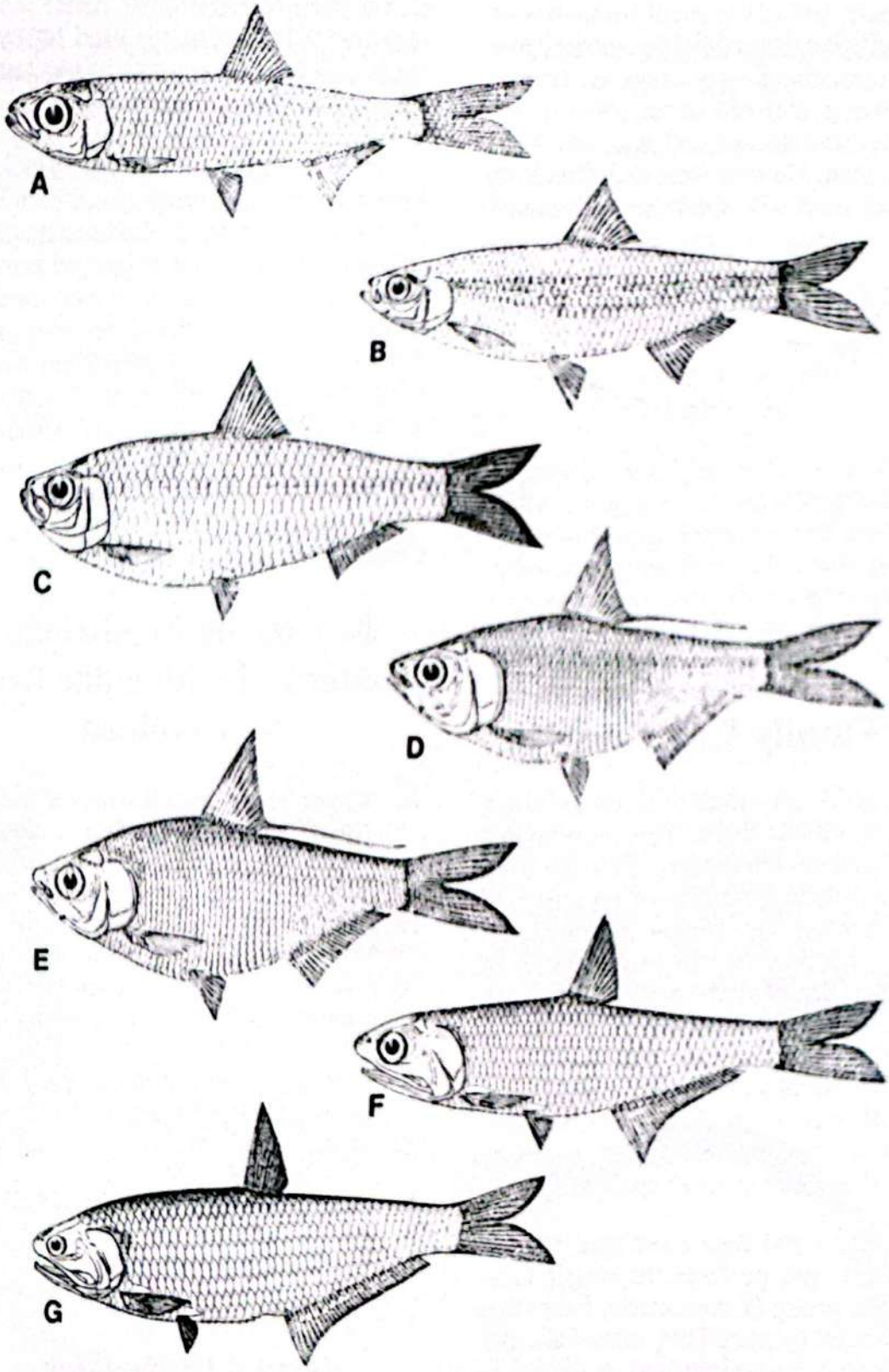


*Fig 9. Clupeid and engraulid fishes from New Guinean fresh waters: A) **Clupeoides papuensis**; B) **Cluepeoides venulosus**; C) **Escualosa thoracata**; D) **Nematalosa flyensis**. E) **Nematalosa papuensis**; F) **Thryssa rastrosa**; G) **Thryssa scratchleyi** (from Whitehead, 1985; Whitehead, et al. 1988).*

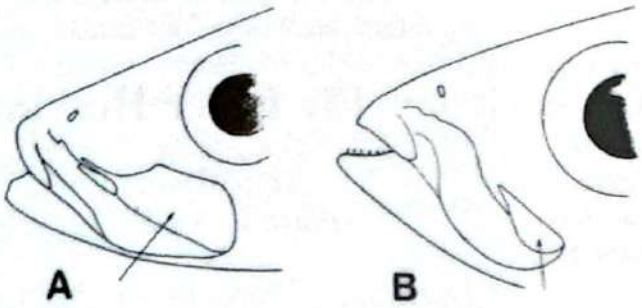


*Fig. 10 - Jaw structure of clupeid fishes showing difference in shape of the second supra-maxillary bone: A) **Escualosa**; B) **Clupeoides** (from Whitehead, 1985).*

New Guinea including the Digul, Fly, and Strickland rivers. In the Fly system it is found in lowland streams and has been taken at sites ranging from 264 km to 905 km upstream from the sea. It inhabits rivers with sand and mud bottoms.

Remarks.- It feeds on small insect larvae as well as zooplankton.

Key to the New Guinean Species of *Clupeoides*

1a. Body slender, its depth 17-23% of SL; predorsal scales 17-19. ..*C. papuensis*

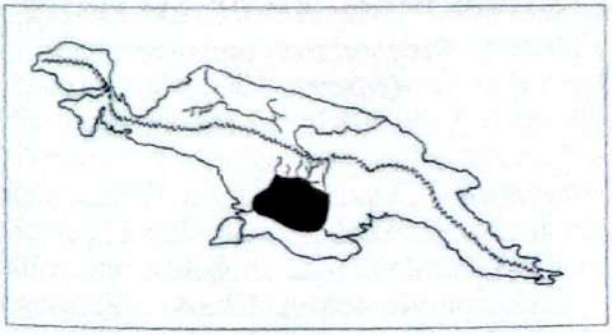
1b. Body deeper, its depth 26-29% of SL; predorsal scales 14-15 ..*C. venulosus*

Toothed River Herring

Clupeoides papuensis
(Ramsay and Ogilby, 1886)
(Plate 1, no. 4; Fig. 9A)

Diagnosis - Dorsal rays 12 to 14; anal rays 20; pectoral rays 11 or 12; pelvic rays 8; lower gill rakers 15-19; predorsal scales 14-15; body depth 17-23% of SL; belly sharply keeled with 10 or 11 prepelvic scutes and 8 or 9 postpelvic scutes; premaxilla short and toothless, but teeth present in lower jaw; a silvery stripe present along middle of side, tapering anteriorly. Maximum size to about 80 mm SL.

Distribution and Habitat. - Central-south



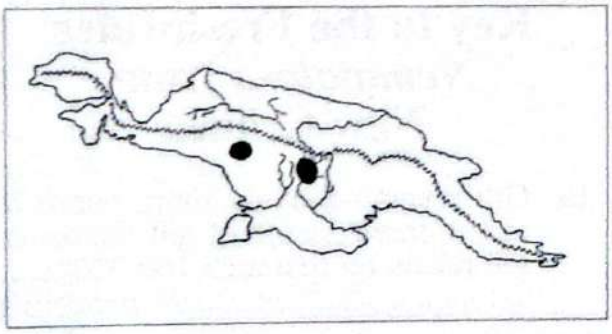
West Irian River Sprat

Clupeoides venulosus
Weber and de Beaufort, 1912
(Fig. 9B)

Diagnosis. - Dorsal rays 14; anal rays 16; pectoral rays 13; pelvic rays 8; lower gill rakers 16 or 17; predorsal scales 17-19, body depth 26-29% of SL; belly sharply keeled with 9-12 prepelvic scutes and 7-9 postpelvic scutes; premaxilla short and toothless, but small teeth in lower jaw; a silvery stripe along middle of side, tapering anteriorly. Maximum size to about 90 mm SL.

Distribution and Habitat. - Known only from mountainous streams in the Lorentz and Fly river systems. It is the only clupeid in the world known to inhabit mountainous rivers. It has been collected in the Fly system at distances between 900 and 934 km upstream from the sea at elevations between about 50 and 500 m.

Remarks. - Lives in streams with gravel or stony bottoms and feeds primarily on aquatic insect larvae.



Genus *Escualosa*
Whitley, 1940

Two species are recognised in this genus: *E. elongata* from the Gulf of Thailand and the widespread *E. thoracata*. They are schooling, pelagic fishes found in coastal waters, including estuaries. The young are found in the lower parts of rivers.

White Sardine
Escualosa thoracata
(Valenciennes, 1847)
(Fig. 9C)

Diagnosis. - Dorsal rays 15 to 16; anal rays 17 to 19; pectoral rays 13 to 14; pelvic rays 8; body strongly compressed, the depth 27-30% of SL; hind margin of gill opening evenly rounded without projections; posterior part of upper jaw (2nd supramaxilla) enlarged and rectangular; belly strongly keeled; a bright silver stripe along middle of side. Maximum size to about 100mm SL.

Distribution and Habitat. - A coastal, pelagic, schooling fish that is widely distributed from Karachi, Pakistan to New Guinea and north-eastern Queensland. Juveniles may enter the lower parts of rivers. In New Guinea the only freshwater record is from the lower Ramu River, about 40 km upstream from the sea.

Genus *Nematalosa*
Regan, 1917

The genus contains nine species that are restricted to the Indo-West Pacific region. All but three freshwater species (two found in New Guinea) are inhabitants of coastal marine and brackish waters.

Key to the Freshwater *Nematalosa* from New Guinea

1a. Gill rakers relatively short, one-fifth to two-thirds length of gill filaments; gill rakers on first arch 160-320 .... *N. papuensis*

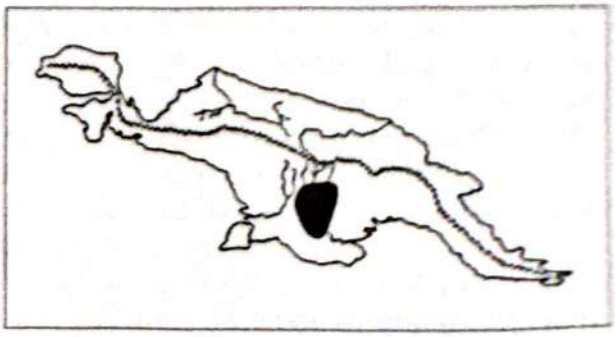
1b. Gill rakers longer, more than two-thirds length of gill filaments; gill rakers on first arch 360-520 ..... *N. flyensis*

Fly River Herring
Nematalosa flyensis
Wongratana, 1983
(Plate 1, no. 3; Fig. 9D)

Diagnosis. - Dorsal rays 13 or 14; anal rays 24 or 25; pectoral rays 14 to 16; pelvic rays 8; gill rakers extremely numerous, about 360-520; gill rakers longer than in the similar *N. papuensis*, at least two-thirds length of adjacent gill filaments; prepelvic scutes 16-18, postpelvic scutes 10-13; head length 29-33% of SL; body depth 32-40% of SL; mouth subterminal; last dorsal finray long and filamentous; colour generally silvery with an orange or golden opercle. Maximum size to about 220 mm SL.

Distribution and Habitat. - Known only from the Fly-Strickland River system.

Remarks. - *N. erebi* (Günther), an Australian species, has been recorded from the Fly and Digul rivers by past authors, but its occurrence there is doubtful. Most likely these records were based on misidentifications of either *N. flyensis* or *N. papuensis*.

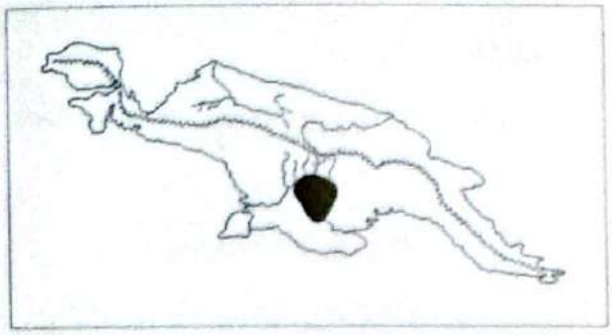


Strickland River Herring
Nematalosa papuensis
(Munro, 1964)
(Fig. 9E)

Diagnosis. - Dorsal rays 16 or 17; anal rays 23 to 24; pectoral rays 14; pelvic rays 8; predorsal scales 21-22; prepelvic scutes 16-18, postpelvic scutes 12-14; gill rakers

numerous, about 160-320; gill rakers shorter than in the similar *N. flyensis*, about one-fifth to two-thirds length of adjacent gill filaments; head length 25-31% of SL; body depth 32-40% of SL; mouth subterminal; last dorsal ray long and filamentous; colour generally silvery with an orange or golden opercle. Maximum size to about 210 mm SL.

Distribution and Habitat. - Known only from the Fly-Strickland River system. It has been collected at distances between 264 and 856 km upstream from the sea.



Anchovies

Family Engraulididae

The anchovies are closely related to the herrings (family Clupeidae), but are easily distinguished by their enlarged snout which usually protrudes in front of the lower jaw, and by the large mouth with the maxilla extending backwards well past the eye. They are small silvery, schooling fishes that mainly frequent coastal waters, often entering estuaries; however, a number of species are restricted to fresh water. They occur in all seas between 60 degrees North and 50 degrees South. The family contains 16 genera and about 140 species. Some marine species are fished commercially, generally being used in the production of fish meal for animal foods and fertilisers. Indeed, the Peruvian Anchovy (*Engraulis ringens*) is the most heavily exploited fish in world history, yielding catches of up to 13 million tons per year. Most species feed on small planktonic animals, especially crustaceans.

Genus *Thryssa*
Cuvier, 1829

The genus contains 24 species that are mainly distributed along continental margins from East Africa to south-eastern Asia and Australia. Most species inhabit shallow coastal seas and brackish estuaries, a few are known from fresh water.

Key to the Freshwater Species of *Thryssa* from New Guinea

1a. Lower gill rakers 55-61; anal rays 33-36 ..... *T. rastrosa*

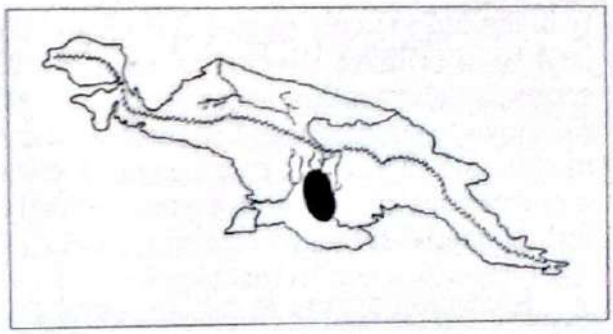
1b. Lower gill rakers 18-23; anal rays 38-42 ..... *T. scratchleyi*

Fly River Thryssa
Thryssa rastrosa Roberts, 1978
(Plate 1, no. 5; Fig. 9F)

Diagnosis. - Dorsal rays 12 or 13; anal rays 33 to 36; pectoral rays 13; belly scutes 17 - 19 + 10 - 11 = 27 - 29; gill rakers on lower limb of first arch 55-61; maxilla short, not quite reaching to hind border of preopercle; generally silvery. Maximum size to 120 mm SL.

Distribution and Habitat. - Known only from the Upper and Middle Fly River system, up to about 850 km upstream from the mouth. It occurs in the turbid channels of large rivers, also in lakes and swampy backwaters.

Remarks. - Apparently a filter feeder that consumes plankton including calanoid copepods.



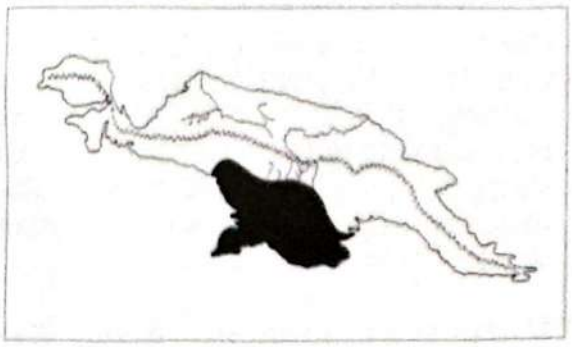
Freshwater Anchovy

Thryssa scratchleyi
(Ramsay & Ogilby, 1886)
(Fig. 9G)

Diagnosis. - Dorsal rays 12 or 13; anal rays 38 to 42; pectoral rays 13; belly scutes 17 - 19 + 10 - 12 = 27 - 31; gill rakers on lower limb of first arch 18 - 23; maxilla short, only reaching to front border of preopercle; generally silvery. Maximum size to 370 mm SL; the largest known species in the genus.

Distribution and Habitat. - Known from central-southern New Guinea and northern Australia. The New Guinea distribution includes the Fly-Strickland and Lorentz rivers. It occurs both in brackish estuaries and well inland, as far as 900 km upstream in the Fly system; found in main river channels as well as smaller tributaries.

Remarks. - Feeds on fishes including clupeids and melanotaeniids.



Milkfishes
Family Chanidae

The milkfish family contains a single species, *Chanos chanos* which occurs widely in the Indo-Pacific region. It is characterised by a brilliant silvery colour, cycloid scales, small mouth without teeth, lack of fin spines, a single dorsal fin situated on the middle of the back, eye covered with membranous tissue, and a very strongly forked caudal fin.

Spawning occurs in estuaries and the young migrate back to this habitat and sometimes into the lower parts of freshwater streams after a marine pelagic stage. The diet consists of both planktonic items and benthic invertebrates. Algae are also consumed. In many areas it is a much esteemed food fish and has the reputation of being a good fighter when hooked. The Milkfish is widely cultured in fish ponds in south-eastern Asia.

Genus *Chanos*
Lacepède, 1803

The genus contains a single species that is discussed below.

Milkfish

Chanos chanos
Forsskål, 1775
(Plate 17, no. 3)

Diagnosis. - Dorsal rays 13 to 17; anal rays 8 to 10; pectoral rays 15 to 17; pelvic rays 10-12; lateral-line scales: 78-90; greatest body depth divided into SL 3.1-4.7; colour generally silver. Maximum size to about 180 cm.

Distribution and Habitat. - Widespread in the Indo-West Pacific region from East Africa and the Red Sea to the islands of Polynesia, including the Hawaiian Islands. It is found in a diversity of habitats including coral reefs, coastal shallows, estuaries, and freshwater streams.

Fork-Tailed Catfishes
Family Ariidae

Ariids are stout-bodied catfishes with a forked caudal fin, small adipose fin, and strong spines in front of the dorsal and pectoral fins. The head is moderately depressed and characterised by a strong dorsal "shield" or bony plate. Three pair of

barbels surround the mouth. These fishes are found worldwide in tropical, subtropical, and warm temperate waters and are usually found in the sea and in estuaries, though some species spend their entire life cycle in fresh water. There are about 14 valid genera and approximately 80 species worldwide. In New Guinea and Australia there are about 43 species. Spawning takes place at the beginning of the wet season. The eggs, which are very large and few in number, are incubated in the mouth of the male. Maturing females in many genera develop "claspers", thickened pads or hooks on the inner ventral fin rays. The small young are cared for by the male (in the buccal cavity). Growth is rapid over the first few years of life.

Genus *Arius*
Valenciennes, 1840

This genus occurs worldwide in tropical marine and fresh waters. It contains approximately 80 species of which 16 occur in fresh waters of New Guinea and Australia. The genus is characterised by broad, unrestricted gill openings and in most species there are 2-4 patches of fine teeth on the palate. Four species formerly classified in *Hemipimelodus* lack palatal teeth. There are no shared species of freshwater ariids between northern and southern New Guinea, therefore two separate keys are presented for these regions.

Key to the Freshwater *Arius* of Northern New Guinea
(from Kailola, 1990)

1a. Adipose fin small, above posterior third of anal, its base 4-9.5 (mean 6.6) % SL; eye 4-7.3 (mean 5.4) % SL; lips thin, closely applied; fin spines thin; pectoral with 8-10 rays; variable development of palatal teeth (absent, to covering most of palate), but usually in a "butterfly"-shaped patch, with the vomerine patches the larger (subgenus *Brustiarius*) 2

1b. Adipose fin moderate, above middle of anal, its base 6.4-14.5 (mean 9.5) % SL; eye 2.7-6 (mean 3.8) % SL; lips moderately well-developed; fin spines moderately stout; pectoral with 10-12 rays; palatal dentition of one, two or four distinct oval patches, or absent..... 3

2a. Total gill rakers on first arch more than 50 (mean 60.6) ..... *A. nox*

2b. Total gill rakers on first arch 19-30 (mean 23.1) ..... *A. solidus*

3a. Palatal teeth in four distinct, equal-sized oval patches transversely arranged; mouth broad, 45-56 (mean 50.4) % of head length; internostril distance 30-39 (mean 35.1) % head length..... *A. utarus*

3b. Palatal teeth not as above; mouth narrower, 30-46 (mean 40.3) % head length; internostril distance 21-31 (mean 28.1) % head length 4

4a. Maxillary barbel short, 9-10.2 (mean 9.5) % of SL; eye small, 8.4-11 (mean 9.5) % head length; single, oval patch of fine teeth on each side of palate .. .. *A. coatesi*

4b. Maxillary barbel 16-32 (mean 24.8) % SL; eye moderate, 10-24 (mean 15.5) % head length; palate naked or (rarely) with one or two small oval patches of fine teeth ..... *A. velutinus*

Key to the Freshwater *Arius* of Southern New Guinea

1a. Palatal tooth patches present 2

1b. Palatal tooth patches absent 8

2a. Rakers or raker-like processes present on posterior face of first and second gill arches 3

2b. Rakers or raker-like processes absent on posterior face of first and second gill arches 5

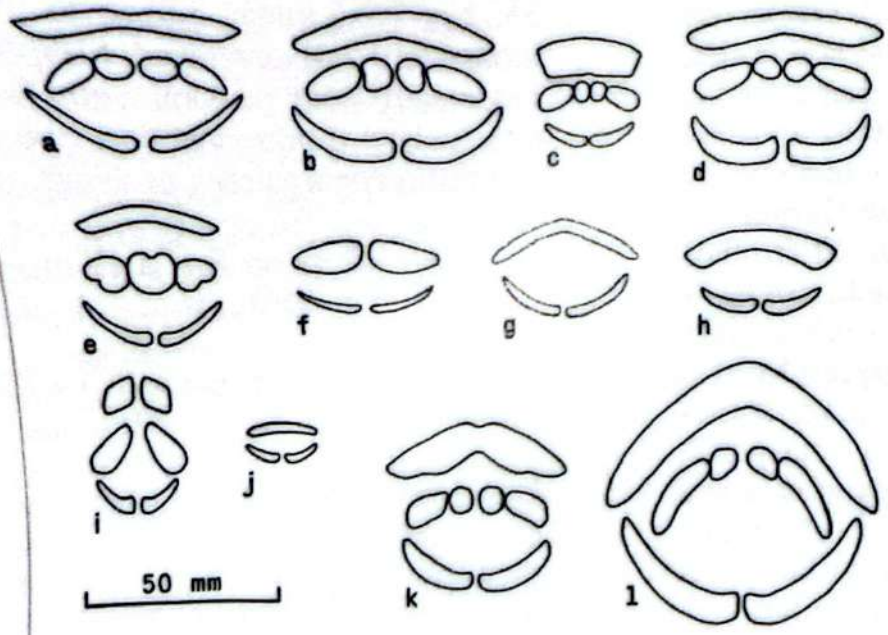


Fig. 11 Oral tooth bands in certain ariid catfishes (from Roberts, 1978):

a) ***Arius leptaspis;***
b) ***A. latirostris,***
c) ***A. carinatus;***
d) ***A. augustus;***
e) ***A. berneyi;***
f) ***A. crassilabris;***
g) ***A. macrorhynchus;***
h) ***A. taylori;***
i) ***Cinetodus froggatti;***
j) ***Nedystoma dayi;***
k) ***Cochlefelis spatula;***
l) ***C. danielsi***

3a. Teeth of upper jaw in broad rectangular band (see Fig. 11c), about twice width of palatal patches; adipose fin long-based .....*A. carinatus*

3b. Teeth of upper jaw in relatively narrow elongate band, about same width as palatal patches; adipose fin short based 4

4a. Eye rounded; maxillary barbels long, 2.1-3.1 (mean 2.5) in SL; palatal tooth patches as in Fig. 11e .....*A. berneyi*

4b. Eye oval; maxillary barbels 2.5-5.8 (mean 3.8) in SL; palatal tooth patches similar to that shown in Fig. 11b ....*A. graeffei*

5a. Barbels extremely short, maxillary barbels reaching halfway or less to base of pectoral spine .....*A. augustus*

5b. Barbels relatively long, maxillary barbels usually reaching to or beyond pectoral spine base 6

6a. Teeth strong, prominent, non-depressible; eye small. .....*Arius* sp.

6b. Teeth fine, depressible; eye moderately large 7

7a. Snout slightly pointed; young of less than 200 mm with a soft, fleshy projection of snout; adults of more than 400 mm often with broad median depression on dorsum of snout between prominent ridge like anterolateral wings of cephalic shield and a pronounced nuchal hump; dorsum uniformly grey or purplish grey in life ..*A. latirostris*

7b. Snout broadly rounded; young without a soft, fleshy projection of snout; adults with a straight dorsal profile anteriorly, without a broad median depression on snout, without prominent ridgelike anterolateral processes of cephalic shield, and without a nuchal hump; dorsum bluish black, purplish, or wine red in life, usually with a series of vertical rows of iridescent gold, round spots centered on dorsolateral lateral line organs .....*A. leptaspis*

8a. Barbels extremely short, maxillary barbel reaching only halfway or less to pectoral spine base; eyes dorsolateral .....*A. crassilabris*

8b. Barbels relatively long, maxillary barbel reaching to or beyond pectoral spine base; eyes usually lateral or slightly ventrolateral 9

9a. Snout flattened or concave dorsally, strongly indented at nostrils, and sharply pointed; barbels blackish brown and relatively long, maxillary barbel extending beyond tip of pectoral spine .....*A. macrorhynchus*

9b. Snout slightly rounded or convex dorsally, not indented at nostrils, and moderately pointed; barbels grey or pale and moderately long, maxillary barbel extending only to middle of pectoral spine .....*A. taylori*

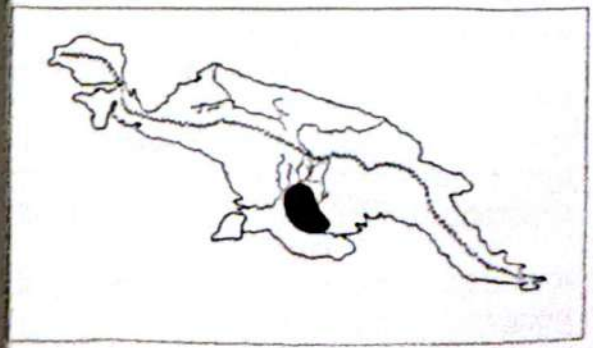
Short Barbelled Catfish

Arius augustus
Roberts, 1978
(Plate 3, no. 11)

Diagnosis. - Dorsal rays I,7; anal rays 20 to 22; pectoral rays I,10 or 11; gill rakers on first arch 20-22; rakers absent on posterior face of first and second gill arches; head broad and snout relatively squarish when viewed from above; palate with two well-developed pairs of tooth patches (Fig. 11d); eyes very small; barbels extremely short, the maxillary barbel extending posteriorly a maximum of half the distance from its origin to that of pectoral spine; bluish on upper half, whitish below. Maximum size to 600 mm SL.

Distribution and Habitat. - Fly River. Relatively common in large tributaries of the Middle Fly, but also ranges as far as 830 km upstream from the sea into the upper Fly.

Remarks. - Feeds exclusively on small fishes including clupeids, chandids, and melanotaeniids.



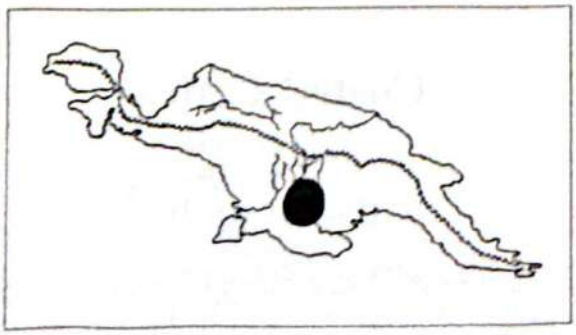
Berney's Catfish

Arius berneyi
(Whitley, 1941)
(Plate 3, no. 6)

Diagnosis. - Dorsal rays I,7; anal rays 16 to 19; pectoral rays I,9 to 11; gill rakers on first arch 15 to 20; raker-like processes on back of all gill arches, 15-23 on first, 16-20 on second, 15-19 on third; palatal teeth in transverse band of 3 or 4 patches (Fig. 11e); maxillary barbels long, 2.1-3.1 in SL, extending beyond head at all ages, usually level with or past dorsal fin origin in juveniles; head ovate, snout rounded and slightly pointed; greyish brown, bluish, or bluish black above, creamy fawn to white below; fins dusky yellow. Maximum size 380 mm SL.

Distribution and Habitat. - Common in lakes, lagoons, and large rivers of the Middle Fly River system and also found in lowland habitats of the Upper Fly as far as 850 km upstream from the sea. It also occurs in northern Australia.

Remarks. - Feeds on terrestrial insects, aquatic insects, plants, prawns, and fishes. *Arius cleptolepis* Roberts is a snyonym (Kailola, pers. comm.).



Comb-Spined Catfish

Arius carinatus
Weber, 1913
(Plate 3, no. 8)

Diagnosis. - Dorsal rays I,7; anal rays 15 to 18; pectoral rays I,10 or 11; gill rakers on first arch 15-19; posterior face of first and second gill arches with relatively

well- developed rakers; palatal teeth in four round to ovate patches (Fig. 11c), the outermost patches larger and more ovate, sometimes the four patches are more or less joined; maxillary barbel variable in length, extending posteriorly as little as three-fourths of distance to pectoral fin base or as much as to the anterior one-third of the pectoral spine; reddish or brownish with golden or bronzy reflections on back, whitish ventrally. Maximum size to 400 mm SL.

Distribution and Habitat. - Central portion of southern New Guinea; thus far known from the Fly and Lorentz rivers, but probably more widespread. In the Fly it is known from the middle and lower portions of the river.

Remarks. - The diet consists of aquatic and terrestrial insects and their larvae, prawns, and detritus.

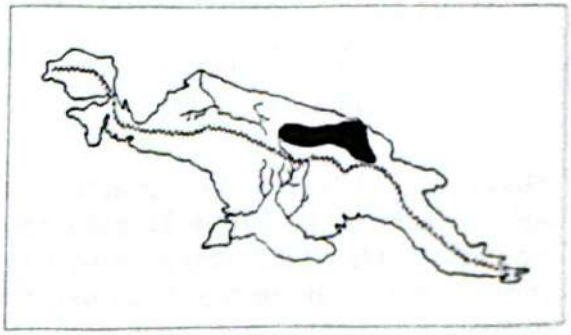
Coates' Catfish

Arius coatesi
Kailola, 1990
(Plate 3, no. 3)

Diagnosis. - Dorsal rays I,7; anal rays 19 to 21; pectoral rays I,10 to 12; gill rakers on first arch 13-17; rakers usually absent on posterior face of first and second gill arches; palatal teeth in two isolated, oval patches; eyes small, 9.5% (mean) of head length; barbels short, the maxillary barbel not extending beyond about 0.5-1.5 eye diameter distance past rear margin of eye; olive bronzy, golden, or bluish on upper half, silvery grey to white on lower sides and ventral parts; fins grey to bluish. Maximum size 750 mm SL.

Distribution and Habitat. - Lower and middle Sepik and Ramu river systems of northern Papua New Guinea. It is restricted to rivers and does not occur in lakes or on the floodplain.

Remarks. - This is the largest ariid north of the central divide. Males and females mature at about 360-370 mm SL. Spawning occurs throughout the year. The brood mass contains between 20 and 173 eggs. Food items include *Macrobrachium* prawns, other smaller prawns, detritus, plants, aquatic insects and nymphs, fishes, worms, and leeches.



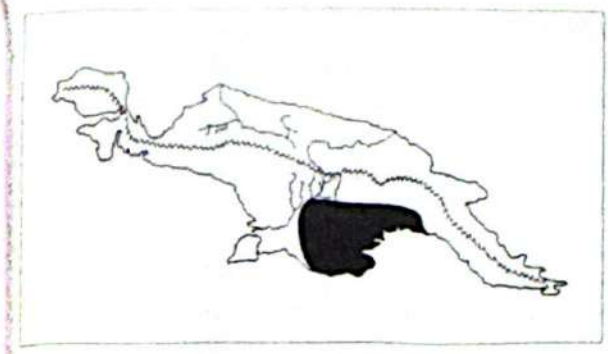
Thick-Lipped Catfish

Arius crassilabris
Ramsay & Ogilby, 1886
(Plate 2, no. 1)

Diagnosis. - Dorsal rays I,7; anal rays 17 or 19; pectoral rays I,10 or 11; gill rakers on first arch 14-18; rakers present on posterior face of first and second gill arches; upper jaw teeth in two separate, broadly oval patches; palatal teeth absent (Fig. 11f); lips thick and fleshy; eyes strongly dorsolateral and very small; maxillary barbel not reaching pectoral fin base; dull grey or pale bluish brown on back, whitish below. Maximum size to 500 mm SL.

Distribution and Habitat. - Rivers of central-southern New Guinea; thus far known from the Purari and Fly-Strickland systems, but certainly more widespread. In the Fly system it occurs in lowland areas of the upper part of the river, at least as far upstream as about 900 km from the mouth.

Remarks. - Feeds on insects and higher plants.



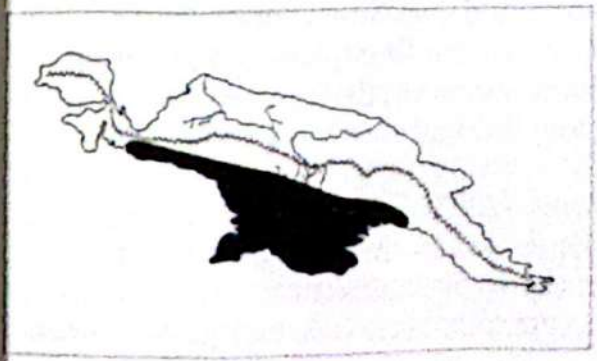
Lesser Salmon Catfish

Arius graeffei
Kner & Steindachner, 1866
(Plate 3, no. 12)

Diagnosis. - Dorsal rays I,7; anal rays 15 to 19; pectoral rays I,10 or 11; gill rakers on first arch 17-22; raker-like processes on back of all gill arches, 12-20 on first, 15-23 on second, 15-21 on third; palatal teeth in transverse series of four oval patches, inner ones smaller than outer ones, patches may fuse in larger specimens to form 1-2 patches; maxillary barbels moderately long, extending to edge of opercle in adults and beyond pectoral fin base in juveniles; dark brown, dark blue, fawn, or ocher above, fading to yellowish cream or white ventrally; fins tan or bluish brown. Maximum size to 500 mm SL.

Distribution and Habitat. - Widespread in rivers of central-southern New Guinea and northern Australia. There are few reliable records from New Guinea, but its distribution extends between the Purari River and Lake Jamur. It inhabits rivers, lakes, estuaries, and coastal seas.

Remarks. - The diet includes arthropods, insects, plants, molluscs, prawns, crayfish, fishes, and detritus.



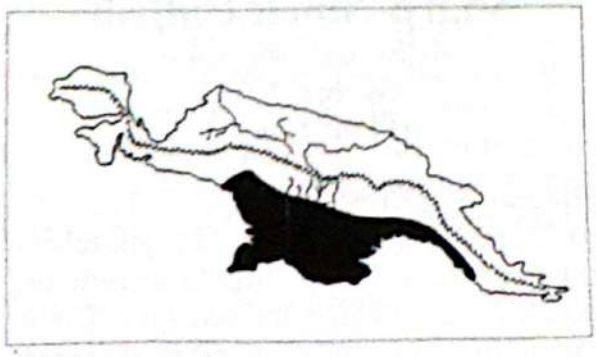
Broad-Snouted Catfish

Arius latirostris
Macleay, 1884
(Plate 3, nos. 4 & 5)

Diagnosis. - Dorsal rays I,7; anal rays 16 to 20; pectoral rays I,10 or 11; gill rakers on first arch 14-16; no rakers on posterior face of first and second gill arches; head moderately broad and gently rounded when viewed from above; palate with two well-developed pairs of tooth patches (Fig. 11b); maxillary barbel usually reaching to or slightly behind origin of pectoral spine; dark brown dorsally and white on ventral parts. Maximum size 500 mm SL.

Distribution and Habitat. - Southern New Guinea; known from the Laloki, Purari, Fly, Digul, and Lorentz river systems, but certainly more widespread. In the Fly it is the only ariid known from highland habitats and is also common in lowland waters. It has been taken as far as 940 km upstream from the sea at an elevation of about 450m.

Remarks. - An omnivore that consumes terrestrial arthropods, aquatic insects, plants, molluscs, prawns, and occasional fishes. Roberts (1978) and Kailola (pers. comm.) have determined that *Arius digulensis* Hardenberg and *A. acrocephalus* Weber are synonyms.



Triangular Shield Catfish

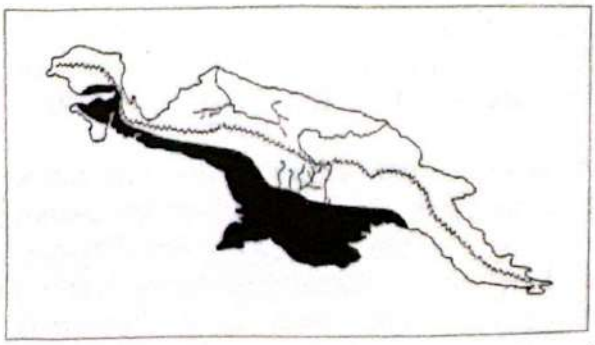
Arius leptaspis
Bleeker, 1862
(Plate 3, no. 2)

Diagnosis.- Dorsal rays I,7; anal rays 16 to 20; pectoral rays I,9 to 11; gill rakers on first arch 13-22; raker-like processes on

back of third gill arch 13-20, absent from first two arches; palatal teeth in transverse band of four rounded or oval patches, often fused, inner patches only slightly smaller than outer ones; maxillary barbel extends past pectoral fin base; bluish black, dark grey brown, brownish red, or purplish on back, shading to pale grey or whitish below; golden spots in vertical rows along back. Maximum size to 500 mm SL.

Distribution and Habitat. - Widespread in rivers of central-southern New Guinea and northern Australia; known in New Guinea between the Purari River and streams flowing into Bintuni Bay; also from the Aru Islands. It is common in lakes, lagoons, and tributaries of the Middle Fly River.

Remarks. - Feeds on terrestrial and aquatic insects, crustaceans, fishes, molluscs, and plants.



Sharp-Nosed Catfish

Arius macrorhynchus
(Weber, 1913)
(Plate 2, no. 3)

Diagnosis. - Dorsal rays I,7; anal rays 20 to 22; pectoral rays I,10 or 11; gill rakers on first arch 12-15; rakers absent on posterior face of first and second gill arch except for 1-2 small, weak rakers on upper limb; teeth of upper jaw in narrow continuous band; palatal teeth absent (Fig. 11g); maxillary barbel reaches base of dorsal fin; top of snout iridescent green with bronze reflections; back and posterior part of head dark brown with bronze reflections; ventral parts off-white, dusky or slightly brownish; barbels blackish brown. Maxi-mum size to 500 mm SL.

Distribution and Habitat. - Rivers of central-southern New Guinea including the Purari, Fly, Digul, and Lorentz. It has been taken from the main channel of the Upper Fly in lowlands near Kiunga, about 830 km upstream from the sea.

Remarks. - Feeds mainly on higher plants, including a variety of fruits; also takes ants, grasshoppers, beetles, small crabs, and prawns.

Comb-Gilled Catfish

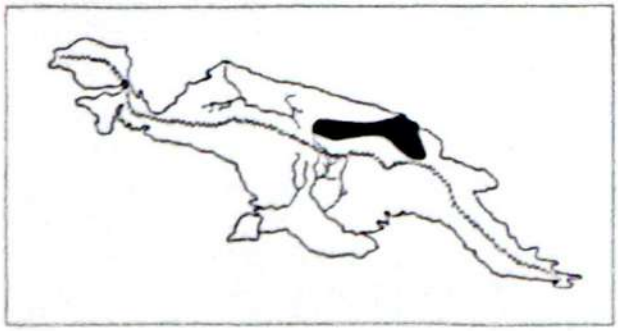
Arius nox
Herre, 1935
(Plate 3, no. 7)

Diagnosis. - Dorsal rays I,7; anal rays 18 to 21; pectoral rays I,8 or 9; gill rakers on first arch 51-67; posterior face of first two gill arches with 0-12 rakers; palate with four distinct tooth patches or they are merged to form a "butterfly"-shaped patch; barbels on chin typically project forward on live and fresh specimens; maxillary barbel extends to about pectoral fin base; blackish brown or charcoal with bluish sheen above, white or yellowish below; fins generally dark brown; barbels black. Maximum size 300 mm SL.

Distribution and Habitat. - Lower and middle Sepik and Ramu river systems of northern Papua New Guinea. It is primarily found on the floodplain and in permanent lakes, occasionally encountered in river channels, but in low numbers.

Remarks. - This is the most abundant of the Sepik ariids. Maturity occurs in both sexes at about 280 mm SL. Spawning occurs year round. A typical brood mass

contains 8 to 30 eggs. Food items include small crustaceans, aquatic insect larvae and nymphs, terrestrial insects, plants, detritus, gastropods, leeches, and worms.



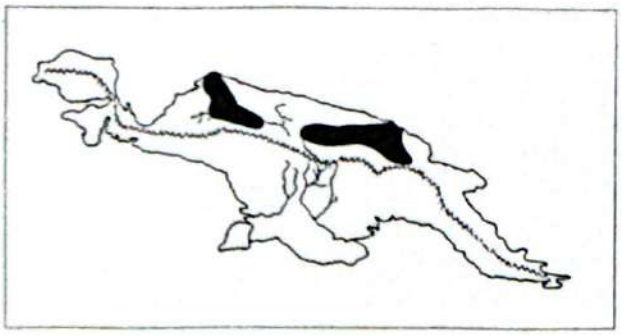
Hard-Palate Catfish

Arius solidus
Herre, 1935
(Plate 3, nos. 9 & 10)

Diagnosis. - Dorsal rays I,7; anal rays 17 to 19; pectoral rays I,8 to 10; gill rakers on first arch 19-30; posterior face of first two gill arches smooth, with 0-10 low rakers; palatal teeth arrangement variable, either in four distinct patches, merged into a "butter-fly"-shaped patch, in a very large single patch, or occasionally without any tooth patches; maxillary barbel extending to pectoral fin base or beyond; 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. Maximum size 600 mm SL.

Distribution and Habitat. - Lower and middle Ramu, Sepik, and Mamberamo river systems of northern New Guinea. It prefers lakes, but also found in the main river channels, occasionally entering the floodplain.

Remarks. - Only slightly less abundant than *A. nox* in the Sepik system. Maturity occurs in both sexes at about 190-200 mm SL. Spawning occurs year round. The brood mass contains 8 to 85 eggs. Food items include large crustaceans such as *Macrobrachium*, large insects and nymphs, fishes (usually *Ophieleotris aporos*), leeches, earthworms, plants, and detritus. Kailola (1990) has determined that *Arius kanganamensis* Herre, *A. microstomus* Nichols, and *Hemipimelodus bernhardi* Nichols are synonyms.



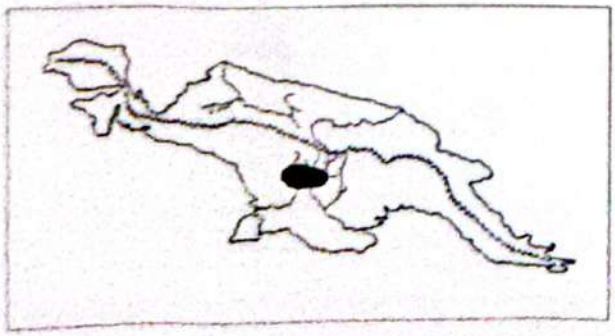
Taylor's Catfish

Arius taylori
Roberts, 1978
(Plate 2, no. 5)

Diagnosis. - Dorsal rays I,7; anal rays 19 or 20; pectoral rays I,11; gill rakers on first arch 15; rakers absent on posterior face of first and second gill arches; teeth of upper jaw in relatively broad, continuous band; palatal teeth absent (Fig. 11h); barbels moderately long, maxillary barbel extending to middle of pectoral spine; live colours unknown, but probably dark grey brown on back and whitish below. Maximum size to 400 mm SL.

Distribution and Habitat. - Known thus far only from the Upper Fly River system, about 930 km upstream from the sea. The type specimens were collected with hook and line in about 3 m depth from a moderately flowing, turbid section of the Palmer River (tributary of the Upper Fly).

Remarks. - Feeds on pulpy fruits of terrestrial plants and terrestrial insects.



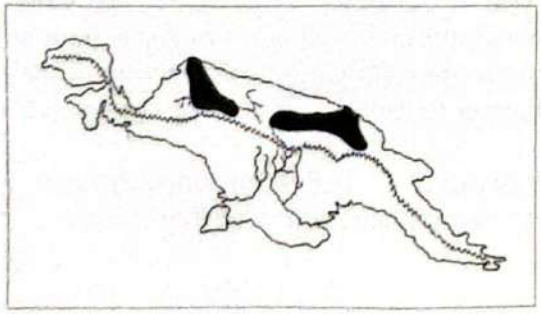
Northern Rivers Catfish

Arius utarus
Kailola, 1990
(Plate 3, no. 1)

Diagnosis. - Dorsal rays I,7; anal rays 18 to 22; pectoral rays I,9 or 10; gill rakers on first arch 13-22; posterior face of first and second gill arches usually without rakers; palatal teeth usually in four distinctly separate patches; maxillary barbel extending to or beyond last dorsal ray in juveniles, no farther than slightly beyond pectoral fin base in adults; 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. Maximum size 550 mm SL.

Distribution and Habitat. - Lower and middle Ramu, Sepik, and Mamberamo river systems of northern New Guinea. It prefers main river channels, but also occurs in lakes and on the floodplain.

Remarks. - Maturity is reached in both sexes at about 245-265 mm SL. Spawning takes place year round. The number of ripe eggs in either ovaries or brood mass is between 15 and 75. Major dietary items include large crustaceans (*Macrobrachium* and *Caridina*), fishes, aquatic and terrestrial insects, nymphs, and detritus. Often misidentified as *A. leptaspis*, a closely related species from southern New Guinea.



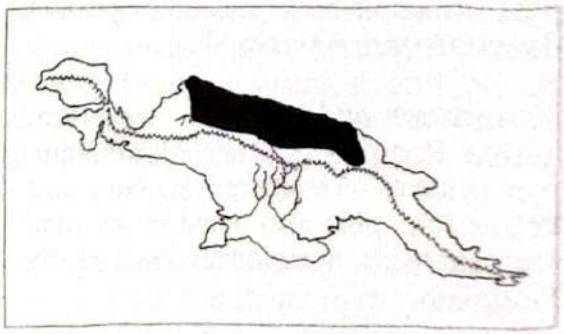
Papillate Catfish

Arius velutinus
(Weber, 1909)
(Plate 2, nos. 2 & 4)

Diagnosis. - Dorsal rays I,6 or 7; anal rays 17 to 24; pectoral rays I,10 to 12; gill rakers on first arch 13-18; posterior face of first two gill arches with up to 7 short rakers above, and many broad papilla below; palate usually toothless, rarely with one or two oval patches of fine teeth; lips moderately thick; maxillary barbel of adults reaching to about rear margin of operculum; olive bronzy to bluish or bluish grey on upper sides; silver to white on lower half; frequently with narrow, whitish bars on sides; lips pinkish; fins bluish to dusky brown with darker margins. Maximum size to 600 mm SL.

Distribution and Habitat. - Ramu, Sepik, and Mamberamo river systems of northern New Guinea; also reported from the Tami River, Lake Sentani, and the Tawarin River, all within about 75 km of Jayapura, Irian Jaya. The habitat consists of rivers and lakes to at least 400 m elevation. In the Ramu and Sepik systems it is strictly confined to turbid river channels.

Remarks. - Maturity occurs between 260-280 mm SL and spawning occurs year round. The number of ripe eggs in the ovaries ranges from about 25 to 90. Dominant food items include detritus, aquatic and terrestrial insects and nymphs, and assorted plant material. *Hemipimelodus papillifer* Herre is a synonym (Kailola, 1990).



Strong-Toothed Catfish

Arius sp.
(Photo 14)

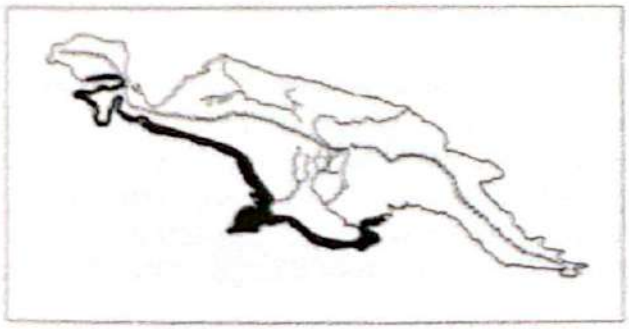
Diagnosis. - Dorsal rays I,7; anal rays 17 to 20; pectoral rays I,11 to 12; gill rakers on first arch 10-11; rakers absent from

Photo 14 - Strong-Toothed Catfish, ***Arius sp.***

posterior face of first and second arches. Head large, rather smooth; snout prominent; jaw teeth strong and not depressible, visible when mouth closed; palate with two well-developed pairs of tooth patches; eyes small; maxillary barbels extend to pectoral fin base or less than this distance; grey blue above, white below, often covered with yellow mucus. Maximum size 120 cm SL.

Distribution and Habitat. - Central-southern New Guinea and northern Australia. Inhabits rivers and coastal waters; seldom encountered.

Remarks. - Carnivorous, consuming fish, prawns and crabs.



Genus *Cinetodus*
Ogilby, 1898

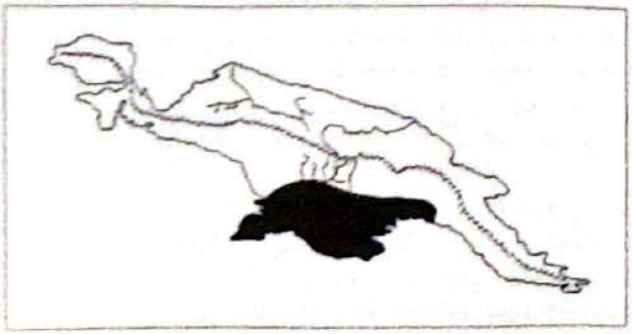
The genus contains a single species that is discussed below. It is characterised by having the gill membranes broadly united to a broad, flat isthmus, distinctively shaped tooth patches on the jaws and palate, and an elevated hump in front of the dorsal fin.

Froggatt's Catfish
Cinetodus froggatti
(Ramsay & Ogilby, 1886)
(Plate 2, no. 8)

Diagnosis. - Dorsal rays I,7; anal rays 17 to 19; pectoral rays I,10 or 11; gill rakers on first arch 11-16; blunt raker-like processes on rear face of all gill arches, 11-18 on first, 13-17 on second, 11-16 on third; palatal teeth in two squarish patches; gill openings restricted, ending about opposite lower pectoral fin base; maxillary barbel reaching to base of pectoral fin or slightly beyond; dark grey, bluish, or blackish blue on back and upper sides, grading to light grey or cream below; fins dark. Maximum size to 400 mm SL.

Distribution and Habitat. - Central-southern New Guinea and northern Australia; in New Guinea it is known from the Purari, Fly-Strickland, and Digul river systems, but is certainly more widespread. It inhabits turbid rivers and coastal waters.

Remarks. - The diet consists entirely of gastropod and bivalve molluscs.



Genus *Cochlefelis*
Whitley, 1942

The genus contains two species that are distributed in southern New Guinea. It is characterised by a relatively long spatulate snout, both jaws with broad bands of exceedingly numerous teeth (those of upper jaw completely exposed when mouth closed), and the inner pair (mental) of barbels extending much farther posteriorly than the outer pair.

Key to Species of *Cochlefelis*
(From Roberts, 1978)

1a. Eyes dorsolateral; snout slightly pointed, projecting beyond tooth band of upper jaw by a distance about equal to diameter of eye; barbels with a membranous inner margin; gill rakers on first arch 15-16...*C. spatula*

1b. Eyes more lateral in position; snout broadly rounded, projecting only a small fraction of eye diameter beyond tooth band of upper jaw; barbels without a membranous inner margin; gill rakers on first arch 21-23..*C. danielsi*

Daniel's Catfish
Cochlefelis danielsi
(Regan, 1908)
(Plate 2, no. 9)

Diagnosis. - Dorsal rays I,7; anal rays 23 to 26; pectoral rays I,9 or 10; gill rakers on first arch 21-23; rakers absent on posterior face of first and second gill arches; palatal teeth in four patches (Fig. 11i), the inner ones rounded and the outer ones very elongate; barbels relatively long, maxillary barbel extends nearly to end of pectoral spine; dark grey brown on back and upper sides, silvery below and on sides; fins tannish. Maximum size to 450 mm SL.

Distribution and Habitat. - Central-southern New Guinea including the Purari, Fly, and Lorentz rivers. It occurs in the middle part of the Fly system at least as far as 675 km upstream from the river mouth. It dwells in turbid channels of main rivers and also in swampy lagoons and backwaters.

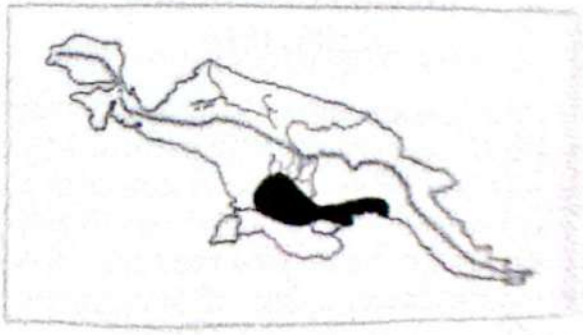
Remarks. - Feeds almost exclusively on *Macrobrachium* and *Caridina* prawns that are ingested whole.

Duckbilled Catfish
Cochlefelis spatula
(Ramsay & Ogilby, 1886)
(Plate 2, no. 6)

Diagnosis. - Dorsal rays I,7; anal rays 20 or 21; pectoral rays I,9 to 11; gill rakers on first arch 15-16; rakers absent on posterior face of first and second gill arches; palatal teeth in four patches (Fig. 11k), the inner patches rounded and outer ones larger and somewhat rectangular; maxillary barbel extending to base of pectoral fin or beyond; back vivid blue, sometimes with violaceous tints; milky white ventrally. Maximum size to 600 mm SL.

Distribution and Habitat. - Central-southern New Guinea including the Purari, Fly-Strickland, and Digul rivers. In the Fly system it occurs in the middle and upper sections, as far as about 900 km upstream from the sea. It inhabits large turbid rivers.

Remarks. - Feeds mainly on *Macrobrachium* and *Caridina* prawns.



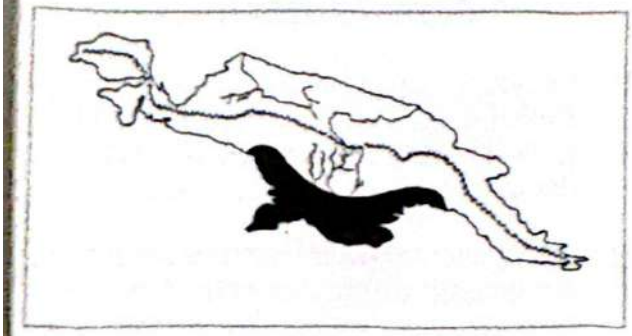
Genus *Doiichthys*
Weber, 1913

The genus contains the single species discussed below. It is characterised by a small eye just behind and level with the mouth, long slender barbels, minute, inconspicuous teeth in the jaws, lack of palatal teeth, and relatively numerous gill rakers.

Spoon-Snouted Catfish
Doiichthys novaeguineae
Weber, 1913
(Plate 2, no. 7)

Diagnosis. - Dorsal rays I,7; anal rays 29 to 33; pectoral rays I,10; gill rakers on first arch 45-51; minute teeth in a single row in jaws and a few laterally on each side of palate; barbels very long, maxillary barbel reaching to about base of pelvic fin; eyes small, situated low on side of head, about level with plane of mouth; eyes without free orbital margin; brownish above with silvery hue on sides and ventral parts; fins dark brown. Maximum size to 150mm SL.

Distribution and Habitat. - Probably has localised distribution pattern in central-southern New Guinea. Thus far known only from a few localities including the Lower Purari River, vicinity of Balimo (Aramia River), and the Lorentz River.



Genus *Nedystoma*
Ogilby, 1898

This monotypic genus is confined to fresh waters of lowland areas in southern New Guinea. A single species has been described. It is characterised by a blunt, rounded snout, gill membranes attached to isthmus without having a free margin, relatively numerous gill rakers, and absence of palatal teeth.

Day's Catfish
Nedystoma dayi
(Ramsay & Ogilby, 1886)
(Plate 2, no. 11)

Diagnosis. - Dorsal rays I,7; anal rays 20 to 25; pectoral rays I,10 or 11; gill rakers on first arch 29-43; posterior face of first and second gill arches with well-developed gill rakers or raker-like processes; jaws with a band of feeble, somewhat deciduous teeth; palatal teeth absent (Fig. 11j); maxillary barbel reaching to about margin of operculum; grey or bluish grey on back, white below. Maximum size to 200 mm SL.

Distribution and Habitat. - Central-southern New Guinea including the Purari, Fly, and Lorentz rivers. Inhabits turbid rivers with densely vegetated margins.

Remarks. - Feeds mainly on aquatic insect larvae.

Genus *Tetranesodon*
Weber, 1913

The genus contains the single species discussed below. It is characterised by a blunt, rounded snout, very short barbels, a relatively large eye, and lack of palatal teeth.

Lorentz Catfish
Tetranesodon conorhynchus
Weber, 1913
(Plate 2, no. 10)

Diagnosis. - Dorsal rays I,7; anal rays 17;

pectoral rays I,10; gill rakers on first arch 8; a narrow patch of conical teeth on each side of jaws; palatal teeth absent; barbels very short, the maxillary barbel only reaching about half the distance to the opercular margin; dark bluish, underside of head and body whitish with silvery hue; fins dark brown. Maximum size to 200 mm SL.

Distribution and Habitat. - A poorly known species thus far recorded only from the Lorentz River, Irian Jaya.

Eel-Tailed Catfishes

Family Plotosidae

Eel-tailed catfishes occur in marine and fresh waters of the Indo-West Pacific region. The family contains approximately 30 species in about eight genera. In most areas they are marine or brackish estuarine dwellers, but in New Guinea and Australia numerous freshwater species have evolved. Indeed, 23 freshwater species are known from this region, including 13 from New Guinea. Diagnostic features include a somewhat laterally compressed body that is elongate and eel-like, a tapering tail ending in a rounded or pointed tip, no adipose fin, caudo-dorsal fin rays that are confluent with the anal fin to form a single continuous fin, stiff spines (except in two Australian species) at the front of the dorsal and pectoral fins, and four pairs of barbels around the mouth. They are easily distinguished from the ariid catfishes on the basis of the tail shape. Generally, the marine plotosids are characterised by the presence of a dendritic organ, a tuft-like structure just posterior to the anus. However, this feature is also found in the New Guinea freshwater genus *Oloplotosus* and a freshwater representative of the otherwise marine genus *Plotosus*. The habitat of plotosids consists of large turbid rivers, slow to fast-flowing creeks, swamps, and lakes. Adults are generally solitary, but juveniles sometimes form aggregations. The diet consists of large aquatic insects and their larvae including *Hemiptera*, *Coleoptera*, and *Odonata*, terrestrial insects, prawns, crabs, molluscs, earthworms, and fishes. Unlike the ariid catfishes they are not oral brooders. Some species construct an oval or circular nest consisting of gravel and rocks with a central sandy depression in which the female deposits the eggs. The number of eggs spawned ranges from about 30 in *Oloplotosus* to as many as 20,000 in some Australian *Tandanus*. The flesh of plotosids is generally good eating and in some areas (such as Lake Kutubu) they are eagerly sought by local fishermen. Care must be exercised when handling these fishes as the sharp dorsal and pectoral fin spines are venomous and capable of producing an extremely painful wound.

Key to the Freshwater Plotosid Genera of New Guinea

1a. Dendritic organ present; caudo-dorsal fin originates well forward of middle of body, only a short distance behind dorsal fin 2

1b. Dendritic organ absent; caudo-dorsal fin usually originates behind middle of body, well behind dorsal fin 3

2a. Upper jaw without teeth .. *Oloplotosus*

2b. Upper jaw with teeth ..... *Plotosus*

3a. Dorsal profile of head concave; eyes relatively low-set on side of head; tail more or less pointed ..... *Porochilus*

3b. Dorsal profile of head straight or

convex; eyes in higher position, approaching dorsal profile of head; tail rounded .....*Neosilurus*

Genus *Neosilurus*
Steindachner, 1867

The genus contains 12 species. New Guinea and Australia are represented by five species each and an additional two species are shared by these regions. The relationships within the genus remain obscure, but preliminary studies indicate that several subgenera should be recognised. The classification is currently being studied by N. Feinberg and the author.

Key to the New Guinean Species of *Neosilurus*

1a. Head relatively broad, its greatest width much greater than length of pectoral fin; pectoral fin short and rounded, its length equal to distance from snout to middle or rear of eye; caudo-dorsal fin base length 32-47% of SL (northern New Guinea). .....*N. idenburgi*

1b. Head narrower, its greatest width about equal to or less than length of pectoral fin; pectoral fin relatively elongate, its length much longer than distance from snout to rear of eye; caudo-dorsal fin base length 17-53% of SL (northern or southern New Guinea) 2

2a. Caudo-dorsal fin base length about half of SL (+ or - 8%);dorsal procurrent caudal rays 68-93 3

2b. Caudo-dorsal fin base length 17-39% of SL; dorsal procurrent caudal rays 35-53 4

3a. Gill rakers on first arch usually 29-35; snout profile of adults (> 200 mm SL) more or less straight (central-southern New Guinea) .....*N. equinus*

3b. Gill rakers on first arch usually 22-28; snout profile of adults (> 200 mm SL), becoming distinctly concave (mainly Sepik-Ramu system of northern New Guinea, but also Upper Purari system).....*N. gjellerupi*

4a. Gill rakers on lower limb of first gill arch 20-23; posterior face of first gill arch with distinct raker-like processes (southern New Guinea) .....*N. ater*

4b. Gill rakers on lower limb of first gill arch 12-19; posterior face of first gill arch without distinct raker-like processes (may have slight protuberances) (northern or southern New Guinea).....5

5a. Caudo-dorsal fin base length 38-39% of SL; total gill rakers on first arch less than 15 (Ramu River system) ... .*Neosilurus* sp.

5b. Caudo-dorsal fin base length 24-34% of SL total gill rakers on first arch usually16 or more 6

6a. Head length much greater than body depth (southern New Guinea) ....*N. brevidorsalis*

6b. Head length about equal to or less than body depth (northern New Guinea).. .....*N. novaeguineae*

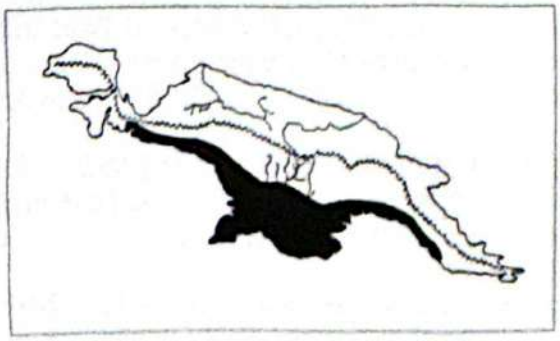
Narrow-Fronted Tandan
Neosilurus ater
(Perugia, 1894)
(Plate 4, no. 2)

Diagnosis. - Dorsal rays I,5 or 6; dorsal procurrent caudal rays 27 to 39; caudal rays 8 or 9; anal rays 89 to 105; pectoral rays I,11 to 14; pelvic rays 12 to 15; gill rakers on first arch 6-9 + 20-23; total vertebrae 49-54; head length 21-24% of SL; snout length 44-51% of head length; eye 15-20% of head length; second dorsal fin originating on rear portion of body, the caudo-dorsal fin base length 17-26% of SL; grey to blackish, including fins, white on underside of head and on belly. Maximum size to 470 mm TL, common to 250 mm TL.

Distribution and Habitat. - Widespread in central-southern New Guinea, Aru Islands, and northern Australia. Most records from mainland New Guinea are from the Fly

Delta region (Balimo to Bensbach River), but it has been recorded from Irian Jaya in the Digul and Lorentz rivers and from Lake Jamur. The only record on the eastern side of the Gulf of Papua is from Inawi (about 75 km northwest of Port Moresby), the type locality of *N. ater*. It inhabits rivers and small streams, often where currents are relatively swift.

Remarks. - *N. ater sepikensis* Whitley is a synonym. It was described from specimens claimed to be collected in the Sepik River, but were actually from the Fly system.



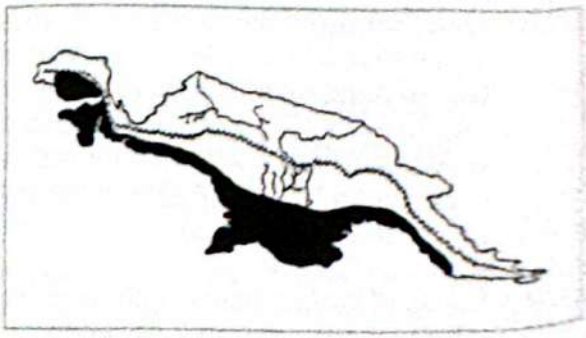
Short-Finned Tandan

Neosilurus brevidorsalis
(Günther, 1867)
(Plate 4, no. 3)

Diagnosis. - Dorsal rays I,4 or 5; dorsal procurrent caudal rays 35 to 53; caudal rays 7 to 10; anal rays 56-93; pectoral rays I,10 to 12; pelvic rays 11 to 13; gill rakers on first arch 3-6 + 12-19; total vertebrae 44-52; head length 18-22% of SL; snout length 33-48% of head length; eye 14-21% of head length; second dorsal fin originating on rear part of body, the caudo-dorsal fin base length 25-34% of SL; overall dark grey to dark brown, often mottled on body and median fins; generally lighter brown on ventral parts. Maximum size to about 160-170 mm TL.

Distribution and Habitat. - Widespread in southern New Guinea; also found on the northern tip of Cape York Peninsula, Australia. The known distribution extends from the Kemp Welsh River (about 100 km east of Port Moresby) westward to the Ajamaru Lakes in the centre of the Vogelkop Peninsula. It generally occurs in lowland areas, but is also found in upland habitats such as the Sogeri Plateau near Port Mores-by. In the Fly system it penetrates well inland at least to about 930 km upstream from the mouth. It inhabits lakes, swamps, and rivers, including turbid backwaters and clear, flowing tributaries.

Remarks. - Sexual maturity occurs at about 120 mm SL. Three populations can be recognized on the basis of modal differences in fin ray counts, total number of vertebrae, and length of the pectoral and pelvic fins. Fish from the Vogelkop Peninsula generally have fewer anal rays ($\bar{x}$ = 68.9) than those from the Port Moresby district ($\bar{x}$ = 79.3), and central southern New Guinea ($\bar{x}$ = 84.3). The population from the central region has higher vertebral counts ($\bar{x}$ = 49.1) compared with those from the Port Moresby district ($\bar{x}$ = 46.3) and the Vogelkop Peninsula ($\bar{x}$ = 46.8). Finally, the Vogelkop population tends to have slightly shorter pectoral and pelvic fins. For the time being these differences do not seem sufficient for the recognition of separate species or subspecies. *Anyperistius perugiae* Ogilby and *Neosilurus bartoni* Regan are considered to be synonyms.



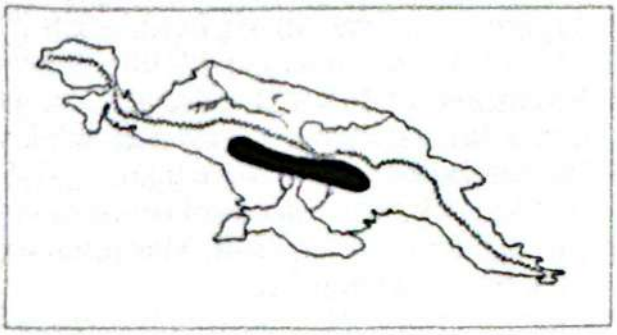
Southern Tandan

Neosilurus equinus
(Weber, 1913)
(Plate 4, no. 1)

Diagnosis. - Dorsal rays I,6 or 7; dorsal procurrent caudal rays 76 to 86; caudal rays 8 or 9; anal rays 75 to 93; pectoral rays I,13 to 16; pelvic rays 13 to 16; gill rakers on first arch 7-9 + 20-25; total vertebrae 51-57 (usually 53-54); head length 19-22% of SL; snout length 46-53% of head length; eye 12-15% of head length; second dorsal

fin originating on middle part of body, the caudo-dorsal fin base length 48-53% of SL; generally grey to brownish, lighter below. Maximum size to 375 mm TL.

Distribution and Habitat. - Central-southern New Guinea including the Upper Kikori (including Lake Kutubu), Fly-Strickland, and Lorentz river systems. It is mainly restricted to headwater streams in hilly or mountainous terrain. It prefers clear, fast-flowing streams, usually in deep rocky pools. It is able to ascend torrential steep-gradient streams and small waterfalls. It is found in the Fly-Strickland system at least as far as 970 km upstream from the sea. According to local villagers it is the only species present in some headwater streams of the Strickland River at an elevation of about 1500 m.



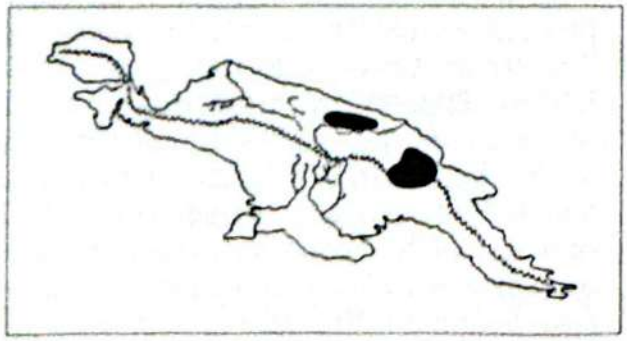
Northern Tandan

Neosilurus gjellerupi
(Weber, 1913)
(Plate 4, nos. 6 & 7)

Diagnosis. - Dorsal rays I,6 to 8; dorsal procurrent caudal rays 68 to 83; caudal rays 8 to 10; anal rays 69 to 89; pectoral rays I,12 to 14; pelvic rays 13 to 15; gill rakers on first arch 5-8 + 17-22, total rakers usually 22-27; total vertebrae 48-54; head length 20-24% of SL; snout length 42-53% of head length; eye 12-16% of head length; second dorsal fin originating on middle part of body, the caudo-dorsal fin base length 41-53% of SL; grey to dark grey brown, lighter below. Maximum size to 300 mm TL.

Distribution and Habitat. - Sepik and Ramu river systems of northern New Guinea; also occurs on the southern side of the central divide in the Upper Purari system. It usually inhabits relatively fast-flowing, rocky streams in hilly or mountainous terrain.

Remarks. - This species is divisible into two subspecies: *N. gjellerupi gjellerupi* (Weber) from the Ramu system, southern watershed of the Sepik River (including the Upper Yuat, Jimmi, and Baiyer rivers), and the Upper Purari system; and *N. gjellerupi coatesi* (Allen) from the Torricelli Mountains and its foothills which form the northern watershed of the Sepik. The two subspecies exhibit strong modal differences in number of gill rakers (usually 22-26 in *coatesi*, 26-28 in *gjellerupi*), and total vertebrae (usually 47-50 in *coatesi*, 51-54 in *gjellerupi*). In addition the dorsal and pectoral fins of *coatesi* are generally more rounded, particularly in small (under about 150 mm SL) specimens.



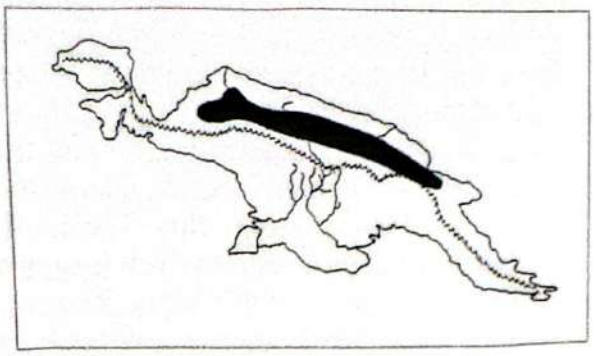
Idenburg Tandan

Neosilurus idenburgi
(Nichols, 1940)
(Plate 4, no. 5)

Diagnosis. - Dorsal rays I,5 to 8; dorsal procurrent caudal rays 68 to 80; caudal rays 8 to 10; anal rays 78 to 86; pectoral rays I,11 to 13; pelvic rays 12 to 14; gill rakers on first arch 5-9 + 18-22; total vertebrae 49-53; head length 21-25% of SL; snout length 40-48% of head length; eye 13-18% of head length; second dorsal fin originating on middle part of body, the caudo-dorsal fin base length 32-47% of SL; usually dark brown to nearly blackish, lighter below. Maximum size to 270 mm TL.

Distribution and Habitat. - Northern New Guinea including the Markham, Ramu, Sepik, Pual, and Mamberamo river systems. It inhabits rainforest streams and also

rivers and creeks in more open situations; often in hilly or mountainous terrain to elevations of at least 800 m.



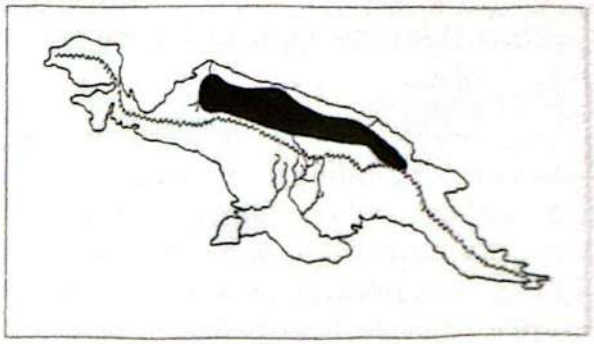
New Guinea Tandan

Neosilurus novaeguineae
(Weber, 1908)
(Plate 4, no. 4)

Diagnosis. - Dorsal rays I,4 or 5; dorsal procurrent caudal rays 36 to 51; caudal rays 7 to 10; anal rays 76 to 103; pectoral rays I,10 to 12; pelvic rays 11 to 14; gill rakers on first arch 4-6 + 12-16; total vertebrae 47-51; head length 19-21% of SL; snout length 35-43% of head length; eye 16-22% of head length; second dorsal fin originating on rear part of body, the caudo-dorsal fin base length 24-30% of SL; dark brown to nearly blackish including fins, lighter ventrally. Maximum size to 210 mm SL.

Distribution and Habitat. - Northern New Guinea including the Ramu, Sepik, and Mamberamo river systems; also reported from Lake Sentani, Irian Jaya, but no confirmed sightings there for over 75 years. It generally occurs in either "blackwater" tributaries of the alluvial lowlands or in creeks and small rivers in hilly terrain. It prefers deeper pools that are often littered with logs and branches.

Remarks. - Sexual maturity is reached at about 110-120 mm SL. There are modal differences in anal ray and vertebral counts between the Lake Sentani and riverine populations. For example, fish from Lake Sentani have a mean count of 83.8 anal rays versus 93.5 for specimens from the Mamberamo drainage, and the means are 48.5 and 50.1 for total vertebrae in these respective populations. *Copidoglanis novaeguineae niger* Nichols is a synonym.

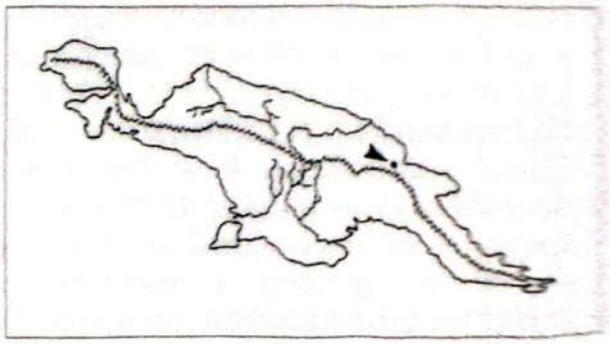


Ramu Tandan

Neosilurus sp.

Diagnosis. - Dorsal rays I,4 or 5; dorsal procurrent caudal rays 49 to 52; caudal rays 7 or 8; anal rays 81 to 83; pectoral rays I,9; pelvic rays 12; gill rakers on first arch 3 + 11; total vertebrae 48-49; head length 20-21% of SL; snout length 37-38% of head length; eye 13-14% of head length; second dorsal fin originating on rear part of body, the caudo-dorsal fin base length 37-39% of SL; dark brown to blackish including fins, lighter on ventral half. Maximum size to at least 100 mm SL.

Distribution and Habitat. - Known only from four specimens collected in 1987 and 1989 from rainforest tributaries of the Middle Ramu River near Brahman Mission. All specimens were taken from very small, shallow (less than 1 m) creeks. The elevation of the collecting sites is about 140 m.



Genus *Oloplotosus*

Weber, 1913

The genus contains three species that inhabit fresh waters of central-southern New

Guinea. This very distinctive group is characterised by an absence of teeth on the upper jaw, a very long-based dorsal procurrent caudal fin, and a pointed tail.

Key to the species of *Oloplotosus*

1a. Oral teeth slender and conical, in 2-3 rows on palate and lower jaw; gill rakers on first arch 13-17; snout portion of head flattened; snout broadly rounded without bulbous projection; lips thick, plicate, and papillose.....2

1b. Oral teeth incisiform, in single rows on palate and lower jaw; gill rakers on first arch 8-10; snout portion of head strongly rounded; snout with bulbous anterior projection between anterior nostrils; lips relatively thin and smooth ..*O. luteus*

2a. Total fin rays 220-235; gill rakers on first arch 17-18; colour dark brown with lighter mottling, lower part of head and abdominal region abruptly white ....*O. mariae*

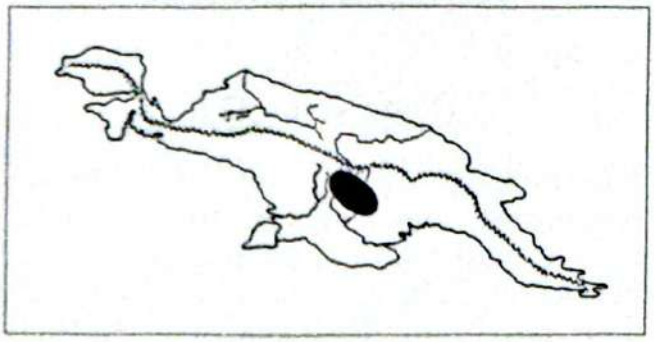
2b. Total fin rays 195-197; gill rakers on first arch 13; colour overall grey brown without mottling; lower part of head and abdominal region not abruptly white. .....*O. torobo*

Pale Yellow Tandan

Oloplotosus luteus
Gomon & Roberts, 1978
(Plate 4, no. 13)

Diagnosis. - Dorsal rays I,5; dorsal procurrent caudal rays 103-106; caudal rays 5; anal rays 86-92; pectoral rays I,10 or 11; pelvic rays 11 or 12; total gill rakers on first arch 8-10; branchiostegal rays 8-9; total vertebrae 63-64; lips thick, plicate, and papillose; upper half of head and body dark brown, variably mottled; median fins brownish, mottled; mental barbels, lips and ventral surface of head bright orange; ventral surface of belly pale yellow or pale orange. Maximum size to at least 150 mm TL.

Distribution and Habitat. - Known only from the Fly-Strickland system of southern Papua New Guinea. Most specimens have been collected from moderate to fast-flowing, gravel-boulder bottom creeks in mountainous tributaries of the Ok Tedi River at distances between about 930-1000 km upstream from the sea. A single specimen was also taken in the Nomad River (tributary of the Strickland River) in foothill terrain about 800 km upstream.

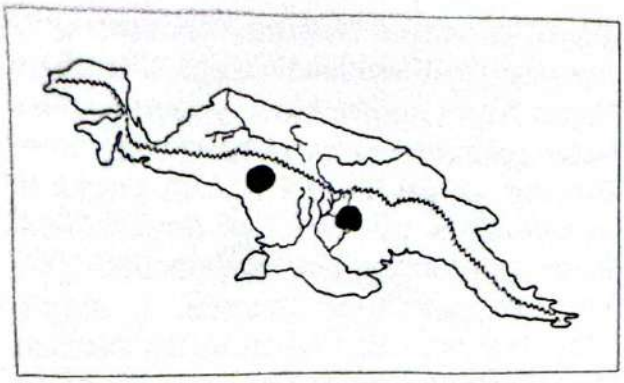


Maria's Tandan

Oloplotosus mariae
Weber, 1913
(Plate 4, no. 11)

Diagnosis. - Dorsal rays I,5; dorsal procurrent caudal rays 110-117; caudal rays 5 or 6; anal rays 101 to 116; pectoral rays I,12 or 13; pelvic rays 13 or 14; total gill rakers on first arch 17 or 18; branchiostegal rays 11 or 12; total vertebrae 73-75; lips relatively thin and smooth; upper half of head and back dark brown; body slightly lighter brown, mottled; nasal and maxillary barbels brown; mental barbels, lips, and ventral part of head pinkish; belly pinkish with pale yellow suffusion; lower part of body in region of pelvic fins light golden brown; median fins dark brown; pelvics dusky brown; pectorals dusky brown, yellowish basally. Maximum size to 150 mm TL.

Distribution and Habitat. - Known only from the Lorentz River (at Sabang and Alkmaar) and from Nomad River, an upper tributary of the Fly-Strickland system. It inhabits clear, rocky streams in deeper pools, usually in hilly or mountainous terrain.

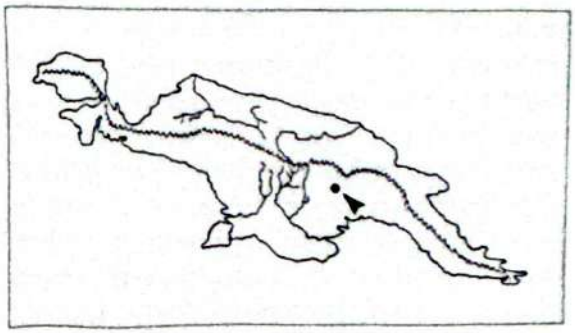


Kutubu Tandan

Oloplotosus torobo
Allen, 1985
(Plate 4, no. 12)

Diagnosis. - Dorsal rays I,5; dorsal procurrent caudal rays 92 to 94; caudal rays 8; anal rays 95; pectoral rays I,12; pelvic rays 10; gill rakers on first arch 3 + 10; branchiostegal rays 9; total vertebrae 64-69; lips relatively thin and smooth; grey brown without mottling, lighter on ventral half. Maximum size to at least 200 mm TL.

Distribution and Habitat. - Known only from Lake Kutubu in the Southern Highlands Province of Papua New Guinea. The only known specimens were captured in 1983 from shallow (0-3 m) water with a soft, muddy bottom and abundant aquatic vegetation.



Genus *Plotosus*

Lacepède, 1803

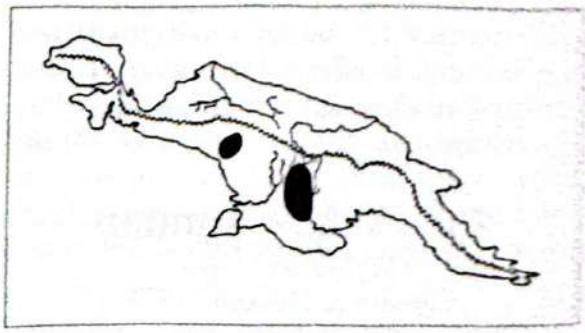
Plotosus contains four species and is primarily marine, occurring on reefs and in brackish estuaries; except for a single freshwater species from New Guinea. The genus is distributed from East Africa to Polynesia.

Papuan Tandan

Plotosus papuensis
Weber, 1910
(Plate 4, no. 8)

Diagnosis. - Dorsal rays I,4; dorsal procurrent caudal rays 110 to 120; caudal rays 8 or 9; anal rays 100 to 113; pectoral rays I,13 or 14; pelvic rays 12 or 13; gill rakers on first arch 18-26; total vertebrae 69 to 73; head length 24-26% of SL; palate with patch of large molariform teeth; a very finely branched dendritic organ present; dark brown to nearly blackish, including fins; ventral surface of head whitish; juveniles from the Lorentz River described as having a pair of pale stripes on side, one dorsally and one ventrally. Maximum size to at least 550 mm TL; according to local fishermen it may reach 100 cm TL. It is the largest member of the family.

Distribution and Habitat. - A poorly known species that has been collected in the Lorentz River and in the Upper and Middle Fly River. It occurs in turbid rivers and swampy lagoons and backwaters.



Genus *Porochilus*

Weber, 1913

This strictly freshwater genus contains four species, including two from Australia, one from New Guinea, and an additional species that is shared by the two regions. The group is characterised by a very thin, laterally compressed body, a somewhat concave forehead profile, a reduced number of dorsal procurrent caudal rays, and a relatively pointed tail.

Key to the New Guinean Species of *Porochilus*

1a. Anterior nostrils open above upper lip; lateral line composed of close-set series of pores; gill rakers on lower limb of first arch 16-21.....*P. meraukensis*

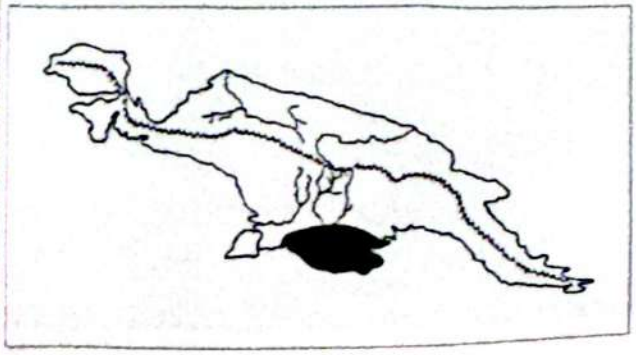
1b. Anterior nostrils open on ventral surface of upper lip; lateral line composed of widely spaced series of pores; gill rakers on lower limb of first arch 10-13 .....*P. obbesi*

Merauke Tandan

Porochilus meraukensis
(Weber, 1913)
(Plate 4, no. 10)

Diagnosis. - Dorsal rays I,5 to 8; dorsal procurrent caudal rays 16 to 26; caudal rays 7 to 9; anal rays 84 to 108; pectoral rays I,9 to 12; pelvic rays 12 to 14; gill rakers on first arch 4-6 + 16-21; branchiostegal rays 8-10; total vertebrae 46-50; anterior nostrils above upper lip; lateral line continuous; generally brown, darker on back, sometimes mottled; belly and ventral part of head whitish. Maximum size to 240 mm TL.

Distribution and Habitat. - Known thus far only from the Merauke and Fly rivers and Balimo Lagoon, but probably occurs throughout the Fly Delta. In the Middle Fly system, it usually occurs in quiet backwaters or in well vegetated, swampy lagoons and lakes.

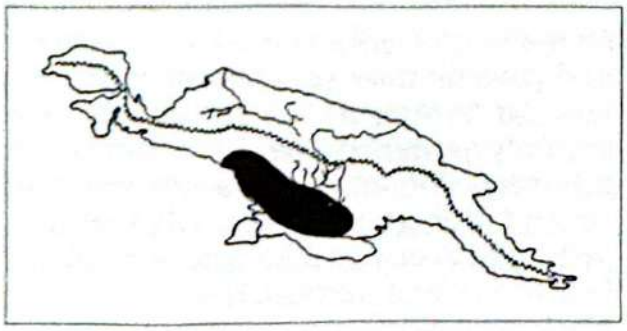


Obbes' Tandan

Porochilus obbesi
Weber, 1913
(Plate 4, no. 9)

Diagnosis. - Dorsal rays I,4 or 5; dorsal procurrent caudal rays 18 to 25; caudal rays 7 to 9; anal rays 78 to 92; pectoral rays I,8 to 10; pelvic rays 11 to 13; gill rakers on first arch 3 + 10-13; branchiostegal rays 7-8; total vertebrae 43-47; anterior nostrils open on ventral surface of upper lip; lateral line discontinuous (widely spaced short canals connecting two adjacent pores); grey to light yellowish brown, often with silvery sheen; fins yellowish or tan. Maximum size to 120 mm TL.

Distribution and Habitat. - Central-southern New Guinea and far northern Australia. The New Guinea distribution includes the Lorentz, Oriomo, and Middle Fly rivers. Generally found in quiet backwaters, lakes, and swamps.



Anglerfishes

Family Antennariidae

Anglerfishes are generally shallow marine reef inhabitants, but one species is found in estuaries and sometimes enters fresh water. The family is distributed worldwide in tropical and temperate seas, but most are found in the Indo-Pacific region, particularly Australia. There are 41 species in 12 genera. These unusual fishes have a globular, somewhat compressed body, limb-like pectoral fins with an "elbow" joint, a small round gill opening usually situated in

the "armpit", a very large upward-directed mouth, and a modified first dorsal fin which is called the illicium. The illicium forms a movable "fishing rod" tipped with an enticing lure (esca). The rod is wiggled vigorously to attract fish prey that are swallowed whole. Anglerfishes can engulf fishes longer than themselves due to their enormous abdominal expansion. Gravid females expel a buoyant "raft" of up to 300,000 eggs. The "raft" remains afloat and intact for several days until hatching.

Genus *Antennarius*
Daudin, 1816

The genus contains 24 species and is distributed in all tropical and subtropical seas.

Brackish-Water Anglerfish
Antennarius biocellatus
(Cuvier, 1817)
(Plate 17, no. 21)

Diagnosis. - Dorsal rays I-I-I,12, as many as 4 posteriormost rays bifurcate; pectoral rays usually 9 (rarely 8 or 10), all unbranched; only posteriormost ray of pelvic fin bifurcate, illicium about same length as second dorsal fin, esca filamentous; yellowish to orange with narrow black bar below eye and vertical row of irregular blackish markings on rear part of head; a prominent yellow-edged black ocellus on basal part of posterior section of dorsal fin. Maximum size to 120 mm SL.

Distribution and Habitat. - Philippines, Indonesia, Palau Islands, New Guinea and Solomon Islands. It is mainly found in brackish mangrove areas, but occasionally enters fresh water.

Garfishes
Family Hemiramphidae

Garfishes are found worldwide in marine and fresh waters. The family contains about 15 genera and approximately 80 species. Most garfishes are marine and epipelagic, but some inhabit fresh waters. The genus *Zenarchopterus* ranges widely in the Indo-Pacific region from Madagascar to Guam and Fiji. It contains about 12 species that are primarily inhabitants of brackish and fresh waters. Seven species in this genus occur in fresh waters of New Guinea. Garfishes, or Halfbeaks as they are called in some regions, are long slender, silvery fishes which resemble the Longtoms (Belonidae), but are easily distinguished by the very short upper jaw. The lower jaw is extended into a long beak-structure in most species. Other family characters include: no spinous elements in the fins; dorsal and anal fins posterior in position, their bases about opposite; pelvic fins abdominal with 6 soft rays; pectoral fins located high on the sides; caudal fin forked or emarginate, except rounded in some *Zenarchopterus*, the lower lobe usually longer than upper; teeth in several rows, tricuspid or unicuspid; scales large, cycloid and easily detached; lateral line beginning on throat, extending along ventral margin of body with a branch to pectoral fin origin.

Garfishes generally form schools near the surface of flowing streams where they feed on terrestrial insects and aquatic insect larvae. Small fishes and algae are also consumed. They are most common in lowland, rainforest tributaries of the larger rivers, but may also occur in relatively swift flowing streams in hilly, forested terrain. Males of *Zenarchopterus* have thickened anal fin rays (Fig. 12) which presumably function as a sperm transferring device. The maximum size attained in the family is about 40 cm, but the freshwater *Zenarchopterus* attain a maximum of about 17 cm. Garfishes are locally abundant and their flesh is tasty, but very bony.

Key to the Freshwater Genera of Hemiramphidae from New Guinea

1a. Nasal papilla elongate and pointed

extending well outside nasal cavity; caudal fin rounded or truncate; lower jaw elongate, more than one-half head length ..... *Zenarchopterus*

1b. Nasal papilla rounded and mostly confined to nasal cavity; caudal fin forked; lower jaw short, less than one-fifth head length ..... *Arrhamphus*

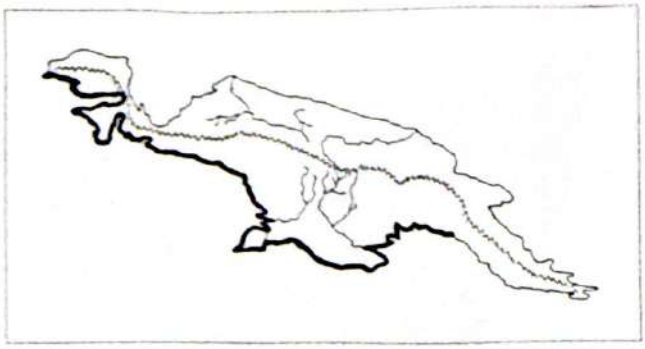
Genus *Arrhamphus*
Günther, 1866

The genus contains a single species that is discussed below.

Snub-Nosed Garfish
Arrhamphus sclerolepis
Günther, 1866
(Photo 15)

Diagnosis. - Dorsal rays 13 to 16; anal rays 14 to 17; pectoral rays 12 to 14; gill rakers on first arch 18-25; lower jaw protruding, but much shorter than in other garfishes from this region; caudal fin forked, the lower lobe slightly longer; olive on back, pale yellow green to whitish on sides and belly; a silvery midlateral stripe from gill cover to caudal fin base. Maximum size to 360 mm SL, common to 150 mm SL.

Distribution and Habitat. - Southern New Guinea and northern Australia. Inhabits brackish estuaries, but frequently found in the lower, tidal portions of freshwater streams.



Genus *Zenarchopterus*
Gill, 1864

The genus contains about 15 species that are distributed in the Indo-West Pacific region from East Africa to Samoa. They are distinguished from other garfishes by the combination of a rounded or truncate caudal fin and an elongate tentacle associated with each nasal opening. Their habitat consists of mangrove swamps, brackish estuaries, river mouths, and freshwater streams. New Guinea is the only locality where specialized freshwater forms have evolved (one species also shared with northern Australia).

Photo 15 - Snub-nosed Garfish, ***Arrhamphus sclerolepis,*** *90 mm SL.*

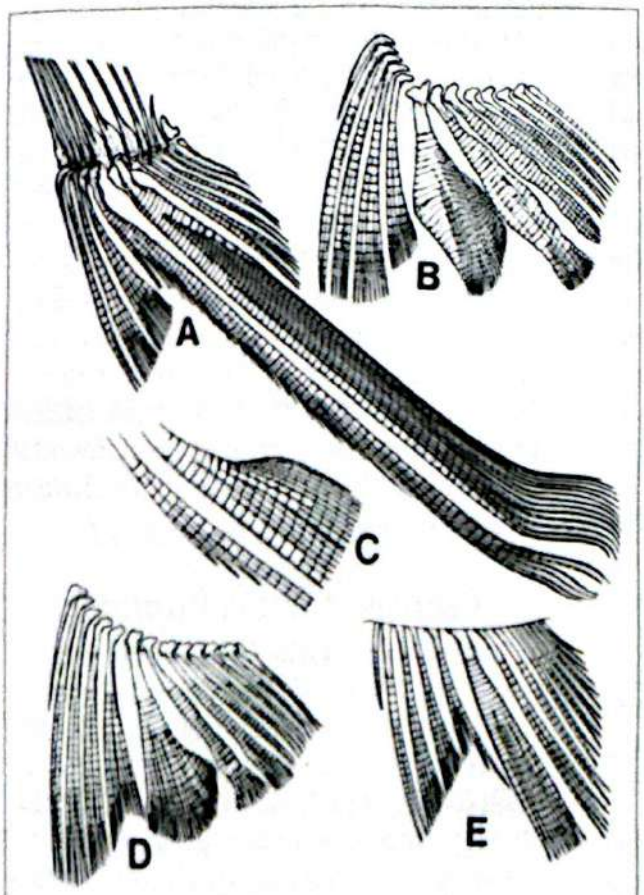


Fig 12. Anal fin of male ***Zenarchopterus****: A)* ***Z. robertsi****; B)* ***Z. kampeni****; C)* ***Z. alleni*** *(only basal portion of rays 5 & 6 shown); D)* ***Z. novaeguineae****; E)* ***Z. ornithocephala*** *(from Collette, 1982 & 1985).*

Key to the Freshwater Species of *Zenarchopterus* from New Guinea

1a. Predorsal scales 47-66 2

1b. Predorsal scales 33-47 4

2a. Fifth and sixth anal rays of male greatly elongate (Fig. 12A & C) 3

2b. Sixth anal ray of male enlarged, but not greatly elongate (Fig. 12E) (Vogelkop Peninsula) ..... *Z. ornithocephala*

3a. Upper jaw longer than wide; pectoral fin longer than head length; predorsal scales about 66 (Mamberamo River) ..... *Z. alleni*

3b. Upper jaw length about equal to its width; pectoral fin equal to or shorter than head length; predorsal scales 47-53 (Kumusi River system near Kokoda, Papua New Guinea) ..... *Z. robertsi*

4a. Predorsal scales 33-47; pectoral fin shorter than head length, its length 1.3-1.9 in head length (northern or southern New Guinea) 5

4b. Predorsal scales 32 or less; pectoral fin about equal to head length, its length 0.9-1.0 in head length (southern New Guinea) ..... *Z. caudovittatus*

5a. Lower jaw longer than head length; total vertebrae 47-51 (southern New Guinea) .... *Z. novaeguineae*

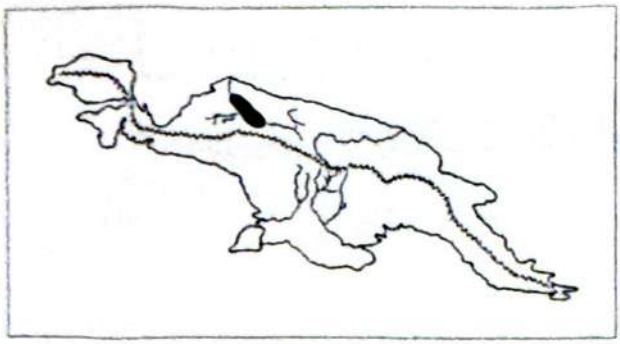
5b. Lower jaw about equal to head length; total vertebrae 43-46 (northern New Guinea) .... *Z. kampeni*

Allen's River Garfish

Zenarchopterus alleni
Collette, 1982

Diagnosis. - Dorsal rays 14; anal rays 13; pectoral rays 10; predorsal scales 66; 5th and 6th anal fin rays in male greatly elongate (Fig. 12C), a posteriorly projecting elbow on posterior surface of 6th anal ray distal to first branch of ray; no dorsal fin rays modified in male; upper jaw longer than wide (width divided by length 0.65); lower jaw slightly longer than head length; pectoral fin longer than in any other species in the genus, much longer than head length, about 30% of SL; olive on back, silvery on sides, and white below. Maximum size to at least 130 mm SL.

Distribution and Habitat. - Known on the basis of a single male specimen collected in 1920 by W. C. Van Heurn at Batavia Bivak on the Mamberamo River.

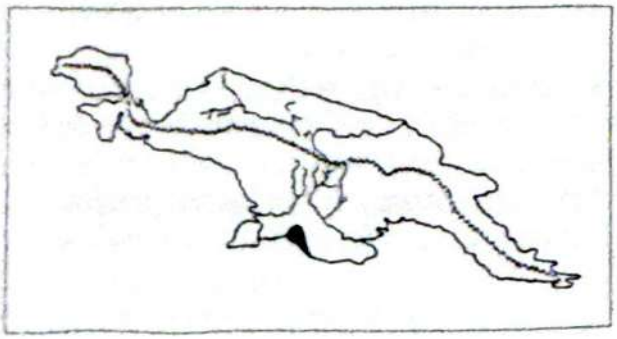


Long-Jawed River Garfish

Zenarchopterus caudovittatus
(Weber, 1908)

Diagnosis. - Dorsal rays 12 or 13; anal rays 13 or 14; pectoral rays 10 or 11; predorsal scales 30-32; 5th anal fin ray of male widened but not elongated beyond rest of anal fin rays; no dorsal fin rays modified in males; upper jaw longer than wide (width divided by length 0.62-0.67); head longer than lower jaw (head length divided by lower jaw length 1.31-1.79); pectoral fin about as long as head; gill cover silvery; olive on back; a midlateral silvery stripe on sides; white on ventral parts. Maximum size to about 115 mm SL.

Distribution and Habitat. - Recorded from the Merauke River, but probably occurs in other rivers of central-southern New Guinea. Also known from fresh waters of Arnhem Land in the Northern Territory of Australia.

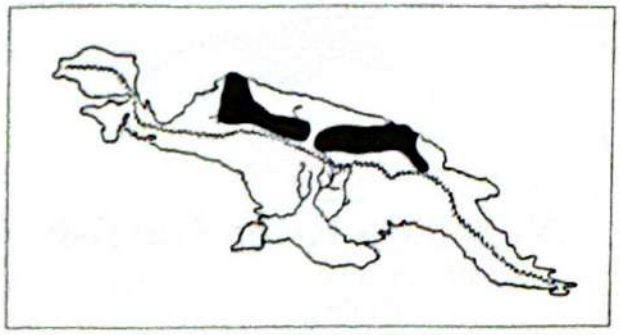


Sepik River Garfish

Zenarchopterus kampeni
(Weber, 1913)
(Plate 1, nos. 12 & 13)

Diagnosis .- Dorsal rays 12 to 14 (usually 12 or 13); anal rays 12 or 13; pectoral rays 10 or 11 (usually 10); predorsal scales 34-54 (usually 34-41); 5th and 6th anal fin rays of male widened (especially 5th) but not elongated beyond rest of anal fin rays (Fig. 12B); adult males with 3rd-6th dorsal rays progressively elongated; upper jaw longer than wide; lower jaw about same length as head; pectoral fins much shorter than head; olive on back; gill cover silvery and a broad silver stripe along middle of sides; whitish ventrally. Maximum size to about 165 mm SL.

Distribution and Habitat. - Occurs extensively in the lower and middle parts of the Ramu, Sepik, and Mamberamo rivers. It is found in the main water courses as well as smaller tributaries flowing through rainforest.



Fly River Garfish

Zenarchopterus novaeguineae
(Weber, 1913)

Diagnosis. - Dorsal rays 12 to 15 (usually 13 or 14); anal rays 11 to 14 (usually 13 or 14); pectoral rays 7 to 10 (usually 8 to 10); predorsal scales 33-47; 6th anal fin ray of male widened but not elongated beyond rest of anal fins (Fig. 12D); males with 3rd-5th dorsal rays slightly longer but not thickened; upper jaw length distinctly longer than wide; lower jaw longer than head; pectoral fins much shorter than head; olive on back; silvery on side of head; a silvery midlateral stripe; whitish ventrally. Maximum size to about 170 mm SL.

Distribution and Habitat. - Recorded from the Lorentz, Fly, and Laloki river systems and therefore presumed to be widespread in central-southern New Guinea. In the

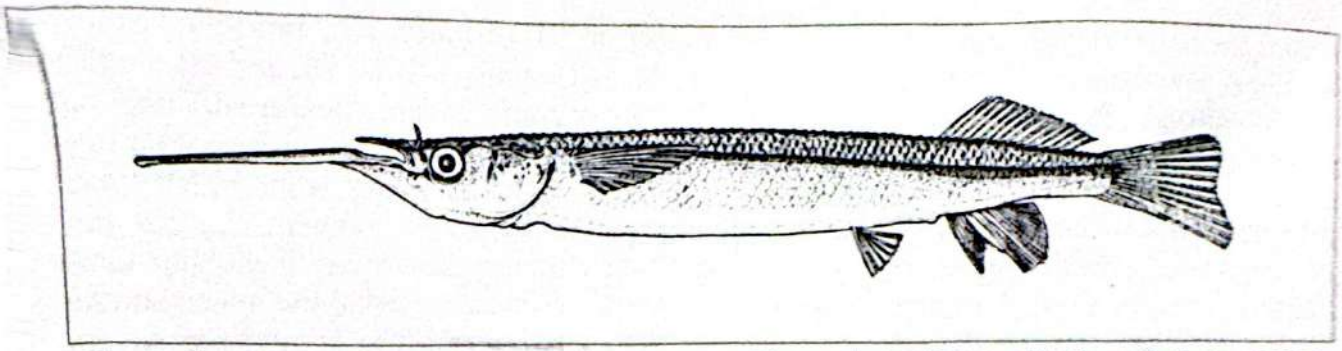
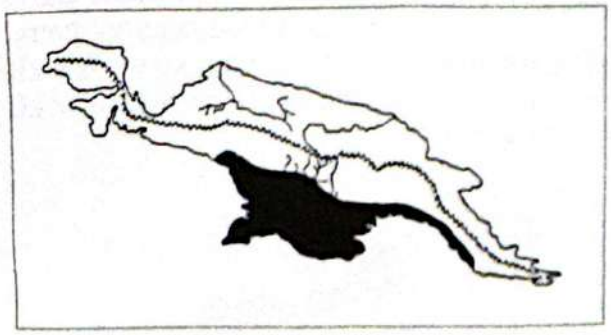


Fig. 13. Vogelkop River Garfish, ***Zenarchopterus ornithocephala****, 124 mm SL (from Collette, 1985).*

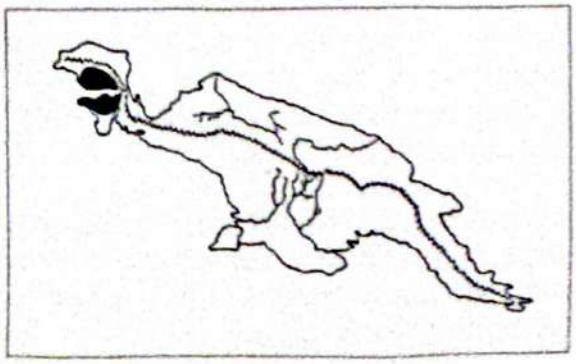
Fly system it has been collected 915 km upstream at an elevation of approximately 52 m.



Vogelkop River Garfish

Zenarchopterus ornithocephala
Collette, 1985
(Fig. 13)

Diagnosis. - Dorsal rays 14; anal rays 14; pectoral rays 10; predorsal scales 48-52; 5th and 6th anal fin rays in male greatly elongate (Fig. 12E); no dorsal fin rays modified in males; upper jaw longer than wide (width divided by length 0.74-0.84); lower jaw about equal to head length; pectoral fin much shorter than head length (head length divided by pectoral length 1.55-1.72); olive on back; silver midlateral stripe on sides; whitish ventrally. Maximum size to at least 125 mm SL.



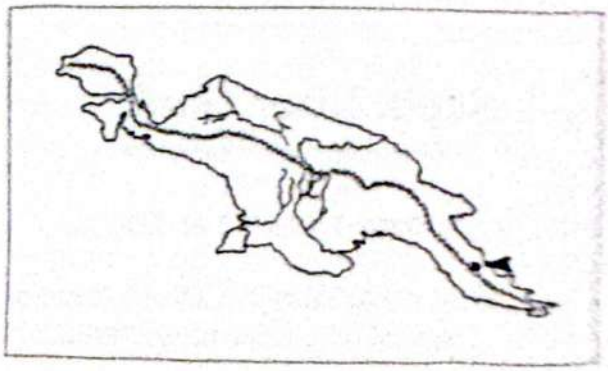
Distribution and Habitat. - Thus far known only from two locations at the western extremity of New Guinea at Senopi and Fruata, but is probably widespread on the Vogelkop and Bomberai peninsulas.

Robert's River Garfish

Zenarchopterus robertsi
Collette, 1982
(Plate 1, no. 11)

Diagnosis. - Dorsal rays 14 or 15; anal rays 11 to 13 (usually 12); pectoral rays 9 or 10; predorsal scales 47-53; 5th and 6th anal fin ray in male greatly elongate (Fig. 12A); no dorsal fin rays modified in male; upper jaw length about equal to width (width divided by length 0.97-1.10); lower jaw about equal to head length; pectoral fin much shorter than head length; olive on back; silvery on gill cover; a silver midlateral stripe on side; whitish ventrally. Maximum size to about 130 mm SL.

Distribution and Habitat. - Known only from creeks in the vicinity of Kokoda in south-eastern Papua New Guinea. Specimens have been collected in rainforest streams to an elevation of approximately 350 m.



Longtoms

Family Belonidae

Longtoms or needlefishes occur worldwide in mainly marine habitats, but a few tropical species are found in fresh water. The family contains about 10 genera and 32 species. The most recognisable features are the slender silvery body and particularly the very elongate structure of the jaws. Other family characters include: no spines in fins; dorsal and anal fins posterior in position, their bases opposite; pelvic fins abdominal with 6 soft rays; short pectoral fins located high on sides; caudal fin forked or emarginate; teeth sharp and needle-like; small cycloid scales that are easily detached.

Longtoms swim near the surface where they feed largely on small fishes. Insects are also consumed by the freshwater species. They lay tiny eggs that have sticky filaments which attach to aquatic plants. The larvae are pelagic. The largest marine longtoms grow to over 125 cm SL. The flesh has an excellent flavour and some marine species have a minor commercial importance.

Genus *Strongylura*
van Hasselt, 1824

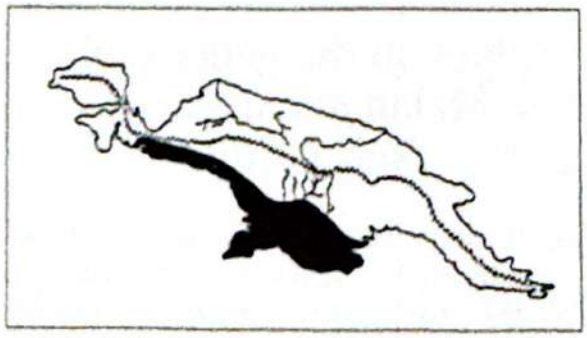
The genus contains about 14 species distributed in all tropical seas; nearly all are marine inhabitants that often enter estuaries. However, one species from New Guinea and northern Australia occurs in fresh water.

Freshwater Longtom
Strongylura kreffti
(Günther, 1866)
(Plate 1, no. 14)

Diagnosis. - Dorsal rays 16 to 18; anal rays 19 or 20; pectoral rays 11; depth of body 10-15 times in SL; head length 2.3-2.4 in SL; pelvic fins midway between preopercle and tail base; caudal fin truncate to slightly emarginate; colour brown to greenish on back, silvery on sides, fins may be dusky. Maximum size to about 60 cm TL.

Distribution and Habitat. - Known to occur at several localities in central-southern New Guinea including Lake Jamur, Mimika River, Lorentz River, Digul River, and Fly River. It was collected in lowland habitats of the Fly as far inland as 830 km upstream. Also known to occur widely in northern Australia from the Fitzroy River of Western Australia to the Dawson River in eastern Queensland.

Remarks. - *Stenocaulis pernornatus* Whitley, was described from the Sepik River, but investigations by the present author indicate that the collecting locality was in error and Whitley's description was based on a specimen of *S. kreffti* from the Fly system.



Rainbowfishes

Family Melanotaeniidae

The rainbowfishes are restricted to tropical and subtropical waters of Australia and New Guinea. The family contains six genera and 53 species. *Cairnsichthys* and *Rhadinocentrus*, each with a single species are endemic to eastern Australia. *Melanotaenia*, the largest genus with 32 species, is well represented in both New Guinea (20 spp.) and Australia (10 spp.). The single species of *Iriatherina* is also shared between these two regions. The remaining genera, *Glossolepis* and *Chilatherina* are confined to northern New Guinea, except for *C. campsi* which is found in highland areas of both northern and southern watersheds. The shape of the jaws (Fig. 14) is a useful character for separating genera, particularly *Glossolepis*, *Chilatherina*, and *Melanotaenia*.

Rainbows are small (usually under 12 cm), schooling fishes found in most freshwater habitats below elevations of 1500 m, including streams, lakes, and swamps. Spawning occurs the year round with local peaks at the onset of the rainy season. A relatively small number of eggs are deposited each day amongst aquatic vegetation. Hatching occurs within 7-18 days. Aquarium studies indicate that most species reach sexual maturity within the first year. Rainbows eat a variety of plant and animal items including algae, ants, aquatic insect larvae, and small crustaceans. Allen and Cross (1984) provided a summary of the known species, although several others have been described since then.

Key to the genera of Melanotaeniidae of New Guinea

1a. A stout, rigid spine present at beginning of first dorsal fin; soft anal fin rays 15-30; first few rays of second dorsal and anal fins not produced into elongate filaments; exposed teeth on premaxillary numerous and well developed 2

1b. All spines of dorsal fin relatively soft and flexible; soft anal fin rays 11 or 12; first few rays of second dorsal and anal fins produced into elongate filaments in adult males; exposed premaxillary teeth resticted to a single row of about 7-8 enlarged canines ... . *Iriatherina*

2a. Scale margins deeply crenulate; vertical scale rows from upper edge of gill opening to caudal fin base 34-60 ..... *Glossolepis*

2b. Scale margins smooth or with only shallow crenulations; vertical scale rows from upper edge of gill opening to caudal fin base 29-44 3

3a. Premaxillaries with an abrupt bend between anterior horizontal portion and lateral portion; jaws about equal or lower jaw protruding slightly.... *Melanotaenia*

3b. Premaxillaries without an abrupt bend between anterior horizontal portion and lateral portion; lower jaw inferior ..... *Chilatherina*

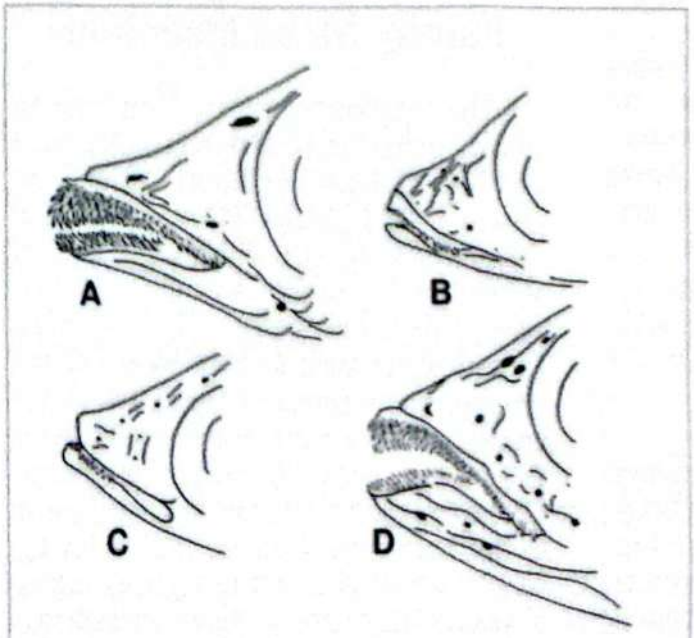


*Fig. 14. Snout region of rainbowfish genera showing external dentition: A) **Chilatherina**; B) **Glossolepis**; C) **Iriatherina**; D) **Melanotaenia**.*

Genus *Chilatherina* Regan, 1914

The genus *Chilatherina* contains eight species that inhabit northern New Guinea between the Markham and Mamberamo River systems as well as the Central Highlands region of Papua New Guinea. They are relatively small fishes, seldom exceeding 100 mm SL. In most cases *Chilatherina* are found in either low-lying riverine flood plain or foothill streams to altitudes of about 500 m. However, at least one species, *C. campsi*, frequents streams of the mountainous Central Highlands to about 1500 m above sea level. The habitat generally consists of flowing streams, but at least three species, *C. bleheri*, *C. fasciata*, and *C.*

sentaniensis, have lake-dwelling populations. In stream habitats they frequent shallow pools where the rate of flow is gentle, although *C. bulolo* is often found in rapid, steep-gradient creeks. Typically these fishes prefer sections of the stream or lake-shore which afford maximum exposure to sunlight.

Key to the Species of *Chilatherina*

1a. Colour generally silvery with more or less distinct black streak on upper and lower edge of caudal fin margin; vomerine teeth absent or with only 1-5 small teeth on vomer 2

1b. Colour not as in 1a, without black streak on upper and lower edge of caudal fin margin; vomerine teeth present or absent 3

2a. Snout rounded (Fig. 15A); first dorsal fin relatively short (Fig. 15A); live male specimens without orange stripes on side ..... *C. bulolo*

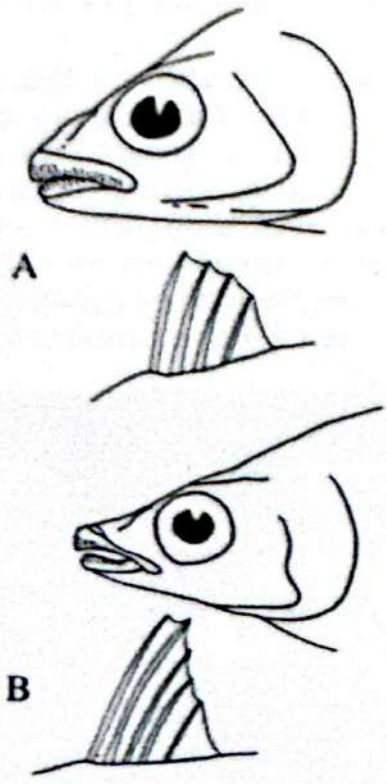


Fig. 15. Head and dorsal fin of Chilatherina: A) C. bulolo; B) C. crassispinosa.

2b. Snout more pointed (Fig. 15B); first dorsal fin taller (Fig. 15B); live male specimens with orange stripes on sides ..... *C. crassispinosa*

3a. Palatine teeth well developed; soft rays in second dorsal fin usually 11 or 12, occasionally 13; midlateral dark stripe interrupted, forming series of blotches on anterior half of body; males deep-bodied, greatest depth frequently greater than 40% of SL in specimens exceeding 70 mm SL and averaging 37% of SL in specimens between 50-69 mm SL ... *C. axelrodi*

3b. Palatine teeth absent; soft rays in second dorsal fin usually 13 to 15, rarely 12 or 16; midlateral dark stripe, if present, not forming series of blotches; males relatively slender, greatest depth not exceeding 33% of SL and averaging 30% of SL in specimens over 50 mm SL. ..... *C. campsi*

4a. Rear edge of maxillary reaching to level of anterior edge of eye or beyond; dorsal fin origin noticeably behind level of anal fin origin, about level with base of 4th or 5th soft anal ray; soft rays in anal fin 26 to 30, usually 27 or 28 ..... *C. lorentzi*

4b. Rear edge of maxillary not reaching level of eye; dorsal fin origin either equal to or only slightly behind level of anal fin origin, about level with base of 1st to 3rd soft anal ray if behind; soft rays in anal fin usually 26 or less, except sometimes 27 or 28 in *C. fasciata* 5

5a. Snout elongate, usually 2.5 to 2.9 in head length; soft rays in second dorsal fin usually 9 to 11, rarely 12 . ..... *C. sentaniensis*

5b. Snout shorter, usually 3.0 to 3.5 in head length; soft rays in second dorsal fin usually 12 to 15, rarely 11 or 16 6

6a. Scales in longitudinal series from above gill opening to caudal fin base usually 43-50; predorsal scales usually 22-25; males reddish on posterior half of body ..... *C. bleheri*

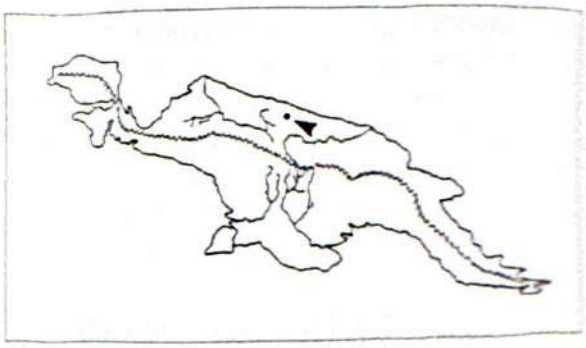
6b. Scales in longitudinal series from above gill opening to caudal fin base usually 39-44; predorsal scales usually 18-21; males not reddish on posterior half of body, but may have several dark bars on middle part of lower half of body. ..... *C. fasciata*

Axelrod's Rainbowfish

Chilatherina axelrodi
Allen, 1980
(Plate 8, no. 1)

Diagnosis. - Dorsal rays V to VII-I,11 to 13 (usually 11 or 12); anal rays I,19 to 24; pectoral rays 13 to 15; midlateral scales 37-40; cheek scales 15-22; predorsal scales 16-19; greatest body depth of adult males as % of SL 34.0-41.3; no teeth on vomer; palatine teeth well developed; colour grey or brownish on back, whitish on lower half; a broad broken black stripe along middle of side; males with several dusky bars on lower half of sides; fins may be yellowish, especially pelvics, anal, and caudal. Maximum size to about 90 mm SL, females to 70 mm SL.

Distribution and Habitat. - Known only from Yungkiri Stream, a tributary of the Pual (Nemayer) River, in the Bewani Mountains, about 37 km southwest of Vanimo. The elevation at this site is approximately 450 m.



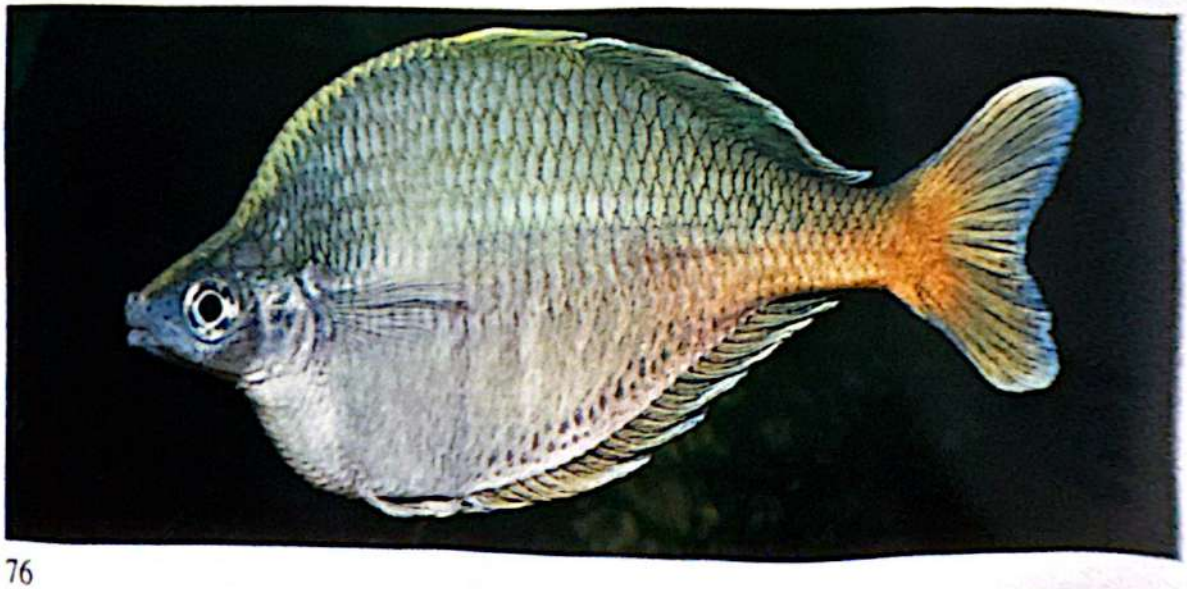
Bleher's Rainbowfish

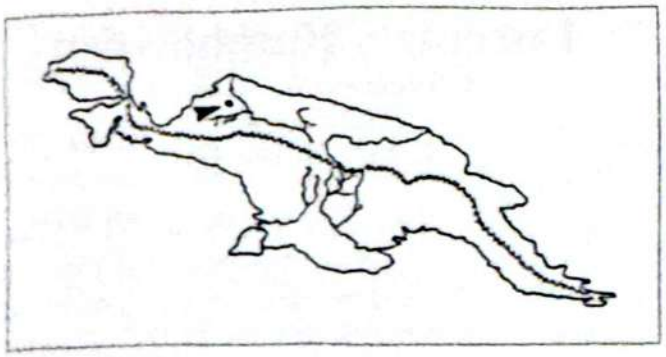
Chilatherina bleheri
Allen, 1985
(Plate 8, no. 4; Photo 16)

Diagnosis. - Dorsal rays IV to VI-I,11 to 16 (usually V-I,13 to 15); anal rays I,21 to 26 (usually 23 to 25); pectoral rays 14 to 16; midlateral scales 43-50; predorsal scales 22-25; cheek scales 20-28; greatest body depth of adult males as % of SL 34.9-45.0; a few scattered teeth on vomer; palatines toothless; colour whitish on anterior half becoming reddish posteriorly; females mainly silvery white or pale bluish grading to grey or olive on back. Maximum size to about 120 mm SL.

Distribution and Habitat. - Known only from Lake Holmes (Danau Bira) in the lower Mamberamo River system. The locality consists of three interconnected lakes lying at an elevation of about 430 m and set in mountainous jungle terrain. The main lake has a length of approximately 4.5 km and maximum width of about 2 km.

Photo 16 - Bleher's Rainbowfish, ***Chilatherina bleheri****, 120mm SL.*



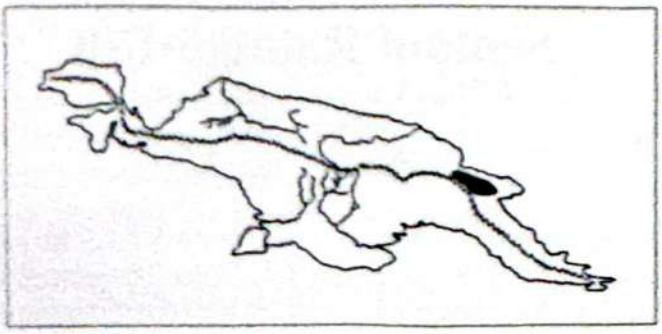


Bulolo Rainbowfish

Chilatherina bulolo
(Whitley, 1938)
(Plate 8, no. 7)

Diagnosis. - Dorsal rays IV to VI-I,9 to13; anal rays I,19 to 24; pectoral rays 14 to 16; cheek scales 17-23; midlateral scales 37-43; predorsal scales 19-22; greatest body depth of adult males as % of SL 25.7-34.7; no teeth on vomer; colour overall silvery with black streak on upper and lower edge of caudal fin; pelvic and anal fins whitish. Maximum size to about 70 mm SL.

Distribution and Habitat. - Known from scattered localities in the Markham (Erap Snake and Bulolo rivers) and Ramu (Whege River) river systems. It is frequently found in fast flowing water of rapids or below waterfalls.

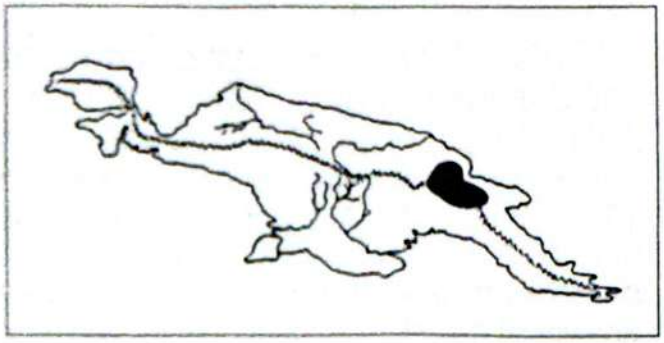


Highlands Rainbowfish

Chilatherina campsi
(Whitley, 1956)
(Plate 8, no. 6)

Diagnosis. - Dorsal rays V to VII-I,12 to 16; anal rays I,21 to 26; pectoral rays 13 to 15; midlateral scales 39-42; predorsal scales 17-23; cheek scales 12-21 (usually 15-20); greatest body depth of adult males as % of SL 28.0-35.0; no teeth on vomer or palatines; colour generally greenish brown to mauve on back, whitish on lower half with bluish-black midlateral stripe (less distinct in females). Maximum size to about 75 mm SL.

Distribution and Habitat. - Known from widely scattered localities in the Markham, Ramu, Sepik, and Purari river systems. It mainly occurs in hilly or mountainous terrain between about 200 and 1525 m elevation. It is the only melanotaeniid known to occur on both sides of the Central Dividing Range. Most collecting sites have been in the northern watershed, but it also occurs in headwater tributaries of the Purari system which flows southward to the Gulf of Papua.



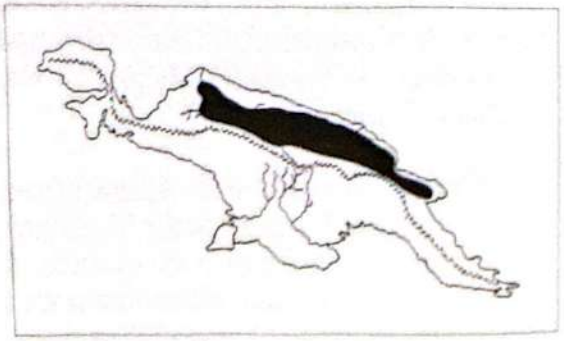
Silver Rainbowfish

Chilatherina crassispinosa
(Weber, 1913)
(Plate 8, no. 5)

Diagnosis. - Dorsal rays IV to VI-I,8 to 12; anal rays I,19 to 24; pectoral rays 14 to 16; midlateral scales 37-43; predorsal scales 20-22; cheek scales 17-23; greatest body depth of adult male as % of SL 27.0-36.5; vomer frequently with 1-5 small teeth; colour overall silvery with faint black streak on upper and lower edge of caudal fin; males with narrow orange stripes on sides and pale yellowish dorsal and anal fins. Maximum size to about 110 mm, females to about 90 mm SL.

Distribution and Habitat. - Widespread in northern New Guinea including the Markham, Gogol, Ramu, Sepik, Pual, and Mamberamo rivers. It also occurs in many

smaller drainage systems. The habitat is usually in hilly or mountainous terrain at elevations between 100-600 m.

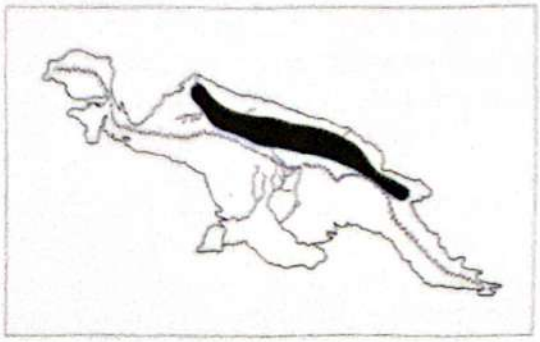


Barred Rainbowfish

Chilatherina fasciata
(Weber, 1913)
(Plate 8, no. 3)

Diagnosis. - Dorsal rays IV to VII-I,11 to 16; anal rays I,21 to 28 (usually 22 to 26); pectoral rays 14 to 16; midlateral scales 39-44; predorsal scales 18-23; cheek scales 14-24 (usually 18-21); greatest body depth of adult males as % of SL 26.1-38.8; teeth present on vomer and palatines; colour brown to bluish green on back, white to yellowish on lower half; males may have several diffuse blackish bars on lower sides above front half of anal fin base; females mainly silvery white. Maximum size to about 110 mm SL.

Distribution and Habitat. - Widespread in northern New Guinea including the Markham, Ramu, Sepik, and Mamberamo river systems. It has also recently been discovered on Yapen Island. It is found both in lowland tributaries and in hilly terrain to an elevation of about 400-500 m.



Lorentz's Rainbowfish

Chilatherina lorentzi
(Weber, 1908)
(Plate 8, no. 8)

Diagnosis. - Dorsal rays IV to VI-I,12 to 15; anal rays I,26 to 30; pectoral rays 14 or 15; midlateral scales 35-37; predorsal scales 17-20; cheek scales 21-27; greatest body depth of adult males as % of SL 32.4-40.8; teeth present on vomer and palatines; colour olive or brownish on back, silvery or bluish to white on lower parts; males with broad blackish midlateral stripe. Maximum size to about 100 mm SL.

Distribution and Habitat. - Known only from the Tawarin River on the north coast of Irian Jaya about 200 km west of Jayapura, and from Puive Creek, a tributary of the Pual River near Vanimo, Papua New Guinea.

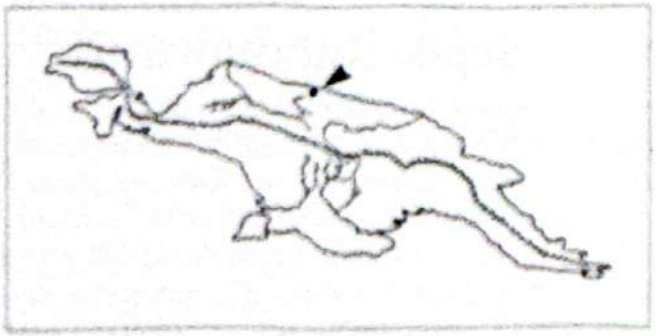
Sentani Rainbowfish

Chilatherina sentaniensis
(Weber, 1908)
(Plate 8, no. 2)

Diagnosis. - Dorsal rays IV to VI-I,9 to 12 (usually 10); anal rays I,21 to 26 (usually 22 to 24); pectoral rays 14 to 16; midlateral scales 38-41; predorsal scales 19-25; cheek scales 16-20; greatest body depth of adult males as % of SL 32.3-39.5; snout very elongate, its length usually fits about 2.5-2.9 in head length; live colours unknown; colour in alcohol brown on back and whitish to tan on lower half with a relatively broad blackish midlateral stripe; males may have about 6-8 faint dark bars in middle of lower half of body. Live colouration is unknown. Maximum size to about 100 mm SL.

Distribution and Habitat. - Known only from Lake Sentani, Irian Jaya.

Remarks. - Virtually all records and illustrations of this species in the aquarium literature pertain to varieties of *C. fasciatus*. The presence of the true *C. sentaniensis* in the aquarium hobby is doubtful and there are fears that it may already by extinct. The last collections were obtained in 1954. Since that time populations of introduced fishes (*Cyprinus, Gambusia, Clarias*, etc.) have greatly increased and lake waters have suffered from man-made pollution. The author failed to find this species during a 1982 visit to Lake Sentani.



Genus *Glossolepis*
Weber 1908

The six species of *Glossolepis* are among the most beautiful members of the family. The genus, which is closely related to *Melanotaenia*, is restricted to northern New Guinea between the Markham and Mamberamo River systems. These fishes are mainly inhabitants of still water; for example, they occur in lakes or in quiet backwaters of major rivers.

Key to the Species of *Glossolepis*

1a. Gill rakers on lower limb of first gill arch 12-14; transverse scales between anal fin origin and base of first dorsal fin 10-11; predorsal scales 17-20; cheek scales 11-16 2

1b. Gill rakers on lower limb of first gill arch 19-32; transverse scales between anal fin origin and base of first dorsal fin 12-20; predorsal scales 23-36; cheek scales 20-38 3

2a. Colour pattern includes about 2-8 large dark spots along middle of sides; scales in longitudinal series from above gill opening to caudal fin base 34-36 ..... *G. maculosus*

2b. Colour pattern not including series of dark spots along middle of sides; scales in longitudinal series from above gill opening to caudal fin base 37-38 ..... *G. ramuensis*

3a. Gill rakers on lower limb of first gill arch 26-32 4

3b. Gill rakers on lower limb of first gill arch 19-23 5

4a. Scales arranged in irregular rows, about 55-60 in lateral series from upper edge of gill opening to base of caudal fin and 16-20 in transverse series between base of anal spine and base of first dorsal fin ..... *G. incisus*

4b. Scales arranged in regular rows, about 38-43 in lateral series from upper edge of gill opening to base of caudal fin and 12-16 in transverse series between base of anal spine and base of first dorsal fin ... *G. pseudoincisus*

5a. Scales above pectoral fin arranged in regular parallel rows; 13 or 14 scales in transverse series from base of anal spine to base of first dorsal fin; maximum size to about 120 mm SL ..... *G. multisquamatus*

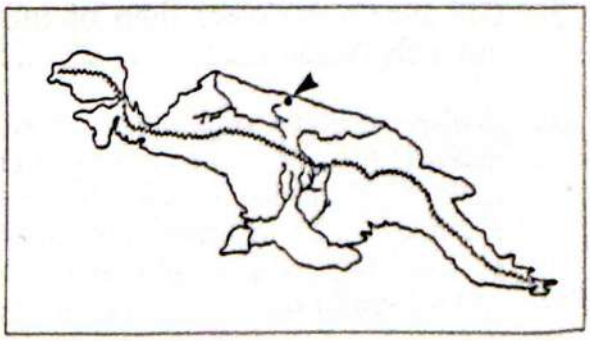
5b. Scales above pectoral fin arranged irregularly, not in parallel horizontal rows; 15-17 scales in transverse series from base of anal spine to base of first dorsal fin; maximum size to about 90 mm SL ..... *G.wanamensis*

Red Rainbowfish
Glossolepis incisus
Weber, 1908
(Plate 7, no. 12)

Diagnosis. - Dorsal rays V to VI-I,9 or 10;

anal rays I,18 to 20; pectoral rays 12 or 13; predorsal scales 30-36; cheek scales 26-38; greatest body depth of adult males as % of SL 27.5-30.7; gill rakers on lower limb of first gill arch 26-32; transverse scale rows 16-20; midlateral scales 50-60; scale arrangement irregular, not in even parallel rows on sides; colour of mature males bright red, females olive to brownish,with silvery reflections on head and sides. Maximum size to about 120 mm SL, females to about 100 mm SL.

Distribution and Habitat. - Lake Sentani, situated in a hilly area (elevation 75 m), about 12 km southwest of Jayapura, Irian Jaya.

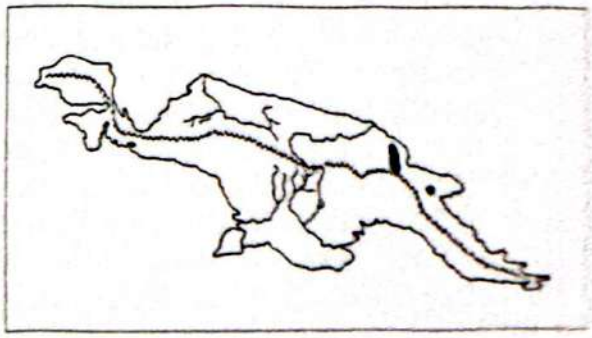


Spotted Rainbowfish

Glossolepis maculosus
Allen, 1981
(Plate 7, no. 14)

Diagnosis. - Dorsal rays V or VI-I,9 or 10; anal rays I,18 to 20; pectoral rays 12 or 13; predorsal scales 17-20; cheek scales 11-14; greatest body depth of adult males as % of SL 27.5-30.7; gill rakers on lower limb of first gill arch 13 or 14; transverse scale rows 10; midlateral scales 34-36; scales of sides arranged in regular parallel rows; colour greenish or olive on back, whitish ventrally, except yellow above anal fin; series of 6-8 (sometimes fewer) large black spots along middle of sides. Maximum size to about 50 mm SL.

Distribution and Habitat. - Markham and Ramu river systems. It has been found at only a few localities, including the Omsis River and a small side branch of it near Lake Wanam, from small swamps and creeks near Brahman in the Ramu system, and from Maram Stream about 20 km north of Josephstaal, also in the Ramu system. The elevation of these sites ranges from about 150-800 m.

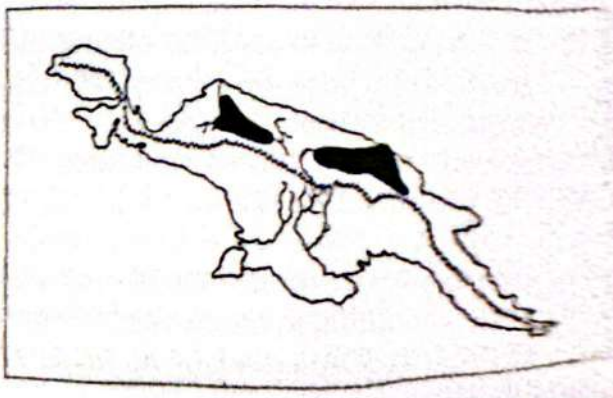


Sepik Rainbowfish

Glossolepis multisquamatus
(Weber & de Beaufort, 1922)
(Plate 7, no. 11)

Diagnosis. - Dorsal rays IV to VI-I,9 or 10; anal rays I,19 to 22; pectoral rays 14 to 17; predorsal scales 24-31; cheek scales 20-26; greatest body depth of adult males as % of SL 33.1-43.5; gill rakers on lower limb of first arch 19-23; transverse scale rows 12-16; midlateral scales 38-43; scales of sides arranged in regular parallel rows; colour greenish or olive to brownish with silvery sheen; narrow yellow-orange stripes between each scale row; dorsal and anal fins of males dusky with golden sheen on membranous portions. Maximum size to about 120 mm SL, females to about 100 mm SL.

Distribution and Habitat. - Floodplains of the Mamberamo, Sepik, and Ramu rivers. Occurs in swampy lagoons, lakes, and small side channels of larger rivers.

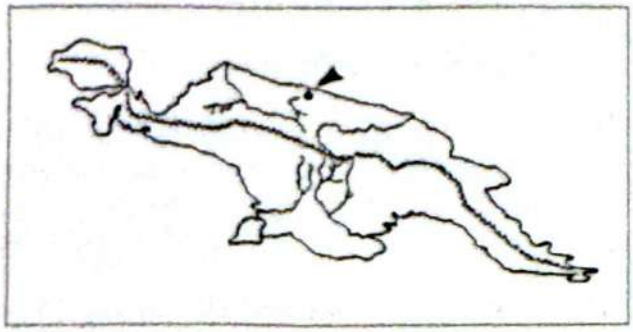


Tami River Rainbowfish

Glossolepis pseudoincisus
Allen & Cross, 1980
(Plate 7, no. 10)

Diagnosis. - Dorsal rays V or VI-I,10 to 12; anal rays I,18 to 22; pectoral rays 13 or 14; predorsal scales 27-34; cheek scales 21-29; greatest body depth of adult males as % of SL 33.5-40.8; gill rakers on lower limb of first gill arch 26-30; transverse scale rows 12-16; midlateral scales 38-43; scales of sides arranged in regular parallel rows; live colours unknown, but probably olive to brownish with silvery sheen on head and sides. Maximum size to about 80 mm SL.

Distribution and Habitat. - Known only from one collection taken in 1954 from an isolated oxbow lake near the Tami River, about 23 km southeast of Jayapura.

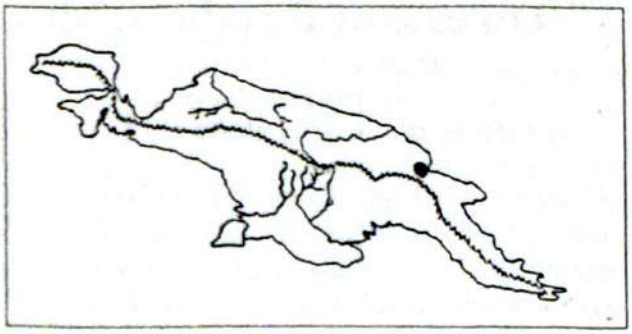


Ramu Rainbowfish

Glossolepis ramuensis
Allen, 1985
(Plate 7, no. 15)

Diagnosis. - Dorsal rays IV to VI-I,9 to 11; anal rays I,19 to 22; pectoral rays 13 or 14; predorsal scales 18-20; cheek scales 11-16; greatest body depth of adult males as % of SL 31.4-39.2; gill rakers on lower limb of first gill arch 12-14; transverse scale rows 10-11; midlateral scales 37-38; scales of sides arranged in regular parallel rows; colour brownish on back and whitish on lower half; males with a pair of yellow-orange stripes along posterior two-thirds of lower side and scattered black blotches above anterior half of anal fin. Maximum size to about 65 mm SL.

Distribution and Habitat - Most specimens have been collected in tributary streams of the Gogol River near Madang, but also known from the middle Ramu system.

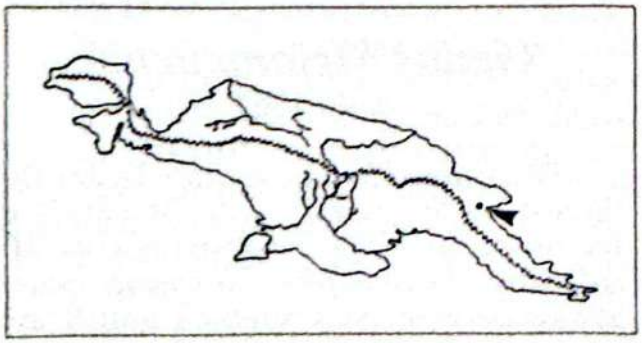


Lake Wanam Rainbowfish

Glossolepis wanamensis
Allen & Kailola, 1979
(Plate 7, no. 13)

Diagnosis. - Dorsal rays V to VII-I,9 to 11; anal rays I,18 to 21; pectoral rays 15 or 16; predorsal scales 23-35; cheek scales 21-30; greatest body depth of adult males as % of SL 28.5-52.0; gill rakers on lower limb of first gill arch 19-23; transverse scale rows 15-17; midlateral scales 39-44; scales on side in region above pectoral fin arranged irregularly, not in parallel horizontal rows; colour green to brownish with golden or brassy sheen on head and sides; fins of adult males dark with metallic lustre on inter-radial membranes. Maximum size to about 90 mm SL.

Distribution and Habitat. - Known only from Lake Wanam, a roughly circular lake situated on a small plateau at an elevation of about 150 m, 24 km west of Lae, Papua New Guinea.



Genus *Iriatherina*, Meinken, 1974

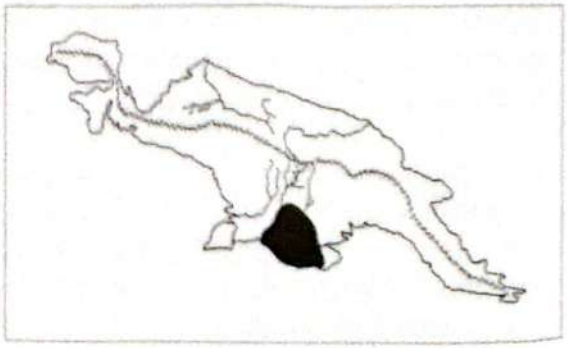
The genus *Iriatherina* contains a single species, *I. werneri*, from south-central New Guinea and Cape York Peninsula.

Threadfin Rainbowfish

Iriatherina werneri
Meinken, 1974
(Plate 5, no. 1 and Plate 9, no. 12)

Diagnosis. - Dorsal rays VI to IX-I,7; anal rays I,10 to 12; pectoral rays 9 to 12; cheek scales 8-12; greatest body depth of adults (males and females) as % of SL 17.8-26.9; all spines of first dorsal fin relatively soft and flexible; first few rays of second dorsal and anal fins forming elongate filaments in adult males; exposed premaxillary teeth restricted to a single row of about 7-8 enlarged canines; colour generally brownish, often silvery on head and sides; pelvic fins and elongated dorsal and anal fin filaments of males blackish. Maximum size to about 35 mm SL, females generally smaller.

Distribution and Habitat. - Central-southern New Guinea between the Merauke and Fly rivers. Besides these major rivers it has been collected in the Bensbach, Morehead, and Pahoturi rivers. It occurs in lowland swamps, drainage ditches, and streams that have abundant vegetation.



Genus *Melanotaenia* Gill, 1862

The genus *Melanotaenia* is by far the largest in the family with 36 species, including at least 5 subspecies of *M. splendida*. Of this total 26 species occur exclusively in New Guinea and 8 are found only in Australia. *Melanotaenia maccullochi* and *M. splendida* are shared by both regions. The status of the various populations and subspecies of *M. splendida* is in need of further study and hopefully future research with the aid of electrophoretic analysis of enzymes will help elucidate the taxonomy of this group.

Because of the large number of species involved and the regional nature of the distribution, separate regional keys are presented below for the Vogelkop-Bomberai Peninsulas, islands off Irian Jaya, northern New Guinea, and southern New Guinea.

Key to the Species of *Melanotaenia* from the Vogelkop and Bomberai Peninsulas

1a. Transverse scale rows 7 or 8. 2

1b. Transverse scale rows 9 to 13 3

2a. Soft rays in second dorsal fin 10 to 14, usually 12 or 13; soft rays in anal fin 17 to 23, usually 18 to 21. ..... *M. boesemani*

2b. Soft rays in second dorsal fin 15 to 19, usually 15 to 17; soft rays in anal fin 21 to 27, usually 22 to 24. ..... *M. ajamaruensis*

3a. Upper and lower edges of caudal fin narrowly black 4

3b. Upper and lower edges of caudal fin not black 5

4a. Second dorsal fin with prominent blackish submarginal stripe... *M. arfakensis*

4b. Second dorsal fin without blackish submarginal stripe ..... *M. irianjaya*

5a. Soft anal rays 26 or 27; body without distinctive marking, midlateral stripe faint or absent ..... *M. fredericki*

5b. Soft anal rays usually 20 to 24 (rarely 19 or 25 to 26); side of body

usually with distinctive midlateral stripe (at least partly developed) 6

6a. Total scales on cheek 14-19 (usually 15-17); maximum standard length about 120 mm. ..... *M. angfa*

6b. Total scales on cheek 9-14 (usually 11 or 12); maximum standard length about 55 mm ..... *M. parva*

Key to the species of *Melanotaenia* from islands off Irian Jaya

1a. Sides without midlateral black stripe; dorsal, anal, and caudal fins often spotted; soft rays in second dorsal fin 9 to 12 (Aru Islands) .... *M. splendida rubrostriata*

1b. Sides with midlateral black stripe; dorsal, anal, and caudal fins not spotted; soft rays in second dorsal fin 11 to 17.....2

2a. Soft anal rays 26 to 28 (Yapen Island) ..... *M. japenensis*

2b. Soft anal rays usually 19 to 25 (rarely 26) 3

3a. Midlateral black stripe about 2 or 3 scales wide just behind base of pectoral fin and is broadly exposed above the pectoral-fin base 4

3b. Midlateral black stripe about 1 scale wide just behind base of pectoral fin and barely visible above the pectoral-fin base (Misool Island)...*M. misoolensis*

4a. Midlateral black stripe distinctive throughout its length and relatively broad (about 3 scales wide) just behind depressed pectoral fins; soft anal rays 19 to 21; cheek scales 12 to 16 (Waigeo Island) ..... *M. catherinae*

4b. Midlateral black stripe usually faint (sometimes absent) and about 2 scales wide just behind depressed pectoral fin; soft anal rays 21 to 26; cheek scales 15 to 25 (Aru Islands) ..... *M. goldiei*

Key to the species of *Melanotaenia* from Northern New Guinea

1a. Upper half of body with 4 broad, longitudinal, dark stripes; second dorsal fin dark brownish with broad white margin; anal fin with longest rays in middle portion giving fin outline a rounded appearance ..... *M. corona*

1b. Upper half of body without broad, longitudinal, dark stripes; second dorsal fin usually pale; anal fin with longest rays posteriorly (males) or anteriorly (females), but not in middle portion...2

2a. Blackish midlateral stripe absent or very faint and narrow (about 1 scale row or less in width); scales in lateral series from above gill opening to caudal fin base 29 to 32; cheek scales 6 to 10; maximum size to about 50 mm SL ..... *M. praecox*

2b. Blackish midlateral stripe present and relatively broad (usually at least 1 1/2 scales in width); scales in lateral series 33 to 40; cheek scales 13 to 35; maximum size from 110-160 mm SL...3

3a. Blackish midlateral stripe continuous from eye to caudal fin base, its width more or less uniform (1 1/2 scales); broad diffuse vertical bar frequently connecting midlateral stripe and ventral region of body between pelvic and anal fin bases; soft rays in second dorsal fin 18 to 21; soft rays in anal fin 21 to 26, usually 24 to 26; cheek scales 23 to 35 ..*M. vanheurni*

3b. Blackish midlateral stripe usually interrupted or very faint anteriorly and expanded on caudal peduncle (to about two scales wide); diffuse vertical bar connecting midlateral stripe and ventral region of body between pelvic and anal fin bases absent, but faint dusky longitudinal stripe sometimes present between midlateral stripe and anal fin base; soft rays in second dorsal fin 13 to 20, usually 14 to 16; soft rays in anal fin 18 to 24, usually 20 to 23; cheek scales 13 to 25 ..... *M. affinis*

Key to the Species of *Melanotaenia* from Southern New Guinea

1a. A broad, solid dark (black or bluish black in life) midlateral stripe running from head to middle of caudal fin base (sometimes interrupted just behind pectoral region); soft rays in second dorsal fin 10 to 19 2

1b. No broad midlateral stripe, stripes if present very thin (except pair of midlateral stripes expanded somewhat in *M. ogilbyi*); soft rays in second dorsal fin 9 to 12 8

2a. Soft rays in second dorsal fin 17 to 19 (usually 18 or 19) 3

2b. Soft rays in second dorsal fin 10 to 17 4

3a. Soft rays in anal fin 24 to 26; total cheek scales 15 to 22 (usually 19 or 20) ..... *M. oktediensis*

3b. Soft rays in anal fin 20 to 24; total cheek scales about 30 to 40 ... *M. iris*

4a. Colour of adults dark brown to blackish (blue or green in life) on upper half and white below; eye large usually exceeding snout length .. *M. lacustris*

4b. Colour not as in 4a; eye smaller, usually about same length or less than snout..... 5

5a. Black midlateral stripe usually very broad (about 2-2 1/2 scales wide) and intensely dark on posterior third of body; 3-3 1/2 horizontal scale rows between stripe and base of first dorsal fin; origin of first dorsal fin about level with anal fin origin... *M. goldiei*

5b. Black midlateral stripe about uniform width (1-1 1/2 scales wide) along its entire length; 4-4 1/2 horizontal scale rows between stripe and base of first dorsal fin; origin of first dorsal fin variable, about equal with or well ahead of anal fin origin.. 6

6a. Body very slender, maximum depth of mature males not exceeding 32% of SL; scales relatively small, the maximum vertical width of widest scale row about equal to vertical width of pupil; about 13 scales between pelvic fin origin and base of first dorsal fin; midlateral stripe usually not intensely dark, very faint on anterior half of body. ... *M. pimaensis*

6b. Body deeper, maximum depth of mature males exceeding 40% of SL (almost always exceeding at least 35% of SL); scales larger, the maximum vertical width of widest scale row significantly greater than vertical width of pupil; about 10-12 (usually 11) scales between pelvic fin origin and base of first dorsal fin; midlateral stripe usually intensely black throughout most of its length, at least in adults 7

7a. Origin of first dorsal fin about one full eye diameter anterior to level of anal fin origin; pale area on lower half of body considerably dusky, this colour imparted by dusky centre of most scales; vomerine teeth relatively large, about same size as largest teeth of upper jaw ..... *M. monticola*

7b. Origin of first dorsal fin either equal with level of anal fin origin or up to 1/2 eye diameter ahead of this point; pale area on lower half of body only slightly dusky, this colour imparted by sprinkling of tiny pepper-like melanophores, most concentrated on edge of scales; vomerine teeth relatively small and inconspicuous, considerably smaller than largest teeth of upper jaw. ..... *M. herbertaxelrodi*

8a. Colour pattern generally pale (whitish grading to greenish brown on upper back) with series of dark stripes or rows of broken spots on sides (or combination of the two); soft anal rays 15 to 17, occasionally 13-14 or 18-19; origin of dorsal fin about 1/2 to one full eye diameter anterior to level of anal fin origin. 9

8b. Colour pattern variable, ranging from uniformly pale to overall reddish brown with series of narrow orange or yellow longitudinal stripes (usually absent in preserved specimens); soft anal rays 18-23, usually 20 or 21; origin of first dorsal about equal to level of anal fin origin or behind this point 12

9a. Intense black streak immediately above pectoral fin base resulting from expansion of anterior part of lower mid-lateral stripe; midlateral pair of stripes, frequently more darkly pigmented than stripes above and below. 10

9b. Intense black streak above pectoral fin base absent; midlateral stripes usually not darker than stripes above and below ..... *M. maccullochi*

10a Stripes on lower portion of body absent or very faint; midlateral stripes frequently fused around the margins of the scales which form the midlateral scale row, resulting in a broad horizontal black band broken only by pale scale centres ..... *M. ogilbyi*

10b. Stripes on lower portion of body usually well developed, at least in adults; mid-lateral pair of stripes not fused together to form broad black band. 11

11a Soft rays in 2nd dorsal fin usually 11 or 12, rarely 10; ground colour of sides uniformly pale with 5-8 narrow black stripes of more or less uniform width and intensity ..... *M. sexlineata*

11b. Soft rays in 2nd dorsal fin usually 9 or 10, occasionally 11 or rarely 12; ground colour of sides noticeably darker (brown) on upper half with series of 5-9 narrow black stripes of which midlateral pair is often broader and/or darker than other stripes. . *M. papuae*

12a Transverse scale rows from anal fin origin to base of first dorsal fin usually 10; median fins bright red orange in life, without spots; relatively slender bodied, maximum depth of mature males not exceeding 40% of SL and that of females generally under 35% of SL ..... *M. parkinsoni*

12b. Transverse scale rows from anal fin origin to base of first dorsal fin usually 11; median fins pinkish to rose coloured in life, usually with some darker spotting particularly near base; relatively deep bodied, maximum depth of mature males regularly exceeding 40% of SL and sometimes 50%, that of females frequently between 35-40% of SL ..... *M. splendida rubrostriata*

North New Guinea Rainbowfish

Melanotaenia affinis
(Weber, 1908)
(Plate 7, no. 1; Photos 17 & 18)

Diagnosis. - Dorsal rays IV to VI-I,13 to 20 (usually 13 to 16); anal rays I,18 to 24; pectoral rays 12 to 15; predorsal scales 14 to 16; cheek scales 13-25; greatest body depth of adult males as % of SL 30.0-37.5; colour olive to brownish on back, silvery white on ventral parts; a blackish midlateral stripe that is interrupted or faint anteriorly and expanded on tail base where it has yellow margins; dorsal and anal fins frequently yellow or orange, especially in males. Maximum size to about 115 mm SL, females to about 100 mm SL. Most specimens under 85 mm SL.

Distribution and Habitat. - New Guinea north of the Central Dividing Range. The distribution extends from the vicinity of Lae, Papua New Guinea, westward into Irian Jaya to at least Nabire. It is the common rainbowfish in the tributary streams of the Markham, Ramu, and Sepik rivers. It occurs in some mountainous headwater streams of the Sepik in the Western Highlands, for example in the Baiyer River Valley.

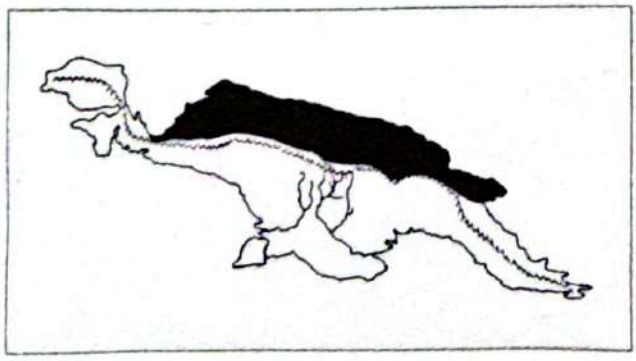


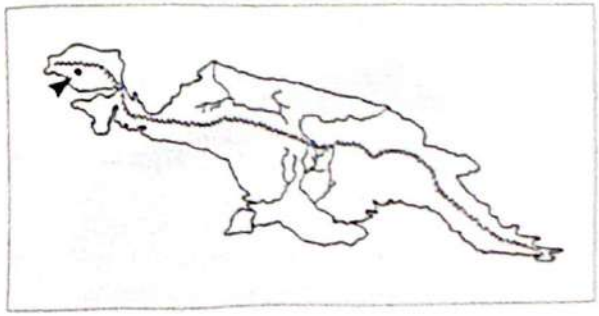
Photo 17 - North New Guinea Rainbowfish, ***Melanotaenia affinis****, 70 mm.*

Ajamaru Lakes Rainbowfish

Melanotaenia ajamaruensis
Allen & Cross, 1980
(Plate 6, no. 8)

Diagnosis. - Dorsal rays IV to VI-I,15 to 19; anal rays I,21 to 27; pectoral rays 13 to 15; transverse scale rows 7 or 8; predorsal scales 13-16; cheek scales 9-16; greatest body depth of adult males as % of SL 36.0-40.1; colour in alcohol generally reddish brown on back and anterior half of body grading to yellow or tan posteriorly; series of reddish brown horizontal stripes on sides. Live colouration unknown. Maximum size to about 85 mm SL.

Distribution and Habitat. - Known only from the Ajamaru Lakes situated near the centre of the Vogelkop Peninsula at the western extremity of Irian Jaya. The lakes have an approximate elevation of 250 m above sea level.

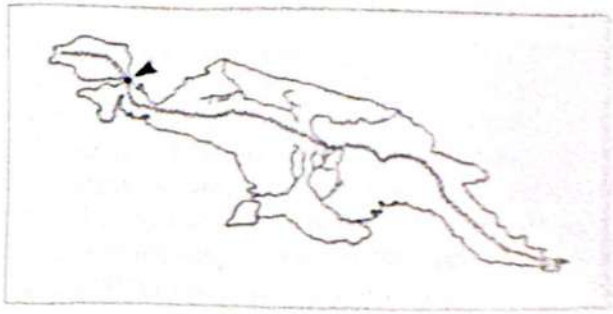


Yakati Rainbowfish

Melanotaenia angfa
Allen, 1990
(Plate 5, no. 2)

Diagnosis. - Dorsal rays IV to VI-I,11 to 15; anal rays I,21. to 26 (usually 22 to 24); pectoral rays 13 to 15; predorsal scales 15-19 (usually 17-18); cheek scales 14-19; greatest body depth of adult males as % of SL 31.5-41.9; colour bright yellow with broken black stripe along middle of side, widest and most intense behind pectoral fin. Maximum size to about 120 mm SL.

Distribution and Habitat. - Known from two tributary streams of the Yakati River in the middle of the narrow isthmus that connects the Vogelkop Peninsula with the remainder of New Guinea. The habitat is in mountainous rainforest terrain at elevations between about 200-400 m.

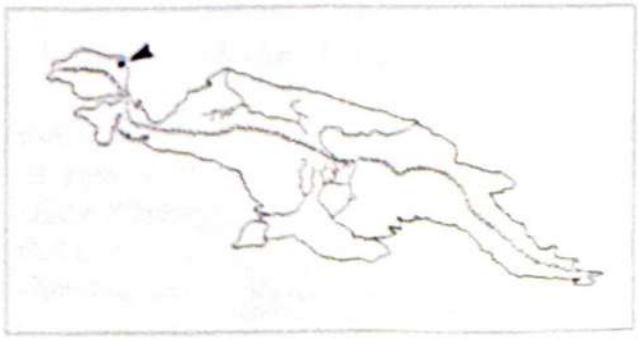


Arfak Rainbowfish

Melanotaenia arfakensis
Allen, 1990
(Plate 5, no. 3)

Diagnosis. - Dorsal rays IV to VI-I,12 to 16; anal rays I,22 to 25; pectoral rays 13 to 15; predorsal scales 15-18; cheek scales 13-17; greatest body depth of adult males as % of SL 34.0-38.7; colour generally pale mauve with blackish midlateral stripe of uniform width; narrow yellow-orange stripes between each longitudinal scale row and base of tail largely yellowish; second dorsal fin with submarginal black stripe and white border; upper and lower edges of caudal fin with black streak. Maximum size to about 80 mm SL.

Distribution and Habitat. - Known only from tributaries of the Prafi River system near Manokwari, Irian Jaya. These streams flow through rainforest and agricultural (mainly oil palm) lands on a flat, alluvial plain



Boeseman's Rainbowfish

Melanotaenia boesemani
Allen & Cross, 1980
(Plate 6, no. 6)

Diagnosis. - Dorsal rays IV to VI-I,10 to 14; anal rays I,17 to 23; pectoral rays 13 to 16; transverse scale rows 7 or 8; predorsal scales 14-16; cheek scales 7-15; greatest body depth of adult males as % of SL 35.6-44.5; colour of adult males blue to blackish on head and anterior part of body and bright orange posteriorly, frequently with alter-nating light and dark bars in middle of body; females and young males less vivid, overall yellowish to pale orange, often bluish on back and upper part of head. Maximum size to about 90 mm SL, females to about 70 mm SL.

Distribution and Habitat. - Known only from the Ajamaru Lakes region near the centre of the Vogelkop Peninsula at the western extremity of Irian Jaya. The lakes are situated at the headwaters of the Ajamaru River which drains into the Kais River, eventually flowing into the Ceram Sea to

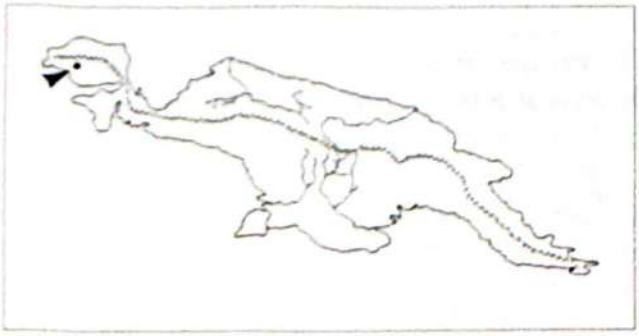


*Photo 18 - North New Guinea Rainbowfish, (Pagwi variety,) **Melanotaenia affinis**, 65mm.*

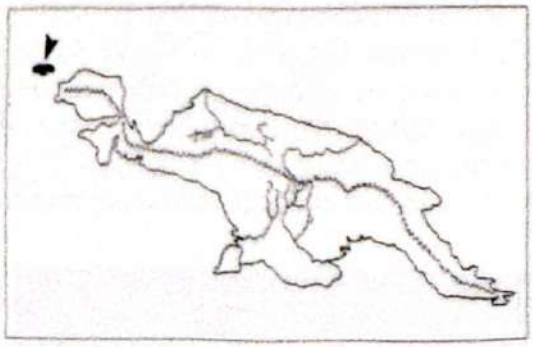
the south. Several specimens have also been collected at Aitinjo Lake, situated about 20 km southeast of the Ajamaru Lakes.

Waigeo Rainbowfish

Melanotaenia catherinae
(de Beaufort, 1910)
(Plate 7, no. 3)

Diagnosis. - Dorsal rays V to VI-I,11 to 13; anal rays I,19 to 21; pectoral rays 12 to 14; predorsal scales 15 or 16; cheek scales 12-16; greatest body depth of adult males as % of SL 32.0-37.3; colour in alcohol generally tan to brownish on upper half of body and whitish on lower half; a broad midlateral stripe from eye to base of caudal fin, fins pale tan to translucent. Live colouration unknown. Maximum size to about 75 mm SL, females to about 65 mm SL.

Distribution and Habitat. - Known only from Waigeo (sometimes spelled Waigeu), a large island lying about 65km to the northwest of the extreme western tip of Irian Jaya. Specimens have been collected at several stream sites including the Rabiai River, the Wai Semie (side branch of the Kaiawat River), and the Wai Meniel.

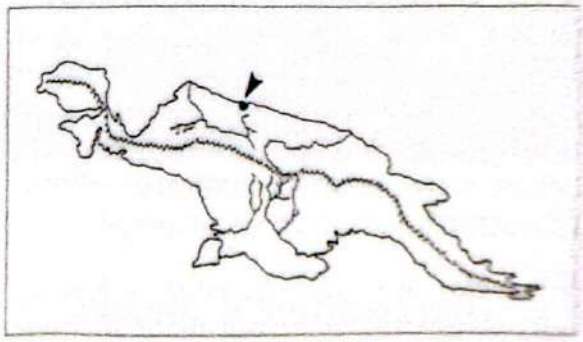


Corona Rainbowfish

Melanotaenia corona
Allen, 1982
(Plate 7, no. 4)

Diagnosis. - Dorsal rays IV-I,13; anal rays I,22; pectoral rays 14 or 15; predorsal scales 15-16; cheek scales 16; greatest body depth of adult males as % of SL 33.0-37.0; longest soft dorsal and anal rays in middle portion of fin; live colouration unknown; colour in alcohol tan with four dark longitudinal stripes on upper half of body; dorsal fins dark brown with distinct white border; anal and caudal fins brownish. Maximum size to about 100 mm SL.

Distribution and Habitat. - Known on the basis of two male specimens collected in 1911 in the Sermowai River of Irian Jaya.

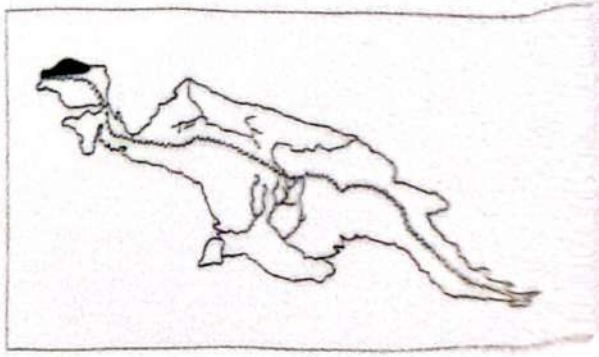


Sorong Rainbowfish

Melanotaenia fredericki
(Fowler, 1939)
(Plate 5, no. 4)

Diagnosis. - Dorsal rays IV to VI-I,13 or 14; anal rays I,25 to 28; pectoral rays 13 to 15; predorsal scales 15-18; cheek scales 11-15; greatest body depth of adult males as % of SL 35.9-36.1; colour generally pale bluish, often with indication of dark midlateral stripe; frequently with yellowish hue on sides. Maximum size to about 90 mm SL.

Distribution and Habitat. - Known from the Samson River system and streams near Sorong on the western portion of the Vogelkop Peninsula, Irian Jaya.



Goldie River Rainbowfish

Melanotaenia goldiei
(Macleay, 1883)
(Plate 6, no. 1)

Diagnosis. - Dorsal rays V or VI-I,12 to 17; anal rays I,21 to 26; pectoral rays 12 to 15; predorsal scales 15-18; cheek scales 15-25; greatest body depth of adult males as % of SL 29.9-38.3; colour brownish with coppery sheen on back; whitish on ventral parts; a blackish to blue midlateral stripe, usually interrupted behind pectoral region and widest on tail base; dorsal and anal fins creamy yellow. Maximum size to about 115 mm SL; females to about 100 mm SL.

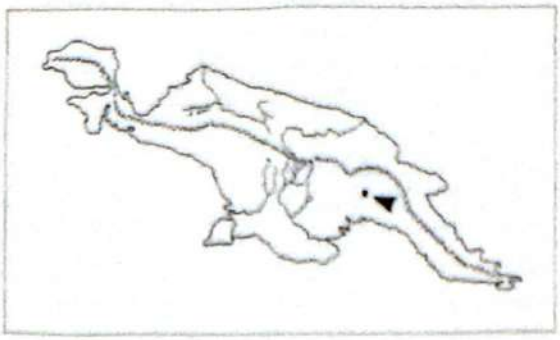
Distribution and Habitat. - It occurs south of the Central Dividing Range from the Port Moresby district westward to at least as far as the Etna Bay district of Irian Jaya. It is also found at the Aru Islands. *Melanotaenia goldiei* is one of the most broadly distributed rainbowfishes in New Guinea and occurs in a variety of habitats including swamps, backwaters, tributary streams, and larger rivers.

Lake Tebera Rainbowfish

Melanotaenia herbertaxelrodi
Allen, 1980
(Plate 6, no. 3)

Diagnosis. - Dorsal rays IV to VI-I,10 to 16; anal rays I,17 to 25; pectoral rays 13 to 15; predorsal scales 14 - 17; cheek scales 11-16; greatest body depth of adult males as % of SL 32.7-42.6; colour largely yellow (sometimes greenish on back) with bluish-black midlateral stripe; dorsal, anal, and caudal fins yellow to red. Maximum size to about 85-90 mm SL.

Distribution and Habitat. - Known mainly from the Lake Tebera basin in the Southern Highlands of Papua New Guinea. It has been collected from the main lake and at a site on a small feeder stream about 4 km east of the lake. The lake and stream are at an elevation of approximately 793 m, and the basin is surrounded by steep mountains which rise to approximately 1200-1500 m. A single specimen has also been collected at Karamui, about 38 km north of the lake.

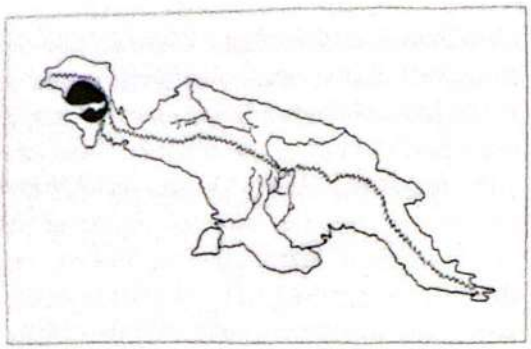


Irian Jaya Rainbowfish

Melanotaenia irianjaya
Allen, 1985
(Plate 6, no. 9)

Diagnosis. - Dorsal rays IV to VI-I,12 to 16; anal rays I,21 to 26; pectoral rays 13 to 15; predorsal scales 15-19; cheek scales 11-17; greatest body depth of adult males as % of SL 31.5-41.0; longest rays of second dorsal and anal fins in middle portion giving these fins a rounded outline; colour pale mauve with blackish midlateral stripe that may be considerably expanded on posteriormost part of body; dorsal and anal fins dark with narrow pink to reddish margin; upper and lower edges of caudal fin with black streak. Maximum size to about 85 mm SL.

Distribution and Habitat. - Widely distributed in southerly flowing river systems of the Vogelkop Peninsula, Irian Jaya. It also occurs on the Bomberai Peninsula immediately to the south. It has been collected from the Djarua River system of the Bomberai Peninsula and the following Vogelkop drainages: Karabra-Kladuk, Kamundan, Timoforo, and Bintuni. It inhabits rainforest creeks and small rivers.

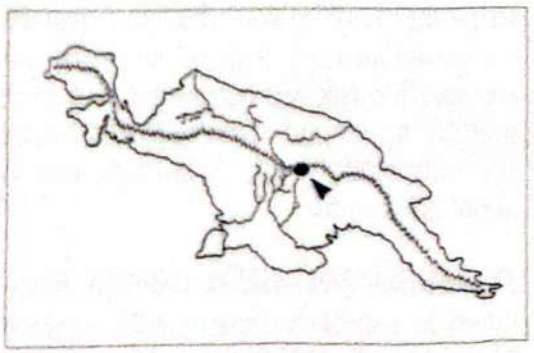


Strickland Rainbowfish

Melanotaenia iris
Allen, 1987
(Plate 5, no. 5)

Diagnosis. - Dorsal rays IV or V-I,17 to 19; anal rays I,21 to 24; pectoral rays 14 or 15; predorsal scales 16-17; cheek scales about 30-40; greatest body depth of adult males as % of SL 30.5-34.3; colour brown on back, whitish on lower parts with vivid blue stripe on side of snout and upper portion of operculum, becoming broader behind pectoral fin base and extending along middle of side to caudal fin base; red-orange stripes between each longitudinal scale row. Maximum size to about 100 mm SL.

Distribution and Habitat. - Known only from five specimens collected with hand lines in 1984 from the Logatyu River, a mountain tributary of the Strickland River near Wankipe, Papua New Guinea. This locality is at an elevation of about 1200 m and is approximately 850 km upstream from the sea.

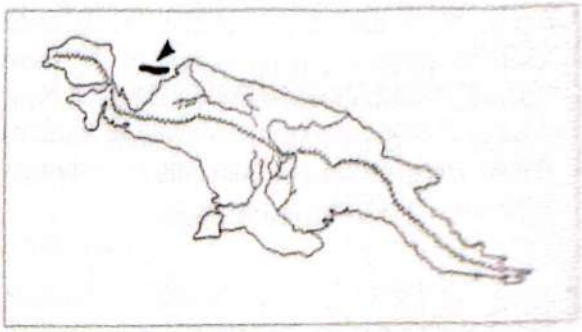


Yapen Rainbowfish

Melanotaenia japenensis
Allen & Cross, 1980
(Plate 7, no. 8)

Diagnosis. - Dorsal rays IV or V-I,15 to 17; anal rays I,26 to 28; pectoral rays 13; predorsal scales 16 or 17; cheek scales 2123; greatest body depth of adult males as % of SL 37.9; upper side with broad bluish stripes corresponding with each longitudinal scale row, with a narrow orange stripe between them; midlateral blue stripe more intense than others; ventral half of head and body whitish. Maximum size to at least 77 mm SL.

Distribution and Habitat. - Known only from streams on Yapen (also spelled Japen) Island, Irian Jaya. Yapen is a long (approximately 160 km), narrow island situated in the Sarera Gulf of northern Irian Jaya. The island represents a continuation of a coastal mountain chain found on the nearby (30 km distance) mainland of Irian Jaya and has a maximum elevation of about 1500m.

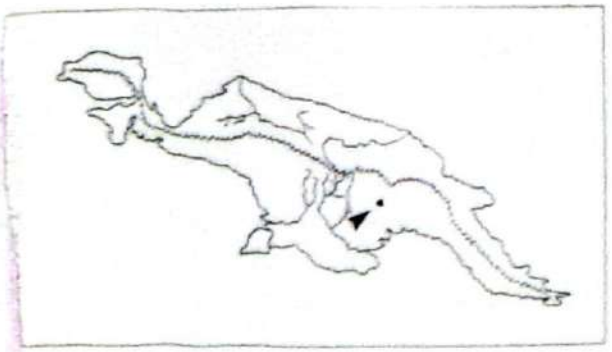


Lake Kutubu Rainbowfish

Melanotaenia lacustris
Munro, 1964
(Plate 6, no. 4)

Diagnosis. - Dorsal rays IV to VI-I,11 to 14; anal rays I,17 to 21; pectoral rays 14 to 16; predorsal scales 15 or 16; cheek scales 14-17; greatest body depth of males as % of SL 33.3-46.9; colour greenish to brilliant turquoise on upper half grading to whitish below. Maximum size to about 100mm SL.

Distribution and Habitat. - Known only from Lake Kutubu and its outlet, the Soro River, in the Kikori River drainage of the Southern Highlands of Papua New Guinea. The lake is situated about 220 km upstream from the Gulf of Papua.

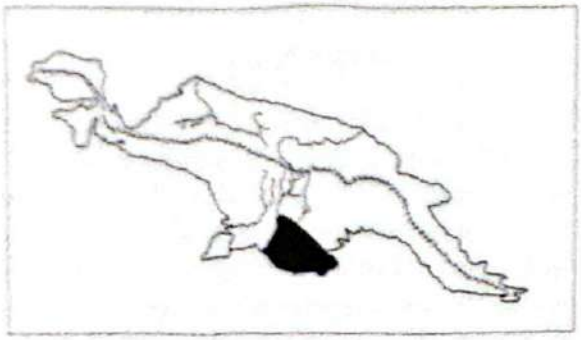


Macculloch's Rainbowfish

Melanotaenia macculloch
Ogilby, 1915
(Plate 5, no. 6)

Diagnosis. - Dorsal rays IV to VII-I,7 to 12; anal rays I,13 to 19; pectoral rays 11 to 14; predorsal scales 14-18; cheek scales 9-14; greatest body depth of adult males as % of SL 30.3-37.8; silvery white, often with yellowish tinge; about 6-8 narrow, reddish-brown stripes on side, generally more prominent on males; dorsal and anal fins of males with broad, brownish submarginal stripe, these markings absent or faint in females. Maximum size to 60 mm SL.

Distribution and Habitat. - Central-southern New Guinea and north-eastern Australia. The known New Guinean distribution encompasses the lower and middle sections of the Fly River westward to the Bensbach River. It generally inhabits l owland swamps and small streams, usually in clear, acidic waters with ample cover in the form of log debris or aquatic vegetation.

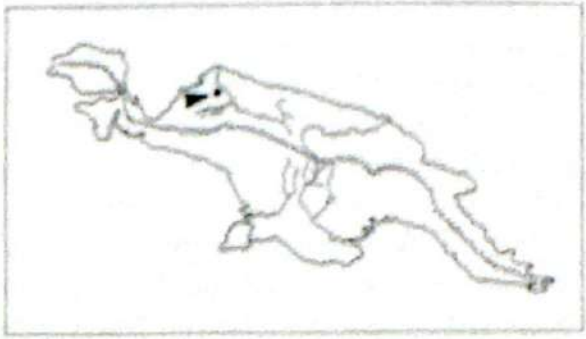


Mayland's Rainbowfish

Melanotaenia maylandi
Allen, 1982
(Plate 7, no. 5)

Diagnosis. - Dorsal rays IV to VI-I,16 to 21 (usually 18 or 19); anal rays I,24 to 29 (usually 25 to 27); pectoral rays 13 to 15; predorsal scales 13-15; cheek scales 16-23; greatest body depth of adult males as % of SL 34.2-37.3; colour olive green or brownish on back, silvery white on lower sides; upper back and sides often reflecting bluish hues; narrow orange stripes on side between each longitudinal scale row; a distinct midlateral black stripe with 3-5 large blotches on middle of sides. Maximum size to about 90 mm SL.

Distribution and Habitat. - Known only from a small creek about 2-3 km from Danau Bira (Lake Holmes), Irian Jaya. This locality is in hilly terrain at an elevation of about 450 m and is part of the Lower Mamberamo River system.

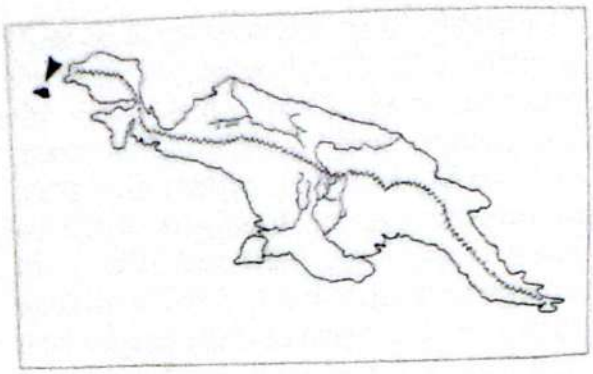


Misool Rainbowfish

Melanotaenia misoolensis
Allen, 1982
(Plate 7, no. 7)

Diagnosis. - Dorsal rays IV to VI-I,12 to 14; anal rays I,20 to 25; pectoral rays 13 to 16 (usually 13 or 14); predorsal scales 13-17; cheek scales 11-15; greatest body depth of males as % of SL 32.6-35.0; live colouration unknown; colour in alcohol light brown on back, yellowish tan on ventral half; a brown midlateral stripe, slightly more than one scale wide at its broadest point; fins pale tan. Maximum size to at least 60 mm SL.

Distribution and Habitat. - Known on the basis of 23 specimens collected in 1948 from a tributary of the Tama River at Fakal, Misool Island.

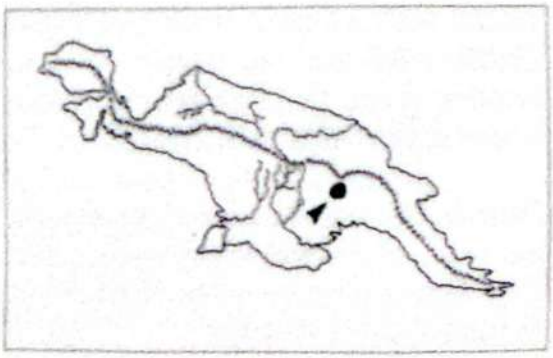


Mountain Rainbowfish

Melanotaenia monticola
Allen, 1980
(Plate 6, no. 2)

Diagnosis. - Dorsal rays IV or V-I,15 to 17; anal rays I,18 to 21; pectoral rays 13 to 16; predorsal scales 13-16; cheek scales 12-17; greatest body depth of adult males as % of SL 34.0-41.2; colour brown to greenish on back, yellowish to mauve on side grading to whitish ventrally; a distinct black midlateral stripe of more or less uniform width (although gradually becoming wider posteriorly). Maximum size to about 80 mm SL.

Distribution and Habitat. - Known from a relatively small area of the Southern Highlands of Papua New Guinea between Mendi and Lake Kutubu. It has been collected from small headwater tributaries in the Purari River system, including Omei Creek, 15 km south of Mendi, and streams near Pimaga (about 13 km southeast of Lake Kutubu). It has been found at higher elevations than any other rainbowfish (between 790-1600 m elevation).

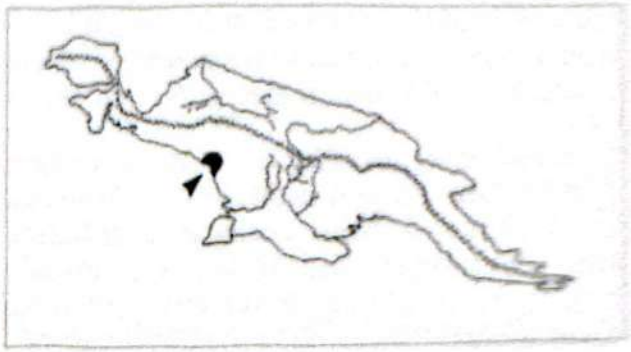


Ogilby's Rainbowfish

Melanotaenia ogilbyi
Weber, 1910
(Plate 5, no. 10)

Diagnosis. - Dorsal rays V or VI-I,11; anal rays I,17 or 18; pectoral rays 12 or 13; predorsal scales 15 or 16; cheek scales 11-15; greatest body depth of adult males as % of SL 32.7-38.0; live colouration unknown; colour in alcohol generally pale yellow or tan, brownish on back; a pair of black midlateral stripes on sides or these stripes expanded to form a single broad band; 3-4 faint stripes (one per scale row) above and below midlateral pair; fins pale to slightly dusky, sometimes with row of black spots on basal portion of dorsal and anal. Maximum size to about 65-70 mm SL.

Distribution and Habitat. - Known only on the basis of seven specimens collected in 1907 in the Lower Lorentz River.



Oktedi Rainbowfish

Melanotaenia oktediensis
Allen & Cross, 1980
(Plate 6, no. 7)

Diagnosis. - Dorsal rays V or VI-I,18 or 19; anal rays I,24 to 26; pectoral rays 14 or 15; predorsal scales 13-15; cheek scales 15-22; greatest body depth of adult males as % of SL 31.9-38.9; colour coppery brown on back, pale mauve to white on lower half with black midlateral stripe. Maximum size to about 100 mm SL.

Distribution and Habitat. - Known only from the Ok Tedi River and its tributaries in the Upper Fly River system of southern Papua New Guinea. Most specimens have been collected from creeks near Tabubil

*Photo 19 - Papuan Rainbowfish, **Melanotaenia papuae**, 60mm SL.*

approximately 900-950 km upstream from the sea in mountainous terrain between 300-500 m elevation.

Papuan Rainbowfish

Melanotaenia papuae
Allen, 1981
(Plate 5, no. 8; Photo 19)

Diagnosis. - Dorsal rays IV to VI-I,9 to 12; anal rays I,14 to 18; pectoral rays 12 to 14; predorsal scales 13-16; cheek scales 9-12; greatest body depth of adult males as % of SL 32.7-35.2; colour olive on back with yellowish hue grading to whitish on ventral parts; a series of black stripes (one per scale row) on sides. Maximum size to about 65 mm SL; females to about 60 mm SL.

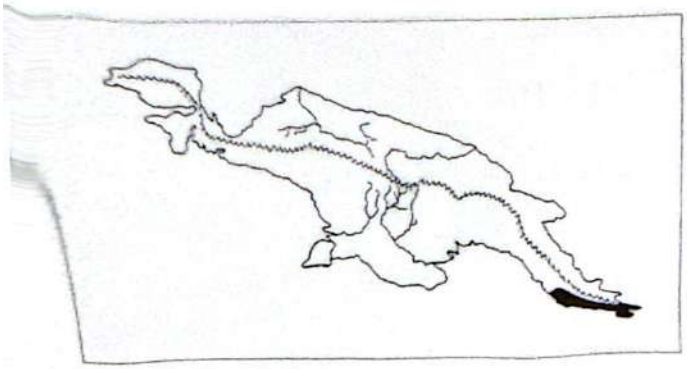
Distribution and Habitat. - Vicinity of Port Moresby, Papua New Guinea. It has been taken from numerous streams within a 35 km radius of Port Moresby. The habitat consists mainly of small rainforest creeks.

Parkinson's Rainbow

Melanotaenia parkinsoni
Allen, 1980
(Plate 5, no. 9)

Diagnosis. - Dorsal rays V or VI-I,9 to 12; anal rays I,18 to 23; pectoral rays 13 to 15; predorsal scales 14-18; cheek scales 9-12; greatest body depth of adult males as % of SL 30.5-39.0; colour olive to brownish on back, silvery on sides with orange stripe between each scale row; dorsal, anal, caudal, and pelvic fins of males largely orange. Maximum size to about 110 mm SL; females to about 90 mm SL.

Distribution and Habitat. - Apparently widespread along the southern coast of eastern Papua New Guinea between the Kemp Welsh River and Milne Bay. However, it has been found at only a few widely scattered sites within this area. The primary habitat consists of rainforest streams in lowland areas.

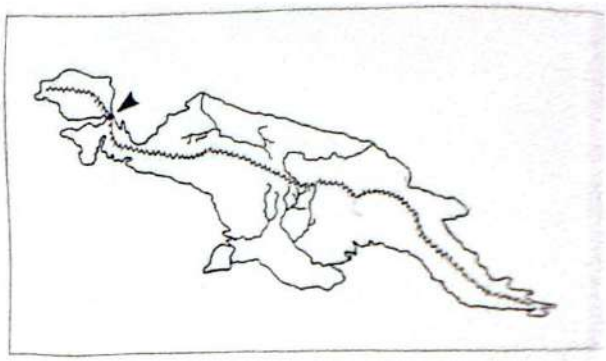


Lake Kurumoi Rainbowfish

Melanotaenia parva
Allen, 1990
(Photo 20)

Diagnosis. - Dorsal rays V or VI-I,11 to 14; anal rays I,19 to 24; pectoral rays 13 or 14; predorsal scales 15-17; cheek scales 9-14; greatest body depth of adult males as % of SL 34.0-38.7; colour variable ranging from overall bluish or pale mauve to reddish with or without black midlateral stripe (sometimes evident only on anterior half); usually narrow reddish or orange stripes between each scale row; fins reddish. Maximum size to about 55 mm SL, common to 45 mm SL.

Distribution and Habitat. - Known only from Lake Kurumoi in the middle of the narrow isthmus that connects the Vogelkop Peninsula with the remainder of New Guinea. The lake is within the Yakati River watershed, but is presently well below the level of its natural outlet and there is no visible drainage. It is in mountainous terrain at an elevation of approximately 400 m.



Pima River Rainbowfish

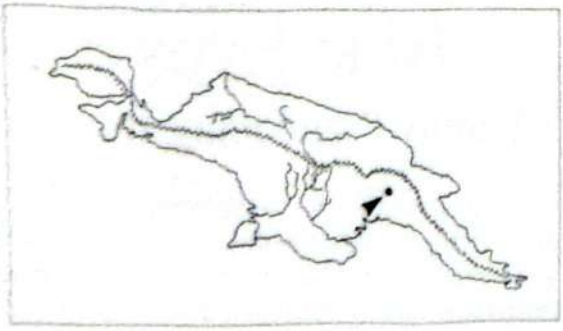
Melanotaenia pimanensis
Allen, 1980
(Plate 6, no. 5)

Diagnosis. - Dorsal rays IV to VI-I,12 to 17; anal rays I,20 to 24; pectoral rays 13 to 16; predorsal scales 14-16; cheek scales 16-22; greatest body depth of adult males as % of SL 28.6-31.6; colour olive or brownish on back grading to pale bluish or silvery white on lower parts; narrow yellow stripes between longitudinal scale rows and a black midlateral stripe from eye to caudal fin base; dorsal and anal fins yellowish. Maximum size to about 70 mm SL, but most specimens under 60 mm SL.

Distribution and Habitat. - Known only from the Pima River at the junction with the Tua River in the Southern Highlands of Papua New Guinea. The Pima and Tua rivers are headwater streams of the Purari River, one of the major watercourses flowing into the Gulf of Papua. The species

*Photo 20. Lake Kurumoi Rainbowfish, **Melanotaenia parva**, 42 mm SL.*

is known on the basis of approximately 70 specimens collected by the author during a helicopter visit to the site in September 1980. The stream is located in mountainous terrain (elevation 823 m) in a relatively broad (about one km in width) valley.



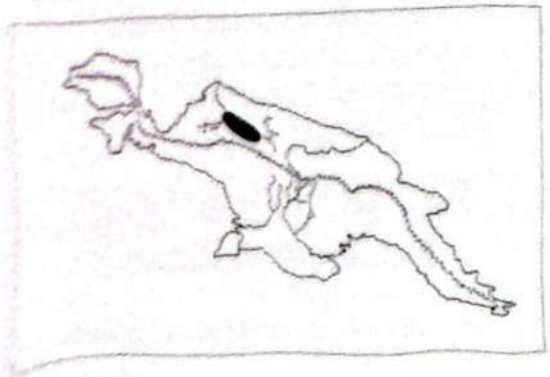
Dwarf Rainbowfish

Melanotaenia praecox
(Weber & de Beaufort, 1922)
(Plate 7, no. 9)

Diagnosis. - Dorsal rays IV to VI-I,10 to 14; anal rays I,16 to 21; pectoral rays 11 to 13; predorsal scales 13-15; cheek scales 6-10; greatest body depth of males as % of SL 38.2-44.0; live colouration unknown; colour in alcohol generally brown on upper half of body and whitish or tan on lower half; fins translucent or slightly darker. Maximum size to about 50 mm SL, but most specimens under 40 mm SL.

Distribution and Habitat. - Middle portion of Mamberamo River, northern Irian Jaya. Known only on the basis of 31 specimens collected in 1920 at Pioniersbivak.

Remarks. - This species develops a very deep body, particularly in males, at a remarkably small size (30-35 mm SL).

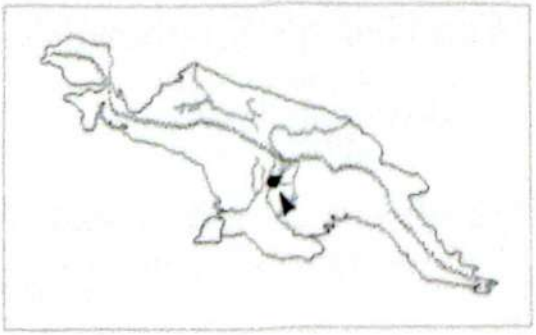


Fly River Rainbowfish

Melanotaenia sexlineata
(Munro, 1964)
(Plate 5, no. 11)

Diagnosis. - Dorsal rays V to VII-I,10 to 12; anal rays I,16 to 19; pectoral rays 13 to 14; predorsal scales 14-17; cheek scales 11-14; greatest body depth of adult males as % of SL 33.7-40.0; colour golden yellow with narrow blackish stripes between each scale row on sides; an intense black mark behind upper pectoral fin base; dorsal, anal, and caudal fins yellowish. Maximum size to about 65 mm SL.

Distribution and Habitat. - Known only from a few sites in the upper Fly River system near Kiunga. It generally inhabits small rainforest creeks.



Red-Striped Rainbowfish

Melanotaenia splendida rubrostriata
(Ramsay & Ogilby, 1886)
(Plate 5, no. 7)

Diagnosis. - Dorsal rays V to VII-I,9 to 12; anal rays I,18 to 23; pectoral rays 13 to 15; predorsal scales 15-18; cheek scales 9-17; greatest body depth of adult males as % of SL 35.3-53.6; colour silvery with series of pinkish-orange longitudinal stripes on sides, more vivid in males; fins reddish to orange with pale spots. Maximum size to about 125 mm SL; females to about 100mm SL. Most specimens under 90-100 mm SL.

Distribution and Habitat. - New Guinea south of the Central Dividing Range. The exact limits of the distribution are uncertain, but it has been recorded from a number of localities between the Aramia River (near the Fly River) of Papua New Guinea and

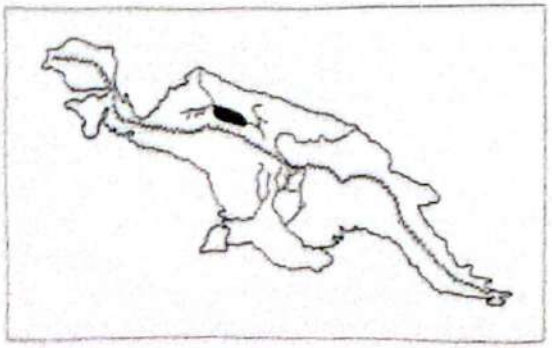
Etna Bay, central Irian Jaya. It is also found at the Aru Islands in the Arafura Sea and at Daru Island near the Torres Strait.

Remarks. - This subspecies is closely related to *M. splendida inornata* of northern Australia, differing from it primarily in colour. In addition, the New Guinea subspecies tends to reach a larger size and is generally deeper bodied.

Van Heurn's Rainbowfish

Melanotaenia vanheurni
(Weber & de Beaufort, 1922)
(Plate 7, no. 6)

Diagnosis. - Dorsal rays IV to VI-I,18 to 28; anal rays I,21 to 26; pectoral rays 13 to 15; predorsal scales 13-18; cheek scales 23-35; greatest body depth of males as % of SL 30.8-40.4; live colouration unknown; colour in alcohol generally tannish or white, darker on dorsal portion of back; blackish midlateral stripe from eye to middle of caudal fin base; a broad, diffuse dusky bar frequently present between midlateral stripe and pelvic fins; fins pale to dusky. Maximum size to about 160 mm SL; females to about 100 mm SL. This is the largest species of rainbowfish, although aquarium reared individuals of some other *Melanotaenia* species may occasionally approach the maximum size for *vanheurni*



Distribution and Habitat. - Known thus far only from the Idenburg (now the Taritatu) River and Doorman River (a tributary of the Idenburg), northern Irian Jaya.

Blue-Eyes

Family Pseudomugilidae

Blue-eyes are tiny fishes that occur in fresh, brackish, and rarely in marine waters of southern New Guinea and several adjacent islands as well as eastern and northern Australia. The family contains 15 species in two genera. They are close relatives of the melanotaeniid rainbowfishes and, were formerly included in that group. However, a recent study (Saeed, Ivantsoff, and Allen, 1989) indicated they are sufficiently distinct to merit separate familial recognition. They have a delicate appearance, lack rigid fin spines, have a small mouth with conical to caniniform teeth that may or may not extend onto the lips outside of the mouth, and usually have a blue iris, hence the common name blue-eyes. They generally form schools that sometimes include hundreds of individuals. Spawning in New Guinea occurs the year round. Males may engage in spectacular courtship displays, swimming rapidly back and forth in front of the females with vigorous fluttering of the pectoral fins and repeated erections of the dorsal, anal, and pelvic fins. Spawning occurs amongst aquatic vegetation or the submerged root fibers of terrestrial plants. The female deposits 4-9 eggs per day, which adhere to the plants. Hatching occurs after an incubation period of 2-3 weeks. The young grow quickly and sexual maturity is attained during the first year. The diet of blue-eyes consists mainly of microcrustaceans and the aquatic larvae of terrestrial and aquatic insects. Blue-eyes are highly recommended as aquarium fishes because of their small size, colourful patterns, and peaceful disposition.

Key to the genera of Pseudomugilidae

1a. First dorsal fin inconspicuous without

magnification, with 2-3 scarcely developed spines; second dorsal fin rays 13-16; keel-like structure between pelvic and anal fins present...*Kiunga*

1b. First dorsal fin conspicuous without magnification, with 3-8 flexible spines; second dorsal fin rays 3-12; no keel-like structure between pelvic and anal fins. .....*Pseudomugil*

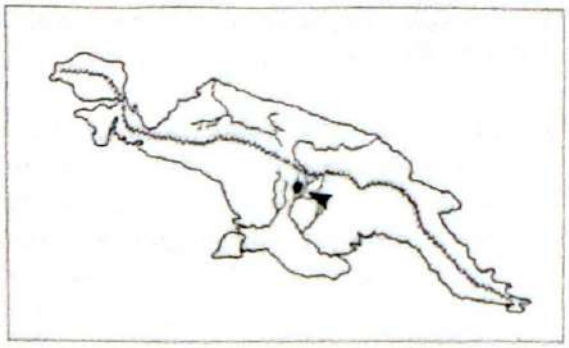
Genus *Kiunga*
Allen, 1983

The genus contains a single species, *K. ballochi* of the upper Fly River system.

Glass Blue-Eye
Kiunga ballochi
Allen, 1983
(Plate 9, no. 13)

Diagnosis. - Dorsal rays II or III-13 to 16; anal rays I,15 to 17; pectoral rays 11 or 12; vertical scale rows from upper pectoral base to caudal fin base 28 or 29; predorsal scales 12-17; cheek scales 2-3; gill rakers 1 or 2 + 7 or 8 = 8 to 10; a sharp, keel-like structure between the pelvic and anal fin origins; premaxilla non-protrusible; thorny teeth in jaws that form prominent symphysial patches on the outside of the upper and lower jaws; generally semi-transparent with dark pigmentation along scale margins; first dorsal, pelvics and anterior half of anal fin yellow; second dorsal fin with yellow stripe along base; second dorsal, caudal, and anal fins with prominent black marginal band and yellow submarginal band; iris blue. Maximum size to about 30 mm SL.

Distribution and Habitat. - Known only from a few small creeks along a 15-20 km stretch of the Ok Tedi Mine supply road between Kiunga and Tabubil, approximately 50 km north of Kiunga. This locality is part of the Upper Fly River system, being situated about 870 km upstream from the sea. The habitat consists of narrow, clear creeks flowing through rainforest in generally flat terrain.



Genus *Pseudomugil*,
Kner 1865

This genus contains 13 species in two subgenera; all except three Australian species occur in southern and eastern New Guinea and at several nearby islands including Batanta, Misool, and the Aru Islands. The subgenus *Popondichthys* was originally described as *Popondetta*, but this name is preoccupied by a genus of beetles. Allen (1987) introduced *Popondichthys* as a substitute name.

Key to the New Guinea Species of *Pseudomugil*

1a. Total anal fin rays 10-15; anal fin usually originates on posterior half of body (excluding caudal fin) (subgenus *Pseudomugil*).....2

1b. Total anal fin rays usually 16-20; anal fin originates on anterior half of body (excluding caudal fin) (subgenus *Popondichthys*).....3

2a. Segmented rays in second dorsal fin usually 10 to 12; dorsal and ventral margins of caudal fin without black border .....*P. connieae*

2b. Segmented rays in second dorsal fin usually 7 to 9; dorsal and ventral margins of caudal fin with black border .....*P. furcatus*

3a. Dorsal, anal, and caudal fins with small black spots, at least in males (Fig. 16) 4

3b. Dorsal, anal, and caudal fins plain, without spots 5

4a. Body with small black spots arranged in longitudinal rows; first dorsal fin of males (Fig. 16B) with short filamentous extension, usually its length shorter than height of main section of fin; posterior outline of second dorsal and anal fins rounded ...*P. gertrudae*

4b. Body without black spots; first dorsal fin of males (Fig. 16A) with long filamentous extension, its length greatly exceeds height of main section of fin; posterior outline of second dorsal and anal fins pointed, at least in adult males .....*P. paskai*

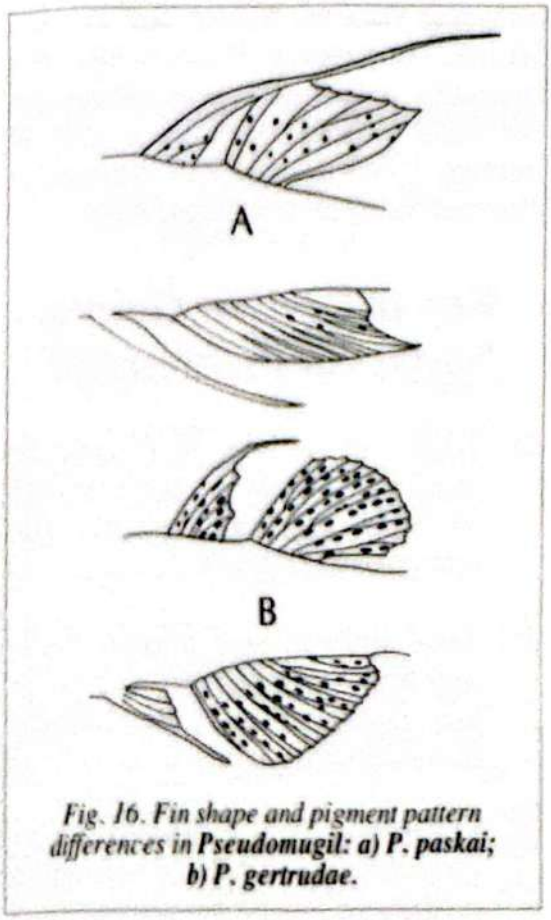


Fig. 16. Fin shape and pigment pattern differences in ***Pseudomugil: a) P. paskai; b) P. gertrudae.***

5a. Gape of jaws wide, unrestricted, with 60 or more teeth on each side of upper jaw .....*P. novaeguineae*

5b. Gape of jaws narrow, rather restricted, with less than about 30 teeth on each side of upper jaw 6

6a. Origin of first dorsal fin generally behind vertical through tips of depressed pelvic fins; origin of second dorsal fin over last few anal rays ...7

6b. Origin of first dorsal fin in front of vertical through tips of depressed pelvic fins; origin of second dorsal fin well in front of last few anal rays 8

7a. Greatest body depth 4.4-5.6 in SL; premaxillary bone with accessory lateral process (Fig. 17); marine and brackish mangrove habitats ....*P. inconspicuus*

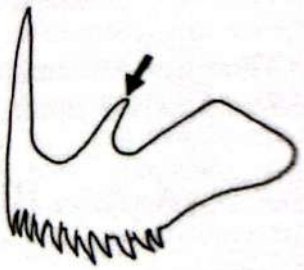


Fig. 17. Premaxillary bone of ***Pseudomugil inconspicuus*** *with accessory lateral process indicated with arrow*

7b. Greatest body depth 3.7-4.5 in SL; premaxillary bone without accessory lateral process; freshwater habitats ... .*P. paludicola*

8a. Second dorsal spine of males forming elongated filament; gill rakers on lower limb of first arch 14; marine or brackish mangrove habitats .....*P. majusculus*

8b. Second dorsal spine of males not forming elongated filament; gill rakers on lower limb of first arch 7-10; freshwater habitats 9

9a. Spine at front of anal fin present, total anal fin rays 13; midlateral row of pearly spots absent .....*P. reticulatus*

9b. Spine at front of anal fin absent, total anal fin rays 7-10; midlateral row of pearly spots present in life...*P. tenellus*

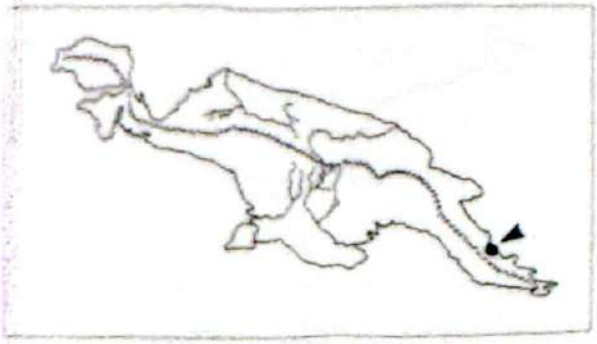
Popondetta Blue-Eye

Pseudomugil (Popondichthys) connieae
(Allen, 1981)
(Plate 9, no. 1)

Diagnosis. - Dorsal rays V to VIII-10 to 12; anal rays I,16 to 19; pectoral rays 10

12; midlateral scales 29-31; transverse scale rows 6-7; predorsal scales 11-13; gill rakers on lower limb of first arch 9-13; sensory pores of interorbital region well developed and conspicuous; a large scale covering much of interorbital; first dorsal fin of adult males elongate and filamentous; grey to olive on back, whitish or semi-transparent on lower sides; blackish stripe in middle of dorsal fins and broader, more diffuse submarginal dark stripe on anal fin; outer half of dorsal fins and dorsal and ventral margins of caudal often yellowish; middle caudal rays dusky to blackish; outer edge of anal fin and upper edge of pectorals white; pelvic fins white to dusky black. Maximum size to about 50 mm SL, females to about 40 mm SL.

Distribution and Habitat. - All known specimens are from an area within about a 50 km radius of Popondetta in eastern Papua New Guinea. The species is generally found in clear, moderate to fairly rapid-flowing streams in both shaded rainforest or sunlit, exposed sections. The altitudinal range is from about 30-300 m.



Forktail Blue-Eye

Pseudomugil (Popondichthys) furcatus
Nichols, 1955
(Plate 9, no. 2)

Diagnosis. - Dorsal rays IV to VII-7 to 9; anal rays I,15 to 18; pectoral rays 10 to 12; midlateral scales 27-31; transverse scale rows 5-6; predorsal scales 10-12; gill rakers on lower limb of first arch 9-12; sensory pores of interorbital region well developed and conspicuous; a large scale covering much of interorbital; first dorsal fin of adult males elongate and filamentous; has similar colour to *P. connieae* (above) except black stripes are missing on dorsal and anal fins, margin of anal fin is yellow rather than white, pelvics are yellow rather than dusky or whitish, upper edge of pectoral is yellow rather than white, and the upper and lower edges of the caudal fin are narrowly black. Maximum size to about 50 mm SL, females to 40 mm SL.

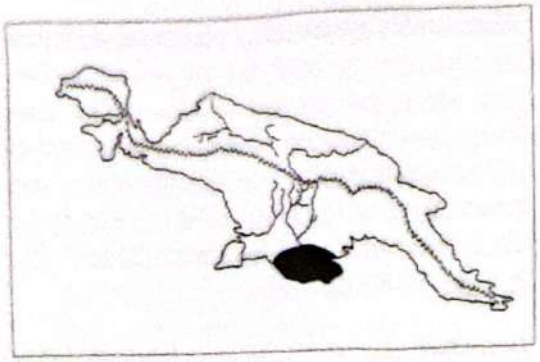
Distribution and Habitat. - Known from lowlands of eastern Papua New Guinea between Dyke Ackland Bay and Collingwood Bay. It is abundant near Safia in clear rainforest streams with thick vegetative cover.

Spotted Blue-Eye

Pseudomugil gertrudae
Weber, 1911
(Plate 9, no. 4)

Diagnosis. - Dorsal rays IV to VI-6 to 8; anal rays I,9 to 12; pectoral rays 10 to 12; midlateral scales 25-28; transverse scale rows 6-7; predorsal scales 9-13; gill rakers on lower limb of first arch 9-12; first dorsal fin of males (Fig. 16B) with short filamentous extension; posterior outline of dorsal and anal fins more or less rounded (Fig. 16B); overall whitish, sometimes with golden sheen; body and median fins (Fig. 16B) with numerous small black spots; upper edge of pectoral fins white. Maximum size to about 30 mm SL.

Distribution and Habitat. - Southern New Guinea, Aru Islands and northern Australia. Collection sites include the Pahoturi, Lower Fly, and Bensbach rivers of south-western Papua New Guinea. It is probably more widespread, particularly in drainages to the west of this area. The habitat consists of swamps and the vegetated margins of streams and lakes.



Misool Blue-Eye

"Pseudomugil" helodes
Ivantsoff & Allen, 1984
(Plate 9, no. 8)

Diagnosis. - Dorsal rays III to V-6 to 8; anal rays I,11 to 13; midlateral scales 28-30; transverse scale rows 5-6; predorsal scales 11-13; gill rakers on lower limb of first arch 16-18; live colouration unknown, but probably semi-transparent with narrow dark scale outlines. Maximum size to 30 mm SL.

Distribution and Habitat. - Known only from the islands of Misool and Batanta off the western extremity of Irian Jaya. It inhabits coastal mangrove swamps in salt water.

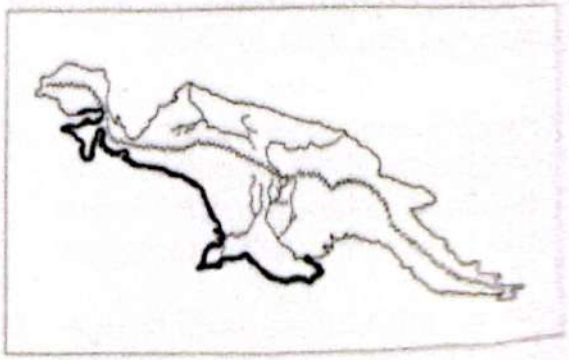
Remarks. - Recent investigations by Basim Saeed indicate that this species should be removed from the Pseudomugilidae and placed in the family Telmatherinidae (Celebes Rainbowfishes). For this reason and the fact that it is known only from salt water, it is excluded from the key to species. It is treated here as a *Pseudomugil* only as a matter of convenience. It will eventually be placed in a new genus.

Inconspicuous Blue-Eye

Pseudomugil inconspicuus
Roberts, 1978
(Plate 9, no. 7)

Diagnosis. - Dorsal rays III or IV-5 or 6; anal rays I,10 to 12; pectoral rays 11 or 12; midlateral scales 26-28; transverse scale rows 5; predorsal scales 14-17; gill rakers on lower limb of first arch 10-12; premaxillary bone with accessory lateral process (Fig. 17); generally semi-transparent, median fins, particularly caudal, sometimes pale yellow. Maximum size to about 30 mm SL.

Distribution and Habitat. - Known from only a few scattered localities in southern New Guinea and northern Australia, but probably widespread over this region in brackish mangrove creeks. Collecting sites include the lower Fly River, Bristow Island near Daru, and creeks draining into Bintuni Bay, Vogelkop Peninsula. It occurs in huge schools, often in highly turbid waters.

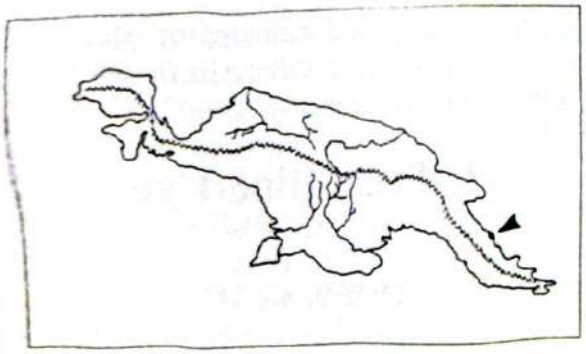


Cape Blue-Eye

Pseudomugil majusculus
Ivantsoff & Allen, 1984
(Plate 9, no. 10)

Diagnosis. - Dorsal rays V-7; anal rays 12; pectoral rays 10; midlateral scales 26; transverse scale rows 5; predorsal scales 12; gill rakers on lower limb of first gill arch 14; second spine of first dorsal fin elongated in males; live colours unknown. Maximum size to at least 32 mm SL.

Distribution and Habitat. - Known from only a single specimen collected in 197 from one m depth among mangroves at Cape Ward Hunt, eastern Papua New Guinea.

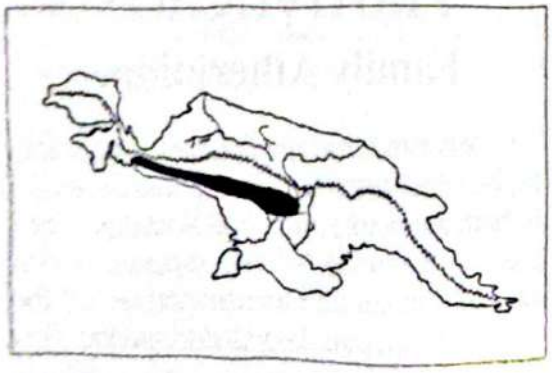


New Guinea Blue-Eye

Pseudomugil novaeguineae
Weber, 1908
(Plate 9, no. 3)

Diagnosis. - Dorsal rays III to V-6 to 9; anal rays I,10 to 13; pectoral rays 11 or 12; midlateral scales 30-34; transverse scale rows 6; predorsal scales 14-18; gill rakers on lower limb of first arch 8-9; gape of jaws wide with 60 or more teeth on each side of upper jaw; semi-transparent with darkly pigmented scale outlines, males with first dorsal spine and outer part of first dorsal fin reddish, anterior edge of anal fin blackish and black streak on upper and lower edge of caudal fin base, lower edge of caudal fin yellow. Maximum size to about 35 mm SL.

Distribution and Habitat. - Central-southern New Guinea between the Fly River and Etna Bay. Also known from the Aru Islands. In the Fly River system it has been collected only from tributaries of the upper Fly at distances between about 835-930 km upstream from the sea. The habitat consists of rainforest creeks and larger streams in relatively flat lowland terrain.



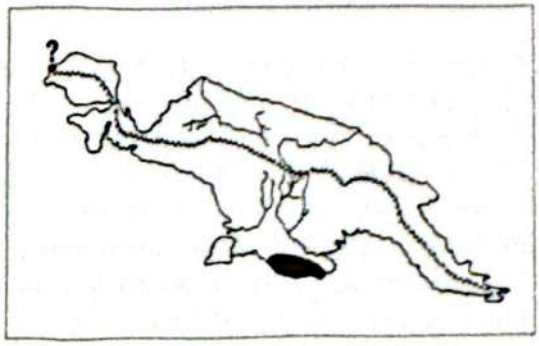
Swamp Blue-Eye

Pseudomugil paludicola
Allen & Moore, 1981
(Plate 9, no. 6)

Diagnosis. - Dorsal rays III to IV-6 or 7; anal rays I,11 to 14; pectoral rays 11 to 13; midlateral scales 24-27; transverse scale rows 5; predorsal scales 12-15; gill rakers on lower limb of first arch 8-10; mainly semi-transparent; pelvic fins pale yellow; mature females with base of caudal fin and anterior part of anal fin yellow; mature males with outer edge of second dorsal fin yellow; a tiny black spot near base of last dorsal and anal fin rays.

Distribution and Habitat. - Swamp lands of the lower Binaturi, Pahoturi, and More-head rivers of south-western Papua New Guinea, possibly ranging westward to the Vogelkop Peninsula (see Remarks).

Remarks. - A species recently collected by the author from a rainforest creek near Sorong at the western extremity of the Vogelkop Peninsula has been provisionally identified as this species. However, it lacks the colouration and markings described above, being primarily semi-transparent with a silvery head and abdomen.



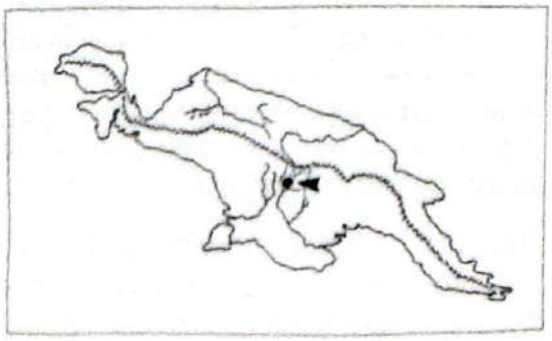
Paska's Blue-Eye

Pseudomugil paskai
Allen & Ivantsoff, 1986
(Plate 9, no. 5)

Diagnosis. - Dorsal rays III to V-6 or 7; anal rays I,9 to 11; pectoral rays 9 to 11; midlateral scales 25-28; transverse scale rows 6; predorsal scales 10-13; gill rakers on lower limb of first arch 8-11; first dorsal

and pelvic fins of males with very long filamentous extension (Fig. 16A); posterior outline of dorsal and anal fins pointed in mature males (Fig. 16A); body uniform pale, often with bluish hue; dorsal, caudal, and anal fins of males with loosely scattered black spots (Fig. 16A); upper edge of pectorals and tips of caudal lobes white in males; pelvic fins yellow in males. Maximum size to about 25 mm SL.

Distribution and Habitat. - Known only from small creeks near Kiunga in the upper Fly River system, approximately 830-850 km upstream from the sea. The habitat consists of rainforest streams with abundant aquatic vegetation.

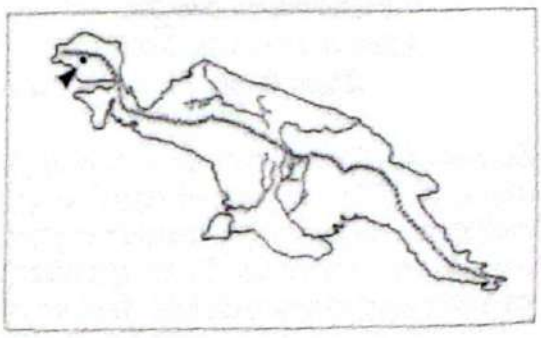


Vogelkop Blue-Eye

Pseudomugil reticulatus
Allen & Ivantsoff, 1986
(Plate 9, no. 9)

Diagnosis. - Dorsal rays III-9; anal rays 12; pectoral rays 10; midlateral scales 25; transverse scale rows 6; predorsal scales 12; gill rakers on lower limb of first arch 9; overall light tan with narrow dusky scale margins giving reticulated appearance; fins and ventral part of breast yellow. Maximum size to at least 28 mm SL.

Distribution and Habitat. - Known only from a single specimen collected from a well-vegetated rainforest stream, about 2 km east of Ajamaru Village in the middle of the Vogelkop Peninsula.

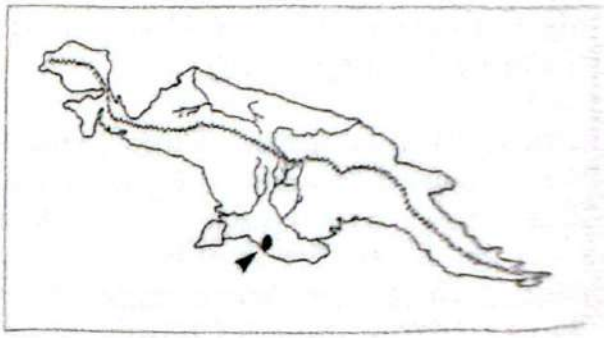


Delicate Blue-Eye

Pseudomugil tenellus
Taylor, 1964
(Plate 9, no. 11)

Diagnosis. - Dorsal rays III to V-6 or 7; anal rays 7 to 10; pectoral rays 10 to 12; midlateral scales 25-28; transverse scale rows 7-9; predorsal scales 9-14; gill rakers on lower limb of first arch 7-10; semi-transparent to light grey with darkly pigmented scale margins giving reticulated appearance a midlateral row of about 12 small pearly spots; fins often with yellowish hue. Maximum size to about 25 mm SL.

Distribution and Habitat. - Known in New Guinea only from the Bensbach River in south-western Papua New Guinea near the Irian Jaya border; also known from the Northern Territory of Australia. Occurs in marshy ponds and quiet backwaters of streams that often have an abundance of aquatic vegetation; usually in waters exposed to full sunlight



Hardyheads

Family Atherinidae

Atherinids are small, silvery schooling fishes which are found throughout the world in both temperate and tropical waters. They are characterised by two separate dorsal fins on the middle to rear portion of the back, no obvious lateral line, pelvic fins

usually in an abdominal position, and a silvery midlateral stripe is frequently present. The family contains approximately 170 species in about 20 genera. Most atherinids inhabit coastal seas and estuaries, but a number of species are restricted to fresh waters, for example members of *Chirostoma* in Mexico and *Craterocephalus* of New Guinea and northern Australia.

Genus *Craterocephalus*
McCulloch, 1913

The genus contains about 24 species and is restricted to the New Guinea-Australia region. Except for five estuarine species, all live in fresh water. Five of the freshwater species are found in New Guinea, mostly in rivers south of the Central Dividing Range.

Key to the Freshwater *Craterocephalus* from New Guinea

(note: numbers in parentheses refer to the mean value)

1a. Anus at or behind tips of pelvic fins; midlateral scales 31-34 (33.2); predorsal scales 11-14; gill rakers 8-10; branched pectoral fin rays 11-13; greatest body depth 3.6-4.5 (4.0) in SL....*C. kailolae*

1b. Anus at or in front of tips of pelvic fins, never behind; midlateral scales never less than 32 (mean always > 34); greatest body depth in SL never less than 4.3 2

2a. Anus always in front of, never at, tips of pelvic fins; midlateral scales always 35 or more (mean > 36); predorsal scales always more than 15 (mean > 16); branched rays of pectoral fins 13-15 (mean > 13) 3

2b. Anus always at or no more than 2 scales in front of tips of pelvic fins; midlateral scales may be more than 35 but average less (34.4); predorsal scales 11-19 (mean < 16); branched rays of pectoral fins 11-15 (mean < 13) 4

3a. Transverse scale rows always 7; gill rakers 6-10 (8.4); head 3.4-4.2 (3.9); greatest body depth 4.0-4.7 (4.3), both in SL. .....*C. nouhuysi*

3b. Transverse scale rows 8-8.5; gill rakers 9-11 (10); head 3.2-3.5 (3.3); greatest body depth 4.0-4.7 (4.3), both in SL .....*C. pimatuae*

4a. Gill rakers in lower limb of first arch 10-13 (11.7); head 3.2-3.8 (3.2), greatest body depth 3.5-3.6 (3.6), both in SL; interorbital 2.9-3.6 (3.2) in head; lower lip protrusive, especially in adults .....*C. lacustris*

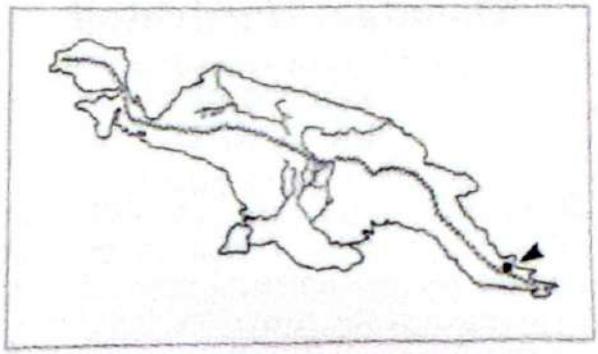
4b. Gill rakers in lower limb of first arch 7-11 (8.6); head 3.4-4.1 (3.7), greatest body depth 4.5-5.7 (5.1), both in SL; interorbital 2.5-3.1 (2.7) in head; lower lip never protrusive .....*C. randi*

Kailola's Hardyhead

Craterocephalus kailolae
Ivantsoff, Crowely & Allen, 1987
(Plate 18, no. 5)

Diagnosis. - Dorsal rays IV to VII-I,6 to 8; anal rays I,8 to 10; branched pectoral rays 11 to 13; midlateral scales 31-34; transverse scale rows 7; predorsal scales 11-14; interdorsal scales 5-7; gill rakers on lower limb of first arch 8-10; total vertebrae 33-35; greatest body depth 3.6-4.5 in SL; yellowish brown above, whitish below; a silvery midlateral stripe from pectoral fin base to caudal base; side of head and belly silvery; fins clear. Maximum size to 60 mm SL.

Distribution and Habitat. - Thus far known only from creeks near Safia in eastern Papua New Guinea on the northern side of



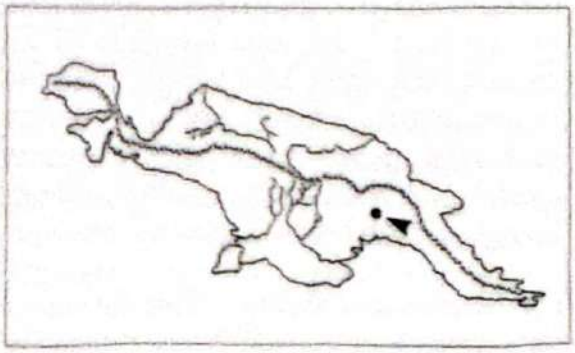
the Owen Stanley Range. It is the only member of the genus found north of the Central Divide. The habitat consists of clear, shallow creeks with gravel bottoms.

Kutubu Hardyhead

Craterocephalus lacustris
Trevawas, 1940
(Plate 18, no. 1)

Diagnosis. - Dorsal rays V to VIII-I,7 to 9; anal rays I,8 to 10; branched pectoral rays 11 to 15; midlateral scales 32-38; transverse scale rows 6-8; predorsal scales 11-18; interdorsal scales 6-9; gill rakers on lower limb of first arch 10-13; total vertebrae 35-39; greatest body depth 3.5-6.0 in SL; overall yellow with silvery sheen, a black spot on each scale forming horizontal rows; midlateral row of spots superimposed with blackish stripe from upper pectoral base to caudal base; blackish midlateral stripe continued across opercle and on snout; cheek and operculum silvery; fins yellowish. Maximum size to 115 mm SL.

Distribution and Habitat. - Known only from Lake Kutubu and its outlet stream, the Soro River. It is extremely abundant, forming schools along the shallow margin of the lake in both open water or amongst aquatic vegetation.

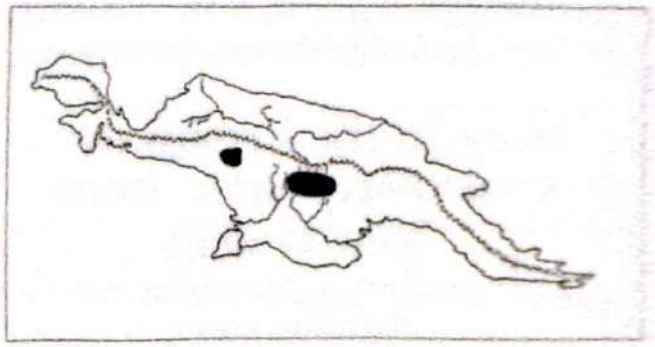


Mountain Hardyhead

Craterocephalus nouhuysi
(Weber, 1910)
(Plate 18, no. 2)

Diagnosis. - Dorsal rays VI to VIII-I,8 to 10; anal rays I,9 to 11; branched pectoral rays 11 to 15; midlateral scales 35-39; transverse scale rows 7-9; predorsal scales 14-17; interdorsal scales 7-9; gill rakers on lower limb of first arch 7-9; total vertebrae 37 or 38; greatest body depth 4.3-4.4 in SL; olive or brownish on back, whitish below; a thin black midlateral stripe from pectoral region to caudal base, bordered above and below by silvery streak; breast, belly, and side of head silvery; fins clear, caudal sometimes yellowish. Maximum size to 100 mm SL.

Distribution and Habitat. - Known from mountainous terrain in the Lorentz and Upper Fly-Strickland River systems. It occurs in relatively fast-flowing streams, usually forming schools in rocky pools or quiet backwaters.



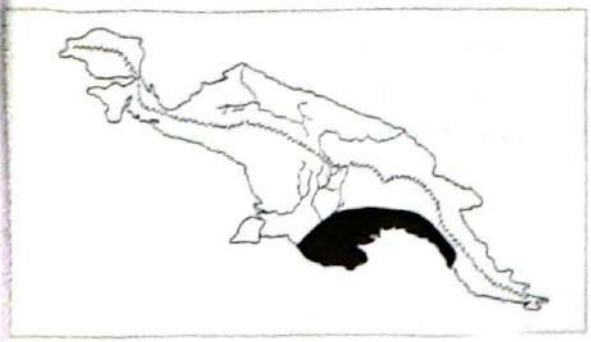
Kubuna Hardyhead

Craterocephalus randi
Nichols & Raven, 1934
(Plate 18, no. 3)

Diagnosis. - Dorsal rays V to VIII-I,7 to 9; anal rays I,7 to 11; branched pectoral rays 11 to 13; midlateral scales 32-37; transverse scale rows 6-9; predorsal scales 11-19; interdorsal scales 6-9; gill rakers on lower limb of first arch 7-11; total vertebrae 34-39; greatest body depth 4.5-5.7 in SL; olive or yellowish brown on back, whitish below; a dark spot on each scale forming 2-6 horizontal rows on side and a black midlateral stripe from snout to base of caudal fin; cheek and opercle silvery; fins clear. Maximum size to about 80 mm SL.

Distribution and Habitat. - Central-southern New Guinea between the Kubuna River (about 80 km north-west of Port Moresby) and Lake Jamur, Irian

Jaya. However, it is known from relatively few localities besides the two mentioned above; these include Balimo Lagoon and the upper Fly-Strickland, Morehead, and Bensbach rivers. It occurs in clear rivers and small tributary streams over mud, sand, and rocky bottoms.

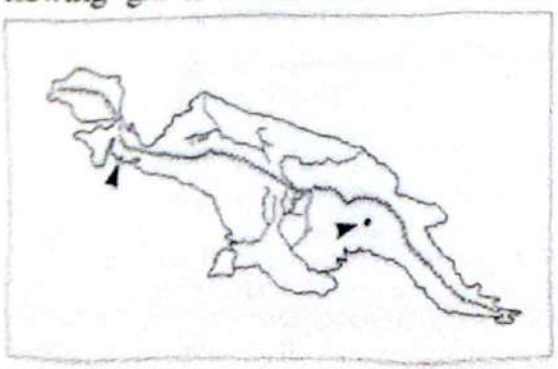


Pima Hardyhead

Craterocephalus pimatuae
Crowley, Ivantsoff, & Allen, 1991
(Plate 18, no. 4)

Diagnosis. - Dorsal rays V to VII-I,8 or 9; anal rays I,9 or 10; branched pectoral rays 13 to 15; midlateral scales 35-37; transverse scale rows 8-9; predorsal scales 16-19; inter-dorsal scales 7-8; gill rakers on lower limb of first arch 9-11; total vertebrae 36-38; greatest body depth 4.7-5.0 in SL; olive to light brown above, whitish below; a silver midlateral stripe from upper pectoral base to caudal base; fins clear.

Distribution and Habitat. - Known only from a single collection near the junction of the Pima and Tua rivers, mountainous tributaries of the Purari River in the Central Highlands of Papua New Guinea. The habitat consists of deeper pools and quiet backwaters of an otherwise fast-flowing gravel-bottom river.



Pipefishes
Family Syngnathidae

Pipefishes are mainly inhabitants of tropical and temperate seas, but a few species in the Indo-Australian Archipelago are largely restricted to fresh water. The family contains about 52 genera and more than 200 species. The Indo-Pacific pipefishes were revised by Dawson (1983). The largest number of species occur in the New Guinea-Australia region. Members of this family, which also includes the seahorses, are characterised by the following features: typically slender-bodied with or without a prehensile tail; body covered by dermal plates arranged to form a series of rings; mouth small, terminal, usually a protruding tubular snout; no true teeth; gill openings a pore in membrane above opercle; spinous dorsal and pelvic fins absent.

Pipefishes display an interesting reproductive pattern in which females deposit their eggs on the ventral surface of the male's trunk or tail, where they are incubated for several weeks, either entirely or partly concealed in a well defined pouch or exposed. Freshwater pipefishes usually occur amongst aquatic vegetation in small creeks and tributary streams within 20-30 km of the sea. The diet consists largely of minute crustaceans. The maximum size for the freshwater species is about 20 cm.

Key to Freshwater Pipefish Genera of New Guinea

1a. Inferior trunk and tail ridges continuous .....*Hippichthys*

1b. Inferior trunk and tail ridges discontinuous, the lateral trunk ridge confluent with inferior tail ridge .....*Microphis*

Genus *Hippichthys*
Bleeker, 1849

This genus contains five species that are mainly inhabitants of brackish

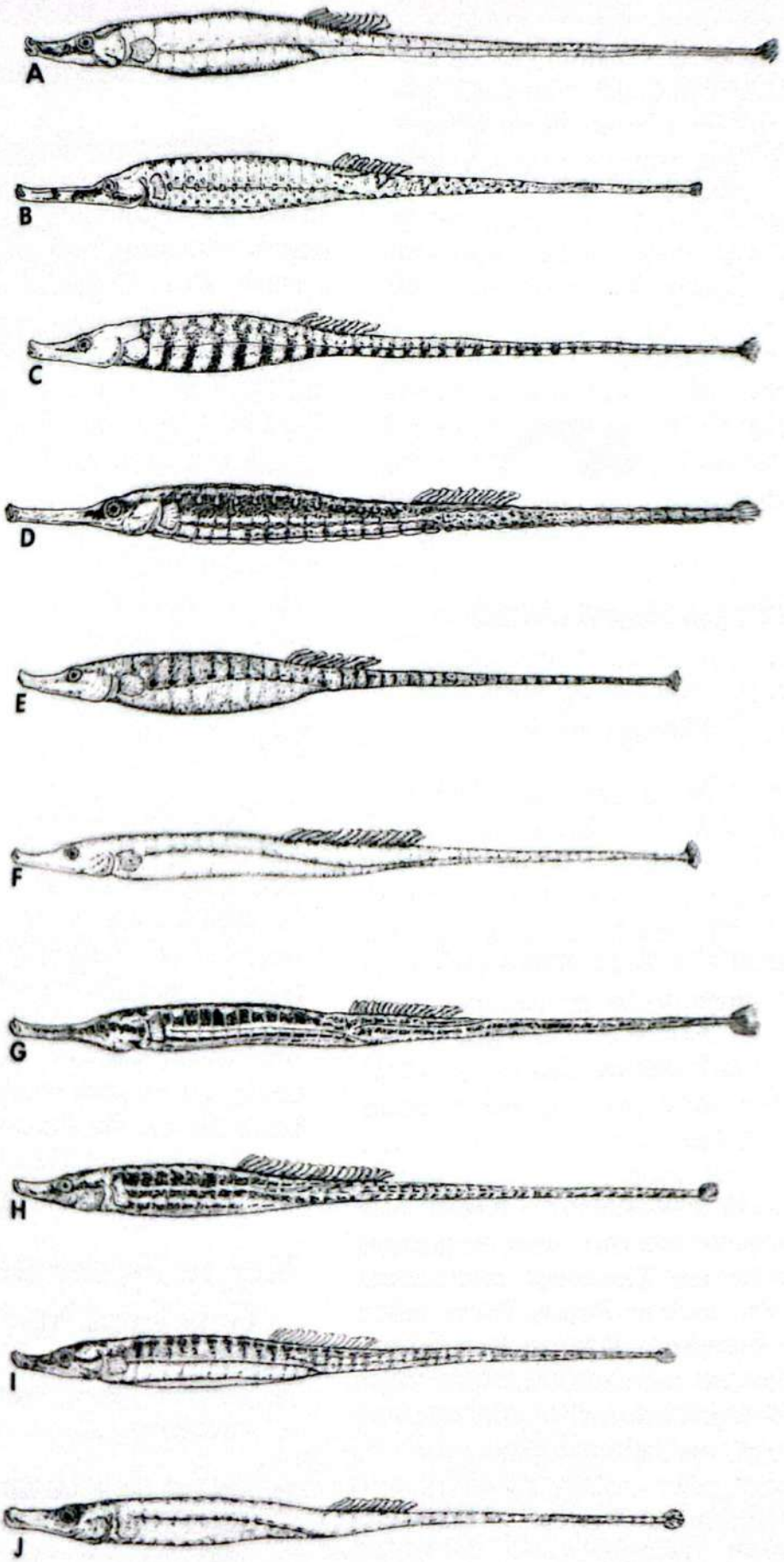


*Fig. 18. Pipefishes of New Guinean fresh waters: A) **Hippichthys heptagonus**; B) **H. penicillus**; C) **H. spicifer**; D) **Microphis brachyurus**; E) **M. brevidorsalis**; F) **M. caudocarinatus**; G) **M. manadensis**; H) **M. mento**; I) **M. retzii**; J) **M. spinachoides**.*

estuaries, although they frequently penetrate fresh water. Most of the species are widely distributed in the tropical Indo-Pacific from East Africa and the Red Sea to high islands of western Oceania.

Key to the Freshwater Species of *Hippichthys* from New Guinea

(adapted from Dawson, 1985)

1a. Lateral trunk ridge not deflected ventrally near anal ring..*H. penicillus*

1b. Lateral trunk ridge deflected ventrally near anal ring 2

2a. Dorsal fin origin usually before second tail ring; scutella without keels; head length averages 10 in SL.*H. heptagonus*

2b. Dorsal fin origin usually on or behind second tail ring; at least some scutella with keels; head length averages 8 in SL .....*H. spicifer*

Reticulated Freshwater Pipefish

Hippichthys heptagonus
Bleeker, 1849
(Fig. 18A)

Diagnosis. - Dorsal rays 23 to 30; dorsal fin origin from posterior fourth of last trunk ring to posterior margin of first tail ring; pectoral rays 13 to 16 (usually 15); body rings 14-15 + 36-42; head length divided into SL 8.6-12.7; snout length divided into head length 1.9-2.8; colour generally brownish, usually up to about 15 blackish bars with adjacent white marking along length of body; a black stripe on side of snout and pair of oblique black bands from rear of eye. Maximum size to about 150 mm SL.

Distribution and Habitat. - Widely distributed along continental margins and at high islands in the Indo-West Pacific region from East Africa to the Solomon Islands and northwards to the Ryukyu Islands of Japan.

Steep-Nosed Pipefish

Hippichthys penicillus
(Cantor, 1849)
(Fig. 18B)

Diagnosis. - Dorsal rays 23 to 31; dorsal fin origin between posterior half of last trunk ring and posterior fourth of second tail ring; pectoral rays 14 to 18 (usually 16 or 17); body rings 15-17 + 35-41 (usually 16 + 36-40); head length divided into SL 1.5-2.2; colour tan, greenish, or brown with numerous dark-edged white spots on sides and series of about 10 narrow pale bars across back; a blackish lateral stripe usually present on snout. Maximum size to about 180 mm SL.

Distribution and Habitat. - Widely distributed along continental margins and at high islands in the Indo-West Pacific region from the Persian Gulf to New Guinea-Australia, and northwards to Japan.

Banded Freshwater Pipefish

Hippichthys spicifer
(Rüppell, 1838)
(Plate 1, no. 9; Fig. 18C)

Diagnosis. - Dorsal rays 25 to 30; dorsal fin origin usually on second or third tail ring; pectoral rays 15 to 18 (usually 17); body rings 14-16 + 36-41; head length divided into SL 5.6-8.0; snout length divided into head length 1.8-2.1; colour brown to red on back, bluish on ventral parts; trunk rings with series of brown to blue bars on ventral half with yellow to whitish spaces between them. Maximum size to about 170 mm SL.

Distribution and Habitat. - Widely distributed along continental margins and at high islands in the Indo-West Pacific region from the Red Sea to Samoa, and ranging northwards to Japan.

Genus *Microphis*

Kaup, 1853

The genus contains 18 species and has a circumtropical distribution, although

most species are found in the Indo-Pacific region. They occur in a wide range of marine, estuarine, and freshwater habitats.

Key to the Freshwater Species of *Microphis* from New Guinea

(adapted from Dawson, 1985)

1a. Longitudinal opercular ridge usually distinct and complete; lateral and inferior trunk ridges distinct; tail rings 20-33....2

1b. Longitudinal opercular ridge vestigal or absent; lateral and inferior trunk ridges indistinct; tail rings 30-34....*M. leiaspis*

2a. Opercle with one or more supplemental ridges below the longitudinal ridge....3

2b. Opercle without supplemental ridges below the longitudinal ridge 7

3a. Snout relatively long and slender, its depth averages 4.3-10.6 in snout length; scutella without keels 4

3b. Snout relatively shorter and deeper, its depth averages 3.5-4.1 in snout length; scutella often with keels 5

4a. Snout length averages 1.6-1.7 in head length; snout depth averages 8.7-10.6 in snout length .....*M. brachyurus*

4b. Snout length averages 1.9-2.2 in head length; snout depth averages 4.3-6.7 in snout length .....*M. manadensis*

5a. Trunk rings 15-17 6

5b. Trunk rings 20. ...*M. caudocarinatus*

6a. Dorsal fin rays 25-29.*M. brevidorsalis*

6b. Dorsal fin rays 32-42 .....*M. retzii*

7a. Trunk rings 17-19; subdorsal trunk rings 10-12. .....*M. mento*

7b. Trunk rings 16; subdorsal trunk rings 5-6 .....*M. spinachioides*

Short-Tailed Pipefish

Microphis brachyurus
(Bleeker, 1853)
(Fig. 18D)

Diagnosis. - Dorsal rays 37 to 47; pectoral rays 19 to 23 (usually 20 or 21); body rings 20-22 (usually 21) + 21-24; head length divided into SL 4.2-5.3; snout length divided into head length 1.5-1.8; colour mainly brown or greenish, often grading to white ventrally; usually with white spots on side of snout and very small pale spots on body. Maximum size to about 210 mm SL.

Distribution and Habitat. - Widely distributed throughout Indonesia, Philippines, New Guinea, and north-eastern Australia. Also ranges west to the Nicobar Islands and Sri Lanka, east to the Society islands, and north to Japan.

Shortfin Pipefish

Microphis brevidorsalis
(de Beaufort, 1913)
(Fig. 18E)

Diagnosis. - Dorsal rays 25 to 29; pectoral rays 17 to 21 (usually 19 or 20); body rings 15-16 + 26-29; head length divided into SL 7.0-9.8; snout length divided into head length 2.2-2.7; mainly brownish with midlateral row of prominent blackish spots or quadrate blotches. Maximum size to 115 mm SL.

Distribution and Habitat. - Eastern Indonesia to the Fiji Islands. New Guinean records include the Lorentz River, eastern tip of Papua New Guinea, and Manus Island. Usually found in coastal fresh waters of streams and rivers to an elevation of at least 150 m.

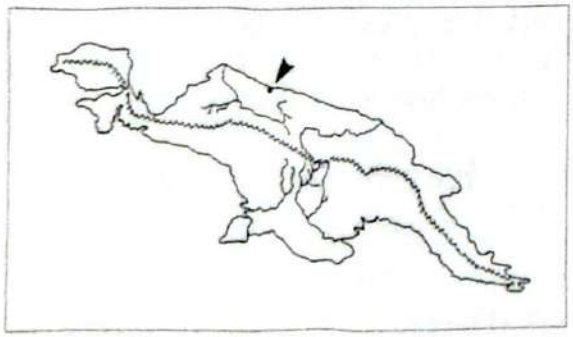
Slender Pipefish

Microphis caudocarinatus
(Weber, 1908)
(Fig. 18F)

Diagnosis. - Dorsal rays 42; pectoral rays 18 or 19; body rings 20 + 27; head length

divided into SL 6.9; snout length divided into head length 2.2; colour was described as brownish with dark shading on lower part of tail and caudal fin. Maximum size to at least 68 mm SL.

Distribution and Habitat. - Known only from a juvenile specimen collected in the Tawarin River, northern Irian Jaya in 1903.



Barhead Pipefish

Microphis leiaspis
(Bleeker, 1853)

Diagnosis. - Dorsal rays 53 to 63; pectoral rays 16 to 20 (usually 17 to 19); body rings 16-18 (usually 17) + 30-34; head length divided into SL 8.1-10.7; snout length divided into head length 2.2-2.6; colour plain brownish without distinctive markings, but bony plates sometimes margined with darker brown. Maximum size to about 180mm SL.

Distribution and Habitat. - Most records are from Indonesia northwards to Japan, ranging eastward to Fiji. There is a single Indian Ocean record from Madagascar. Most specimens have been collected in rivers and smaller streams, but juveniles have been found in estuarine harbours.

Menado Pipefish

Microphis manadensis
(Bleeker, 1856)
(Fig. 18G)

Diagnosis. - Dorsal rays 37 to 44; pectoral rays 18 to 21 (usually 19 or 20); body rings 20-22 (usually 21) + 24-26; head length divided into SL 6.0-7.3; snout length divided into head length 1.8-2.0; colour olive or brownish with midlateral black or dark brown stripe of variable width; caudal fin dusky with upper edge whitish. Maximum size to about 200 mm SL.

Distribution. - Indonesia, Taiwan, Palau Islands, New Guinea, eastern Australia, and the Solomon Islands. All New Guinea records are from the north coast. It is known to range upstream as far as 30 km.

Red Pipefish

Microphis mento
(Bleeker, 1856)
(Fig. 18H)

Diagnosis. - Dorsal rays 62 to 74; pectoral rays 17 to 20 (usually 19); body rings 17-19 (usually 18-19) + 23-26; head length divided into SL 5.4-8.2; snout length divided into head length 2.4-2.8; colour greenish to brown, trunk with narrow red stripes; posterior half with blackish bar on each segment; a black stripe on snout through eye. Maximum size to about 150 mm SL.

Distribution and Habitat. - Known previously only from Indonesia (Sulawesi) and the Philippine Islands, but collected in 1987 from a small creek near Bogia on the north coast of Papua New Guinea.

Ragged-Tail Pipefish

Microphis retzii
(Bleeker, 1856)
(Fig. 18I)

Diagnosis. - Dorsal rays 32 to 42; pectoral rays 16 to 20 (usually 17 or 18); body rings 15-17 (usually 16) + 27-31; head length divided into SL 7.1-10.7; snout length divided into head length 2.2-2.6; colour light tan to brown, darker specimens may have light tan colour on top of head and on back, also several wedge-shaped tan saddles on dorsal part of trunk and tail.

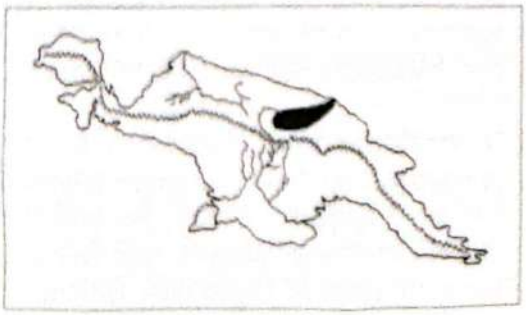
Distribution and Habitat. - Indonesia, Philippines, and New Guinea; also ranging south-eastward to Vanuatu, Fiji, and Samoa.

Spinach Pipefish

Microphis spinachioides
(Duncker, 1915)
(Fig. 18J)

Diagnosis. - Dorsal rays 57 to 63; pectoral rays 19 to 20; body rings 16-18 + 26-28; head length divided into SL 5.8-6.2; snout length divided into head length 2.4-2.6; live colours unknown, preserved specimens mottled brown, lighter on back with dark lateral stripe on head and faint dark stripe on middle of side. Maximum size to about 150 mm SL.

Distribution and Habitat. - Known only from a few specimens. Most were collected in the Sepik River at distances between 35-100 km upstream from the sea. However, the most recent specimen was captured in 1986 in the May River (a tributary of the middle Sepik), about 570 km upstream. It was a male with about 150 embryos in its brood pouch.



Swamp Eels

Family Synbranchidae

Synbranchids are eel-like fishes with rudimentary dorsal and anal fins and no pectoral fins. They inhabit mostly tropical, fresh or brackish waters, although there is one marine species. The range includes Africa, Asia, and the Indo-Australian Archipelago, and Central and South America. Five genera containing about eight species are known. Three species, including one each from Mexico, Liberia, and Western Australia, inhabit subterranean waters and lack functional eyes. The two species known from New Guinea are relatively cryptic fishes that frequently conceal themselves under soft bottom sediments or leaf litter.

Genus *Ophisternon*
McClelland, 1845

The genus contains six species that are distributed in New Guinea, Australia, Indo-Malaysian region including Philippine Islands, West Africa, Central America, and northern South America.

Key to the species of *Ophisternon* from New Guinea

(From Rosen & Greenwood, 1976)

1a. Distance from middle of eye to bony snout tip 37-50% of distance from bony snout to corner of mouth gape; caudal vertebrae 49-61...*O. bengalense*

1b. Distance from middle of eye to bony snout tip 59-76% of distance from bony snout to corner of mouth gape; caudal vertebrae 30-40 ..*O. gutturale*

Onegilled Eel

Ophisternon bengalense
McClelland, 1845
(Fig. 19)

Diagnosis. - Body eel-like, long and slender; dorsal and anal fins reduced to folds of skin on posterior part of body; pectoral and pelvic fins absent; gill opening a small slit located ventrally at rear of head; anus on posterior half of body; 1-2 rows of fine pointed teeth in jaws; caudal vertebrae 49-61; blackish green to reddish brown with purple tint, paler below. Maximum size to about 550 mm TL.

Distribution and Habitat. - India and Sri Lanka to south-eastern Asia, Indonesia, Philippines, and New Guinea. In New Guinea it has been collected in the Lower Sepik River (Angoram), Mimika River (central-southern Irian Jaya), and from Lake Iaraguma (about 75 km northwest of Port Moresby).

The habitat consists of both fresh and brackish waters of rivers and swamps.

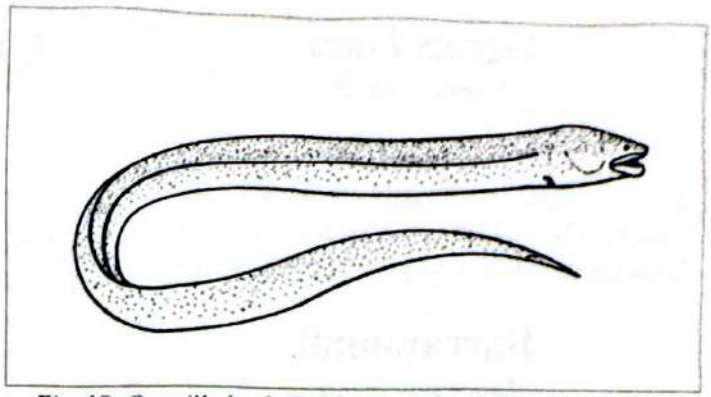


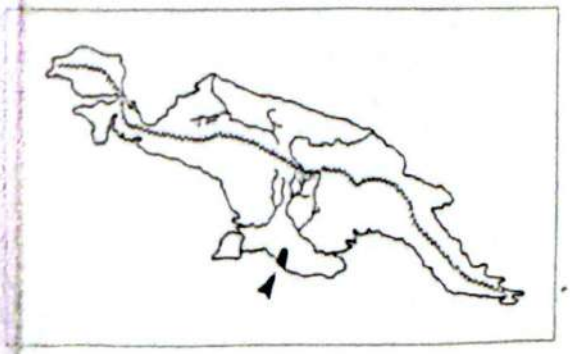
*Fig. 19. Onegilled eel, **Ophisternon bengalense** (from Day, 1875-1878).*

Swamp Eel

Ophisternon gutturale
(Richardson, 1844)

Diagnosis. - Body eel-like, long and slender; dorsal and anal fins reduced to folds of skin on posterior part of body; pectoral and pelvic fins absent; gill opening a small slit located ventrally at rear of head; anus on posterior part of body; 1-2 rows of fine pointed teeth in jaws; caudal vertebrae 30-40; overall brown, darker on back. Maximum size to 600 mm TL; common to 200 mm TL.

Distribution and Habitat. - Central-southern New Guinea and northern Australia. Known from New Guinea on the basis of a single specimen collected in the Bensbach River, Papua New Guinea. It inhabits backwaters of rivers, swamps, and stagnant ponds.



Giant Perches

Family Centropomidae

Centropomids are medium to large sized fishes inhabiting coastal seas and fresh waters, mainly in the tropics. The family includes 18 species in three genera: *Centropomus* contains nine species distributed on both sides of the Americas. *Lates* is the main genus of the Old World, with eight species. The Barramundi (*L. calcifer*) of south-eastern Asia and New Guinea-Australia is a popular food fish and an important commercial species. Therefore its general biology and life history has been the focus of intensive research. Fish from rivers flowing into the Gulf of Papua, including the Fly, undergo an annual migration to spawning grounds lying from about 65 km west of the island of Daru to the mouth of the Morehead River. The migration usually begins in September and spawning commences in October, with the last individuals terminating by February. After spawning the adults disperse eastward along the Gulf and ascend various rivers. Spawning occurs near shore in shallow 2-3 m depths and at a salinity of about 31 ppt. Newly hatched larvae are about 1.5 mm long. By a length of 4.5 mm the larvae have moved into mangrove areas or into brackish or fresh water coastal swamps if they are accessible. Growth is rapid in this environment and by July-August young of 170-200 mm leave the mangroves or swamps and re-enter the sea. By the end of their first year, they have gradually moved eastward and begun to enter the mouth of the Fly or other nearby rivers. During their second year they disperse throughout the Fly and other Gulf rivers, some probably remaining in the delta area near the mouths of rivers. Males mature during their third or fourth year, females in their fifth year or later. Male to female sex reversal has been noted, although apparently all males do not undergo this process. The largest Barramundi specimens are invariably females. The diet consists of prawns, crayfish, crabs, aquatic insects, and fishes.

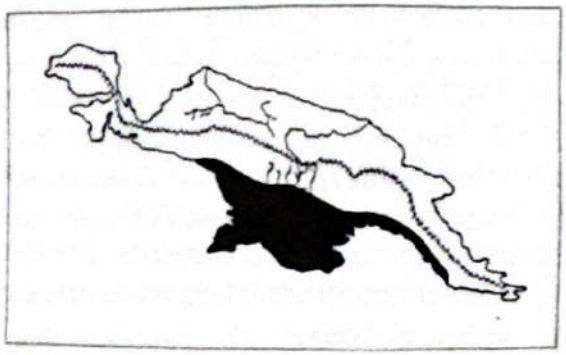
Genus *Lates*
Cuvier, 1828

The genus contains eight species that are primarily inhabitants of African fresh waters. The Nile Perch, *L. niloticus*, is perhaps the best known of the African species.

Barramundi
Lates calcarifer
(Bloch, 1790)
(Plate 12, no. 1)

Diagnosis. - Dorsal rays VIII or IX,10 or 11; anal rays III,7 or 8; pectoral rays 17; lateral-line scales 52-61; transverse scale rows about 19; predorsal scales 27 or 28; gill rakers on first arch 4 + 16 or 17; greatest body depth about 3.0-3.4 in SL; blue grey to greenish brown on back, silvery on sides, and white on belly; scale margins dusky brown or blackish; fins mainly dusky brown to blackish; juveniles with broad brownish stripes on side and prominent white stripe on middle of forehead. Maximum size to 180 cm TL, common to about 120 cm TL. May reach a weight of 60 kg.

Distribution and Habitat. - Widely distributed along the Asian coast from the Persian Gulf to China and the Indo-Australian Archipelago. The New Guinea range is confined to southerly flowing rivers draining into the Gulf of Papua and Arafura Sea. It has been collected from the area extending between the Port Moresby district, Papua New Guinea to the Lorentz River, Irian Jaya. It has not been collected from the Vogelkop Peninsula, which is surprising considering the extensive mangrove habitat of Bintuni Bay. It is very common in the Middle Fly, including Lake Murray, and occurs at least as far upstream as Kiunga, more than 800 km from the mouth.



Glass Perchlets
Family Chandidae

The family Chandidae contains approximately 40 species which are mainly confined to the tropical Indo-West Pacific region. About two-thirds of this total dwell in fresh waters of India, southeast Asia, and the Indo-Australian Archipelago. The remaining species are inhabitants of shallow coastal seas and brackish estuaries. The common appellation is derived from the transparent appearance of many of the species. Most glass perchlets are small, generally under 10 cm, but members of the genus *Parambassis* sometimes attain standard lengths in excess of 25 cm. They are generalised perch-like fishes characterised by a dorsal fin that is deeply notched in most species, 7-9 dorsal spines, usually 3 (4 in one species) anal spines, pelvic fin of one spine and five soft rays, and a forked to emarginate caudal fin.

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

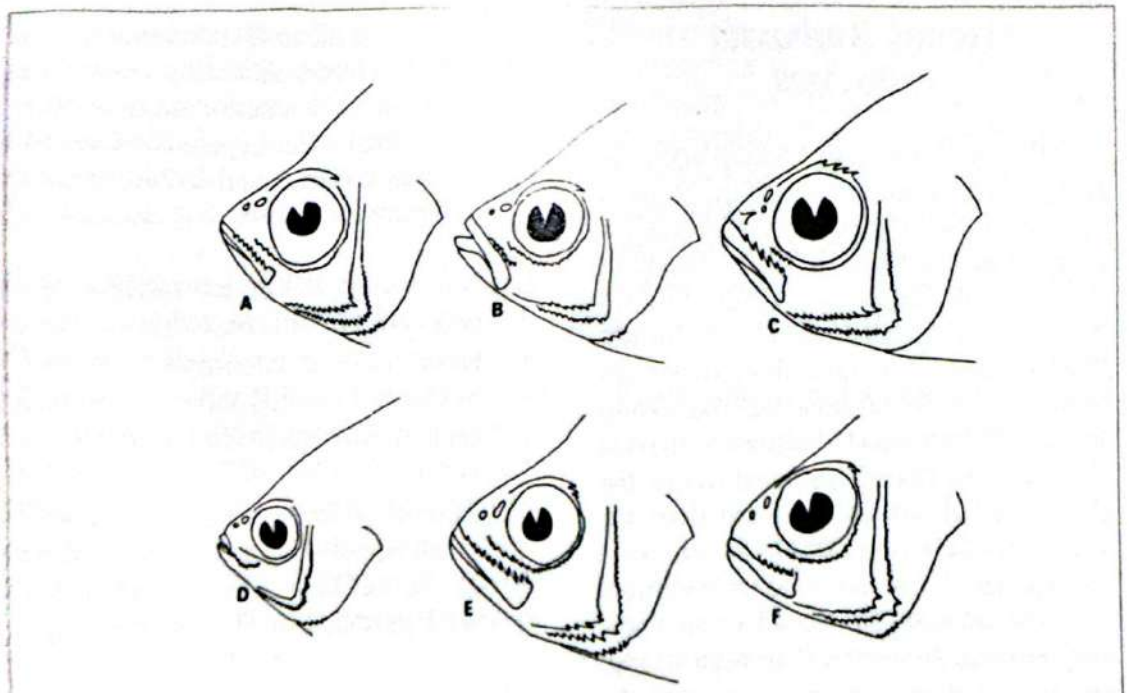


*Fig. 20. Heads of New Guinean freshwater chandids showing serration patterns: A) **Ambassis macleayi**; B) **A. agrammus** C) **A. vachellii** D) **Denariusa bandata**; E) **Parambassis confinis**; F) **Tetracentrum apogonides**.*

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

The chandids of New Guinea and Australia were reviewed by Allen and Burgess (1990).

Key to the Chandid Genera of New Guniea

1a. Spinous dorsal fin continuous with soft dorsal fin, the last dorsal spine not much longer than penultimate spine (Eastern New Guinea) .....*Tetracentrum*

1b. Spinous dorsal fin deeply notched, the last spine more than twice the length of penultimate one. 2

2a. Scales relatively small, 36-52 in longitudinal series from upper edge of gill opening to caudal fin base; transverse scale rows on cheek 3 or 4 .....*Parambassis*

2b. Scales larger, 24-34 in longitudinal series from upper edge of gill opening to caudal fin base; transverse scale rows on cheek usually 1 or 2 3

3a. Gill rakers well developed, 15 or more on lower limb of first gill arch (including raker at angle); pores on preorbital, supraorbital and preopercle bones not conspicuous; pectoral rays 11 to 17; colour more or less uniform pale without vertical bars ...*Ambassis*

3b. Gill rakers reduced to rudimentary stumps, about 6-9 on lower limb of first gill arch; enlarged and conspicuous pores on preorbital, supraorbital, and preopercle bones; pectoral rays 9 or 10; series of 6 narrow dark bars often present on sides .....*Denariusa*

Genus *Ambassis*
Cuvier, 1828

The genus *Ambassis* contains about 24 species which are primarily inhabitants of brackish estuaries and the lower reaches of freshwater streams. However, a number of species of the Australia-New Guinea region are restricted to purely freshwater habitats, sometimes hundreds of kilometres inland. The distribution of the group includes Mauritius and Madagascar, the east African coast from Natal northwards, the Arabian Peninsula and eastward along the coast of southern Asia to the Indo-Australian Archipelago. A few species range northward to Japan and eastward into Oceania where they are mainly restricted to high islands as far east as the Samoan Group in the South Pacific and Pohnpei, Caroline Islands in the North Pacific. A total of 15 species has been recorded from Australia and New Guinea.

Key to Freshwater *Ambassis* of New Guinea

1a. Lateral line usually continuous from upper edge of gill opening to caudal fin base. 2

1b. Lateral line either terminating on anterior part of body or interrupted in middle portion 4

2a. Cheek with a single transverse scale row ..... *A. urotaenia*

2b. Cheek usually with 2 transverse scale rows 3

3a. Second dorsal spine longer than third dorsal spine; predorsal scales 17 to 22 ..... *A. macracanthus*

3b. Second dorsal spine slightly shorter than third dorsal spine; predorsal scales 13 to 15 ..... *A. miops*

4a. Supraorbital spines 4 or 5...*A. vachelli*

4b. Supraorbital spines 1 or 2 5

5a. Nasal spine present; lateral line always well developed consisting of 8 to 13 tubed scales in anterior section and 9 to 14 tubed scales in posterior section; inhabits estuaries and lower sections of freshwater streams 6

5b. Nasal spine absent; lateral line often poorly developed consisting of 0 to 14 tubed scales in anterior section and 0 to 15 tubed or pitted scales in posterior section; inhabits fresh water only ...7

6a. Margin of interopercle with 2 to 10 small serrae; height of spinous dorsal fin 34.0 to 38.0% of SL; depth of body 37.2 to 47.8% of SL ...*A. interruptus*

6b. Margin of interopercle smooth; height of spinous dorsal fin 27.6 to 32.7% of SL; depth of body 32.9 to 39.5% of SL ..... *A. buruensis*

7a. Rakers on lower limb of first gill arch 24 to 29; dorsal and anal soft rays usually 10 (occasionally 9 or 11); pectoral rays 14 or 15; base of pectoral fin frequently blackish ...*A. macleayi*

7b. Rakers on lower limb of first gill arch 16 to 20; dorsal and anal soft rays usually 8 or 9 (rarely 7 or 10); pectoral rays 11 to 14; base of pectoral fin pale ..... *A. agrammus*

Sailfin Glass Perchlet

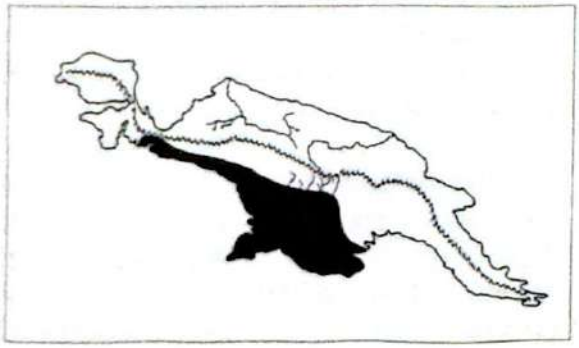
Ambassis agrammus
Günther, 1867
(Plate 10, nos. 5 & 6)

Diagnosis. - Dorsal rays VII,I,7 to 10 (usually 8 or 9); anal rays III,7 to 10 (usually 8 or 9); pectoral rays 11 to 14; tubed lateral-line scales 0-11 + 0-10, usually terminating below spinous dorsal fin or interrupted in middle portion by series of tubeless scales; a single supraorbital spine; 2 transverse scale rows on cheek; gill rakers on lower limb of first arch 16-20; predorsal scales 12-15; scales in longitudinal series 28-34; height of spinous dorsal fin 29.1-41.8% of SL;

usually greater than 33%; colour semi-transparent, often olive on back with silvery sheen on head and sides; scale outlines narrowly dark forming network pattern; specimens from turbid water uniform pale. Maximum size to about 65 mm SL.

Distribution and Habitat. - Central-southern New Guinea in drainages that flow into the Arafura Sea and Gulf of Papua. Thus far it has been taken from Jamur Lake, and the following river systems: Setakwa, Lorentz, Merauke, Bensbach, and Fly-Strickland. It also occurs on the island of Daru. In Australia there are two populations: (1) Cape York north of about 15° S latitude), and (2) coastal streams of the Northern Territory.

Remarks. - *Ambassis reticulatus* Weber is a junior synonym.



Buru Glass Perchlet

Ambassis buruensis
Bleeker, 1857
(Plate 10, no. 14)

Diagnosis. - Dorsal rays VII,I,9; anal rays III,8 or 9 (usually 9); pectoral rays 15; tubed lateral-line scales 8-13 + 11-14, interrupted in middle portion by several tubeless scales; a single supraorbital spine; 2 transverse scale rows on cheek; gill rakers on lower limb of first gill arch 23-26; predorsal scales 11-14; scales in longitudinal series 26-28; margin of interopercle smooth; height of spinous dorsal fin 27.6-32.7% of SL; depth of body 32.9-39.5% of SL; colour semi-transparent, often olive on back with silvery sheen on head and sides; caudal fin may be yellowish. Maximum size to about 60 mm SL.

Distribution and Habitat. - Relatively widespread in the Indo-Malayan region including Sumatera, Java, Bali, Sulawesi, Buru, Ambon, Timor, and the Philippines. In New Guinea it has been collected at Bintuni Bay, Wewak, and Madang. It inhabits brackish mangrove estuaries and the lower reaches of freshwater streams, usually within about 10 km of the sea.

Long-Spined Glass Perchlet

Ambassis interruptus
Bleeker, 1852
(Plate 10, no. 13)

Diagnosis. - Dorsal rays VII,I,9 to 10; anal rays III,9 or 10; pectoral rays 14 to 16; tubed lateral-line scales 11-13 + 9-13, interrupted in middle portion by about 3-6 tubeless scales; a single supraorbital spine; 2 transverse scale rows on cheek; gill rakers on lower limb of first gill arch 24-27; predorsal scales 13-16; scales in longitudinal series 27-28; margin of interopercle with 2-10 small serrae; height of spinous dorsal fin 34.0-38.0% of SL; depth of body 37.2-47.8% of SL; colour semi-transparent, often olive on back with silvery sheen on head and sides; caudal fin may be yellowish and frequently white tips on pelvic and anal fins. Maximum size to about 90 mm SL.

Distribution and Habitat. - Widespread throughout the Indo-Australian region including Indonesia, Philippines, New Guinea, New Caledonia, and northern Australia. In New Guinea it has been collected at Bintuni Bay, Wewak, Manus Island, Madang, and from the lower Sepik, Ramu, Fly and Oriomo rivers. It occurs in brackish mangrove estuaries and the lower reaches of freshwater streams, usually within about 20 km of the sea.

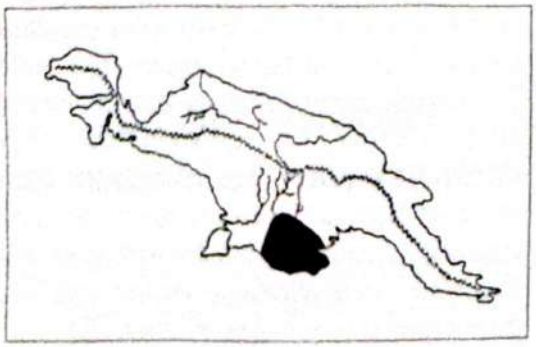
Macleay's Glass Perchlet

Ambassis macleayi
(Castelnau, 1878)
(Plate 10, no. 7)

Diagnosis. - Dorsal rays VII,I,9 to 11; anal rays III,9 to 11; pectoral rays 14 to 15; tubed

lateral-line scales 5-14 + 0-6, terminating below spinous dorsal fin or anterior to this point, or interrupted by series of tubeless scales; a single supraorbital spine; 2 transverse scale rows on cheek; gill rakers on lower limb of first gill arch 24-29; predorsal scales 12-16; scales in longitudinal series 27-28; colour semi-transparent, often olive on back with silvery sheen on head and sides; scale margins dark forming a network pattern; a dark brown bar across base of pectoral fin. Maximum size to about 80 mm SL.

Distribution and Habitat. - Streams of central-southern New Guinea including the Bensbach, Middle Fly, and lower Strickland (including Lake Murray) rivers; also from the Balimo area. In Australia it ranges from the Carson River of northern Western Australia to the Jardine River at the tip of Cape York Peninsula, Queensland.



Estuarine Glass Perchlet

Ambassis macracanthus
Bleeker, 1849

Diagnosis. - Dorsal rays VII-I,9; anal rays III,9; pectoral rays 14 to 15; tubed lateral-line scales 27-29, continuous throughout its length; a single supraorbital spine; 2 transverse scale rows on cheek; gill rakers on lower limb of first gill arch 23-25; predorsal scales 17-22; scales in longitudinal series 27-29; body depth 40.0-44.7% of SL; colour semi-transparent, often olive on back with silvery sheen on head and sides. Maximum size to about 105 mm SL.

Distribution and Habitat. - Widespread throughout Indonesia from Sumatera to Irian Jaya, ranging eastward into Papua New Guinea. At the latter locality it is known only from Madang. It occurs in brackish estuaries and the lower reaches of freshwater streams, usually within about 10 km of the sea.

Flag-Tailed Glass Perchlet

Ambassis miops
Günther, 1871
(Plate 10, no. 15)

Diagnosis. - Dorsal rays VII,I,9 or 10; anal rays III,9 or 10; pectoral rays 13 to 15; tubed lateral-line scales 28-30, continuous throughout its length; a single supraorbital spine; 2 transverse scale rows on cheek; gill rakers on lower limb of first gill arch 18-22; predorsal scales 12-15; scales in longitudinal series 28-30; body depth 33.4-38.6% of SL; colour semi-transparent, often olive on back with silvery sheen on head and sides; scales with dark outlines, especially on upper half, forming network pattern; caudal fin may be yellowish. Maximum size to about 65 mm SL.

Distribution and Habitat. - Widespread in the western Pacific including Indonesia (Flores eastward), New Guinea, north-eastern Australia, New Caledonia, and Rarotonga. In New Guinea it has been collected at Vailala Creek (near Port Moresby), streams near Bogia, the Lorengau River on Manus Island and near Kavieng, New Ireland. It is usually found in clear, flowing streams within 20 km of the sea.

Bleeker's Glass Perchlet

Ambassis urotaenia
Bleeker, 1852
(Plate 10, no. 17)

Diagnosis. - Dorsal rays VII-I,10; anal rays III,9 or 10; pectoral rays 16; tubed lateral-line scales 26-27, continuous throughout its length; a single supraorbital spine; a single transverse scale row on cheek; gill rakers on lower limb of first gill arch 23 or 24; predorsal scales 9-11; scales in longitudinal series 26-27; body depth 35.8-36.9% of SL; colour semi-transparent, often with silvery sheen on head and sides

scales with dark outlines, forming network pattern. Maximum size to 75 mm SL.

Distribution and Habitat. - Widespread from India to the Indo-Australian Archipelago. It inhabits coastal seas, frequently entering estuaries and sometimes found in the lower parts of freshwater streams.

Remarks. - This is the only New Guinean chandid with a single scale row on the cheek. It has often been misidentified as *A. commersoni*. *Ambassis papuensis* Alleyne and Macleay is a synonym.

Vachelli's Glass Perchlet

Ambassis vachellii
Richardson, 1846
(Plate 10, no. 16)

Diagnosis. - Dorsal rays VII-I,9; anal rays III,9; pectoral rays 14 to 16; tubed lateral-line scales 10-13 + 12-14, interrupted in middle portion by 1-3 tubeless scales; supraorbital spines 4-5; 2 transverse scale rows on cheek; gill rakers on lower limb of first arch 22-25; predorsal scales 13-16; scales in longitudinal series 27 or 28; body depth 34.6-37.6% of SL; generally semi-transparent with black pigment narrowly concentrated on scale margins, particularly on upper side; snout, lower jaw, and interorbital dusky; a thin blackish stripe along middle of side frequently present; fins clear except membrane between second and third dorsal spines blackish. Maximum size to at least 50 mm SL.

Distribution and Habitat. - Possibly wide-ranging in the Indo-West Pacific region, but the exact distributional limits are obscure. Definite records include Indonesia, New Guinea, and northern Australia. It inhabits brackish waters of bays, estuaries and tidal mangrove creeks, sometimes entering fresh water.

Genus *Denariusa*
Whitley, 1948

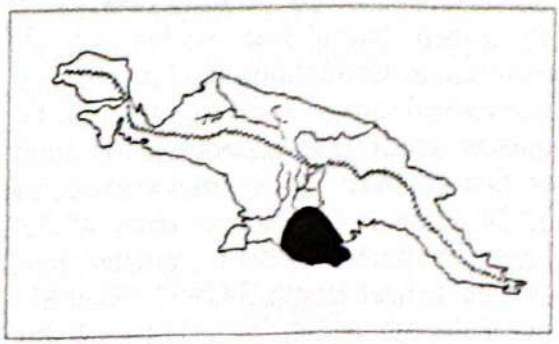
The genus contains a single species, *D. bandata*, that inhabits fresh waters of southern New Guinea and northern Australia.

Pennyfish

Denariusa bandata
Whitley, 1948
(Plate 10, no. 8)

Diagnosis. - Dorsal rays VII,I,9 to 10; anal rays III,7 to 9; pectoral rays 9 or 10; lateral-line scales weakly developed or absent, tubed scales 0-4; supraorbital spines absent; 2 transverse scale rows on cheek; gill rakers on lower limb of first arch 7-9; predorsal scales 12-16; scales in longitudinal series 24-26; colour semi-transparent, often olive on back with silvery sheen on head and lower sides; scale outlines dark forming network pattern; usually about six narrow dark bars on side; intense black spot on upper portion of pectoral fin axil. Maximum size to about 35 mm SL.

Distribution. - Central-southern New Guinea. Known only from the Bensbach River and Fly River system. Also occurs in Australia in Arnhem Land (Northern Territory) and north-eastern Queensland.



Genus *Parambassis*
Bleeker, 1874

The limits and relationships of this group are poorly understood and require study. The genus (sometimes referred to as *Chanda*) contains about 11 species distributed from India eastward to the Malaysian Peninsula, Indonesia, New Guinea, and northern Australia. They are inhabitants of freshwater rivers and small tributary streams, primarily in lowland areas.

Key to the Species of *Parambassis* from New Guinea

1a. Body relatively slender, depth 34.8-37.5% of SL; lateral-line scales 47-52 ..... *P. altipinnis*

1b. Body deeper, depth 38.1-47.5% of SL; lateral-line scales 36-48 2

2a. Sides with series of narrow dark stripes corresponding with horizontal scale rows; gill rakers on lower limb of first gill arch 20-22; body depth 42.0-47.5% of SL ..... *P. gulliveri*

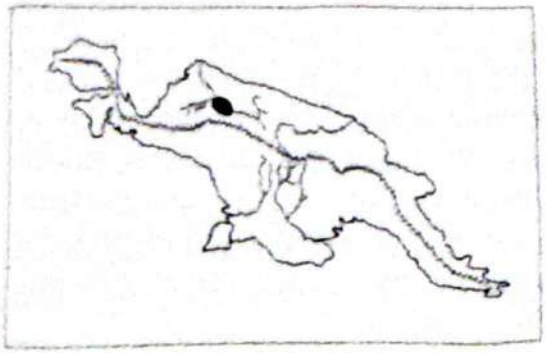
2b. Sides with broad, midlateral longitudinal band; gill rakers on lower limb of first gill arch 11-14; body depth 38.1-42.3% of SL ..... *P. confinis*

High-Finned Glass Perchlet

Parambassis altipinnis
Allen, 1982
(Plate 10, no. 2)

Diagnosis. - Dorsal rays VII,I,10 or 11; anal rays III,9 or 10; pectoral rays 15 or 16; tubed lateral-line scales 47-52, continuous throughout its length; 1-2 supraorbital spines; 3 or 4 transverse scale rows on cheek; gill rakers on lower limb of first gill arch 17-19; predorsal scales 23-29; scales in longitudinal series 47-52; height of spinous dorsal fin greater than, or equal to head length, 34.0-37.5% of SL; live colouration unknown, but probably brownish on back grading to whitish below with silvery sheen on head and sides. Maximum size to about 120 mm SL.

Distribution. - Known only from specimens collected in 1920 at Prauenbivak on the Mamberamo River, Irian Jaya.

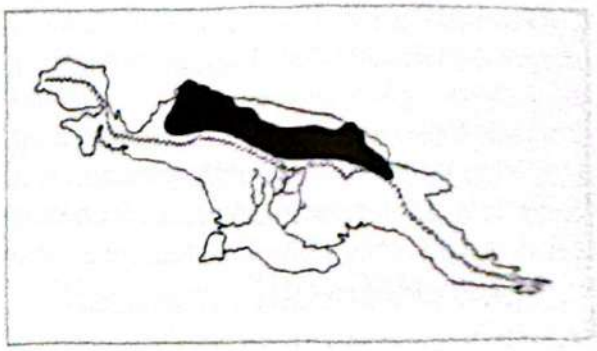


Sepik Glass Perchlet

Parambassis confinis
(Weber, 1913)
(Plate 10, no. 3)

Diagnosis. - Dorsal rays VII,I,10; anal rays III,9 or 10; pectoral rays 16 or 17; tubed lateral-line scales 36-48, continuous throughout its length; 2-3 supraorbital spines; 3-4 transverse scale rows on cheek; gill rakers on lower limb of first gill arch 11-14; predorsal scales 20-21; scales in longitudinal series 36-48; height of spinous dorsal fin less than head length, 25.3-27.6% of SL; brown on back, silvery white on ventral parts; a black midlateral stripe on sides; caudal fin lobes blackish. Maximum size to about 100 mm SL.

Distribution and Habitat. - Central-northern New Guinea in the following river systems (proceeding westward): Gogol, Ramu, Sepik, Mosso, Sermowai, and Mamberamo. It occurs in flood plain water courses as well as foothill streams to an altitude of about 200-300 m.



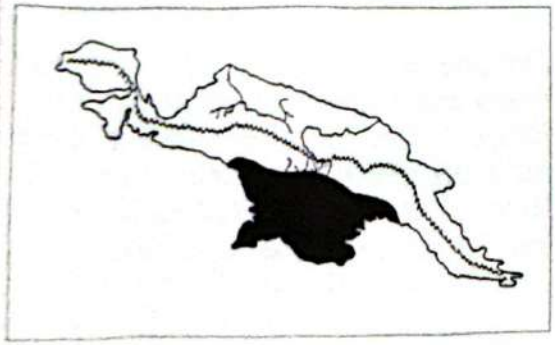
Giant Glass Perchlet

Parambassis gulliveri
(Castelnau, 1878)
(Plate 10, no. 1)

Diagnosis. - Dorsal rays VII,I,10 or 11; anal rays III,9 or 10; pectoral rays 15 to 17; tubed lateral-line scales 37-42, continuous throughout its length; 0-2 supraorbital spines; 4 transverse scale rows on cheek gill rakers on lower limb of first gill arch 20-22; predorsal scales 17-22; scales

in longitudinal series 37-42; greatest body depth of adults as % of SL 42.0-47.5; colour mainly silvery with 8-9 dark stripes on sides; pelvic and anal fins may be yellow. Maximum size to about 180 mm SL.

Distribution and Habitat. - Central-southern New Guinea where it is known from the following river systems (proceeding westward): Purari, Pie, Ok Tedi, Strickland, Fly, Oriomo, Digul, and Lorentz. It also occurs in northern Australia between the Ord River, Western Australia and Norman River, Queensland. It is found in large lowland rivers that are generally quite turbid.



Genus *Tetracentrum*
Macleay, 1884

This small genus contains three species that are restricted to eastern Papua New Guinea. It inhabits rivers, but is more commonly found in smaller tributaries, generally in rainforest to elevations of about 300-400 m. *Synechopterus* Norman, *Negambassis* Whitley, and *Xenambassis* Schultz are junior synonyms.

Key to the Species of *Tetracentrum*

1a. Supraorbital serrae usually 3 or 4; anal fin spines usually 4 (about 5% of specimens with 3 spines) ...*T. apogonides*

1b. Supraorbital serrae usually 0 or 1; anal fin spine 3.....2

2a. Total dorsal spines 9 (very rarely 8); penultimate dorsal spine 85-98% of last dorsal spine.....*T. caudovittatus*

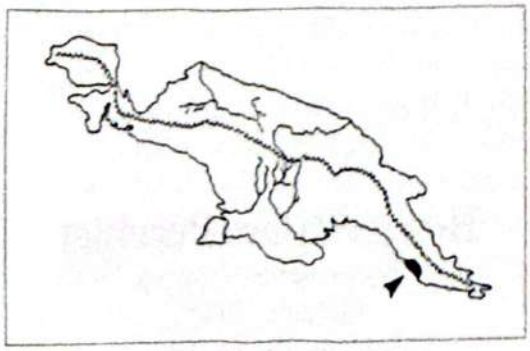
2b. Total dorsal spines 8; penultimate dorsal spine 71-82% of last dorsal spine .....*T. honessi*

Four-Spined Glass Perchlet
Tetracentrum apogonoides
Macleay, 1884
(Plate 10, no. 2)

Diagnosis. - Dorsal rays IX,10; anal rays III or IV (usually IV),9; pectoral rays 15 to 17; tubed lateral-line scales 29-31, continuous throughout its length; 2-4 (usually 3) supraorbital spines; 2-3 transverse scale rows on cheek; gill rakers on lower limb of first gill arch 13-15; predorsal scales 15-16; scales in longitudinal series 29-31; greatest body depth as % of SL 39.3-44.6; colour brown or olive on back, silvery on head and sides; a blackish midlateral stripe on side, broader and most vivid on caudal peduncle; a pronounced dark blotch or streak immediately above anterior part of anal fin base. Maximum size to about 125 mm SL, common to 75 mm SL.

Distribution and Habitat. - Vicinity of Port Moresby, Papua New Guinea. Thus far it has been collected from the Brown, Goldie, Laloki, and Kemp Welsh rivers. It is also common in Sirinumu Reservoir (Laloki River) on the Sogeri Plateau at an elevation of 540 m.

Remarks. - *Xenambassis lalokiensis* Munro is a junior synonym.



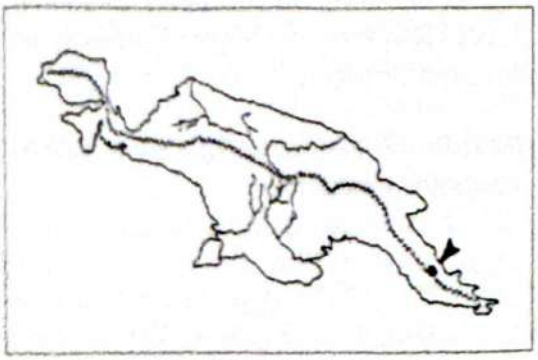
Kokoda Glass Perchlet
Tetracentrum caudovittatus
Norman, 1935
(Plate 10, no. 9)

Diagnosis. - Dorsal rays IX,9 or 10 (usually

10); anal rays III,8 to11 (usually 10); pectoral rays 15 or 16; tubed lateral-line scales 30-32, continuous throughout its length; supraorbital spines usually absent; 3-4 transverse scale rows on cheek; gill rakers on lower limb of first gill arch 12-15; predorsal scales 13-16; scales in longitudinal series 30-32; anal fin origin level with base of penultimate dorsal spine or between it and the last spine; length of penultimate dorsal spine 85-98% of length of last dorsal spine; brownish on back, whitish on ventral parts and head with silvery sheen; scattered black blotches on scales of sides and a concentration of black pigment forming a broad stripe along middle of caudal peduncle; a black blotch above anterior part of anal fin base. Maximum size to about 110 mm SL.

Distribution and Habitat. - Creeks near Kokoda in south-eastern Papua New Guinea at elevations of 300-400 m. It was also reported from a lowland stream near Popondetta, but recent collections there yielded only *T. honessi*. This locality may therefore be erroneous.

Remarks. - *Xenambassis simoni* Schultz is a junior synonym.

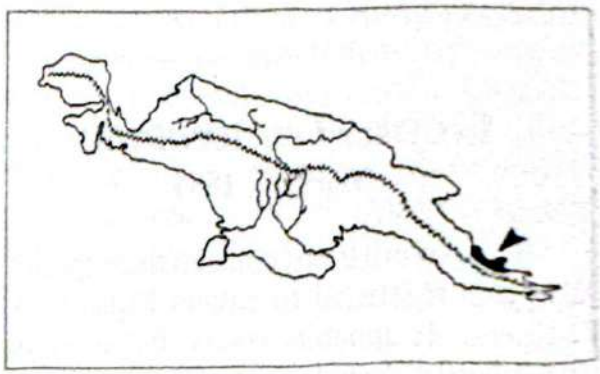


Honess' Glass Perchlet

Tetracentrum honessi
(Schultz, 1945)
(Plate 10, no. 10)

Diagnosis. - Dorsal rays VIII,10 or 11; anal rays III,9 to 11 (usually 10); pectoral rays 14 or 15; tubed lateral-line scales 31-35, continuous throughout its length; a single supraorbital spine (often embedded); 3-4 transverse scale rows on cheek; gill rakers on lower limb of first gill arch 12-14; predorsal scales 13-16; scales in longitudinal series 31-35; anal fin origin at a level between last dorsal spine and first soft dorsal ray; length of penultimate dorsal spine 71-82% of length of last dorsal spine; colour brownish on back, whitish on ventral parts, and head with silvery sheen; scattered black blotches on scales of sides; a diffuse, broad blackish stripe along middle of side, usually more pronounced on posterior part of body and expanded into a large blackish spot at base of caudal fin; a large black blotch immediately above anterior part of anal fin base; males in courtship are overall blackish. Maximum size to about 115 mm SL.

Distribution and Habitat. - Known only from a small area north of the Owen Stanley Range, eastern Papua New Guinea. Thus far it has been collected from the Moni River and its tributaries near Safia and in lowland streams around Popondetta.



Grunters

Family Terapontidae

Grunters are small to medium-sized perch-like fishes that inhabit marine, brackish and fresh waters of the Indo-West Pacific region. The family contains about 15 genera and 45 species. Six genera and all except about 12 species are restricted to fresh waters of New Guinea and Australia. Diagnostic characters for the family include a single dorsal fin of 11-14 spines and 8-14 soft rays; anal fin with 3 spines and 7-12 soft rays; lateral line continuous and extending onto caudal fin; vomer and palatine teeth absent in most species; paired extrinsic swim bladder muscles arising from rear of skull

or post-temporal bone and inserting on antero-dorsal surface of the anterior chamber of the swim bladder (used for production of grunting sounds, hence their common name); swim bladder transversely divided. The New Guinean species were reviewed by Mees and Kailola (1977) and the family was revised by Vari (1978), who also gave details of the unique swim bladder features. The region's freshwater species probably evolved from marine ancestors, perhaps in the late Cretaceous or early Tertiary. A fossil terapontid found in Queensland dates back to the Oligocene Epoch, indicating the family has been present in Australia for at least 30 million years.

Several of the brackish water species range a few kilometres upstream into pure fresh water, but many species spend their entire life cycle in fresh water. Habitats range from quiet lowland streams to lakes and swift-flowing brooks in mountainous terrain. Most of the stream dwelling species prefer deeper, rocky pools, frequently below waterfalls and rapids. The New Guinean species are generally carnivorous, feeding on aquatic and terrestrial insects and their larvae, crustaceans, molluscs, fishes, and frogs. Algae and floating fruits, flowers, leaves, and seeds of terrestrial plants are also consumed by some species. Several of the Australian species lay demersal eggs that sink into crevices in the gravel. The young hatch after 3-4 days. Small grunters are handsome and interesting aquarium pets, but unfortunately they often prove troublesome when kept with other fishes such as rainbows and blue-eyes. They have an aggressive nature and voracious appetites and for these reasons are best kept by themselves.

Key to the New Guinean Genera of Terapontidae

(adapted from Vari, 1978)

1a. Posttemporal bone covered with skin and scales,not expanded posteriorly, and without serrated edge 2

1b. Posttemporal bone exposed posteriorly, expanded and serrate posteriorly 3

2a. Lateral-line scales 60-66. .... *Varia* new genus

2b. Lateral-line scales 44-52 ..*Amniataba*

3a. Lower opercular spine greatly developed,extending beyond edge of opercle; caudal fin lobes with oblique dark stripes ..... *Terapon*

3b. Lower opercular spine smaller, not reaching edge of opercle; caudal fin lobes without oblique stripes 4

4a. Teeth flattened, strongly depressible; dorsal spines 13 or 14 ..... *Pingalla*

4b. Teeth conical, nondepressible or only slightly depressible; dorsal spines 11 or 12 5

5a. Dorsal and anal spines extremely long, the second anal spine longer than longest soft anal ray; forehead very steep and contrasted with flat ventral profile; snout pointed with mouth nearly even with ventral profile, well below level of eye; adults plain silvery, juveniles with 4 distinct black stripes on side ..... *Mesopristes*

5b. Dorsal and anal spines shorter, the second anal spine about equal to or shorter than longest soft anal ray; forehead less steep and ventral profile somewhat rounded rather than flat; snout blunt with mouth somewhat above plane of ventral profile; colour not as in 5a ..... *Hephaestus*

Genus *Amniataba*

Whitley, 1943

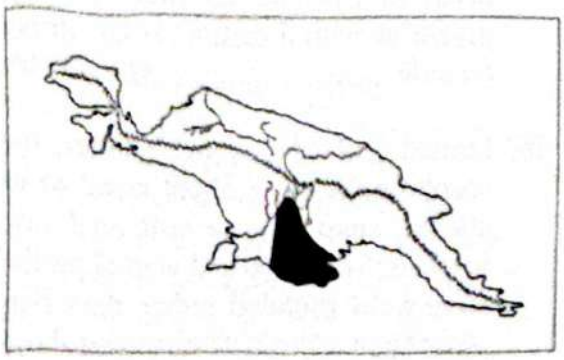
The genus contains a single New Guinean member and one marine and one freshwater species from Australia. They are generally small, silvery grunters with dark spots and/or bars on the sides.

Tiger Grunter

Amniataba affinis
(Mees & Kailola, 1977)
(Plate 11, no. 13)

Diagnosis.- Dorsal rays XIII,9 or 10; anal rays III,8 or 9; pectoral rays 13 to 15 (usually 14); gill rakers on first arch 6 or 7 + 12-14; lateral-line scales 43-46; horizontal scale rows above lateral line 6-7; head length 2.9-3.5, greatest body depth 2.5-2.8, both in SL; silvery with 4 narrow dark bars on upper two-thirds to three-fourths of side and dark spot or bar in front of tail; fins pale except lowermost rays of caudal fin dusky or blackish. Maximum size to 150 mm SL.

Distribution an Habitat. - Central-southern New Guinea. Thus far known only from the Fly, Morehead, and Bensbach river systems. It is widespread in the Fly system, occurring in the lowland, swampy parts of the river as far upstream as the Ok Mart River near Rumginae (about 870 km upstream from the sea). The habitat consists of swampy lagoons and back-waters as well as the main channel of turbid rivers.



Genus *Hephaestus*
de Vis, 1884

The genus is restricted to freshwater habitats of New Guinea and Australia. It contains three Australian and eight New Guinean species plus an additional species (*H. fuliginosus*) that is shared by the two regions.

Key to the New Guinean Species of *Hephaestus*

1a. Gill rakers on lower limb of first arch (including raker at angle) 15-19 2

1b. Gill rakers on lower limb of first arch (including raker at angle) 9-13 3

2a. Scales between origin of lateral line and caudal fin base (hypural) counted just below lateral line 55-62; transverse scale rows above lateral line 9 or 10 ..... *H. roemeri*

2b. Scales between origin of lateral line and caudal fin base (hypural) counted just below lateral line 48-52; transverse scale rows above lateral line 7 or 8 .. .. *H. fuliginosus*

3a. Scales between origin of lateral line and caudal fin base (hypural) counted just below lateral line 60-65; soft dorsal rays 14; body with variegated pattern of whitish or light yellowish spots on blackish background ..... *H. raymondi*

3b. Scales between origin of lateral line and caudal fin base (hypural) counted just below lateral line 45-59; soft dorsal rays 10-13; body often with longitudinal dark bands 4

4a. Dorsal spines very short, the longest spine equal, shorter, or only slightly longer than snout length (Lake Kutubu) ..... *H. adamsoni*

4b. Dorsal spines somewhat longer, the longest spine equal to snout length plus eye width, or even longer 5

5a. Colour white with 4-5 prominent black longitudinal stripes that persist in adults (northern drainages only) 6

5b. Colour of adults generally grey to dark brown without dark stripes, juveniles with 5-8 dark longitudinal stripes (if 5 there is also a large black spot on the rear edge of the gill cover) (southern drainages) 7

6a. Lateral-line scales 46-54; circumpeduncular scales 13-15; distance between base of last dorsal ray and middle of caudal fin base (hypural) about equal to distance between snout tip and rear of eye (Bewani Mountains and coastal drainages of northern Irian Jaya) ....*H. obtusifrons*

6b. Lateral-line scales 57-68; circumpeduncular scales 16-17; distance between base of last dorsal ray and middle of caudal fin base (hypural) longer than distance between snout tip and rear of eye (Ramu and Sepik systems) .....*H. transmontanus*

7a. Upper rear edge of gill cover with prominent pale-edged black spot; juveniles with 5 or 6 dark longitudinal stripes .....*H. lineatus*

7b. Upper rear edge of gill cover without black spot; juveniles with 6-8 dark longitudinal stripes. 8

8a. Scales between origin of lateral line and caudal fin base counted just below lateral line 54-59 .....*H. habbemai*

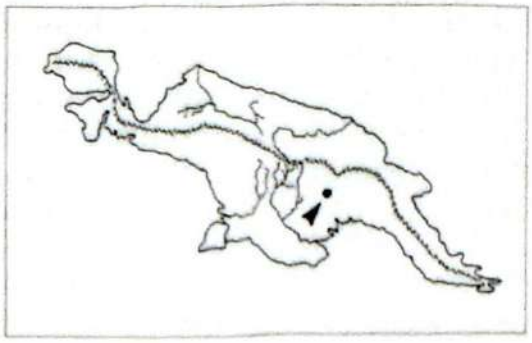
8b. Scales between origin of lateral line and caudal fin base counted just below lateral line 45-51 .....*H. trimaculatus*

Adamson's Grunter

Hephaestus adamsoni
(Trewavas, 1940)
(Plate 11, no. 6)

Diagnosis. - Dorsal rays XII,10 to 12; anal rays III,9 or 10; pectoral rays 13 to 16; gill rakers on first arch 5-6 + 10-12; lateral-line scales 52-56; horizontal scale rows above lateral line 8-10; head length 2.6-3.2, greatest body depth 2.5-3.2, both in SL; juveniles olive or brownish on back becoming white on lower sides with about 7-10 wavy or broken longitudinal stripes on side, these gradually disappear in adults which are brownish above and white below. Maximum size to about 350-400 mm SL.

Distribution and Habitat. - Known only from Lake Kutubu in the Southern Highlands Province of Papua New Guinea. It is extremely common there; juveniles are found in the shallows close to shore, whereas adults form large schools over deep water adjacent to rocky cliffs. It is one of the main food fishes of the Foi people who live along the shores of the lake.

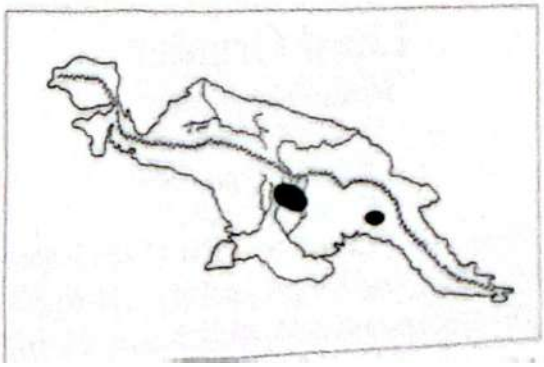


Sooty Grunter

Hephaestus fuliginosus
(Macleay, 1883)
(Plate 11, no. 1)

Diagnosis. - Dorsal rays XII,12 or 13; anal rays III,9; pectoral rays 15 to 17; gill rakers on first arch 7-10 + 16-18; lateral-line scales 43-51; horizontal scale rows above lateral line 7 or 8; head length 2.6-3.1, greatest body depth 2.4-2.9, both in SL; dark grey, often with greenish hue; white on lower part of head, breast, and belly; juveniles with large black blotch on anal fin and smaller black spot at base of last dorsal rays. Maximum size to 45 cm SL.

Distribution and Habitat. - Known from southern Papua New Guinea in the Purari and upper Fly River systems. It occurs well upstream in rocky pools; in the Fly system it was taken from the main river at Kiunga and from the Ok Mart River near Rumginae



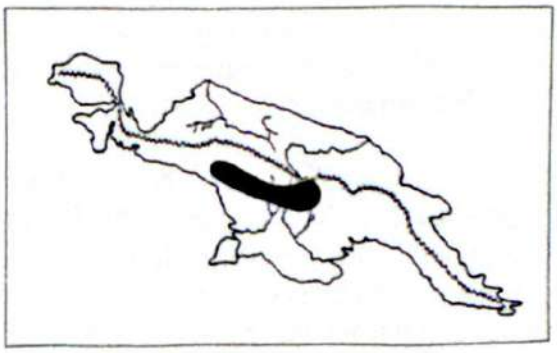
at distances between about 850-900 km upstream from the sea.

Mountain Grunter

Hephaestus habbemai
(Weber, 1908)
(Plate 11, no. 7)

Diagnosis. - Dorsal rays XII or XIII (usually XIII),11 to 13; anal rays III,10 or 11; pectoral rays 15 to 17; gill rakers on first arch 4-6 + 11-12; lateral-line scales 56-58; horizontal scale rows above lateral line 8-10; head length 2.8-3.2, greatest body depth 2.5-2.7, both in SL; dark brown, often with lighter blotching and speckling on back and head, ventral surface of head and body white; juveniles with pale ground colour and 6-8 dark stripes, sometimes superimposed with 5 vertical dark bars. Maximum size to at least 150 mm SL.

Distribution and Habitat. - River systems of central-southern New Guinea including the Fly-Strickland, Digul, Lorentz and Mimika. It appears to be largely restricted to the upper mountainous portions of these systems. For example, in the Fly River it is common around Tabubil, approximately 970-980 km upstream from the sea. The habitat consists of cobble and gravel bottom streams and deep pools below rapids and waterfalls.

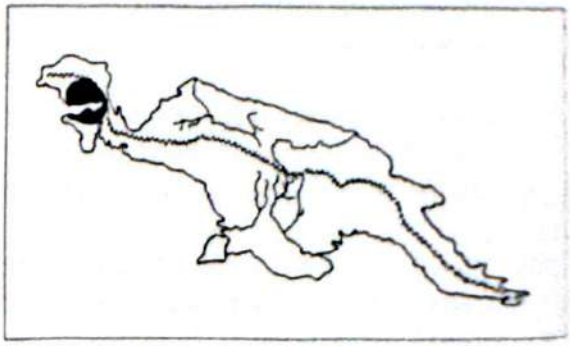


Lined Grunter

Hephaestus lineatus
Allen, 1984
(Plate 11, no. 4)

Diagnosis. - Dorsal rays XIII,12 or 13; anal rays III,12 or 13; pectoral rays 14 to 16; gill rakers on first arch 6-8 + 13-14; lateral-line scales 54; horizontal scale rows above lateral line 7; head length 2.7-3.0, greatest body depth 2.6-2.8, both in SL; adults dark grey brown, white ventrally; head golden brown; a prominent pale-margined black spot on rear upper edge of gill cover; juveniles whitish with 5 black-margined dark grey stripes on side, and 3 black spots in a vertical row at base of caudal fin; freshly captured individuals may have checker-board pattern of bars and stripes. Maximum size to at least 200 mm SL.

Distribution and Habitat. - Widely distributed on the Vogelkop Peninsula and the Bomberai Peninsula immediately to the south. It has been collected to date from relatively few widely scattered river systems including the Djarua, Yakati, Karabra, and Kamundan. Specimens have been captured in rocky creeks and small rivers flowing through rainforest. Adults congregate in deep holes below rapids.



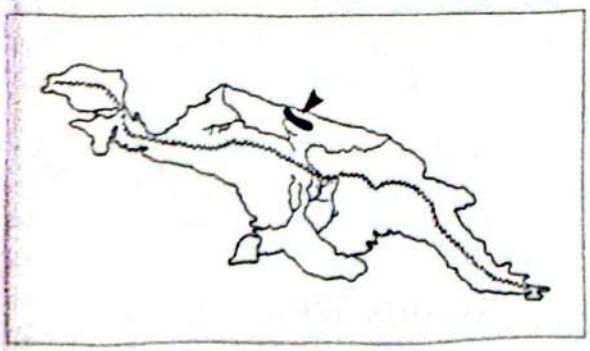
Striped Grunter

Hephaestus obtusifrons
(Mees & Kailola, 1977)
(Plate 11, no. 8)

Diagnosis. - Dorsal rays XII,10 or 11; anal rays III,9 or 10; pectoral rays 15 to 16; gill rakers on first arch 5-6 + 10-11; lateral-line scales 46-54; horizontal scale rows above lateral line 8-10; head length 3.0-3.4, greatest body depth 2.7-3.0, both in SL; olive or brown on back grading to white on sides, 4-5 prominent black stripes on head and upper two-thirds of side. Maximum size to 125 mm SL.

Distribution and Habitat. - Known only from the Bewani Mountains, Papua New

Guinea and the upper Sermowai River, Irian Jaya. These localities, which straddle the Papua New Guinea-Irian Jaya border on the northern coast are separated by about 100 km. The Sermowai specimens were collected in 1911 from the main river and a small tributary above a 50 m waterfall. Those from the Bewani Mountains were taken in 1982 from a small gravel-bottom creek in the headwaters of the Pual (or Nemayer) River system. The altitude of the two localities ranges from about 200-400 m.



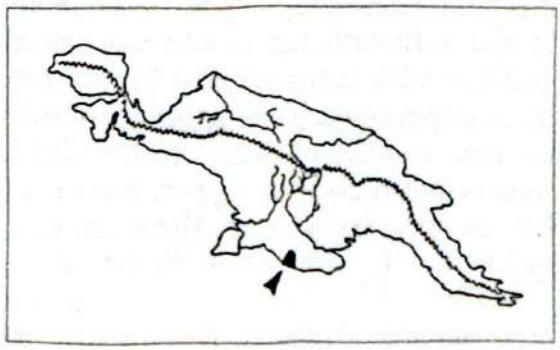
Raymond's Grunter

Hephaestus raymondi
(Mees & Kailola, 1977)
(Plate 11, no. 3)

Diagnosis. - Dorsal rays XII,14; anal rays III,10 or 11; pectoral rays 16 or 17; gill rakers on first arch 6-7 + 12; lateral-line scales about 65; horizontal scale rows above lateral line 10 or 11; head length 2.8-2.9, greatest body depth 2.3-2.6, both in SL; dark brown to blackish with golden flecks on scales of body and maze of golden lines and spots on head; juveniles black with irregular white or pale yellow spots and blotching, including some that form 4-5 broken vertical bands on side. Maximum size to 250 mm SL.

Distribution and Habitat. - Thus far known only from the Morehead River in south-western Papua New Guinea. Occurs in clear, rainforest creeks over gravel and cobble bottoms.

Remarks - Closely related to *H. carbo* of northern Australia. The two species are nearly identical in appearance, but *H. raymondi* has smaller scales (about 65 in lateral line and 71-73 in longitudinal series just below lateral line) compared to *H. carbo* (about 53-59 in lateral line and 57-61 just below lateral line).

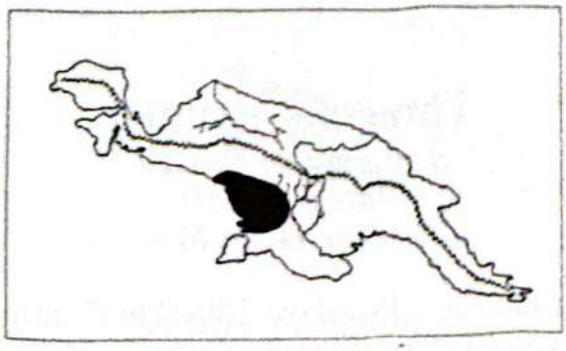


Röemer's Grunter

Hephaestus roemeri
(Weber, 1910)
(Plate 11, no. 2)

Diagnosis. - Dorsal rays XI or XII,12 to 14; anal rays III,9 or 10; pectoral rays 14 to 16; gill rakers on first arch 8-9 + 15-19; lateral-line scales 50-56; horizontal scale rows above lateral line 5-7; head length 2.9-3.3, greatest body depth 2.4-2.6, both in SL; head, body, and fins of adults dark grey; juveniles brown, white ventrally, with black blotch at base of soft dorsal and anal fins. Maximum size to 300 mm SL.

Distribution and Habitat. - Known only from southern Irian Jaya in the Digul and Lorentz rivers. The habitat consists of large turbid lowland rivers.



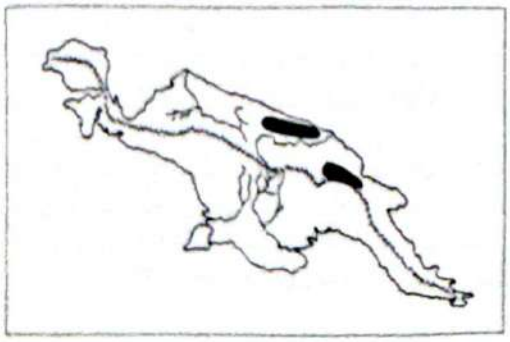
Sepik Grunter

Hephaestus transmontanus
(Mees & Kailola, 1977)
(Plate 11, no. 9)

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 4-5 + 9-11; lateral-line scales 57-68; horizontal scale rows above lateral line 9-11; head length 3.2-3.5, greatest body depth 2.7-3.6, both in SL; yellowish tan to olive on back grading to white ventrally with 4-5 prominent black stripes on head and upper two-thirds to three-fourths of side; freshly dead specimens may assume 6 or more transverse bars on upper half of side. Maximum size to 125 mm SL, common to 90 mm SL.

Distribution and Habitat. - Ramu and Sepik River systems of northern Papua New Guinea. Common in rainforest creeks flowing through hilly or mountainous terrain. Also occurs in the Ramu main stream in the upper Ramu Valley upstream of the Brahman Mission Bridge. It is found in most creeks in the Torricelli Mountain range and its foothills on the northern side of the Sepik watershed and on the southern side it is found in the Jimmi River and some of its tributaries, including the Baiyer River. The altitudinal distribution ranges from about 120 m to 1500 m.

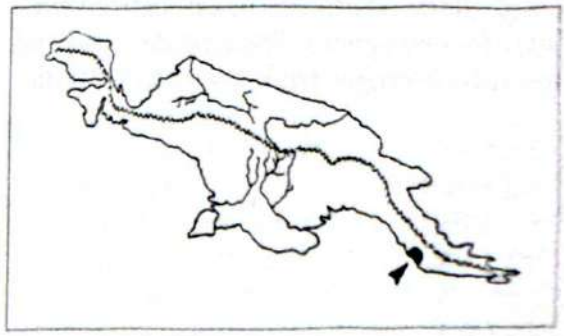


Threespot Grunter

Hephaestus trimaculatus
(Macleay, 1884)
(Plate 11, no. 5)

Diagnosis. - Dorsal rays XIII,11 to 13; anal rays III,10 or 11; pectoral rays 15 or 16; gill rakers on first arch 5-6 + 12-13; lateral-line scales 46-52; horizontal scale rows above lateral line 7-8; head length 2.6-3.0, greatest body depth 2.3-2.9, both in SL; grey brown with lighter brown scale centres, white on ventral parts; side of body with 8 dark brown stripes, more vivid in small juveniles; base of caudal fin with 3 dark brown spots in a vertical row. Maximum size to 220 mm SL.

Distribution and Habitat. - Known only from the vicinity of Port Moresby, Papua New Guinea in the Laloki River and its tributaries including the Brown and Goldie rivers. It occurs in rocky pools of lowland streams.



Genus *Mesopristes*
Bleeker, 1845

These grunters have a distinctive shape characterised by a steep forehead, flattened ventral profile, and very long dorsal and anal fin spines. The genus contains four species that inhabit coastal embayments, estuaries, and the lower sections of freshwater streams. Two species are present in New Guinea; the other two, *M. elongatus* and *M. kneri* are endemic to Madagascar and the Fiji Islands respectively.

Key to New Guinean Species of *Mesopristes*

1a. Transverse scale rows on cheek 4-6; pored lateral-line scales posterior to caudal base (hypural) 5-6; body with vertical bars on back and horizontal stripes on lower sides except in large adults ..... *M. cancellatus*

1b. Transverse scale rows on cheek 8-9; pored lateral-line scales posterior to caudal base (hypural) 10-12; horizontal black stripes on body of juveniles, adults plain silvery ..... *M. argenteus*

Silver Grunter

Mesopristes argenteus
(Cuvier, 1829)
(Plate 11, no. 14)

Diagnosis. - Dorsal rays XII,10 or 11; anal rays III,8 or 9; pectoral rays 12 to 14; gill rakers on first arch 7-9 + 16-18; lateral-line scales 52-58; horizontal scale rows above lateral line 6-8; head length 2.4-3.1, greatest body depth 2.4-2.8, both in SL; adults mainly silvery; small juveniles silvery white with 4 black stripes on side and yellowish dorsal, caudal, and anal fins. Maximum size to 280 mm SL.

Distribution and Habitat. - Indonesia, Philippines, New Guinea, New Britain, Solomon Islands, Vanuatu, and Queensland (Cape York Peninsula). In New Guinea it is widely distributed along the coast. Juveniles commonly enter the lower sections of creeks and may penetrate several kilometres into fresh water.

Tapiroid Grunter

Mesopristes cancellatus
(Cuvier, 1829)

Diagnosis. - Dorsal rays XI or XII,10 or 11; anal rays III,8 or 9; pectoral rays13 to 16; gill rakers on first arch 9-11 + 16-19; lateral-line scales 48-58; horizontal scale rows above lateral line 6-8; head length 2.8-3.2, greatest body depth 2.5-3.0, both in SL; adults overall silvery; juveniles with several bars on back and 3 horizontal stripes or broken lines on lower side. Maximum size to 230 mm SL.

Distribution and Habitat. - Widespread in the Western Pacific including Okinawa, Taiwan, Philippines, Indonesia, New Guinea, New Britain, Solomon Islands, and Vanuatu. Juveniles are sometimes encountered in streams within 5-10 km of the sea.

Genus *Pingalla*

Whitley, 1953

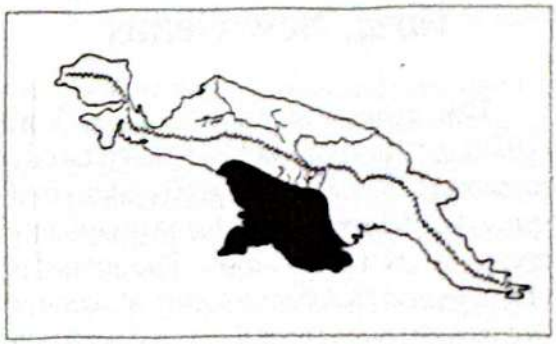
The genus contains two Australian representatives and a third species that is shared by both New Guinea and Australia. They are silvery fishes characterised by a small mouth with very flattened teeth arranged in two distinct rows in each jaw, in contrast to the multiserial teeth arranged in bands found in other grunters.

Lorentz's Grunter

Pingalla lorentzi
(Weber, 1910)
(Plate 11, no. 12)

Diagnosis. - Dorsal rays XIII or XIV, 11 to 13; anal rays III,8 or 9; pectoral rays 15; gill rakers on first arch 6 + 12 or 13; lateral-line scales 48-54; horizontal scale rows above lateral line 6-7; head length 2.6-3.6, greatest body depth 2.3-2.5, both in SL; silvery with dusky scale margins; fins mainly clear, but duskiness present on pelvics and anal fin and basal half of caudal fin. Maximum size to 170 mm SL.

Distribution and Habitat. - Central-southern New Guinea and northern Australia (Cape York Peninsula). New Guinea localities include the following rivers (proceeding westward): Fly, Morehead, Bensbach, Digul, and Lorentz. It occurs well upstream in all of these systems; as far as about 870-900 km from the sea in the Fly River. The habitat consists of backwaters, swamps, and turbid channels of large rivers.



Genus *Terapon*

Cuvier, 1817

This is the most widely distributed genus in the family ranging from East Africa and the Red Sea east to Samoa and north to Japan. The genus contains three marine species, but one of these *(T. jarbua)* is present in brackish estuaries and sometimes penetrates fresh water.

Crescent Perch

Terapon jarbua
(Forsskål, 1775)
(Plate 11, no. 15)

Diagnosis. - Dorsal rays XI or XII,9 to 11; anal rays III,7 to 10; pectoral rays 13 or 14; gill rakers on first arch 6-8 + 13-16; lateral-line scales 75-100; horizontal scale rows above lateral line 13-17; head length 2.3-3.6, greatest body depth 2.5-3.2, both in SL; silvery white with 3 or 4 curved stripes on sides; large black blotch on outer half of anterior half of spinous dorsal fin and pronounced stripes on caudal fin. Maximum size to 300 mm SL, common to 150 mm SL.

Distribution and Habitat. - Widespread from East Africa and Madagascar to the Red Sea and Arabian Gulf, then eastward along the continental margin of the northern Indian Ocean to the Indo-Malayan region and Australia; also ranges across southern Oceania to Samoa and northward along the east Asian coast to southern Japan. It inhabits harbours, river mouths, estuaries, and the lower reaches of streams. Apparently spawning occurs in the sea and juveniles migrate into fresh water.

Varia, New Genus

This genus was referred to by Vari (1978) as "*Terapon*" in his detailed family revision. He stated that it was an undescribed genus, but did not name it due to uncertainty regarding its relationships. The genus is characterised by a combination of features that include: posttemporal covered with skin and scales, not expanded posteriorly, and not having a serrate edge; two spines arising from the first proximal dorsal pterygiophore; lateral-line scale count 55-66; each jaw with band of fixed (non-depressible) conical teeth, the outer row somewhat enlarged. The genus contains two species distributed in southern New Guinea *Therapon jamoerensis* Mees (1971) is designated as the type species. The genus is named for Richard P. Vari in recognition of his work on the Terapontidae.

Key to the Species of *Varia*

1a. Eye large, 3.0 in the head length (Lake Jamur, Irian Jaya) ..... *V. jamoerensis*

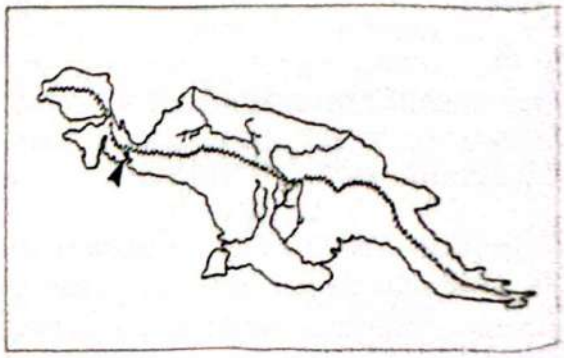
1b. Eye moderate, 3.4-4.4 in the head length (Fly River Delta) ..... *V. lacustris*

Jamur Lake Grunter

Varia jamoerensis
(Mees, 1971)
(Plate 11, no. 11)

Diagnosis. - Dorsal rays XII to XIV,10 or 11; anal rays III,8 or 9; pectoral rays 14 or 15; gill rakers on first arch 5-6 + 11-12; lateral-line scales 60-66; horizontal scale rows above lateral line 9-10; head length 2.9-3.0, greatest body depth 2.4-2.5, both in SL; brownish with silvery sheen, white on ventral parts. Maximum size to 85 mm SL.

Distribution and Habitat. - Known only from Lake Jamur in the centre of the narrow isthmus that separates the Bomberai and Vogelkop peninsulas from the remainder of New Guinea. The lake drains south into the Arafura Sea via the Waoedoe and Omba rivers. This small (6-8 km diameter) lake is relatively shallow with clear water and moderate aquatic vegetation.



Lake Grunter

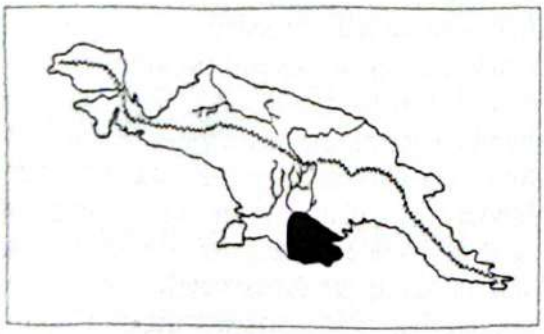
Varia lacustris
(Mees & Kailola, 1977)
(Plate 11, no. 10)

Diagnosis. - Dorsal rays XIII,10 or 11; anal rays III,8 or 9; pectoral rays 14 or 15; gill rakers on first arch 4-7 + 11-13; lateral-

line scales 55-62; horizontal scale rows above lateral line 9-11; head length 2.6-3.5, greatest body depth 2.4-2.7, both in SL; brownish, darker on back, white on ventral surface. Maximum size to 150 mm SL, common to 100 mm SL.

Distribution and Habitat. - Known only from the Fly River Delta region. It has been collected from the Balimo area, lower Fly River, including Lake Murray, and from the Morehead River. The habitat consists of still waters of lowland lakes and swamps.

Remarks. - This species is very closely related to *V. jamoerensis*, differing primarily in eye size. Mees and Kailola (1977) suggested that it might eventually be recognised as only a subspecies. The closest populations of the two species are separated by a distance of about 750 km. Perhaps the future discovery of new populations from intermediate localities will help to clarify the status of the presently recognised species.



Flagtails
Family Kuhlidae

These small, silvery fishes are found on shallow coral reefs, in estuaries, and fresh waters of the tropical Indo-Pacific region and eastern Atlantic. They are elongate and oval in shape, somewhat resembling the North American sunfishes (Centrachidae). Diagnostic features include a notched dorsal fin consisting of 10-12 strong spines and 9-16 soft rays, body covered with ctenoid scales, mouth with fine teeth in jaws arranged in bands, preopercle serrate, and opercle with two flattened spines. This family, previously referred to as Duleidae, contains two genera, *Parakuhlia*, with a single Atlantic species, and the Indo-Pacific *Kuhlia* with six species. Flagtails are often seen in schools; the reef species in particular may form dense aggregations in shallow water, often where there is surge. Freshwater species inhabit mainly coastal streams, but sometimes penetrate 200-300 km inland in large rivers such as the Sepik. They feed on insects and their larvae, prawns, crabs, and small fishes.

Genus *Kuhlia Gill*, 1861

The genus contains six species that are distributed from East Africa to the western coast of Central America.

Key to the Freshwater species of *Kuhlia* from New Guinea

1a. Anal fin with 11-13 branched rays; maxilla not reaching vertical through middle of eye; caudal fin deeply emarginate with pointed lobes, the median rays about half length of the outer rays; caudal fin without oblique blackish blotch across each lobe or black bar across fin ..... *K. marginata*

1b. Anal fin with 10 branched rays; maxilla extending to below middle of eye or beyond; caudal fin with a shallow emargination and bluntly rounded lobes, the median rays more than half length of the outer rays; caudal fin with oblique blotch across each lobe or broad dark bar across posterior part of fin .... *K. rupestris*

Spotted Flagtail
Kuhlia marginata (Cuvier, 1829)
(Plate 1, no. 18)

Diagnosis. - Dorsal rays X,10 to 12; anal rays III,11 to 13; pectoral rays 13 to 15; lateral-line scales 40-45; transverse scale rows 14-15; predorsal scales 9-12; gill rakers

on first arch 9 + 16-18; greatest body depth 2.5-2.9 in SL; generally silvery grey, adults developing dark spots on upper sides; blackish submarginal band on soft dorsal and anal fins; caudal fin base sometimes spotted, posterior margin of fin may be blackish, especially in juveniles. Maximum size about 180 mm SL.

Distribution and Habitat. - New Guinea northward to southern Japan and east to the Society Islands. Most New Guinean records are from the north coast of Papua New Guinea; it is also present at Bougainville. It inhabits brackish waters of estuaries and also penetrates fresh water. It is often seen in small, clean, fast-flowing coastal brooks, within several kilometres of the sea, where it congregates in rocky pools below rapids and small waterfalls.

Rock Flagtail or Jungle Perch

Kuhlia rupestris
(Lacepède, 1802)
(Plate 1, no. 17)

Diagnosis. - Dorsal rays X,11; anal rays III,9 or 10; pectoral rays 13 or 14; lateral-line scales 41-44; transverse scale rows 13-16; predorsal scales 14-16; gill rakers on first arch 5-6 + 16-19; greatest body depth 2.4-3.0 in SL; brown or olive on back grading to silvery grey on sides and whitish on belly; sides covered with numerous dusky or red-brown spots; broad black band on upper half of soft dorsal fin; caudal fin with oblique black blotch across each lobe, these fusing in large adults to form a continuous black bar. Maximum size to 400 mm SL, common to 250 mm SL.

Distribution and Habitat. - Widely distributed in the tropical Indo-Pacific region from East Africa to Melanesia and eastern Australia. Most New Guinean records are from the Port Moresby district and Madang Province. It inhabits relatively fast-flowing, clear streams frequently in rainforest.

Remarks. - In eastern Australia it is a popular angling species that may reach a weight of 2-3 kg.

Mouth-Almighty or Cardinalfishes

Family Apogonidae

Most members of this family live in the sea, often around coral reefs and are known as cardinalfishes. However, the genus *Glossamia* of New Guinea and northern Australia is restricted to freshwater streams, lakes, and swamps. The genus contains nine species, all which occur in New Guinea.

The species of *Glossamia* are commonly referred to as Mouth Almighties because of their relatively large gape. They are carnivores which feed on juvenile fishes, crustaceans, terrestrial insects, and aquatic insect larvae. They are most often found in thick vegetation on the edge of streams. *Glossamia* and other marine cardinal fishes are mouth brooders. An egg mass containing up to several hundred ova is extruded by the female and taken into the mouth of the male where they are incubated for several days. The eggs are relatively large (about 4 mm diameter) and the young are well developed at hatching. A maximum size of about 20 cm is reached in some species, but most are below about 12 cm.

Key to the Freshwater Genera of New Guinea Apogonidae

1a. Longitudinal scale rows between lateral line and base of spinous dorsal fin 4 to 6.. ..... *Glossamia*

1b. Longitudinal scale rows between lateral line and base of spinous dorsal fin 1 1/2 to 2 ..... *Apogon*

Genus *Apogon*

Lacepède 1802

This genus is mainly marine and contains well over 100 species. They occur

in all tropical and subtropical seas, but most inhabit the Indo-Pacific region. Several species are regularly found in brackish water, but only two of these are commonly encountered in fresh water.

Key to the Species of Freshwater *Apogon* from New Guinea

1a. Side with 1-2 dark stripes; dorsal profile without marked concavity at nape .....*A. amboinensis*

1b. Side without dark stripes, uniform pale; dorsal profile with marked concavity at nape .....*A. hyalosoma*

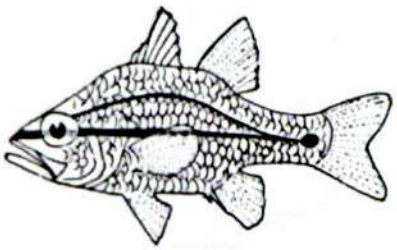


Fig. 21. Ambon cardinalfish, ***Apogon amboinensis.***

Ambon Cardinalfish

Apogon amboinensis
Bleeker, 1853
(Fig. 21)

Diagnosis. - Dorsal rays VI-I,9; anal rays II,8; pectoral rays 14; gill rakers on first arch 22; lateral-line scales 24-25; greatest body depth 2.0-2.3 in SL; preopercle serrate; colour whitish with narrow blackish midlateral stripe ending at tail base where there is a black spot, about pupil size; frequently with a second dark stripe on upper side. Maximum size to about 70 mm SL.

Distribution and Habitat. - Indo-Malayan region northward to Japan and southeast ward to New Caledonia. Forms schools in brackish water of mangrove bays and river mouths. Apparently moves into fresh water at low tide. Usually found within 2-3 km of the sea.

Mangrove Cardinalfish

Apogon hyalosoma
Bleeker, 1852
(Plate 17, no. 8)

Diagnosis. - Dorsal rays VI-I,9; anal rays II,8; pectoral rays 14; gill rakers on first arch 7-8 plus several small rudiments; lateral-line scales 24-26; greatest body depth 2.3-2.6 in SL; rear edge and lower border of preopercle feebly serrate; profile of nape concave, particularly in adults; whitish or with slight golden tinge; a large (equal or greater than eye size) black spot at base of caudal fin; fins pale except membrane between second and third spines of first dorsal fin black. Maximum size to 150 mm SL.

Distribution and Habitat. - Widespread from East Africa to the Indo-Australian Archipelago. It inhabits brackish mangrove estuaries and the lower reaches of freshwater streams.

Genus *Glossamia*
Gill, 1863

This genus is unique among the Apogonidae in being entirely confined to fresh waters. The group contains six species that are restricted to New Guinea and an additional species that is shared by New Guinea and northern Australia. They are nocturnal predators of small fishes, insects, and prawns, resting amongst vegetation and log snags during the day.

Key to the Species of *Glossamia*

(adapted from Roberts, 1978)

1a. Body with dark vertical bars, sometimes obscured by uniformly dark colouration or by mottling..... ..2

1b. Body with horizontal or oblique stripes, rarely obscured by uniformly dark or dull colouration, but never by mottling 5

2a. Body with 8-13 vertical bars, rarely obscured by uniformly darkened colouration; scales in lateral line 46-50 ..... *G. sandei*

2b. Body with 3-4 vertical bars, sometimes obscured by uniformly darkened colouration or by mottling; scales in lateral line 45 or fewer 3

3a. First gill arch with 8 gill rakers; vertical bars rarely obscured by uniformly darkened colouration, but never by mottling; vertical bar below base of first dorsal fin much wider than eye diameter ..... *G. trifasciata*

3b. First gill arch with 7 gill rakers; vertical bar sometimes obscured by mottling, but never by uniformly darkened colouration; vertical bar below base of first dorsal fin narrower than eye diameter 4

4a. Body usually with heavy mottling between vertical bars; snout immediately below posterior nostril without distinctive mark; body depth at first dorsal fin origin 2.7-3.0 in SL ..... *G. aprion*

4b. Body without mottling; a well defined, intensely pigmented spot immediately below posterior nostril; body depth at first dorsal fin origin 3.2-3.5 in SL ..... *G. narindica*

5a. Body with horizontal stripes. ..... *G. beauforti*

5b. Body with oblique stripes 6

6a. Body with 5-10 stripes; lateral-line scales 24-35 ..... *G. wichmanni*

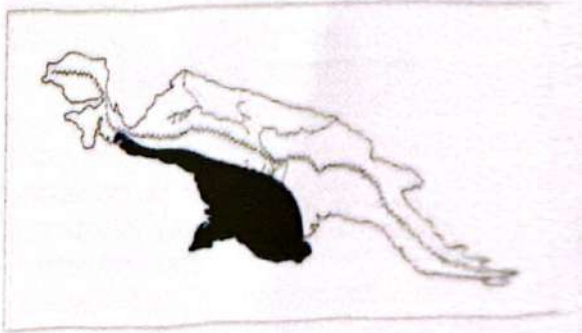
6b. Body with 10-20 stripes (often 12-15); lateral-line scales usually 32-47 ..... *G. gjellerupi*

Mouth Almighty

Glossamia aprion
(Richardson, 1842)
(Plate 12, no. 11)

Diagnosis. - Dorsal rays VI-I,9 to 11; anal rays II,8 to 10; pectoral rays 12 or 13; lateral-line scales 25-43; colour brown or red brown on back, white or silvery on side with large and small irregular blotches of brown or reddish brown; usually 2-3 dark bars evident on sides below each dorsal fin and across caudal peduncle; a broad dark brown band from snout through eye to side of forehead; a second band frequently present from bottom of eye across cheek; most fins dusky brown, pelvics mainly blackish, white around edges; outer portion of first dorsal fin blackish. Maximum size to about 180 mm SL, common to about 120 mm SL.

Distribution and Habitat. - Central-southern New Guinea from the Fly-Strickland system westward to Lake Jamur. Collecting localities include the Upper and Middle Fly (including Lake Murray), Oriomo, Bensbach, and Digul rivers. It also occurs widely in northern Australia.

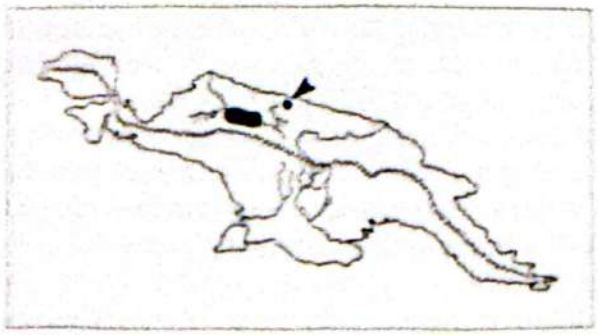


Beaufort's Mouth Almighty

Glossamia beauforti
(Weber, 1908)
(Plate 11, no. 9)

Diagnosis. - Dorsal rays VI-I,9; anal rays II,9; pectoral rays 14 or 15; lateral-line scales 37-41; colour coppery brown with series of about 6-10 blackish horizontal stripes on sides; fins dusky brown to yellowish. Maximum size to about 160 mm SL.

Distribution. - Recorded from both Lake Sentani and the Mamberamo River system, but I have only been able to confirm its presence in Lake Sentani. Records of this species by Weber and de Beaufort (1929) from the Lorentz River of southern New Guinea and the Aru islands are probably erroneous.



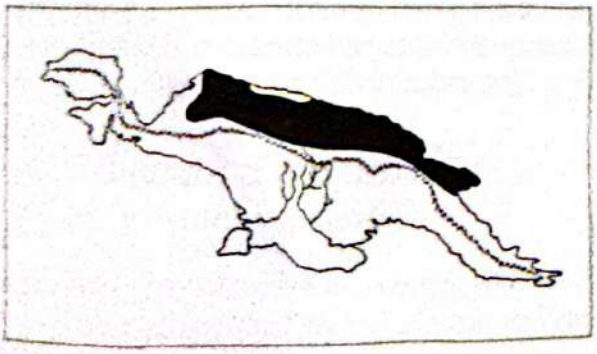
Gjellerup's Mouth Almighty

Glossamia gjellerupi
(Weber & de Beaufort, 1929)
(Plate 11, no. 12)

Diagnosis. - Dorsal rays VI-I,9 or 10; anal rays II,9 or 10; pectoral rays 14; lateral-line scales 24-47; colour light to dark brown with series of about 10-20 blackish or dark brown forward slanting stripes (rarely obscured by uniform dark or dull colouration); frequently a dark band below eye across cheek. Maximum size to about 160 mm SL.

Distribution. - Widely distributed in major river systems and small independent coastal drainages between Lae and the Mamberamo basin, including the Markham, Gogol, Ramu, Sepik, and Mamberamo rivers.

Remarks. - There is an increase in lateral-line scale counts proceeding in a north-easterly direction. Populations from the Markham, Ramu, and Gogol systems generally have 32-38 scales; those from the Sepik have 32-40 in lowland areas and usually 37-45 from the Torricelli Mountains area; the highest counts are found in Mamberamo specimens (40-46).

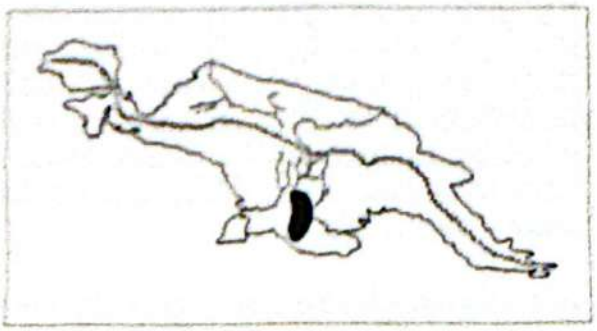


Slender Mouth Almighty

Glossamia narindica
Roberts, 1978
(Plate 11, no. 15)

Diagnosis. - Dorsal rays VI-I,9 or 10; anal rays II,9 or 10; pectoral rays 12 or 13; lateral-line scales 39-42; colour generally brown with silvery reflections on head and lower sides; 3 narrow dark brown bars, one below each dorsal fin and one across base of caudal fin; an oblique dark band on side of snout, continued behind eye on upper part of head; fins dusky, outer part of first dorsal fin blackish. Maximum size to at least 125 mm SL.

Distribution. - Known only from 11 specimens collected in the Bensbach and middle Fly rivers.



Sande's Mouth Almighty

Glossamia sandei
(Weber, 1908)
(Plate 11, no. 16)

Diagnosis. - Dorsal rays VI-I,10; anal rays II,8; pectoral rays 15; lateral-line scales 46-50; colour generally brown with about 8-12 darker brown bars on sides; lower part of head and breast silvery to bluish; fins dusky. Maximum size to about 190 mm SL.

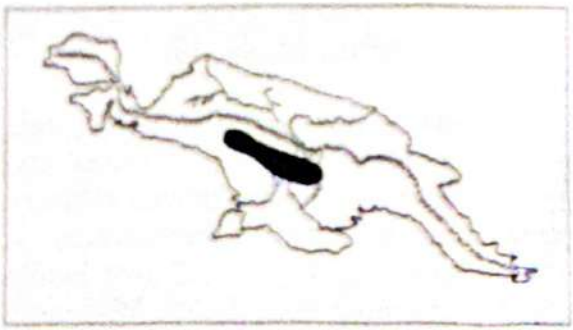
Distribution. - Purari River of Papua New Guinea westward to the Wagani River of Irian Jaya. Most collecting localities, including the Purari, Fly, Strickland, Digul, Lorentz, and Mimika rivers, are in the southern watershed, but the Wagani flows north into Cenderawasih Bay.

Three-Barred Mouth Almighty

Glossamia trifasciata
(Weber, 1913)
(Plate 11, no. 14)

Diagnosis. - Dorsal rays VI-I,9; anal rays II,8 to 10; pectoral rays 16; lateral-line scales 26-37; colour brown, often with golden or yellow-orange hue on breast and abdomen; 3 dark brown or blackish bars (rarely obscured by uniform darkened colouration) on side, one below each dorsal fin and one across base of caudal fin; fins yellowish to dusky brown except pelvics blackish or dark brown. Maximum size to about 100 mm SL.

Distribution. - Known only from the Fly-Strickland system of Papua New Guinea and Lorentz River of Irian Jaya. Specimens from the Fly-Strickland have lower gill raker counts (26-33 versus 35-37).

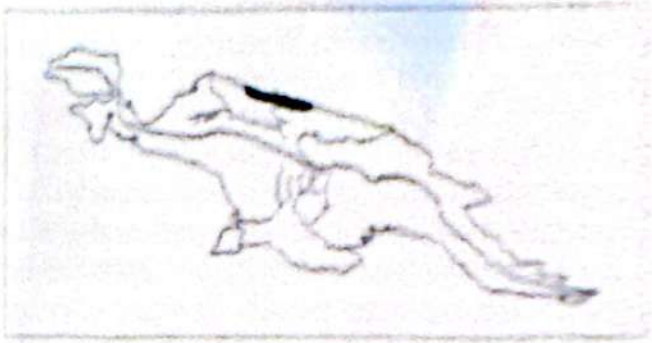


Wichmann's Mouth Almighty

Glossamia wichmanni
(Weber, 1908)
(Plate 11, nos. 10 & 13)

Diagnosis. - Dorsal rays VI-I,9; anal rays II,9; pectoral rays 15; lateral-line scales 24-35; colour light to dark brown with series of about 5-10 blackish or dark brown forward slanting stripes (rarely obscured by uniform dark or dull colouration); usually a dark band below eye across cheek. Maximum size to about 180 mm SL.

Distribution. - Bewani Mountains in northern Papua New Guinea westward to the Tawarin River. Collection sites include Luap Creek, Mosso River, Lake Sentani, Sennowai River, and Tawarin River.



Trevallies

Family Carangidae

The trevally or jack family is an important group of circumglobal marine fishes containing approximately 140 species. They are especially common around tropical reefs. Most species are silvery in colour, laterally compressed, and have a very narrow-based, forked caudal fin. They also have specialised bony scales, called scutes, on the posterior part of the lateral line. Many are good eating and they are commercially utilised in some areas. The young of at least one species, *Caranx sexfasciatus*, penetrates fresh water and may be found well inland in larger river systems. Trevallies are predators of fishes and crustaceans. The largest species grow to 1.5 m in length.

Genus *Caranx*
Lacepède, 1801

The genus contains about 13 species and is distributed in all tropical seas.

Bigeye Trevally

Caranx sexfasciatus
Quoy & Gaimard, 1824
(Plate 17, no. 4)

Diagnosis. - Dorsal rays VIII-I,19 to 22; anal rays II-I,14 to 17; gill rakers on first arch 6-8 + 15-19; straight (posterior) section of lateral line with 27-36 strong scutes adults iridescent blue green above, silvery white below; soft dorsal lobe with white tip; lateral line scutes dark; juveniles generally silver with clear to yellowish fins except upper half of dorsal fin lobe and upper lobe of caudal fin usually dark. Maximum size to 750 mm SL.

Distribution and Habitat. - Widespread in the tropical Indo-Pacific from East Africa to the Americas. Adults are strictly marine, forming schools on reefs. Juveniles are found in brackish mangrove estuaries and sometimes enter rivers, penetrating well inland, for example 200-300 km up the Sepik River.

Ponyfishes

Family Leiognathidae

Ponyfishes are common inhabitants of estuaries throughout the Indo-West Pacific region, particularly on continental coasts. They are similar in general appearance to Silver Biddies, but generally lack scales (or have embedded scales that are difficult to detect). Both groups have characteristic protrusible jaws used for feeding on benthic invertebrates that live on soft muddy bottoms. Several ponyfishes have been found in fresh water in the New Guinea-Australia region, but only *Leiognathus equulus* is commonly encountered in New Guinea. The largest ponyfishes attain a length of about 25 cm.

Genus *Leiognathus*

Lacepède, 1802

The genus contains at least 20 species and is confined to the Indo-West Pacific region, except for one species that has reached the Mediterranean via the Suez Canal. The genus is in need of a comprehensive revision.

Common Ponyfish

Leiognathus equulus
(Forsskål, 1775)
(Plate 17, no. 5)

Diagnosis. - Dorsal rays VIII,15 or 16; anal rays III,14 or 15; pectoral rays 18 to 20; lateral-line scales 54-63, but difficult to count due to their small size and embedded nature; mouth protrudes in a downward direction; silvery, sometimes with faint narrow bars on back and dark saddle on upper caudal fin base; axil of pectoral fin dusky; fins clear or with yellowish hue. Maximum size to about 220 mm SL.

Distribution and Habitat. - Widespread in the tropical Indo-West Pacific from East Africa to Samoa. It inhabits shallow coastal seas, frequently in estuaries and sometimes penetrating fresh water.

Snappers

Family Lutjanidae

Snappers are mainly marine fishes found worldwide in tropical and subtropical latitudes. They are much esteemed food fishes and are commercially important in some places. The family contains 103 species in 17 genera. *Lutjanus*, with 65 species, is by far the largest genus. Characteristic features of this family include: body moderately deep to elongate; a single dorsal fin that is sometimes deeply incised; soft dorsal and anal fins scaleless, scaly, or with a basal scaly sheath; pelvic axillary scale process usually well developed; upper jaw usually moderately protractile; jaws usually with distinct canines; vomer and palatines usually with small conical teeth; preopercle usually serrate; scales ctenoid; cheek and opercle scaly; and caudal fin truncate to deeply forked.

There is little information on the biology of the freshwater species, but they appear to spend most, if not all of their life cycle in fresh water. So far neither young or adults of *L. goldiei*, have been found in marine or estuarine conditions. Each female snapper may lay thousands of eggs averaging about 1 mm in diameter. In marine species these are generally pelagic and hatching occurs within 17-27 hours. The pelagic larval stage lasts about 25 to 47 days. The maximum life span of snappers has been estimated between 4 and 21 years. Snappers are active predators feeding mainly at night on a variety of items, although fishes and crustaceans are dominant in the diet of most species. The larger snappers attain a length of slightly over 100 cm.

Genus *Lutjanus*
Bloch, 1790

The genus contains 65 species that are distributed in tropical waters as folows: Indo-West Pacific - 39 species; Eastern Pacific - 9 species; Western Atlantic - 12 species; and Eastern Atlantic - 5 species. Nearly all are marine fishes, but three species are mainly restricted to fresh waters of the Indo-Pacific region, including New Guinea. In addition, the young of several marine species, including the Mangrove Jack *(L. argentimaculatus)*, frequent mangrove estuaries and lower reaches of freshwater streams.

Key to the Freshwater Species of *Lutjanus* from New Guinea

1a. Juvenile colour pattern consisting of 4 relatively wide brown or black stripes on whitish ground colour, stripes gradually replaced by plain brown colour in older specimens ..... *L. maxweberi*

1b. Colour pattern not as in 1a 2

2a. Large blackish spot usually present on upper back ..... *L. fuscescens*

2b. Blackish spot on back absent 3

3a. Body depth 2.5-2.9 (average 2.7) times in SL; least depth of caudal peduncle 3.0-3.5 times in head length; longitudinal scale rows on upper back parallel to lateral line anteriorly and some rows usually ascending obliquely below posterior dorsal spines ..... *L. argentimaculatus*

3b. Body depth 2.2-2.6 times in SL; least depth of caudal peduncle 2.5-3.0 times in head length; longitudinal scale rows on upper back entirely parallel to lateral line ..... *L. goldiei*

Mangrove Jack
Lutjanus argentimaculatus
(Forsskål, 1775)
(Plate 12, no. 8)

Diagnosis. - Dorsal rays X,13 or 14; anal rays III,8; pectoral rays 16 or 17; longitudinal scale rows above lateral line 4-6; depth of preorbital 4.5-7.9 in head length; preopercular notch poorly developed; vomerine teeth in a crescentic band without a medial posterior extension; canine teeth at front of jaws greatly enlarged; caudal fin truncate; colour greenish brown on upper half, silvery or whitish on lower parts; juveniles with a series of about 8 narrow whitish bars across body; 1-2 horizontal blue lines on cheek of juveniles and subadults, sometimes persisting in adults. Maximum size to about 100 cm and weight to at least 16 kg. Fish from freshwater are considerably smaller.

Distribution and Habitat. - Widely distributed in the Indo-Pacific region from East Africa and the Red Sea to Samoa and the Line Islands in the central Pacific. Adults are found on coastal reefs and deeper offshore areas, but juveniles and subadults favour estuaries and the lower sections of freshwater streams. In New Guinea the young are often found in mangrove areas.

Papuan Spotted Bass
Lutjanus fuscescens
(Valenciennes, 1830)
(Plate 12, no. 6)

Diagnosis. - Dorsal rays X,13 to 15; anal

rays III,8; pectoral rays 16 or 17; longitudinal scale rows above lateral line 6-7; depth of preorbital 6.5-6.8 in head length; preopercular notch poorly developed; vomerine teeth in a crescentic band without a medial posterior extension; canine teeth well developed; caudal fin slightly emarginate; colour dark brown or greenish brown on back grading to silvery on sides with ventral parts whitish; a large black spot on upper side below middle of soft part of dorsal fin; juveniles may have 8-10 diffuse pale bars on the side in addition to the black spot. Maximum known size to about 40 cm, but probably grows considerably larger.

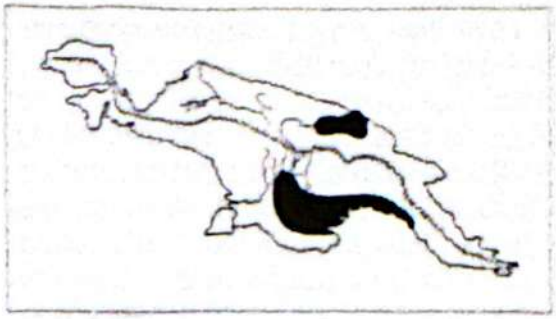
Distribution and Habitat. - China, Philippines, Indonesia, New Guinea, and Solomon Islands. Most New Guinean specimens have been collected on the island of New Britain. It is apparently common and much sought after by Australian anglers in rivers in the vicinity of the Talasea Peninsula on the north coast

Papuan Blackbass or Moonfish

Lutjanus goldiei
(Macleay, 1884)
(Plate 12, no. 7)

Diagnosis. - Dorsal rays X,13 or 14; anal rays III,8; pectoral rays 16 or 17; longitudinal scale rows above lateral-line 5-6; depth of preorbital 4.7-6.1 in head length; preopercular notch poorly developed; vomerine teeth in a crescentic band without a medial posterior extension; canine teeth at front of jaws greatly enlarged; caudal fin truncate; colour metallic golden brown to charcoal grey or blackish, paler ventrally; juveniles dark brown with yellowish fins. Maximum size to about 100 cm.

Distribution and Habitat. - Known only from New Guinean fresh waters. Most specimens have come from streams draining into the Gulf of Papua, but it also occurs in the Sepik and Ramu rivers in the north. In the Fly River it has been taken as far upstream as 828 km from the sea, but is most common in the Middle Fly



(about 200-400 km upstream). It occurs in narrow "blackwater" rainforest tributaries in the lower Ramu system, and in the Sepik mainstream at Angoram.

Pygmy Snapper

Lutjanus maxweberi
Popta, 1921

Diagnosis. - Dorsal rays X,13; anal rays III,8; pectoral rays 16; longitudinal scale rows above lateral line 5; depth of preorbital 6.9-10.1 in head length; preopercular notch poorly developed; vomerine teeth in a crescentic or triangular band without a medial posterior extension; canine teeth well developed; caudal fin emarginate; colour of young whitish to grey with 4 dark brown or blackish stripes on side; stripes begin to fade at about 100 mm SL and have disappeared by 140 mm SL, at this size the body is mainly brown, darker on back and top of head and silvery white on lower half. Maximum known size is 150 mm SL.

Distribution and Habitat. - A very poorly known species. Only nine specimens are known that were collected at Sulawesi, Philippines, and New Guinea (near Wewak and Lae).

Tigerfishes
Family Datnioididae

This small family contains a single genus, *Datnioides*, and only two species, found in fresh and brackish waters of South-east Asia, Indonesia, and New Guinea. They are strongly marked with a pattern

of black bars, have a laterally compressed and relatively deep body, and possess strong, sharp fin spines. The small young are excellent aquarium fishes and large (up to 30-40 cm) adults are considered good eating. The taxonomic position of *Datnioides* has always been controversial and many authors have included it in the Lobotidae (commonly known as tripletails), now believed to contain a single circumtropical marine species, *Lobotes surinamensis*. However, there does not seem to be a logical basis for linking *Datnioides* to the Lobotidae or any other group and I have followed Roberts (1989), who is the first to recognise Datnioididae as a separate family.

Genus *Datnioides*
Bleeker, 1853

The genus contains two species, *D. microlepis* (fresh waters of Kampuchea, Thailand, and Borneo), and *D. quadrifasciatus* (see below).

Four-Banded Tigerfish
Datnioides quadrifasciatus
(Sevastianov, 1809)
(Plate 1, no. 15)

Diagnosis. - Dorsal rays XII,13 or 14; anal rays III,8 or 9; lateral-line scales 55-62; transverse scales above lateralline 10-12, below lateral line 18-19; predorsal scales about 26; gill rakers on first arch 7 + 9; greatest body depth 2.0-2.5 in SL; caudal fin rounded; generally whitish to tan with 8-10 dark brown to blackish bars of which 6 are complete and intermediate ones are shorter and narrower; bars reduced to only 4 or become entirely diffuse in large adults; juveniles with black opercular blotch and 3 bands radiating from eye. Maximum size to 300 mm SL; common to 180 mm SL.

Distribution and Habitat. - India, Burma, Thailand, Vietnam, Sumatera, Borneo, and New Guinea. It occurs in brackish river mouths, coastal lagoons, and fresh waters of lakes and rivers above tidal influence. In New Guinea it apparently occurs only south of the central divide; thus far it has been recorded from Balimo Lagoon and the Fly, Oriomo, and Lorentz rivers. It occurs as far as 900 km upstream in the Fly system.

Remarks. - *Datnioides campbelli* Whitley is a synonym. It was originally described from specimens thought to have been collected in the Sepik River, but this locality is erroneous and they were actually from the Fly.

Silver Biddies
Family Gerriidae

The members of this family, also sometimes called Whipfins or Mojaras have a circumtropical distribution, mainly in shallow seas and estuaries. At least one species in the New Guinea-Australia region, *Gerres filamentosus*, is regularly encountered in the lower parts of fresh water streams. Silver Biddies are similar to the ponyfishes (Leiognathidae) in general appearance, but have well developed, relatively large scales. Both groups are characterised by highly protrusible jaws that are used for feeding on small benthic invertebrates. Silver Biddies grow to a maximum length of about 25 cm.

Genus *Gerres*
Quoy & Gaimard, 1824

The genus contains about 30 species and is distributed in all tropical seas. Knowledge of many species is poor and a comprehensive revision of the group is needed.

Threadfin Silver-Biddy
Gerres filamentosus
Cuvier, 1829
(Plate 17, no. 6)

Diagnosis. - Dorsal rays IX,10 or 11; anal rays II,7 or 8; lateral-line scales 45-48; transverse scale rows 17-19; predorsal scales 13-22; gill rakers on first arch 4-6 + 17; greatest body depth 2.0-2.5 in SL; second dorsal spine forming prolonged filament, absent

in small (below 40-50 mm SL) juveniles, but gradually increasing with age; silvery, usually with 7-10 vertical rows of dark spots, these forming bars in small specimens. Maximum size to 220 mm SL.

Distribution and Habitat. - Widespread in the Indo-West Pacific from East Africa to Melanesia and Australia. It inhabits shallow coastal seas to at least 50 m depth. Juveniles occur in brackish mangrove estuaries and sometimes penetrate fresh water.

Croakers
Family Sciaenidae

Croakers are mainly marine and estuarine fishes, although a number of species sometimes occur in fresh water. This large family contain approximately 300 species in 24 genera and has a world-wide distribution. Most species inhabit tropical or subtropical latitudes. Species identification is often difficult and sometime relies on the shape and structure of the swim bladder. In addition to providing buoyancy, this organ is used to produce a peculiar noise which is responsible for the name "Croaker." These fishes usually occur on soft mud or silt bottoms where they feed on a variety of invertebrates. Some species attain a length of nearly 2 m.

Genus *Nibea*
Jordan & Thompson, 1911

This genus contains about six species and is distributed along the continental margin of Asia from India to Japan, also extending to Indonesia, Philippines, New Guinea and Queensland.

Key to the Freshwater Species of *Nibea* from New Guinea

1a. Snout not projecting, its length 23-28% of head length; anal spine 13-17% of SL; pectoral fin 19-23% of SL .... *N. soldado*

1b. Snout projecting, its length 27-31% of head length; anal spine 11- 13.5% of SL; pectoral fin 23.5-26.5% of SL ..... *N.* sp.

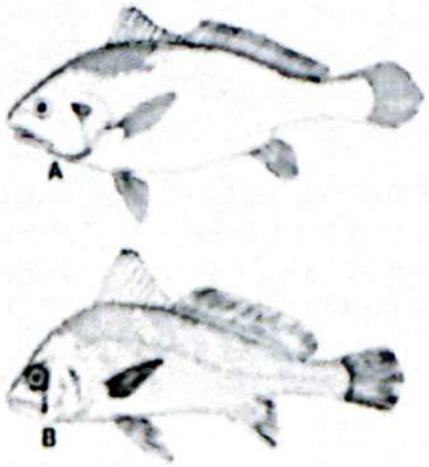


*Fig. 22. Freshwater sciaenids: A) **Nibea** sp. B) **N. soldado** (from Fischer and Whitehead, 1974; Fischer and Bianchi, 1984)*

Sharpnose Jewfish
Nibea sp.
(Fig. 22A)

Diagnosis. - Dorsal rays XI,26; anal rays II,7; pectoral rays 16; lateral-line scales 51; transverse scale rows about 20; gill rakers on first arch 5 + 10; snout rounded, protruding prominently over lower jaw; maxillary extending to below posterior margin of eye; generally silvery grey, whitish on ventral parts. Maximum size to at least 530 mm SL.

Distribution and Habitat. - An undescribed species known from Australia and New Guinea. Adult specimens were collected by Roberts from the Middle and Lower Fly-Strickland system at distances between 300-515 km upstream from the mouth. The habitat consists of both turbid river channels and swampy lagoons along the edge of rivers. It also occurs in coastal waters. Roberts (1978) referred to it as *N. semifasciata*.

Silver Jewfish

Nibea soldado (Lacepède, 1802)
(Fig. 22B)

Diagnosis. - Dorsal rays XI,28 to 31; anal rays II,7; lateral-line scales 50-55; transverse scale rows 25-27; gill rakers on first arch 6-7 + 8-13; snout rounded, but only slightly protruding over lower jaw; maxillary extending to below posterior margin of eye; overall silvery. Maximum size to about 550 mm SL.

Distribution and Habitat. - Widespread from India and Sri Lanka eastward to New Guinea and eastern Australia. It inhabits coastal waters to at least 40 m depth. Juveniles frequent brackish estuaries and often ascend the lower parts of large, turbid rivers.

Silver Moonfishes

Family Monodactylidae

This small family contains only three species, of which *Monodactylus argenteus* is represented in New Guinea-Australia and surrounding regions. This species inhabits harbours, estuaries, river mouths, and frequently ascends clear freshwater streams up to about 5-10 km inland. It generally occurs in schools which feed on planktonic items. The largest member of the family attains a length of about 25 cm.

Genus *Monodactylus*

Lacepède, 1800

The genus contains two species, *M. falciformis* of the western Indian Ocean and the wide-ranging *M. argentus*.

Silver Moonfish

Monodactylus argentus
(Linnaeus, 1758)
(Plate 17, no. 9)

Diagnosis. - Dorsal rays VIII,27 to 30; anal rays III,27 to 30; pectoral rays 16 to 18; gill rakers 8 + 18-22; lateral-line scales 52-58; body diamond-shaped; pelvic fins present in juveniles, reduced or absent in adults; silvery with brown to blackish tips on dorsal and anal fin lobes; juveniles with pair of curved dark bars on head. Maximum size to about 200 mm SL.

Distribution and Habitat. - Widespread in the tropical Indo-West Pacific region from East Africa to Fiji. Common in mangrove estuaries, often entering creeks.

Archerfishes

Family Toxotidae

Archerfishes are well known for their ability to knock down insects from overhanging vegetation by squirting a jet of water from their mouth. When prey is sighted the archerfish quickly rises to the surface and ejects its aqueous "bullets" by forcefully compressing the gill covers, causing the expulsion of a jet of water through a tube formed by corresponding grooves on the roof of the mouth and the tongue. Large archerfishes can hit a target 2-3 m away, and in most cases the victim is knocked into the water and instantly devoured. The family contains a single genus, *Toxotes*, that is represented by six species and is distributed from India and Sri Lanka to Melanesia, including New Guinea, Solomon Islands, and Vanuatu. They inhabit coastal mangrove swamps, brackish estuaries, and fresh water, with some species penetrating hundreds of kilometres inland. Besides insects, they feed on fruits, berries, and flowers of terrestrial plants that fall onto the surface. Archerfishes are easily recognised by their distinctive appearance that includes a strongly compressed body, flattened dorsal profile, usually 4-5 dorsal and 3 anal spines that are stout and sharp, and a pattern of black spots or bars. The young make fine aquarium pets and adults are considered good eating. They are excellent angling fishes, readily accepting hooks baited with live grass-hoppers or cockroaches, and can also be caught with man-made flies.

Genus *Toxotes*
Cuvier, 1817

The genus contains six species, most of which have localised distributions in southeast Asia and the Indo-Australian Archipelago, although two species are relatively widespread from India to Melanesia.

Key to the New Guinea Species of *Toxotes*

1a. Dorsal spines 4; series of 4-5 black bars on upper half of body. ...*T. jaculatrix*

1b. Dorsal spines 5 (rarely 6); pattern variable, either plain or with about 8-10 narrow bars or 6-7 black spots on sides. 2

2a. Colour uniform without markings or with about 8-10 narrow bars on side; pectoral rays usually 14 (occasionally 15); lateral line running in a straight course; gill rakers on lower limb of first arch 2-4 (usually 3). ..*T. lorentzi*

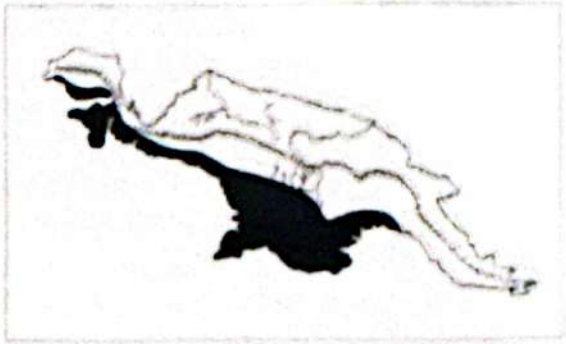
2b. Colour pattern consisting of 6-7 alternating large and small black spots (except small juveniles may have 4-5 broad bars); pectoral rays 11-14 (usually 13); lateral line arched over pectoral region; gill rakers on lower limb of first arch 5-7.. ...*T. chatareus*

Seven-Spot Archerfish
Toxotes chatareus
(Hamilton, 1822)
(Plate 12, no. 4)

Diagnosis. - Dorsal rays V or VI,12 or 13; anal rays III,15 to 17; pectoral rays 11 to 14; lateral-line scales 29 to 37 (usually 29 to 32); horizontal scale rows above lateral line 3-5, below lateral line 9-11; gill rakers on lower limb of first arch 5-7; greatest body depth 1.9-2.4 in SL; fourth dorsal spine usually the longest, 1.3-2.3 in head length; overall white or silvery white with 6-7 black spots on upper side, 3 of these usually much larger than others; fins clear to dusky, outer margin of anal fin usually blackish. Maximum size to 400 mm SL; usually under 250 mm SL.

Distribution and Habitat. - India and Sri Lanka to New Guinea and northern Australia. In New Guinea it has been recorded only from southern drainages at numerous localities between the Purari River area and Bintuni Bay, including Lake Jamur. It inhabits brackish mangrove estuaries and freshwater streams. Breeding populations are known from both fresh and brackish water. It is frequently found well inland, for example as far as 800 km upstream in the Fly River.

Remarks. - A 400 mm SL specimen reported by Roberts from the Fly River is the largest record for this species.



Banded Archerfish
Toxotes jaculatrix
(Pallas, 1767)
(Plate 12, no. 5 & Plate 17, no. 7)

Diagnosis. - Dorsal rays IV,11 to 13 (usually IV,12); anal rays III,15 to 17; pectoral rays 12 or 13; lateral-line scales 26-30; horizontal scale rows above lateral line 3-4, below lateral line 8-9; gill rakers on lower limb of first arch 5-7; greatest body depth 2.1-2.4 in SL; third dorsal spine the longest, 1.7-1.9 in head length; generally white or silvery white with 4-5 black bars, primarily on upper sides. Maximum size to 200 mm SL.

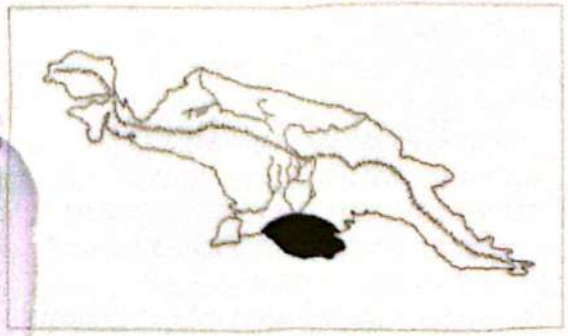
Distribution and Habitat. - India to New Guinea, Queensland, Solomon Islands, and Vanuatu. It generally occurs in mangrove swamps, sometimes in brackish water and very rarely in the lower parts of freshwater creeks. Unlike the other New Guinean *Toxotes*, it seldom penetrates fresh water.

Lorentz's Archerfish

Toxotes lorentzi
Weber, 1910
(Plate 12, no. 3)

Diagnosis. - Dorsal rays V,13 or 14; anal rays III,15 to 17; pectoral rays 14 or 15; lateral-line scales 39-47; horizontal scale rows above lateral line 7, below lateral line 12 or 13; gill rakers on lower limb of first arch 2-4; greatest body depth 2.1-2.5 in SL; fourth dorsal spine the longest, 2.0-2.3 in head length; overall brown or bronze, sometimes silvery grey, grading to darker brown dorsally; 8-10 faint dusky brown bars on side; fins dusky. Maximum size to 150 mm SL.

Distribution and Habitat. - Central-southern New Guinea and Australia (Northern Territory). Known in New Guinea only from Balimo Lagoon, the Lower Fly River (Lake Daviumbu) and Merauke River, but certainly more widespread in the Fly Delta area. It inhabits swamps and well vegetated margins of streams.



Scats

Family Scatophagidae

Scats are similar in general appearance to the marine butterflyfishes of the family Chaetodontidae, but are distinguished from them by the presence of four rather than three anal spines,17 instead of 16 principal caudal fin rays, and a non-protractile mouth. The family contains only two species in two genera, *Scatophagus argus* and *Selenotoca multifasciata*. They are mainly confined to the region encompassed by south-eastern Asia and the Indo-Australian Archipelago. They inhabit silty harbours, mangrove estuaries, and the lower reaches of freshwater streams. The young, which may be found in schools, are good aquarium fishes. Scats feed on small invertebrates and detritus that is scavanged from the bottom.

Genus *Scatophagus*
Cuvier, 1831

The genus contains a single species that is discussed below.

Spotted Scat

Scatophagus argus
(Linnaeus, 1766)
(Plate 17, no. 10)

Diagnosis. - Dorsal rays XI,16 to 18; anal rays IV,13 to 15; lateral-line scales 85-120; gill rakers on first arch 5 + 13; head profile ascending steeply with a deep concavity above the eyes in adults; fin spines stout and sharp; caudal fin truncate; brown or greenish with silver sheen on sides; sides covered with brown or reddish-brown spots; small juveniles with alternating light and dark bars, often reddish orange on top of head, along back, and on adjacent dorsal fin. Maximum size to 300 mm SL.

Distribution and Habitat. - India to Society Islands. Common in New Guinea in silty bays and harbours, and in mangrove estuaries. Juveniles sometimes enter fresh water, but usually remain within a few km of the sea.

Damselfishes

Family Pomacentridae

Damselfishes occur worldwide in mainly tropical and subtropical seas. The family contains 28 genera and 325 species, of which only three are regularly found in fresh water,

including *Neopomacentrus taeniurus* of New Guinea and surrounding regions.

Most species are associated with coral reefs. Damselfishes exhibit an interesting reproductive pattern that has been the subject of much scientific research. One or both parents prepare a nest site on the bottom and then engage in a courtship ritual which includes much chasing, zig-zag or up and down swimming, and fin erection. After the eggs are deposited they are closely guarded until hatching, usually by the male. The largest damselfishes attain 30 cm, but most species are under about 10 cm.

Genus *Neopomacentrus*
Allen, 1975

The genus contains about 12 species that are restricted to the Indo-West Pacific region; all but one are purely marine species.

Freshwater Demoiselle
Neopomacentrus taeniurus
(Bleeker, 1856)
(Plate 17, no. 12)

Diagnosis. - Dorsal rays XIII,11 or 12; anal rays II,11 or 12; pectoral rays 16 to 18; tubed lateral-line scales 15 to 17; total gill rakers on first arch 21 to 23; greatest body depth 2.3-2.5 in SL; brown with lighter scale centres; fins brown except pectorals, posterior part of dorsal and anal fins, and middle part of caudal fin yellowish; upper and lower edges of caudal fin with dark brown streak; margins of dorsal, anal, and pelvic fins narrowly blue; a small dark brown spot at base of upper pectoral rays. Maximum size to 60 mm SL.

Distribution and Habitat. - East Africa from Mozambique northwards and east to Queensland, Australia and Melanesia, including New Guinea. Found along continental margins in brackish water near the mouth of small rivers and creeks, and in estuaries. It also occurs in pure fresh water, but always within a few kilometres of the sea. Spawning may occur in both brackish and freshwater conditions.

Mullets
Family Mugilidae

Mullets are distinctive, well known fishes, that occur worldwide in tropical and temperate seas. The family contains about 70 species in 13 genera. They are generally elongate, silvery fishes characterised by a small mouth with feeble teeth or no teeth, two well separated dorsal fins (the first containing four slender spines), the lateral line is absent, and there is often an enlarged scale present at the upper axil of the pectoral and pelvic fins or just below the first dorsal fin. The eye is often partly surrounded by transparent fatty tissue that is referred to as the adipose eyelid. Most species are schooling, coastal dwellers that exhibit a wide tolerance to fluctuating salinities. They are common in estuaries, particularly in brackish mangrove areas and some species penetrate well inland. Most species spawn in the sea, but a few probably also spawn in brackish or fresh waters. At least one New Guinean species, *Cestraeus goldiei*, lives in rapid-flowing streams in hilly or mountainous terrain, and may breed in fresh water. Mullets are important commercial fishes in many parts of their range; in New Guinea they are a major sustenance fish for coastal villagers. The diet of mullets consists largely of bottom detritus and plant material.

Key to the Freshwater Genera of Mullets from New Guinea

1a. Jaw elongate, reaching to below eye; 2-4 bluntly rounded fleshy lobes at the posterior end of the lower jaw.. .. .. *Cestraeus*

1b. Jaws short, not reaching eye; no fleshy lobes at the posterior end of the lower `jaw. 2

2a. Lips with several rows of papillae .... *Crenimugil*

2b. Lips without papillae. 3

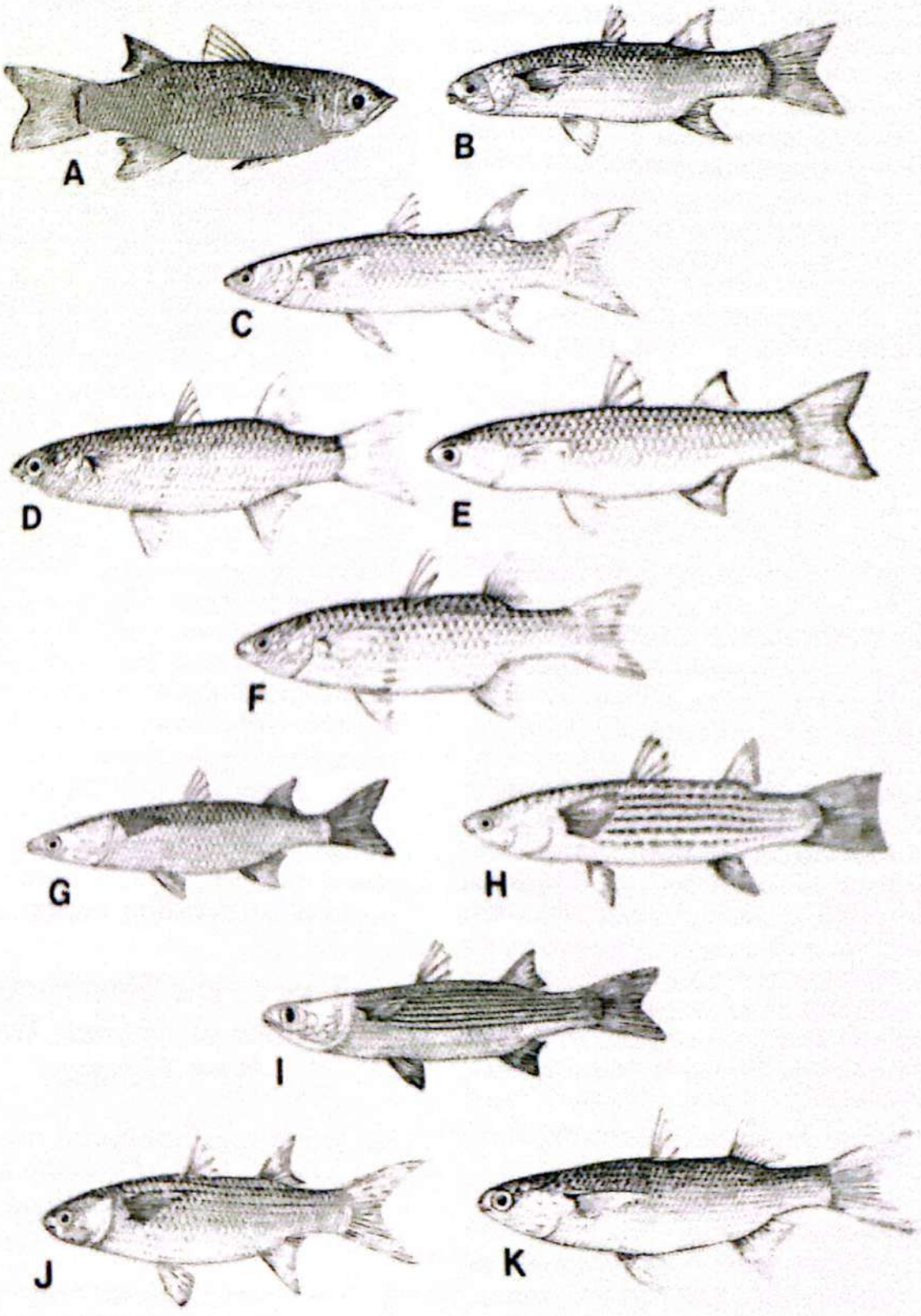


*Fig. 23. Freshwater mullets of New Guinea: A) **Cestraeus goldiei**; B) **Crenimugil heterocheilus**; C) **Liza alata**; D) **L. macrolepis**; E) **L. subviridis**; F) **L. melinoptera**; G) **L. tade**; H) **L. vaigiensis**; I) **Mugil cephalus**; J) **Valamugil buchanani**; K) **V. seheli** (from Weber and de Beaufort, 1922; Fischer and Bianchi, 1948).*

3a. Pectoral axillary scale rudimentary or absent ..... *Liza*

3b. Pectoral axillary scale well developed. 4

4a. Adipose eyelid well developed....*Mugil*

4b. Adipose eyelid absent. ..... *Valamugil*

Genus *Cestraeus*
Valenciennes, 1836

This highly distinctive mullet genus is represented by three species and is distributed in the Indo-Melanesian Archipelago from Sumatera to New Caledonia.

Goldie River Mullet
Cestraeus goldiei
(Macleay, 1884)
(Fig. 23A)

Diagnosis. - Dorsal rays IV-I,8; anal rays III,9; pectoral rays 16 or 17; midlateral scales 37-39; transverse scales 13-14; predorsal scales about 22; greatest body depth 4.0-4.8; snout pointed; jaws relatively long, reaching to below eye; adipose eyelid reduced to a narrow rim around eye; grey above, silvery on sides, and white below. Maximum size to 410 mm SL.

Distribution and Habitat. - Sulawesi, Timor, New Guinea,Vanuatu, and New Caledonia. Most New Guinean records are from the Port Moresby district. It is reported from fresh and brackish water; adults may occur well inland to an altitude of at least 350 m in fast-flowing streams.

Genus *Crenimugil*
Schultz, 1946

The genus contains two species and is widely distributed throughout the tropical Indo-West and Central Pacific region.

Fringe-Lipped Mullet
Crenimugil heterocheilus
Bleeker, 1855
(Fig. 23B)

Diagnosis. - Dorsal rays IV-I,8; anal rays III,9; pectoral rays 15; midlateral scales 35-37; transverse scales 14; predorsal scales about 21; an elongate axillary scale present at pectoral fin base; snout blunt; adipose eyelid poorly developed; upper lip thick with 2-5 irregular rows of papillae terminating in hard, pointed tubercles; back dark with bluish reflections; sides of head, body, and abdomen white with silvery reflections; dorsal fins blackish, second dorsal with bright orange tip; caudal fin pale bluish with tips of both lobes bright orange yellow; anal fin whitish with yellow tip; pectorals bluish black with bright orange yellow tip. Maximum size to 500 mm SL.

Distribution and Habitat. - Relatively wide ranging from Indonesia to New Hebrides. There are apparently few reports from New Guinea, including those from the Fly and Kemp Welsh rivers of southern Papua New Guinea. It occurs throughout the lower and middle sections of the Fly, and also penetrates the Upper Fly at least 900 km upstream from the mouth. The habitat consists of turbid main river channels as well as gravel-bottom tributaries.

Genus *Liza*
Jordan & Swain, 1884

This genus contains about 15 species and is widely distributed in the tropical Indo-West and Central Pacific.

Key to the Freshwater Species of *Liza* from New Guinea

1a. Caudal fin only slightly emarginate, its posterior margin nearly straight; anal rays I,8. ..... *L. vaigiensis*

1b. Caudal fin clearly emarginate or forked; anal rays I,9. 2

2a. Transverse scale rows between bases of first dorsal and pelvic fins 12..... ..... *L. macrolepis*

2b. Transverse scale rows between bases of first dorsal and pelvic fins 10 or 11....3

3a. Second dorsal fin origin over posterior half of anal fin base.. .....*L. tade*

3b. Second dorsal fin origin over anterior half of anal fin base.. 4

4a. Preorbital bone not filling space between lip and eye; rear corner of mouth level with posterior nostril. ....*L. subviridis*

4b. Preorbital bone filling space between lip and eye; rear corner of mouth behind level of posterior nostril.. 5

5a. Midlateral scales 25-28..*L. melinoptera*

5b. Midlateral scales 29-32.....*L. alata*

Basket Mullet

Liza alata
(Steindachner, 1892)
(Fig. 23C)

Diagnosis. - Dorsal rays IV-1,8; anal rays III,9; pectoral rays 16; midlateral scales 29-32; transverse scales 11; pectoral axillary scale absent; snout more or less pointed; adipose eyelid poorly developed; second dorsal and anal fins falcate; light brown dorsally, silvery on sides, and whitish below; scale margins dark, especially on upper half of body, giving characteristic reticulate appearance; fins grey, except pelvics often bright orange or yellow. Maximum size to 650 mm SL; common to 350 mm SL.

Distribution and Habitat. - Widespread in the tropical Indo-West Pacific from East Africa to Tonga. It has been reported from the Sepik River near Angoram. The habitat consists mainly of coastal waters and estuaries, but it sometimes ascends rivers.

Large-Scaled Mullet

Liza macrolepis
Smith, 1849
(Fig. 23D)

Diagnosis. - Dorsal rays IV-1,8; anal rays III,9; pectoral rays 16; midlateral scales 33-35; transverse scales 12; pectoral axillary scale poorly formed; adipose eyelid absent; greenish grey on back and top of head, silvery on sides and belly; fins grey or bluish with dusky margins. Maximum size to 300 mm SL.

Distribution and Habitat. - Widespread in the tropical Indo-West Pacific from East Africa to Indonesia, Philippines, and New Guinea. A marine and estuarine species that sometimes enters fresh water. It has been reported from the Sepik River near Angoram.

Cream Mullet

Liza melinoptera
(Valenciennes, 1836)
(Fig. 23F)

Diagnosis. - Dorsal rays IV-1,8; anal rays III,9; pectoral rays 15; midlateral scales 25-28; transverse scales 10; pectoral axillary scale absent; rear adipose eyelid covers about one-third of iris and is better developed than front eyelid; greenish brown above, white to silvery below; fins dusky. Maximum size to about 250 mm SL.

Distribution and Habitat. - Widespread in the tropical Indo-West Pacific from East Africa to Indonesia, Philippines, and New Guinea. It has been reported from the Sepik River, near Angoram and also from the lower Ramu River. It is a coastal fish that enters estuaries and rivers.

Greenback Mullet

Liza subviridis
(Valenciennes, 1836)
(Plate 17, no. 11; Fig. 23E)

Diagnosis. - Dorsal rays IV-1,8 or 9; anal rays III,9; pectoral rays 15; midlateral scales 27-32; transverse scales 11; pectoral axillary scale rudimentary or absent; adipose eyelid well developed, covering most of iris; dark greenish above, white below; caudal fin edged with dusky black. Maximum size to 260 mm SL.

Distribution and Habitat. - Widespread in the tropical Indo-West and Central Pacific from the Persian Gulf to Polynesia. It inhabits

shallow coastal waters, estuaries, and the lower parts of fresh water streams.

Remarks. -*Liza dussumieri* (Valenciennes) is a synonym.

Rock Mullet

Liza tade
(Forsskål, 1775)
(Fig. 23G)

Diagnosis. - Dorsal rays IV-I,8; anal rays III,9; pectoral rays 15 or 16; midlateral scales 30-35; transverse scales 10 or 11; pectoral axillary scale absent; adipose eye-lid well developed, covering most of iris; greenish brown above, silvery below, often with 5-7 indistinct stripes on upper half of body. Maximum size to 650 mm SL; common to 300 mm SL.

Distribution and Habitat. - Widespread in the tropical Indo-West Pacific from the Red Sea to Melanesia and Micronesia. It has been reported from the Sepik River in backwaters near Angoram. Usually occurs in shallow coastal areas, including estuaries.

Diamond-Scaled Mullet

Liza vaigiensis
(Quoy & Gaimard,1824)
(Fig. 23H)

Diagnosis. - Dorsal rays IV-I,8; anal rays III,8; pectoral rays 16; midlateral scales 24-27; transverse scales 10-12; pectoral axil scale absent; adipose eyelid forming a narrow rim around eye; caudal fin only slightly emargi-nate; back olive brown, silvery on sides, and white with pale yellow tint on belly; scales on upper sides with brown blotches forming longitudinal stripes; fin margins dusky; pectoral fins entirely black in juveniles. Maximum size to 500 mm SL.

Distribution and Habitat. - Widespread in the tropical Indo-West Pacific from East Africa to the Tuamotu Islands. It inhabits shallow coastal seas, frequently entering estuaries and rivers; often seen in schools in coastal creeks within about 10 km of the sea.

Genus *Mugil*
Linnaeus, 1758

This genus contains about 10 species and is found in all tropical and temperate seas. However, only *M. cephalus* occurs in the Indo-West Pacific region.

Sea Mullet

Mugil cephalus
Linnaeus, 1758
(Fig. 23I)

Diagnosis. - Dorsal rays IV-I,8; anal rays III,8; pectoral rays 16 or 17; midlateral scales 38-42; transverse scales 14 or 15; pectoral axillary scale well developed; adipose eyelid well developed, covering most of eye; olive green on back, silvery on sides, and white below; 6-7 indistinct brown stripes on upper side; a dark spot at base of pectoral fin; margins of dorsal and caudal fins dusky. Maximum size to 600 mm SL.

Distribution and Habitat. - Worldwide in tropical and temperate seas. Occurs in shallow coastal seas, often entering estuaries and rivers it is widely cultivated in freshwater ponds in southeast Asia.

Genus *Valamugil*
Smith, 1948

This genus contains about six species and is widespread in the Indo-West and Central Pacific region.

Key to the Freshwater Species of *Valamugil* from New Guinea

1a. Midlateral scales 38-42; origin of second dorsal fin opposite 26th to 28th scale of midlateral series ..... *V. seheli*

1b. Midlateral scales 32-36; origin of second dorsal fin opposite 21st to 23rd scale of midlateral series ..... *V. buchanani*

Bluetail Mullet

Valamugil buchanani
(Bleeker, 1853)
(Fig. 23J)

Diagnosis. - Dorsal rays IV-I,8; anal rays III,9; pectoral rays 17 or 18; midlateral scales 32-36; transverse scales 11-13; pectoral axillary scale well developed; adipose eyelid absent; greenish on back, silvery on sides and belly; a dark axillary spot on pectoral fin base; upper opercle and iris with golden sheen. Maximum size to 500 mm SL.

Distribution and Habitat. - Widespread in the tropical Indo-West Pacific from East Africa to Melanesia and Micronesia. It inhabits coastal seas; young fish are frequently found in estuaries and also ascend rivers and coastal creeks.

Bluespot Mullet

Valamugil seheli
(Forsskål, 1775)
(Fig. 23K)

Diagnosis. - Dorsal rays IV-I,8; anal rays III,9; pectoral rays 18; midlateral scales 38-42; transverse scales 12-14; pectoral axillary scale well developed; adipose eyelid absent; greenish brown on back, silvery below; upper rows of scales on side with dusky spots, forming indistinct longitudinal stripes; pectoral fin dull yellow with a blue axillary spot. Maximum size to 450 mm SL.

Distribution and Habitat. - Widespread in the Indo-West and Central Pacific from East Africa to the Hawaiian Islands. Generally seen in schools in shallow coastal seas and estuaries. It frequently ascends freshwater and brackish tidal creeks and rivers.

Blennies

Family Blenniidae

Blennies are small, often colourful fishes that are primarily inhabitants of tropical and temperate seas. A large portion of the estimated worldwide total of 300 species are associated with benthic coral reef habitats in the Indo-Pacific region. They are generally small (usually less than 15 cm) scaleless, elongate fishes with a long-based (frequently notched) dorsal fin, a relatively small pelvic fin, consisting of a hidden spine and 1-4 segmented rays, that is situated ahead of the level of the pectoral fins (i.e. just behind the head), and there are often cirri or a fleshy crest on the head. The tribe Nemophini of which the single New Guinea species treated here belongs to, is characterised by greatly enlarged canine teeth on the lower jaw. Their common name, sabre-tooth blennies, is derived from this feature.

Genus *Meiacanthus*
Norman, 1943

The genus contains 16 species that mainly inhabit coral reefs in the Indo-West Pacific region. They are unique among fishes in having a toxic gland that is associated with elaborately grooved canine teeth on the lower jaw. Their toxic bite is a useful deterrent in avoiding predation by larger fishes.

Threadless Blenny

Meiacanthus anema
(Bleeker, 1852)
(Plate 17, no. 13)

Diagnosis. - Dorsal rays VI to X,20 to 24, total elements 28-31; anal rays II,16 to 19; pectoral rays 13 to 16; segmented caudal fin rays 11 to 13; a greatly enlarged, curved canine tooth on each side at the back of the lower jaw; juveniles and females whitish with 3 distinct black stripes on side, the lowermost is continued across the head to the lower lip; males with similar pattern except lowermost stripe is diffuse and does not extend across lower part of head; also males differ in having a wider black stripe along the base of the dorsal fin and much more vivid black stripe on the margin of the anal fin. Maximum size to 72 mm SL.

Distribution and Habitat. - Indonesia.

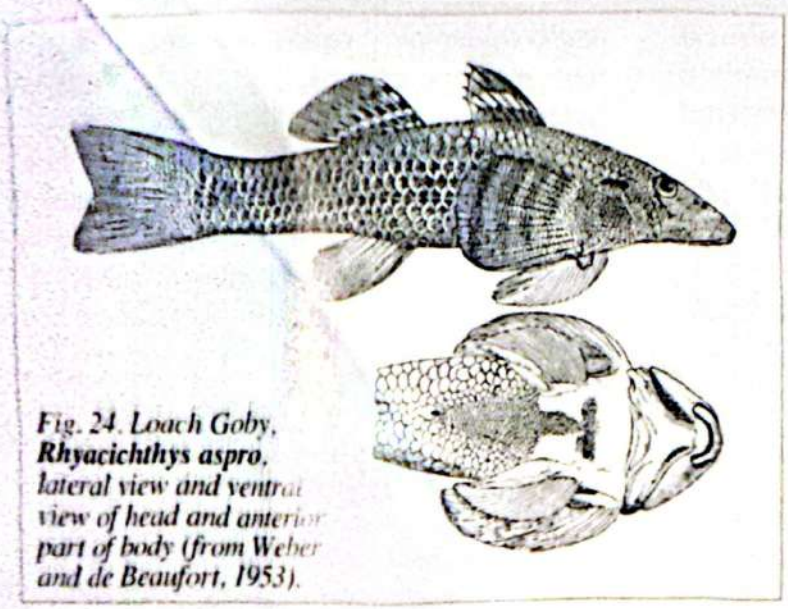


*Fig. 24. Loach Goby, **Rhyacichthys aspro**, lateral view and ventral view of head and anterior part of body (from Weber and de Beaufort, 1953).*

rays I,8 or 9; pectoral rays 21 or 22; lateral-line scales 36-40; transverse scales 10-11; predorsal scales about 20; body depressed anteriorly and compressed posteriorly; lower surface of head and belly extremely flattened; pectoral fins large and fan-like; pelvic fins widely separated; lips fleshy; teeth in numerous rows, outer teeth enlarged; yellow brown or tannish with dark blotches on sides; dorsal, pectoral, and pelvic fins with bands or transverse bars. Maximum size to 250 mm SL.

Philippines, New Guinea, Solomon Islands, Santa Cruz Islands, and Vanuatu. It lives in estuarine and freshwater habitats, frequently where mangroves are abundant; in coastal creeks it is usually found within 2-3 km of the sea.

Distribution and Habitat - Indonesia, Philippines, New Guinea, Solomon Islands, and some Japanese islands. Lives in relatively steep gradient coastal streams in hilly or mountainous terrain.

Loach Gobies

Family Rhyacichthyidae

The family contains a single species characterised by a peculiar wedge-shaped head with the ventral part of the head and belly greatly flattened. The enlarged fan-like pectoral fins and emarginate caudal fin are also distinctive. It superficially resembles the homalopterid loaches of Asia. Its unusual shape is apparently adapted for dwelling in torrential mountain streams. It feeds largely on diatoms.

Genus *Rhyacichthys*
Boulenger, 1859

The genus contains a single species that is discussed below.

Loach Goby
Rhyacichthys aspro
(Valenciennes, 1837)
(Fig. 24)

Diagnosis. - Dorsal rays VII-I,8 or 9; anal

Gudgeons

Family Eleotrididae

This family (often spelled Eleotridae in past literature) is distributed throughout tropical, subtropical, and some temperate regions. Worldwide there are approximately 175 species in about 40 genera. Most of the species occur in the Indo-West Pacific province, particularly the area bordered by Indonesia, Philippines, New Guinea, and Australia. Although they are found in both marine and freshwater habitats, the majority of species are either estuarine or freshwater dwellers. It is one of the largest freshwater families represented in New Guinea with 41 species thus far recorded. They are close relatives of the gobies (family Gobiidae) and generally share a similar appearance and benthic dwelling mode. The body is relatively long and slender and the head is frequently flattened to varying degrees. Unlike most gobies the pelvic fins are not fused to form a disc apparatus, rather they are separate. Gudgeons occur in a diversity of habitats including coral reefs (few species), brackish estuaries and their mangrove creek

tributaries, floodplain waters, rainforest creeks, lakes, and torrential mountain streams. Eleotridids generally lay demersal eggs that are attached to solid objects or vegetation. The number of eggs is largely dependent on the size of the species involved. For example, small gudgeons such as *Oxyeleotris nullipora* or *Tateurndina ocellicauda*, lay batches of about 30 eggs, whereas large species such as *Oxyeleotris heterodon* may release up to 250,000 eggs. Several species that have spawned in captivity exhibit parental nest care. Generally the male guards the nest until hatching, hovering close by it, and periodically fans the eggs with its pectoral fins. Hatching

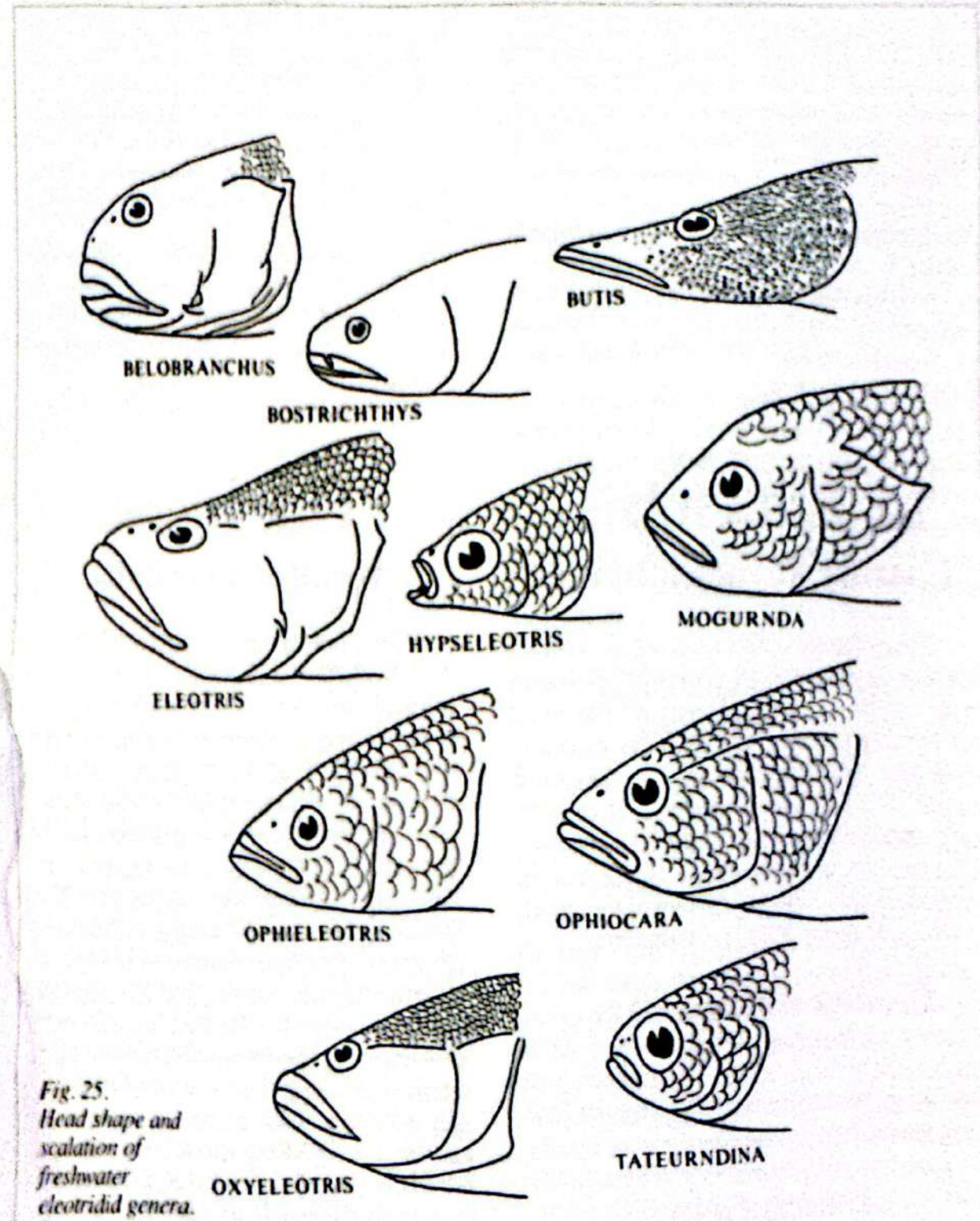


Fig. 25. Head shape and scalation of freshwater eleotridid genera. The very tiny and numerous scales on the head of ***Bostrichthys*** *are not shown.*

time is variable, less than 24 hours for some *Hypseleotris* to about 10 days for *Tateurndina*. Gudgeons feed on a wide variety of organisms including aquaticand terrestrial insects and their larvae, crustaceans, snails, worms, and fishes. Many species also consume algae and other plant material.

Key to Freshwater Genera of Eleotrididae from New Guinea

1a. Midlateral scales less than 50 (usually < 45). 2

1b. Midlateral scales more than 50 (usually > 60) 6

2a. Total rays in first dorsal fin 6. 3

2b. Total rays in first dorsal fin 7-9. ..... *Mogurnda*

3a. Midlateral scales from upper pectoral base to caudal fin base 36-40. ..... *Ophiocara*

3b. Midlateral scales from upper pectoral base to caudal fin base 24-33. 4

4a. Head laterally compressed. *Hypseleotris*

4b. Head not laterally compressed, but instead moderately to greatly depressed (i.e. dorsally flattened). 5

5a. Head more or less pointed, snout very elongate and greatly flattened; bony crests in interorbital space. ..... *Butis*

5b. Head more rounded, snout short and not greatly flattened; no bony crests in interorbital space ..... *Ophieleotris*

6a. Midlateral scales from upper pectoral base to caudal fin base about 100-140; total rays in second dorsal fin 12-18 ..... *Bostrichthys*

6b. Midlateral scales from upper pectoral base to caudal fin base about 55-85; total rays in second dorsal fin 8-13.... 7

7a. Head entirely scaleless; first or first and second branchiostegal end anteriorly in forward directed spine... *Belobranchus*

7b. Head scaled, at least above; no branchiostegal spines. 8

8a. Lower rear corner (angle) of preopercle with an enlarged, downward curved, strong spine (may be obscured by flesh, but is easily exposed with a sharp probe). ..... *Eleotris*

8b Lower rear corner of preopercle without spine. ..... *Oxyeleotris*

Genus *Belobranchus*
Bleeker, 1856

The genus contains a single distinctive species that ranges throughout the Indo-Malaysian region.

Throatspine Gudgeon
Belobranchus belobranchus
(Valenciennes, 1837)
(Photo 21)

Diagnosis. - Dorsal rays VI-I,7; anal rays I,7; pectoral rays 19 to 23; midlateral scales about 70; transverse scales about 20; prdorsal scales about 30; head entirely scaleless; first or first and second branchiostegal ray ends anteriorly in a sharp, conical forward directed spine; plain dark brown or with about 5 broad, light (tannish) bars; usually numerous (about one per scale row) narrow dark horizontal lines on sides; occasionally light brown with dark brown midlateral stripe; 4-5 spoke-like lines radiating from eye across cheek and opercle; fins plain or spotted. Maximum size to 160-170 mm SL.

Distribution and Habitat. - Indonesia, Philippines, and New Guinea. It inhabits estuaries and coastal streams, usually over rocky or gravel bottoms.

Genus *Bostrichthys*
Dumeril, 1806

The genus contains four species including one marine dweller, *B. sinensis*,

Photo 21 - Throatspine Gudgeon, ***Beloranchus belobranchus****, 70, mm SL.*

that is widespread from India to Samoa, and three freshwater species confined to southern New Guinea and the Aru Islands. Distinguished from other New Guinea freshwater gudgeons by the very small scales and presence of teeth on the vomer.

Key to the Freshwater Species of *Bostrichthys*

1a. Dorsal rays VI-I,11 to 13..*B. strigogenys*

1b. Dorsal rays VII to X-I,14 to 17 2

2a. Dorsal rays VII or VIII-I,14 or 15; body without cross-bars (Aru Islands). ....*B. aruensis*

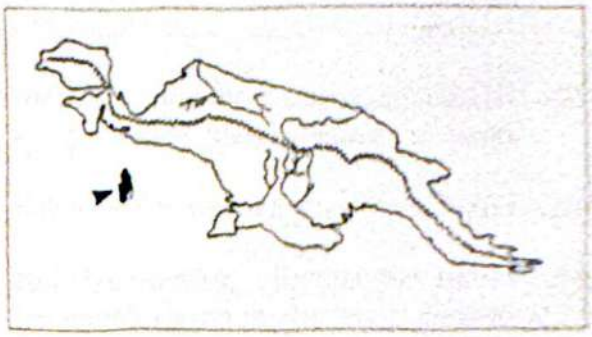
2b. Dorsal rays IX or X-I,16 or 17; body with about 8-9 dark cross-bars (central-southern New Guinea) .....*B. zonatus*

Island Gudgeon

Bostrichthys aruensis
(Weber, 1911)

Diagnosis. - Dorsal rays VII or VIII-I,14 or 15; anal rays I,10 or 11; pectoral rays 17; midlateral scales about 130-140; transverse scales about 45; head scaled; snout short and rounded; eyes small; plain dark brown, white on ventral parts and white oblique blotches on lower part of head; an indistinct ocellus on upper portion of caudal fin; fins dark brown, narrow white edges on most. Maximum size to 180 mm SL.

Distribution and Habitat. - Known only from fresh waters of the Aru Islands.

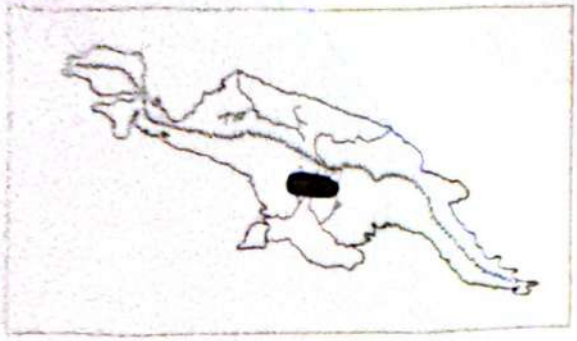


Striped-Cheek Gudgeon

Bostrichthys strigogenys
(Nichols, 1937)
(Plate 13, no. 5)

Diagnosis. - Dorsal rays VI-I,11 to 13; anal rays I,9 or 10; pectoral rays 16 or 17; mid-lateral scales about 100-130; transverse scales about 35; predorsal scales about 60; head scaled; snout short and rounded; eyes small; dark brown on upper two-thirds of side, white below; head with 3 dark stripes slanting downward and backward below and behind eye; fins dark brown with narrow pale edges; an ocellus on upper part of caudal fin base. Maximum size to 180 mm SL.

Distribution and Habitat. - Central-southern New Guinea in the upper Fly and Ok Tedi rivers and Digul River at Tanah Merah. Inhabits swamps, backwaters, well vegetated slow-flowing creeks and rocky pools.

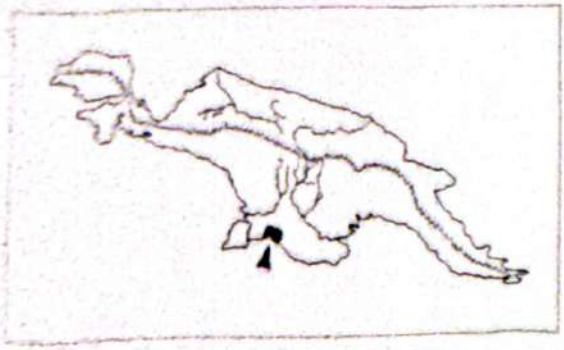


Barred Gudgeon

Bostrichthys zonatus
(Weber, 1908)

Diagnosis. - Dorsal rays IX or X-I,16 or 17; anal rays I,12; pectoral rays 16; mid-lateral scales about 120-130; transverse scales about 35; head scaled; snout short and rounded; eyes small; dark brown with 8-9 broad darker brown cross-bars on side, between each broad band, which are sometimes divided into two bands, there is a narrow horizontal stripe; fins dark brown, an ocellus on upper caudal fin base. Maximum size to 130 mm SL.

Distribution and Habitat. - Fresh waters and estuaries in the vicinity of Merauke, Irian Jaya.



Genus *Butis*

Bleeker, 1874

The genus contains five species, including three from fresh waters of New Guinea. They are primarily inhabitants of estuaries, brackish creeks, and the lower reaches of freshwater streams. The group is widely distributed in the Indo-West Pacific region from East Africa to Melanesia.

Key to New Guinea *Butis*

1a. Body depth 4.5-5.0 in SL; jaws extend to below middle of eye; outer row of teeth in jaws not enlarged; auxiliary scales (small extra scales) present..... .....*B. melanostigma*

1b. Body depth 5.0-6.0 in SL; jaws extend to below anterior part of eye or short of this point; outer row of teeth may or may not be enlarged; auxiliary scales present or absent 2

2a. Outer row teeth of jaws enlarged; scales of body and head with auxiliary scales .....*B. butis*

2b. Outer row teeth of jaws not or scarcely enlarged; no auxiliary scales or only a few scattered auxiliary scales ....*B. amboinensis*

Ambon Gudgeon

Butis amboinensis
(Bleeker, 1853)
(Plate 17, no. 19)

Diagnosis. - Dorsal rays VI-I,8; anal rays I,8; pectoral rays 18 or 19; midlateral scales about 30; transverse scales 9 or 10; predorsal scales about 20; area between eye and interorbital crest usually scaled; no small auxiliary scales on body or sometimes a few scattered auxiliary scales; greatest body depth 5.0-5.5 in SL; colour variable depending on habitat conditions, specimens from turbid water often lighter brown than those from clear water, which may be nearly black or very dark brown with tan scale centres forming longitudinal rows of spots; a broad dark brown stripe from snout through eye and continued across operculum; fins variously dark and light spotted or banded; upper caudal lobe abruptly pale; anal and pelvic fins and sometimes second dorsal fin with red margin; base of pectoral fin with black blotch edged with red; pelvic

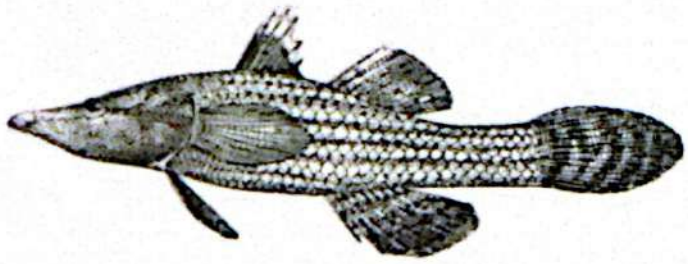


*Fig. 26 Crimson-tipped Gudgeon, **Butis butis** (from Weber and de Beaufort, 1953).*

fins dark brown. Maximum size to 100 mm SL.

Distribution and Habitat. - India to Indonesia, Philippinies, New Guinea and Solomon Islands. Common in brackish mangrove areas and in creeks and rivers, sometimes well upstream; in the Sepik River it has been captured 300 km upstream from the sea.

Crimson-Tipped Gudgeon

Butis butis
(Hamilton, 1822)
(Fig. 26)

Diagnosis. - Dorsal rays VI-I,8; anal rays I,8; pectoral rays 18 to 21; midlateral scales about 30; transverse scales 9-10; predorsal scales about 20; area between eye and interorbital crest usually scaled; scales of head and body with auxiliary scales; greatest body depth 5.0-6.0 in SL; colour variable, light to dark brown; head and body sometimes with reddish spots, a dark stripe from snout to eye and continued from rear of eye to edge of operculum; vertical fins dusky brown with light spotting, outer margin of first dorsal and anal fins reddish; pectoral fin base with 1-2 red-bordered spots. Maximum size to 110 mm SL.

Distribution and Habitat. - Andaman Islands to Australia and New Guinea. Inhabits brackish and freshwater streams; frequently found in mangrove swamps.

Black-Spotted Gudgeon

Butis melanostigma
(Bleeker, 1849)

Diagnosis. - Dorsal rays VI-I,8; anal rays I,8; pectoral rays 18 to 20; midlateral scales about 30; transverse scales 9-10; predorsal scales about 25; area between eye and inter-orbital crest usually scaled; most of head and body scales with auxiliary scales; greatest body depth 4.5-5.0 in SL; light to dark brown stripes radiating behind and below eye; fins dusky to dark brown with lighter spotting; second dorsal, anal, and pelvic fins with red margin; base of pectoral fin with black blotch bordered with red. Maximum size to 110 mm SL.

Distribution and Habitat. - East Africa to New Guinea. It inhabits rivers, creeks, and brackish estuaries.

Genus *Eleotris*

Bloch & Schneider, 1801

The genus contains about 10 species that occur throughout the tropics in fresh and estuarine waters; three are found in freshwater habitats in New Guinea.

Key to Freshwater Species of *Eleotris* from New Guinea

1a. Scales in midlateral series from upper pectoral base to caudal fin base 36-40 (Sepik and Ramu rivers)...*E. aquadulcis*

1b. Scales in midlateral series from upper pectoral base to caudal fin base 46-56 (coastal streams, usually within 10-20 km of the sea). 2

2a. Scales in midlateral series 46-56; anterior three vertical lines of papillae below eye extend below the horizontal

line of papillae on the middle of the cheek ..... *E. melanosoma*

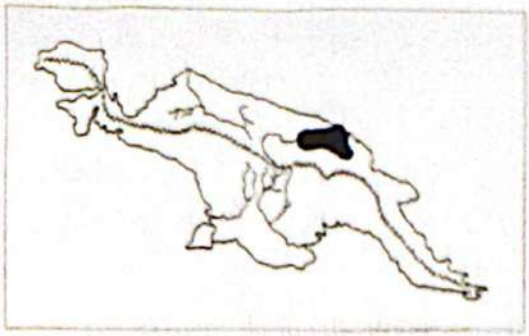
2b. Scales in midlateral series 57-65; second vertical line of papillae below eye does not extend below the horizontal line of papillae on the middle of the cheek ..... *E. fusca*

Freshwater Gudgeon

Eleotris aquaduleis
Allen & Coates, 1990
(Plate 13, no. 11)

Diagnosis. - Dorsal rays VI-I,7 or 8; anal rays I,9; pectoral rays 16 or 17; midlateral scales 36-40; transverse scales 13; predorsal scales 35-42; a downward projecting blunt spine at lower corner of preopercular margin; 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 irregular light brown to whitish bars and blotches on darker brown ground colour. Maximum size to 250 mm SL.

Distribution and Habitat. - Known only from the Sepik and Ramu rivers of Papua New Guinea. Most specimens have been collected from floodplain lakes. It has been recorded as far upstream as Chambri Lakes, about 300 km from the Sepik River mouth.



Remarks. - Spawns during the flood season (December-May). Feeds mainly on large insect larvae, snails, and small fishes.

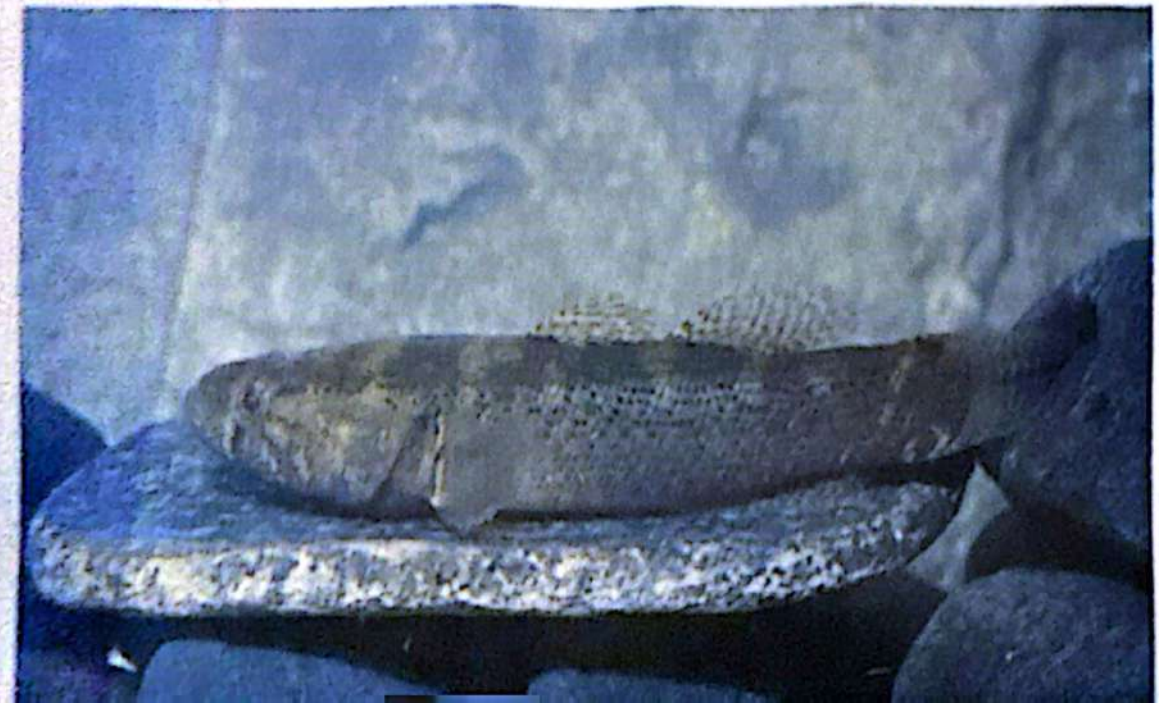
Brown Gudgeon

Eleotris fusca
(Bloch & Schneider, 1801)
(Photo 22)

Diagnosis. - Dorsal rays VI-I,8; anal rays I,8; pectoral rays 17 to 19; midlateral scales 57-65; transverse scales 16-20; predorsal scales 38-50; a downward projecting spine at lower corner of preopercle margin; brown to black; numerous dark horizontal lines on body (approximately one per scale row); fins spotted in young. Maximum size to 150 mm SL.

Distribution and Habitat. - East Africa to high volcanic islands of Oceania. It inhabits estuaries and the lower sections of freshwater streams.

*Photo 22 - Brown Gudgeon, **Eleotris fusca** 120 mm SL.*



Ebony Gudgeon

Eleotris melanosoma
Bleeker, 1852
(Plate 17, no. 17)

Diagnosis. - Dorsal rays VI-I,8; anal rays I,8; pectoral rays 17 to 20; midlateral scales 46-56; transverse scales 17-20; predorsal scales 35-53; a downward projecting spine at lower corner of preopercle margin; dark brown or black, sometimes with pale longitudinal lines (approximately one per scale row) on side; fins spotted in young, becoming dark brown in adults. Maximum size to 160 mm SL.

Distribution and Habitat. - East Africa to the Society Islands and north to Japan. The habitat consists of brackish estuaries and freshwater streams.

Genus *Hypseleotris*
Gill, 1863

The genus contains about 15 species, including 2 or 3 which are relatively widespread in the Indo-West Pacific. Most species (about 9) occur in Australia. They are restricted to purely freshwater habitats. The genus requires revision. The status of various island populations, including those from New Guinea, are particularly problematical.

Key to New Guinea *Hypseleotris*

1a. Side of body with blackish longitudinal band from operculum to lower caudal fin base (northern New Guinea) .... *H. guentheri*

1b. Side of body without black band from operculum to lower caudal fin base (southern New Guinea)...*H. compressa*

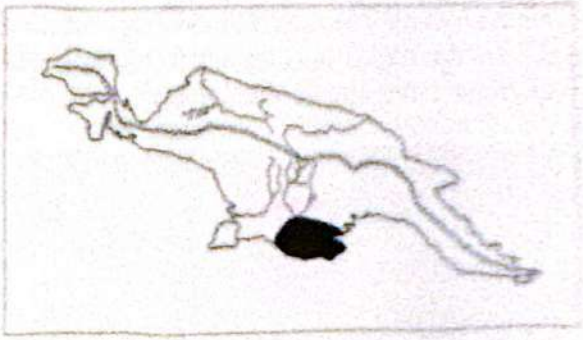
Empire Gudgeon

Hypseleotris compressa
(Krefft, 1864)
(Plate 13, no. 8)

Diagnosis. - Dorsal rays VI-I,8 or 9; anal rays I,10 to 12; pectoral rays 14 to 17; midlateral scales 25-29; transverse scales 9-10; predorsal scales 14-18; brownish or yellow tan, often with 7-8 darker bars forming X-shaped marks along side; adult males with broad white marginal and black submarginal bands on dorsal and anal fins; breeding males have bright red colour on head, breast, and fins; females with narrow white margin and broad submarginal band on dorsals and anal fins, also with white spotting on dorsal and caudal fin. Maximum size about 100 mm SL, but common to 50 mm SL.

Distribution and Habitat. - Coastal drainages of southern New Guinea and northern Australia. Unlike Australia, where this fish is common, there are few reported localities from New Guinea. Most are from the Fly River Delta region including the Bensbach River. It is usually found in flowing streams amongst vegetation or submerged tree branches. Juveniles are sometimes present in brackish estuaries.

Remarks. - Females deposit up to 3,000 tiny (0.3 mm) eggs on rock, wood, or plants. These hatch in less than 24 hours, but the minute larvae require a further 10 days to absorb their yolk sacs.



Rainbow Prigi

Hypseleotris guentheri
(Bleeker, 1875)
(Plate 13, nos. 6 & 7; Photo 23)

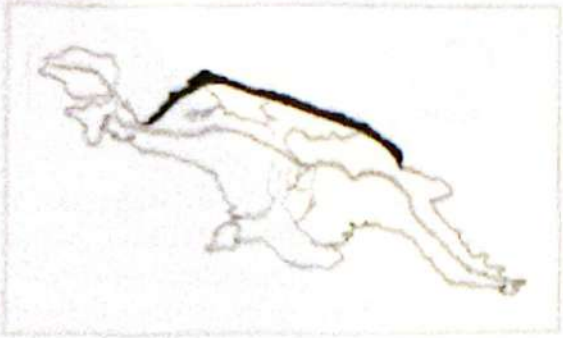
Diagnosis. - Dorsal rays VI-I,9; anal rays I,9 or 10; pectoral rays 14; midlateral scales 26-28; transverse scales 8; predorsal scales 15-19; generally brown with diffuse blackish stripe extending from operculum to lower caudal fin base; a black spot at

*Photo 23 - Rainbow Prig, **Hyseleotris guentheri** 40 mm SL.*

base of lower caudal fin rays; females with colourless fins except faint spotting on caudal; males with black dorsal fins with large white spots, also caudal fin dusky blackish with white spots in vertical rows. Maximum size to 55 mm SL.

Distribution and Habitat. - Indonesia, New Guinea, New Ireland, Caroline Islands, New Caledonia, Fiji, and Samoa. In New Guinea it has been collected only from streams along the northern coast; localities include Madang, Manus Island, Wewak, Lae, Popondetta, and Nabire. It occurs in clear-flowing streams, usually within 5-10 km of the sea.

Remarks. - The status of the New Guinea population is problematical and requires further study. The type locality of *H. guentheri* is in the Caroline Islands and there is a possibility that it is different from the New Guinea fish. Another species, *H. montana* (Regan), was described from upland streams of the Popondetta district of eastern Papua New Guinea. It was described in 1908, but has not been seen since, in spite of extensive collecting in this region by the author in the 1970's and 1980's. It seems closely related to, if not the same as *H. guentheri*.



Genus *Mogurnda*
Gill, 1863

The genus contains about 14 species and is confined to New Guinea and Australia; 10 occur in New Guinea. Half of the New Guinean species are endemic to Lake Kutubu and its immediate surroundings. *Mogurnda nesolepis* and *Mogurnda* spp. 1-5 comprise a distinctive group that is characterised by having the pectoral fin inserted in a slightly higher position (Fig. 27). The group is possibly deserving of separate generic status and is currently being studied by the author and D. F. Hoese.

Key to the Species of *Mogurnda* from New Guinea

1a. Upper part of pectoral fin base below upper edge of gill cover (Fig. 27A); dorsal spines modally 8 2

1b. Upper part of pectoral fin base about level with upper edge of gill cover (Fig. 27B); dorsal spines modally 7. 10

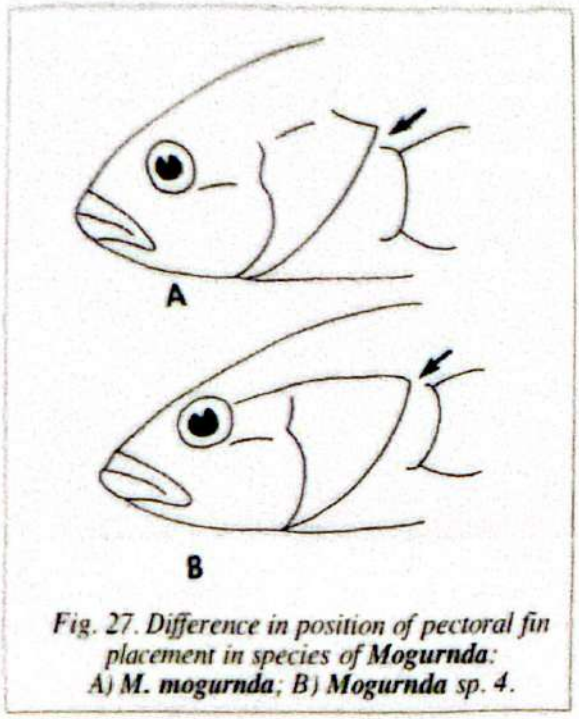


Fig. 27. Difference in position of pectoral fin placement in species of ***Mogurnda****:*
A) ***M. mogurnda****; B)* ***Mogurnda*** *sp. 4.*

2a. Head somewhat depressed with concave snout-nape profile (Fig. 28B); colour pattern variable, either uniformly dark, mottled or with longitudinal stripes (Lake Kutubu only) 3

2b. Head not depressed, with straight or convex snout-nape profile (Fig. 28A); colour pattern usually consisting of dark bars and/or a midlateral row of dark blotches 6

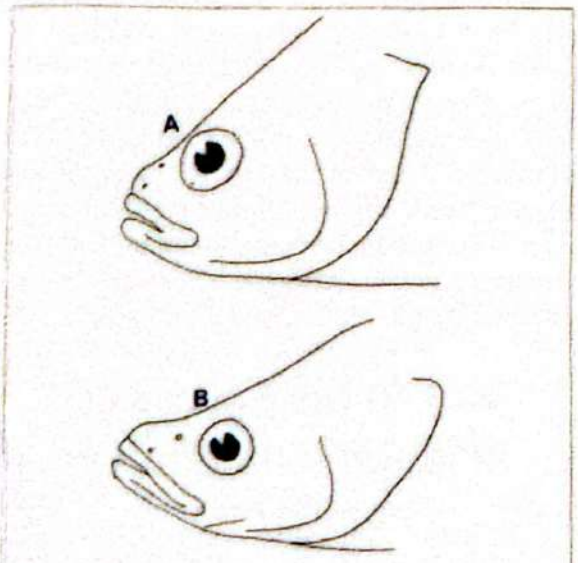


Fig. 28. Head shapes of ***Mogurnda****:*
A) ***M. kutubuensis****; B)* ***M. variegata****.*

3a. Body and fins blackish without distinguishing marks. .....*M. furva*

3b. Body and fins either with dark blotching, dark and light mottling or with broad pale midlateral stripe 4

4a. Body mainly dark on upper half with a broad, white stripe (series of white blotches in juveniles) along middle of side. .....*M. vitta*

4b. Body pattern not as in 3a 5

5a. Colour overall pale with extensive network of dark mottling on head and body; usually a pair of narrow dark stripes radiating from back of eye across preopercle. .....*M. variegata*

5b. Colour overall dark on upper two-thirds of body with 2-3 longitudinal rows of pale blotches on side, of which midlateral row is most prominent; a pair of pale stripes (on dark ground) radiating from back of eye across preopercle. .....*M. spilota*

6a. Scales in lateral series 37 or less.....7

6b. Scales in lateral series 38 or more.....8

7a. Lowermost dark stripe on head extends from posterior part of upper lip to edge of preopercle, uppermost stripe more or less horizontal extending from lower rear corner of eye to upper pectoral fin base; first dorsal fin somewhat pointed, sometimes as tall as second dorsal fin; dominant colour pattern consisting of 7 to 9 broad bars (New Guinea north of dividing range) .....*M. orientalis*

7b. Lowermost dark stripe on head extends from lower edge of eye to edge of preopercle, uppermost stripe oblique, arising on operculum and extending to middle of pectoral fin base; first dorsal fin not pointed, always much shorter than second dorsal fin; dominant colour pattern consisting of midlateral

row of dark blotches with faint bars (eastern Papua New Guinea south of dividing range) ..... *M. pulchra*

8a. Pectoral rays usually 16 or 17 (rarely 15 or 18); predorsal scales 19 to 24 (northern New Guinea). .... *M . aurofodinae*

8b. Pectoral rays usually 14 or 15; predorsal scales 16 to 20 (southern New Guinea. 9

9a. Dominant colour pattern consisting of dark bars, although a midlateral row of 10 to 12 dark blotches may be evident; spotting on dorsal and caudal fins absent or weakly developed; scales in lateral series 41 to 53 ..... *M. cingulata*

9b. Dominant colour pattern consisting of midlateral row of 5 to 9 rectangular dark blotches, although sometimes obscured by darker mottled pattern; spotting on dorsal and/or caudal fins frequently evident; scales in lateral series of single New Guinean specimen 38 (but 37 to 48 in Australian specimens). ..... *M. mogurnda*

10a Midlateral scales 46-50; transverse scales 17-19 (mountain streams of Upper Purari system, Papua New Guinea). ..... *Mogurnda* sp. 3

10b. Midlateral scales 36-45; transverse scales 9-15 11

11a. Sides with dark midlateral stripe, sometimes divided into segments and joined with dark bars on upper half of body (Lae to Mamberamo River) ..... *M. nesolepis*

11b. Sides without dark midlateral stripe, generally uniform, barred, or spotted 12

12a. Dorsal fins with broad yellow margin (Bulolo River system, Papua New Guinea). ..... *Mogurnda* sp. 2

12b. Dorsal fins without yellow margin.... 13

13a. Side with about 10 narrow (much less than pale nterspaces) dark bars between head and caudal base (Torricelli Mtns., Sepik drainage) ..... *Mogurnda* sp. 5

13b. Side uniformly plain or blotched, sometimes barred, but bars are irregular and wider than pale interspaces.... 14

14a. Midlateral scales 38-39; predorsal scales 21-22 (mountain streams near Karamui, Papua New Guinea) .... *Mogurnda* sp. 1

14b. Midlateral scales 40-45; predorsal scales usually 22-26, seldom 19-21 or 27-30 (coastal drainages of eastern Papua New Guinea)..*Mogurnda* sp. 4

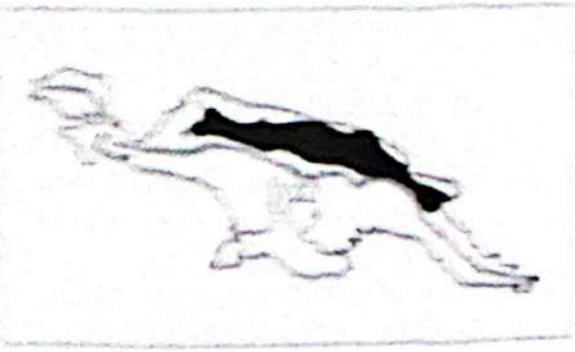
Northern Mogurnda

Mogurnda aurofodinae
Whitley, 1938
(Plate 14, no. 3)

Diagnosis. - Dorsal rays VII to IX-1,11 to 15; anal rays I,11 to 15; pectoral rays 16 or 17 (rarely 15); midlateral scales 38-51; transverse scale 12-15; predorsal scales 19- 24; postdorsal scales 9-10; brown or purplish brown with about 10 darker brown bars and alternating light brown interspaces on upper two-thirds of body; some specimens mottled or nearly uniform dark without bars; 2-3 narrow dark brown stripes radiating from rear part of eye across cheek; prominent dark brown spot on caudal fin base and upper half of pectoral base. Maximum size to 100 mm SL.

Distribution and Habitat. - Widespread in river systems of northern New Guinea including the Markham, Gogol, Ramu, Sepik, and Mamberamo. It is generally found in slow-flowing, shaded streams, in rocky pools or well-vegetated sections; also found in swampy areas. The altitudinal range is from near sea level to at least 1200 m.

Remarks. - *Mogurnda bloodi* Whitley is a synonym.

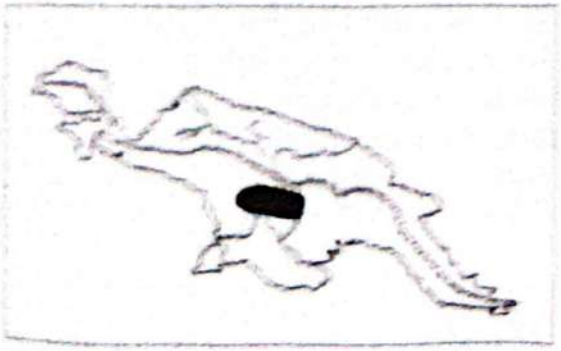


Banded Mogurnda

Mogurnda cingulata
Allen & Hoese, 1991
(Plate 14, no. 2)

Diagnosis. - Dorsal rays VIII-I,12 to 15; anal rays I,12 to 16; pectoral rays 14 or 15; midlateral scales 41-51 (often 42 or 43); transverse scales 12-14; predorsal scales 16-20; postdorsal scales 9-11; brown or reddish brown with about 10 dark brown bars with reddish interspaces; scattered small blue spots along base of second dorsal and anal fins; 2-3 dark brown or reddish stripes radiating from rear part of eye across cheek; caudal and anal fins yellowish, caudal sometimes with a few small red spots; juveniles much lighter with midlateral row of about 10 rectangular dark brown blotches that are frequently linked by a dark brown stripe. Maximum size to 130 mm SL.

Distribution and Habitat. - Fly-Strickland and Upper Digul River systems. Inhabits rocky pools in relatively fast-flowing streams in mountainous terrain; also occurs in quiet backwaters and swamps of lowland areas in the Upper Fly.

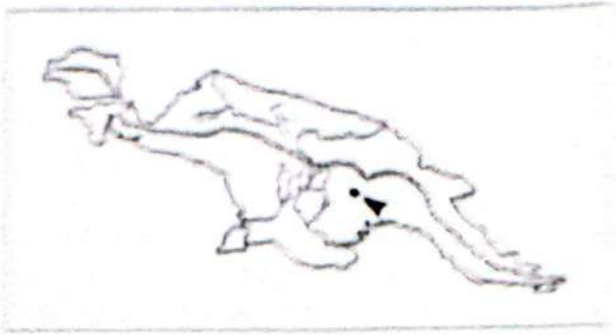


Black Mogurnda

Mogurnda furva
Allen & Hoese, 1986
(Plate 14, no. 11)

Diagnosis. - Dorsal rays VIII-I,11 or 12; anal rays I,10 to 13; pectoral rays 15 or 16; midlateral scales 39-42; transverse scales 12-13; predorsal scales 20-26; postdorsal scales 11 or 12; snout relatively elongate and concave; body depth at pelvic origin 23.2-23.7% of SL; overall dark brown to black. Maximum size to 120 mm SL.

Distribution and Habitat. - Known only from Lake Kutubu, Papua New Guinea where it is apparently rare.



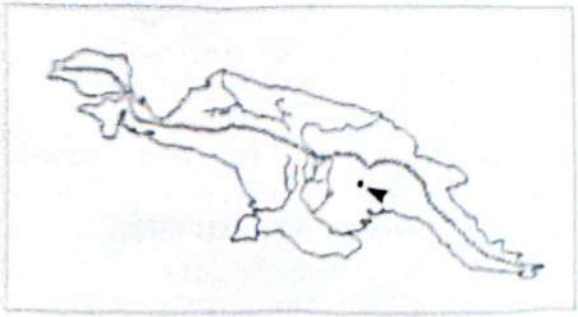
Lake Kutubu Mogurnda

Mogurnda kutubuensis
Allen & Hoese, 1986
(Plate 14, nos. 6 & 7)

Diagnosis. - Dorsal rays VII or VIII-I, 10 to 12; anal rays I,10 to 12; pectoral rays 15 or 16; midlateral scales 36-39; transverse scales 13; predorsal scales 18-20; postdorsal scales 10-12; generally dark brown to nearly blackish with lighter blotching on sides forming irregular bars; a pair of obliquedark stripes radiating from lower edge of eye across cheek. Maximum size to 95 mm SL.

Distribution and Habitat. - Known only from Lake Kutubu and surrounding areas. Besides the lake it has been collected in the Soro River (outlet of Lake Kutubu and headwater stream of the Kikori River) and the Sura River and its tributaries between Lake Kutubu and Pimaga (about 20 km west of the lake, and part of the

Purari system). It is one of the most abundant fishes in Lake Kutubu, being commonly found among vegetation close to shore.

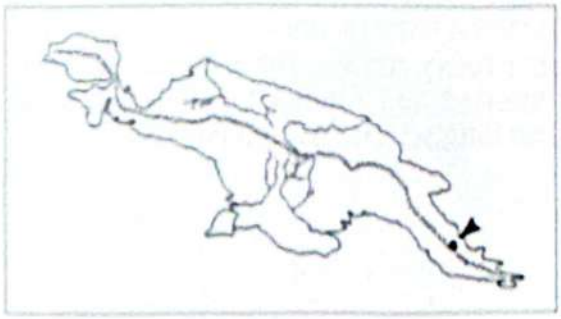


Kokoda Mogurnda

Mogurnda lineata
Allen & Hoese, 1991
(Plate 14, no. 5)

Diagnosis. - Dorsal rays VII or VIII-I, 10 or 11; anal rays I,11 or 12; pectoral rays 13 or 14; midlateral scales 33-34; transverse scales 11-12; predorsal scales 16-22; postdorsal scales 9-10; purplish on head and back, grading to yellowish on sides and ventral part of body; a broad, purplish midlateral stripe from rear edge of operculum to base of caudal fin; a pair of broad, oblique red-brown stripes from lower rear corner of eye to rear edge of operculum, the upper most continued on to pectoral fin base; fins purplish or mauve with small red spots on dorsals and caudal; all fins except pectorals with broad yellow margin. Maximum size to 85 mm SL.

Distribution and Habitat. - Known only from Kali, Ejava, and Oivi creeks, about 12-15 km east of Kokoda, Papua New Guinea. This locality, consisting of small, clear, rainforest streams, is situated in foot-hills on the north-eastern side of the Owen Stanley Range at an altitude of about 280-350 m.



Trout Mogurnda

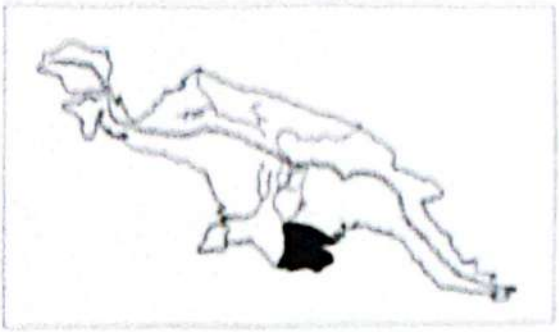
Mogurnda mogurnda
(Richardson, 1844)
(Photo 24)

Diagnosis. - Dorsal rays VII to IX-I,10 to 13 (usually VIII-I,11 or 12); anal rays I,10 to 13; pectoral rays 14 to 16; midlateral scales 37-48; transverse scales 12-14; predorsal scales 18-24; postdorsal scales 9-11; purplish or reddish brown, frequently with midlateral row of about 5-10 rectangular reddish blotches; and scattered red spots on side; 3 oblique red stripes on cheek; fins mainly reddish brown with red spots along base and posterior edge of second dorsal and anal fins; caudal fin with scattered red spots. Maximum size to 100 mm SL.

*Photo 24 - Trout Mogurnda, **Mogurnda mogurnda** 100 mm SL.*

Distribution and Habitat. - Central-southern New Guinea and northern Australia. It is far less common in New Guinea than in Australia; thus far it is known only from the Fly River delta. It occurs in swamps and well-vegetated streams.

Remarks. - Females deposit up to several hundred large (about 3 mm) elongate eggs on a rocky surface. These are meticulously guarded and fanned by the male until hatching which takes about 6 days.

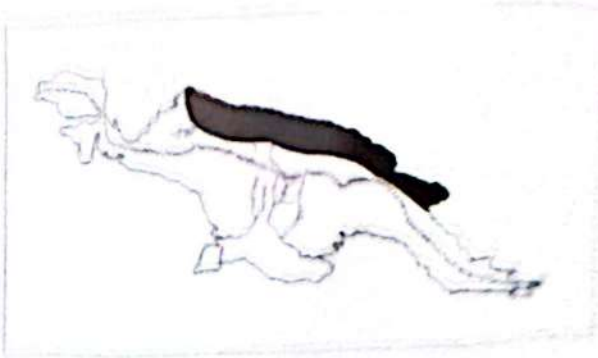


Yellowbelly Gudgeon

Mogurnda nesolepis
(Weber, 1908)
(Plate 13, no. 1)

Diagnosis. - Dorsal rays VII-I,10 or 11; anal rays I,8 to 10; pectoral rays 13 to 15; midlateral scales 36-41; transverse scales 9-12; predorsal scales 15-24; postdorsal scales 7-9; generally tan or light brown with scale edges narrowly dusky; a broad, dark brown to blackish midlateral stripe along side, sometimes broken and/or overlaid with series of dark bars or saddles on upper half of body; a pair of dark stripes on head, across cheek; belly or lower half of body sometimes yellow in adult males; median fins yellowish or orange, dorsals and caudal with small red spots. Maximum size to 35 mm SL.

Distribution and Habitat. - Northern New Guinea in the Markham, Gogol, Ramu, Sepik, and Mamberamo river systems; also occurs in numerous small, independent coastal drainages between these rivers. Inhabits rainforest tributaries with gravel or mud bottoms; usually very common, but inconspicuous due to its small size.

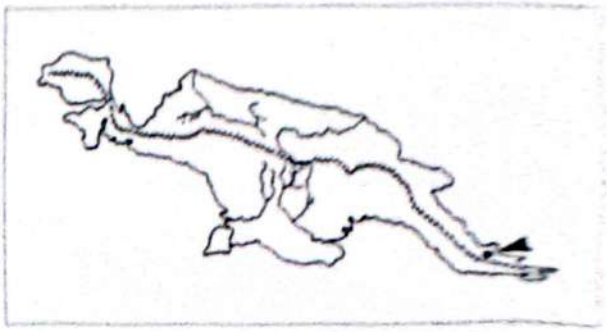


Eastern Mogurnda

Mogurnda orientalis
Allen & Hoese, 1991
(Plate 14, no. 4)

Diagnosis. - Dorsal rays VII or VIII-I,12 or 13; anal rays I,13 or 14; pectoral rays 14 or 15; midlateral scales 33-35; transverse scales 13 or 14; predorsal scales 21-22; postdorsal scales 9 or 10; purplish brown with red spots and series of broad dark bars and pale yellowish interspaces on sides; 3 oblique red stripes on cheek below eye; dorsal fins and caudal with numerous small red spots, and prominent red stripe at base of anal fin. Maximum size to 110 mm SL.

Distribution and Habitat. - Known thus far only from streams in the vicinity of Safia near the eastern extremity of New Guinea on the north-eastern side of the Owen Stanley Range. It frequents deeper pools among vegetation and log debris.



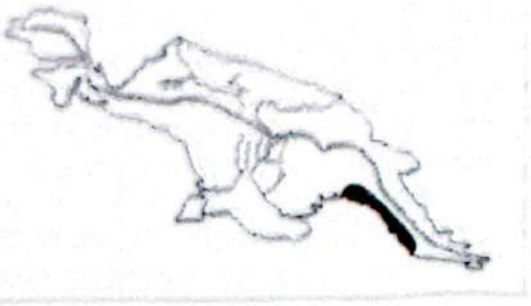
Moresby Mogurnda

Morgurnda pulchra
Horsthemke & Staeck, 1990
Plate 14, no. 1

Diagnosis. – Dorsal rays VII to IX-1, 11 to

14; anal rays I, 11 to 14; pectoral rays 14 to 16; midlateral scales 24-37; transverse scales 11-13; predorasal scales 14-18; postdorsal scales 7 or 8; generally brownish, sometimes blue on mid sides, with about 8-9 blackish to brownish bars, also a midlateral row of dark blotches corresponding with each bar; sides also with nuerous red spots; 3 red stipes radiating from eye across cheek; small red spots on dorsal and caudal fin, and row of red spots or red stripes along base of anal fin. Maximum size to 80 mm SL.

Distribution and Habitat. Laloki River system near Port Moresby and the Purari Delta area. It is probably widespread in eastern Papua New Guinea, south of the Owen Stanley Range. It occurs in lowland streams and swamps and also on the Sogeri Plateau (elevation about 500 m) near Port Moresby.

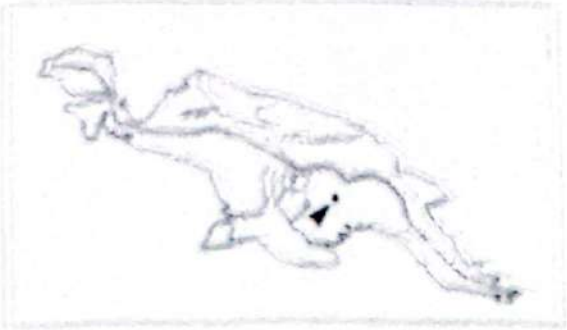


Blotched Mogurnda

Mogurnda spilota
Allen & Hoese, 1986
(Plate 14, no. 10)

Diagnosis. - Dorsal rays VII or VIII-I,11 or 12; anal rays I,11 or 12; pectoral rays 15; midlateral scales 37-40; transverse scales 12-13; predorsal scales 11-12; postdorsal scales 11-12; greenish brown, white ventrally; about 10 whitish or tan eye-sized blotches along middle of side; additional row of similar, but smaller blotches often present both above and below midlateral row; 3 broken, whitish stripes on cheek; fins pale or slightly dusky, often with spotting on dorsal, caudal, anal and pectoral fins. Maximum size to 130 mm SL.

Distribution and Habitat. - Known only from Lake Kutubu, where it appears to be uncommon. Only a few specimens have been collected, mainly from dense vegetation near shore.

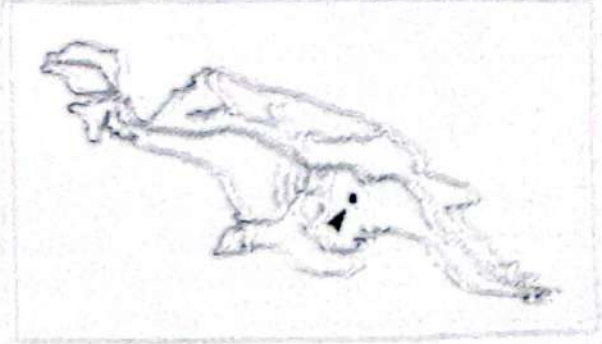


Variegated Mogurnda

Mogurnda variegata
Nichols, 1951
(Plate 14, no. 9)

Diagnosis. - Dorsal rays VIII-I,11 or 12; anal rays I,12 or 13; pectoral rays 15; midlateral scales 36-40; transverse scales 14-15; predorsal scales 19-24; postdorsal scales 11-12; yellowish tan with large mottled dark brown spots on upper two-thirds of body; a pair of dark brown stripes radiating from lower rear corner of eye across cheek; dorsal fins and caudal fin pale with dark brown spots. Maximum size to 130 mm SL.

Distribution and Habitat. - Known only from Lake Kutubu, Papua New Guinea. It is seen regularly, but is far less abundant than *M. kutubensis*. Most specimens have been collected from shallow vegetated areas near shore.

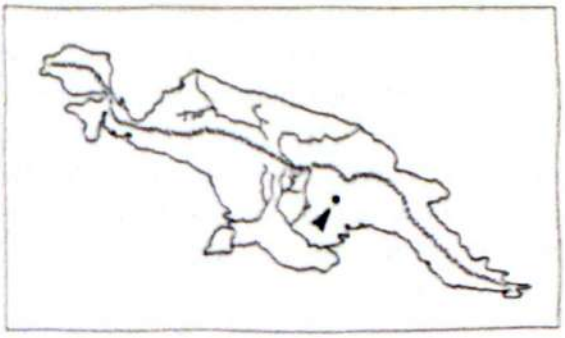


Striped Mogurnda

Mogurnda vitta
Allen & Hoese, 1986
(Plate 14, no. 8)

Diagnosis. - Dorsal rays VII or VIII-I,10 to 13; anal rays I,10 to 13; pectoral rays 14; midlateral scales 42-43; transverse scales 12-13; predorsal scales 21-27; postdorsal scales 12-14; brown with broad white midlateral stripe from operculum to caudal fin base, lower part of head and body whitish; a pair of brown stripes radiating from lower rear corner of eye across cheek; dark spotting sometimes evident on dorsal and caudal fins; juveniles have a series of white blotches along the side instead of the broad stripe of adults and the caudal fin is more strongly spotted. Maximum size 125 mm SL.

Distribution and Habitat. - Known only from Lake Kutubu, where it is apparently rare. A few specimens have been collected from thick vegetation along the lake margin.

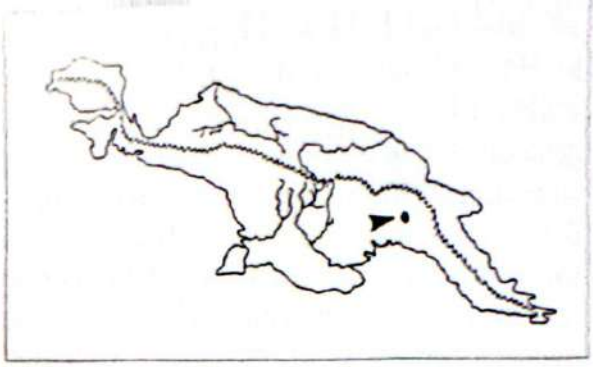


Karamui Gudgeon

Mogurnda sp. 1

Diagnosis. - Dorsal rays VII-I,10 or 11; anal rays I,10 or 11; pectoral rays 15 or 16; midlateral scales 38-39; transverse scales 13-14; predorsal scales 21-22; postdorsal scales 8-9; live colours unknown, in preservative more or less uniformly brown. Maximum size to 80 mm SL.

Distribution and Habitat. - Known only from a few specimens collected from a mountain stream near Karamui in the Central Highlands of Papua New Guinea.

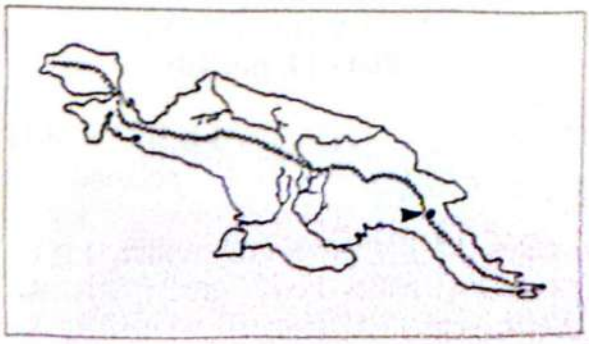


Wau Gudgeon

Mogurnda sp. 2
(Plate 14, no. 14)

Diagnosis. - Dorsal rays VII-I,10 or 11; anal rays I,9 or 10; pectoral rays 15; midlateral scales 38-39; transverse scales 12-13; predorsal scales 19-20; post-dorsal scales 10-11; purplish brown; a faint, broken dark brown stripe along middle of side; a dark brown stripe below eye to pectoral base and a pair of slightly less prominent stripes below it across cheek; a thin dark brown bar at base of pectoral fin; fins greyish with yellow suffusion, red spotting present on dorsals and caudal fin; outer margin of both dorsal fins broadly yellow. Maximum size to at least 62 mm SL.

Distribution and Habitat. - Known only from a small steep-gradient rivulet near the Wau Ecology Institute in eastern Papua New Guinea. The only known specimens were netted under a metre-high waterfall.



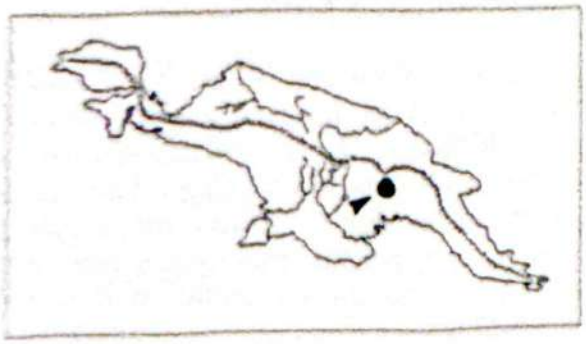
Highlands Gudgeon

Mogurnda sp. 3
(Plate 14, no. 13)

Diagnosis. - Dorsal rays VII-I,10 or 11; anal rays I,9 or 10; pectoral rays 15 to 17;

midlateral scales 46-50; transverse scales 17-19; predorsal scales about 28-32; postdorsal scales 12-13; dark brown or greyish with scattered brown or reddish spots on body; fins brown or grey except caudal yellowish; young with about 9-12 broad dark brown bars with narrow tan interspaces, these bars gradually fading, but still visible in specimens 60-70 mm SL. Maximum size to 80 mm SL.

Distribution and Habitat. - Known only from streams in the upper Purari River system, Papua New Guinea at altitudes between about 1500-2000 m. Thus far it has been collected only from the Mendi District (near Ialibu).



Papuan Gudgeon

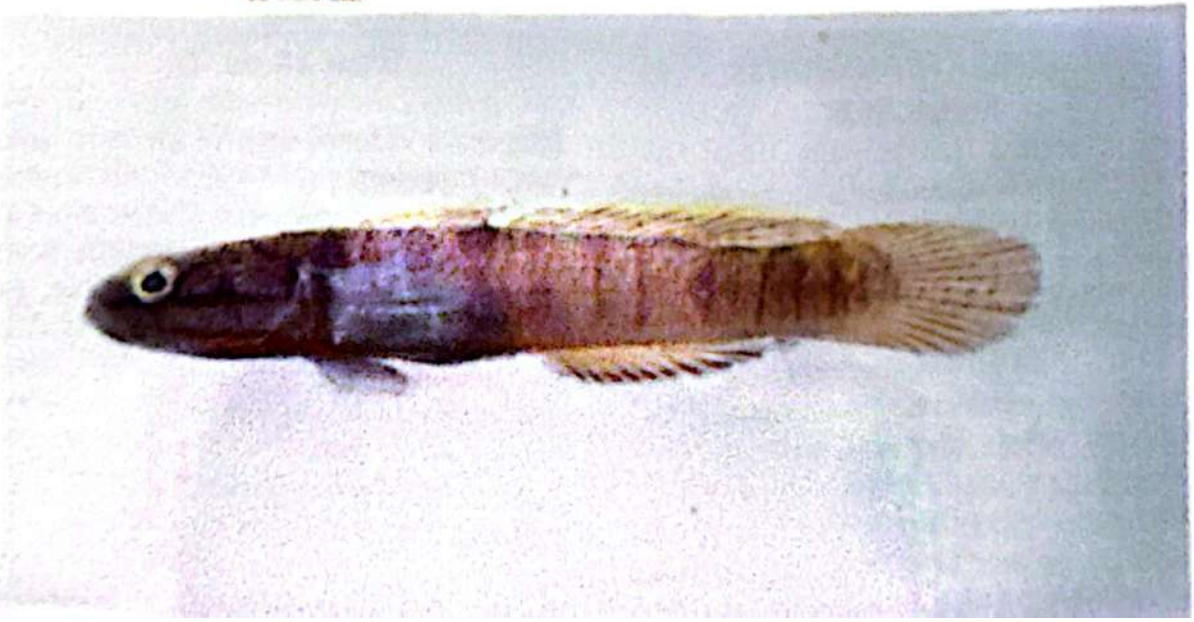
Mogurnda sp. 4.

(Plate 14, nos. 15 & 16)

Diagnosis. - Dorsal rays VII or VIII-I,9 to 12; anal rays I,8 to 10; pectoral rays 14 to 17 (usually 14 or 15); midlateral scales 40-45; transverse scales 11-15 usually 12-14); predorsal scales 19-30 (usually 22-26); postdorsal scales 8-11; brown or purplish-brown with several dark stripes on head, particularly across cheek and opercle; scattered small red spots on sides, on dorsal and caudal fins, and along base of anal fin; base of pectoral with dark bar or blotch. Maximum size to 65 mm SL.

Distribution and Habitat. - Eastern New Guinea on both sides of the Central Dividing Range. South of the range it occurs as far west as the Laloki River system near Port Moresby and north of the range it is distributed north-westward to coastal streams flowing into the northern side of Huon Gulf near Lae, Papua New Guinea. It is found both in lowland streams near the coast and well inland to elevations of about 500 m (Sogeri Plateau and vicinity of Kokoda). Common in rain-forest streams over mud and rocky bottoms.

*Photo 25. Malas Gudgeon, **Mogurnda** sp. 5, 40 mm SL.*



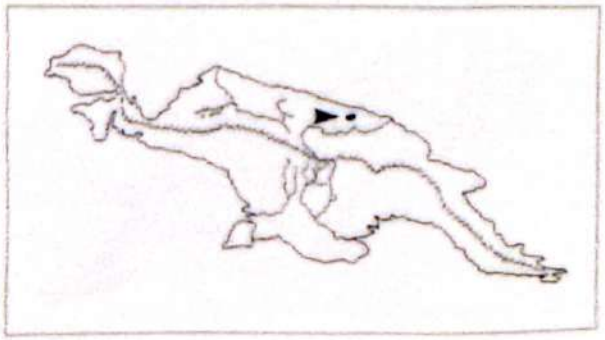
Malas Gudgeon

Mogurnda sp. 5

(Photo 25)

Diagnosis. - Dorsal rays VII-I,10 or 11; anal rays I,10; pectoral rays 13 or 14; midlateral scales 41-43; transverse scales 12-13; predorsal scales 18-19; postdorsal scales 7-8; generally light brown with about 10 narrow dark brown bars on side between head and caudal fin base; a pair of dark brown stripes below eye from mouth to edge of operculum; median fins yellowish; small dark spots on dorsal and caudal fins; a dark spot on upper pectoral fin base. Maximum size to 45 mm SL.

Distribution and Habitat. - Known only from Malas Creek, about 20 km west of Maprik, Papua New Guinea on the Lumi Road. The habitat consists of a narrow rain-forest creek with slow-flowing sections interrupted by occasional rapids. The fish congregate around submerged logs, branches, and other forest debris. Probably occurs in other streams of the Torricelli Range.



Genus *Ophieleotris*

Aurich, 1938

The genus contains the single widely distributed species discussed below.

Snakehead Gudgeon

Ophieleotris aporos

(Bleeker, 1854)

(Plate 13, nos. 2 & 3)

Diagnosis. - Dorsal rays VI-I,8 or 9; anal rays I,9; pectoral rays 14 or 15; midlateral scales about 30-32; transverse scales 8-9; predorsal scales 13-19; head dorsally flattened; greenish brown with 8-10 faint blackish or brownish bars across side; lower half of head tan or yellowish with 3-4 dark brown to reddish stripes radiating from lower part of eye across cheek; a large black blotch at base of pectoral fin; fins dusky, second dorsal and caudal fins with yellow spotting. Maximum size to 200 mm SL.

Distribution and Habitat. - Madagascar to northern Australia and islands of Melanesia. Occurs in a variety of habitats including large rivers, swamps, lakes and turbid or clear tributary streams to elevations of at least 400 m. It is particularly common throughout the floodplain of the Lower and Middle Sepik River.

Remarks. - Spawning occurs year round with a peak in January and February (Sepik River). Each female deposits between 100,000-220,000 eggs. The main items in the diet of adults are aquatic insects and nymphs with lesser amounts of algae, other aquatic plants, and small crustaceans.

Genus *Ophiocara*

Gill, 1863

The genus contains a single widely distributed species that is discussed below.

Spangled Gudgeon

Ophiocara porocephala

(Valenciennes, 1837)

(Plate 14, no. 4)

Diagnosis. - Dorsal rays VI-I,8 or 9; anal rays I,7; pectoral rays 14 or 15; midlateral scales 33-37; transverse scales 12-14; predorsal scales 18-26; tip of tongue with shallow notch; generally dark brown or blackish, often with pale centres forming scattered white spots on sides; juveniles dark brown or blackish with two or more narrow white bars on sides and across back. Maximum size to 300 mm SL, common to 200 mm SL.

Distribution and Habitat. - East Africa to

high volcanic islands of Oceania. Inhabits brackish estuaries, river mouths, and freshwater creeks. Young commonly encountered while wading in rocky creeks near the coast; they hover a short distance above the bottom, but swim away rapidly when disturbed.

Genus *Oxyeleotris*
Bleeker, 1874

This genus contains small to relatively large gudgeons that are mainly distributed in the Indo-Australian Archipelago. Although the taxonomy of the group requires study, there are approximately 15 species. The genus *Bunaka* Herre characterised by having the teeth of the outer row not or only slightly enlarged, is here considered to be a synonym of *Oxyeleotris*.

Key to New Guinea *Oxyeleotris*

1a. Total rays in second dorsal fin 9-10....2

1b. Total rays in second dorsal fin 11-15..5

2a. Teeth of jaws more or less uniform, or some only slightly enlarged 3

2b. Teeth of jaws with outer row enlarged 4

3a. Spotting absent on anal, pelvic, and pectoral fins; indistinct dark lines along scale rows of sides; usually a broad dark longitudinal band from snout to caudal fin ....*O. herwerdenii*

3b. Spotting present on anal, pelvic, and pectoral fins; scales of body with a dark spot forming longitudinal stripes on sides; no broad longitudinal band on body .....*O. gyrinoides*

4a. Colour overall dark brown including fins; no spotting on caudal fin (Sepik and Ramu rivers and Lake Sentani) . .....*O. heterodon*

4b. Colour mottled, often with narrow dark stripes on sides; dark spotting on caudal fin (central-southern New Guinea) .....*O. lineolarus*

5a. Midlateral scale series from upper pectoral base to caudal fin base 34-38 ..6

5b. Midlateral scale series from upper pectoral base to caudal fin base 55-102. 7

6a. Sensory pores of head entirely absent. .....*O. nullipora*

6b. Sensory pores (preopercular and lateral line) of head present ....*O. paucipora*

7a. Head flattened (Fig. 29B); 3-4 dark lines radiating from eye across cheek (southern and northern New Guinea) 8

7b. Head more rounded (Fig. 29A); no dark lines on cheek (Wissel or Panai Lakes, Irian Jaya) .....*O. wisselensis*

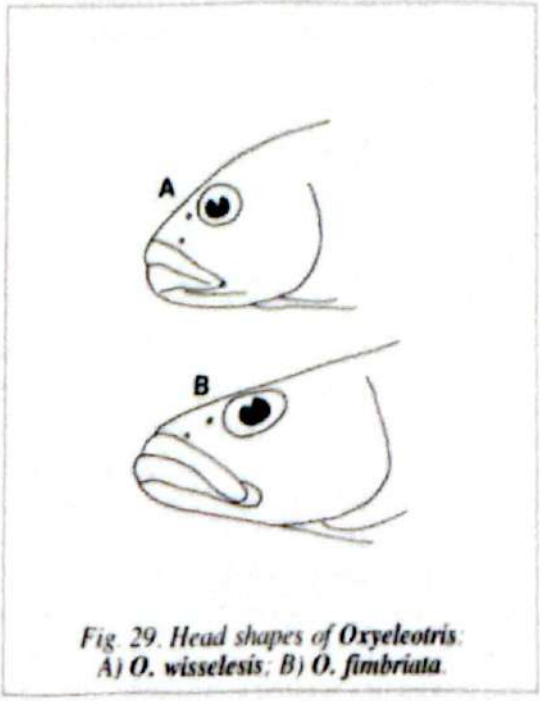


Fig. 29. Head shapes of ***Oxyeleotris****:*
A) ***O. wisselesis****; B)* ***O. fimbriata****.*

8a. Head pore system generally less developed, although an extra pore present between snout and upper eye; pores Q, H, I, and J missing from preopercular and upper opercular rows (Fig. 30A) .....*O. aruensis*

8b. Head pore system better developed, although one less pore present between snout and upper eye; pores Q, H, I, and J present on preopercular and upper opercular rows (Fig. 30B). .....*O. fimbriata*

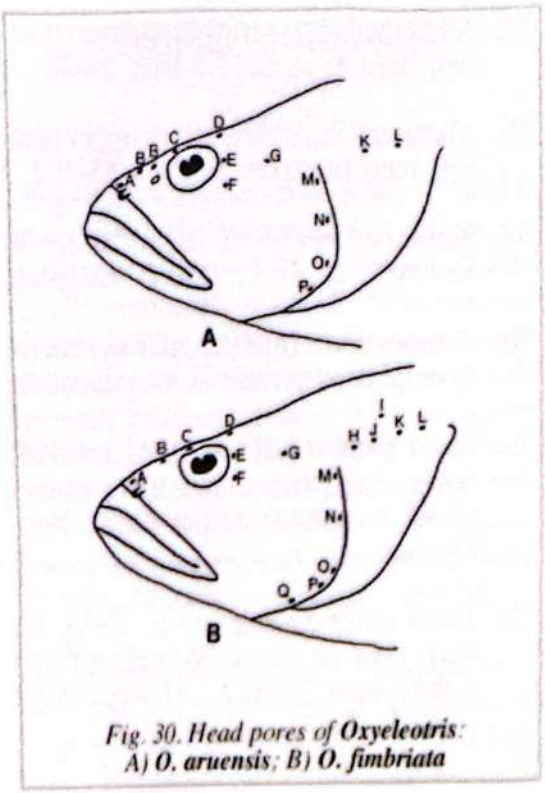


Fig. 30. Head pores of ***Oxyeleotris****:*
A) ***O. aruensis****; B)* ***O. fimbriata***

Aru Gudgeon

Oxyeleotris aruensis
(Weber, 1911)
(Plate 13, no. 14)

Diagnosis. - Dorsal rays VI-I,12 to 14; anal rays I,10 to 12; pectoral rays 13 to 16; mid-lateral scales 55-60; transverse scales 16-18; predorsal scales 35-40; dark to light brown, frequently with chevron-shaped marks on sides; 2-3 dark brown bands radiating from eye across cheek; often a dark brown spot or ocellus at base of upper caudal rays, particularly in small specimens; dorsal and caudal fins spotted in juveniles and some adults. Maximum size to 150 mm SL.

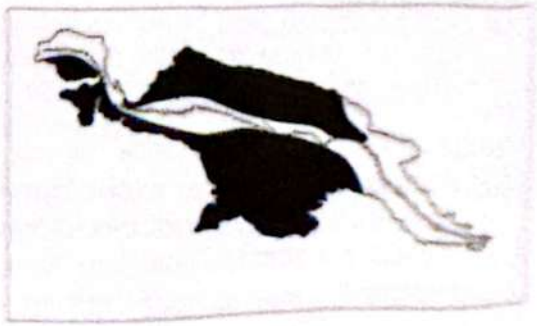
Distribution and Habitat. - Known in New Guinea thus far only from the Aru Islands, Fly River near Kiunga, and the Bensbach River; also occurs on Cape York Peninsula, Australia. Found in large rivers as well as smaller tributaries; it prefers well-vegetated stream margins with soft mud bottoms.

Fimbriate Gudgeon

Oxyeleotris fimbriata
(Weber, 1908)
(Plate 13, no. 15)

Diagnosis. - Dorsal rays VI-I,11 or 12; anal rays I,9 or 10; pectoral rays 15 or 16; mid-lateral scales about 60-83; transverse scales 19-24; predorsal scales 37-45; generally medium to dark brown with whitish belly and underside of head; frequently a series of narrow, dark brown chevron markings on side and 2-3 dark lines radiating from eye across cheek; median fins often with dark spotting; a dark spot or ocellus at base of upper caudal fin rays usually present, at least in specimens under 100 mm SL. Maximum size to 160 mm SL.

Distribution and Habitat. - Widely distributed throughout New Guinea; it is one of the few purely freshwater fishes that occur on both sides of the central dividing range, although further study may reveal that more than one species is involved. The southern distribution includes the following river systems and lakes: Purari, Kikori (including Lake Kutubu), Fly-Strickland, Merauke, Digul, Lorentz, Lake Jamur, Djarua, Yakati, Bintuni, and Ajamaru Lakes. North of the dividing range it has been reported from the Ramu, Sepik, Puaal, Sermowai, Mamberamo, and Wagani river systems. In nearly all of these systems it is known from the headwaters, often in hilly or mountainous terrain. It is found on both rock and mud bottoms. It is very common in the weedy shallows of Lake Kutubu.

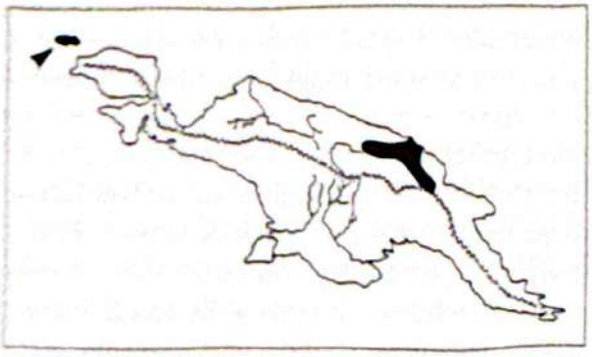


Greenback Gauvina

Oxyeleotris gyrinoides
(Bleeker, 1853)
(Photo 26)

Diagnosis. - Dorsal rays VI-I,8; anal rays I,8; pectoral rays 18 or 19; midlateral series 55-60; transverse scales 16-17; predorsal scales 36-45; dark brown with narrow dark lines (one per scale row) on side; light brown or tan blotches usually on side of head and on lips; all fins with dark spotting, although dorsal fins and caudal mainly uniform brown in some large adults; juveniles have an abruptly light brown back and tan spots on side. Maximum size to 300 mm SL.

Distribution and Habitat. - Sri Lanka, Indonesia, Philippines, New Guinea, Admiralty Islands, Australia (Cape York Peninsula), and Pohnpei (Caroline Islands). In New Guinea it is known from Waigeo Island and the Ramu and Gogol river systems. Found on soft mud bottoms of rainforest creeks to elevations of at least 150m.



Blackbanded Gauvina

Oxyeleotris herwerdenii
(Weber, 1910)
(Plate 13, no. 9)

Diagnosis. - Dorsal rays VI-I,8 or 9; anal rays I,7 or 8; pectoral rays 17; midlateral scales 62-70; transverse scales18-22; predorsal scales about 35-40 plus several small scales; dark brown on back grading to whitish or tan on ventral parts of head and body; a broad blackish longitudinal band from snout, through eye to base of caudal fin on middle of side; caudal fin blackish or dark brown with indistinct pale blotching or stripes; dorsal fins often with faint spotting. Maximum size to 300 mm SL.

Distribution and Habitat. - Central-southern New Guinea in the Purari, Fly, Bensbach, and Lorentz rivers; probably more wide spread in this area, but most streams remain unsampled. Specimen were collected from the Bensbach River on a muddy bottom, close to shore in turbid conditions.

Remarks. - The fish frequently identified as *O. herwerdenii* from northern Australia is apparently an undescribed species.

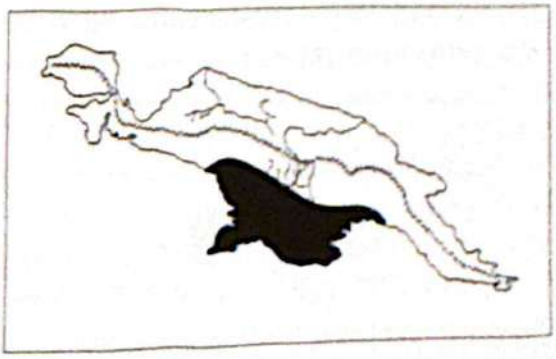
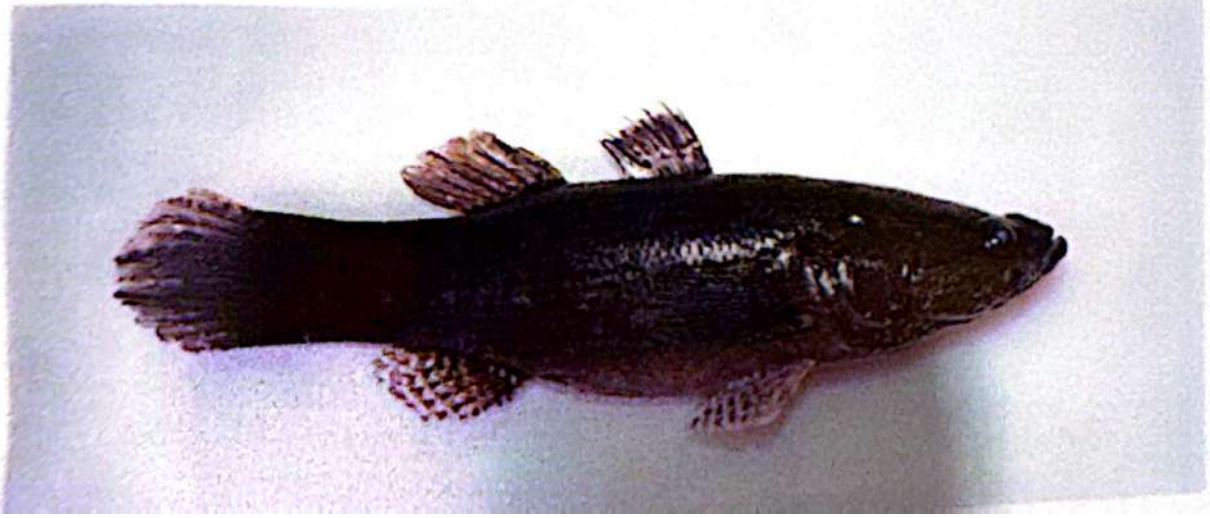


Photo 26 - Green-backed Gauvina, ***Oxyeleotris gyrinoides*** *195 mm SL.*



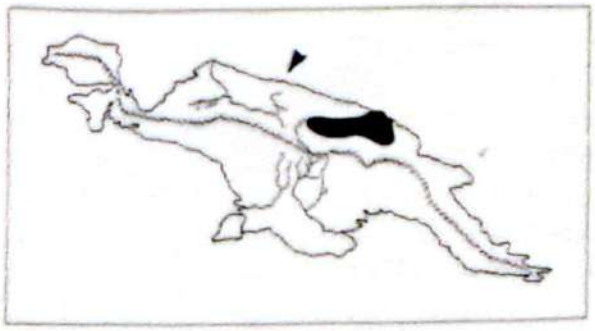
Sentani Gudgeon

Oxyeleotris heterodon
(Weber, 1908)
(Plate 13, no. 10)

Diagnosis. - Dorsal rays VI-I,9; anal rays I,8; pectoral rays 18; midlateral scales 62-68; transverse scales 19-22; predorsal scales about 50-60; overall dark brown, lighter 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 spotting. Maximum size to about 410 mm SL.

Distribution and Habitat. - Known only from the Sepik and Ramu river systems and from Lake Sentani. It is 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.

Remarks. - Spawning occurs year round with a slight increase during the dry season (May-October); each female lays between 15,000-250,000 eggs. The diet consists mainly of the eleotridid fish *Ophieleotris aporos* and large crustaceans, such as *Macrobrachium* prawns.



Sleepy Cod

Oxyeleotris lineolatus
(Steindachner, 1867)
(Photo 27)

Diagnosis. - Dorsal rays VI-I,8 or 9; anal rays I,7 to 9; pectoral rays 17 or 18; midlateral scales 62-70; transverse scales 18-22; predorsal scales 35-45; dark brown, lighter on sides and belly; a series of closeset narrow dark stripes frequently on side; dorsal and caudal fins clear to dusky with dark brown spots; pelvic, pectoral, and anal fins without dark spotting; juveniles often with white or cream area on back and top of head, brown on sides, and whitish on belly. Maximum size 360 mm SL.

Distribution and Habitat. - Northern Australia and central-southern New Guinea, but there are no precise locality records from New Guinea and its occurrence there needs to be confirmed. In Australia it inhabits creeks, rivers, and swamps, frequently being found in weeds or around log snags.

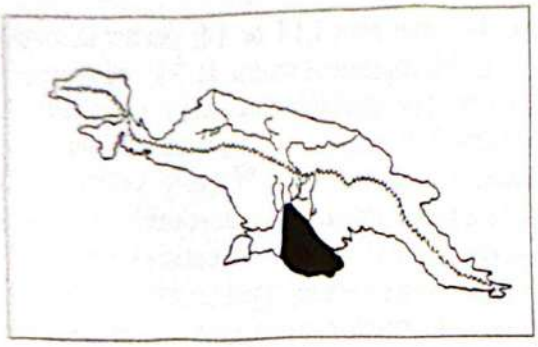
Poreless Gudgeon

Oxyeleotris nullipora
Roberts, 1978
(Plate 13, no. 12)

Diagnosis. - Dorsal rays VI-I,10 or 11; anal rays I,7 to 10; pectoral rays 11 or 12; midlateral scales 30-38; transverse scales 10-12; predorsal scales 19-23; brown, darker on back, grading to whitish on belly and underside of head; series of dark brown chevron-shaped markings often present on sides; a pair of vertical dark brown blotches at upper and lower base of caudal fin; dark brown spot with white center above base of pectoral fin; 3 dusky brown bands radiating posteriorly from eye; fins mainly clear or whitish, dorsals with small brown spots forming stripes and caudal with similar spots forming wavy, transverse bands. Maximum size to 30 mm SL.

Distribution and Habitat. - Reported from the Bensbach and middle Fly rivers, but probably widespread in the Fly Delta. Also found in northern Australia. Inhabits backwaters of rivers and small creeks, swamps, and lily lagoons, usually among thick aquatic vegetation over soft mud bottoms.

Remarks. - About 30 large (2 mm) eggs are laid by the female on the ceiling of overhanging rocks or in crevices. These are guarded and cared for by the male until hatching which takes about 8 days.

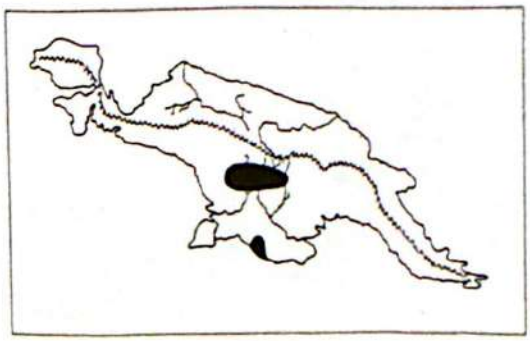


Fewpored Gudgeon

Oxyeleotris paucipora
Roberts, 1978

Diagnosis. - Dorsal rays VI-I,11 or 12; anal rays I,8 or 9; pectoral rays 11 to 13; midlateral scales 34-37; transverse scales 9-10; predorsal scales 17-19; similar in appearance to *O. nullipora* (Plate 13, no. 12); overall brownish sometimes with diffuse dark brown longitudinal bands from eye to upper caudal base; body may have 9-11 narrow dark chevron markings on side; 2-3 oblique dark brown stripes radiating from eye across cheek; the most diagnostic marking is a small white spot surrounded by black above the upper pectoral fin base; both dorsal fins and anal fin usually with black submarginal stripe. Maximum size to 45 mm SL.

Distribution and Habitat. - Known only from the Upper Fly, Digul (at Tanah Merah), and Bensbach rivers, but probably more widespread in central-southern New Guinea. In the Fly system it has been found between 830-900 km upstream from the sea. Occurs in the same habitats as O. nullipora (see above).



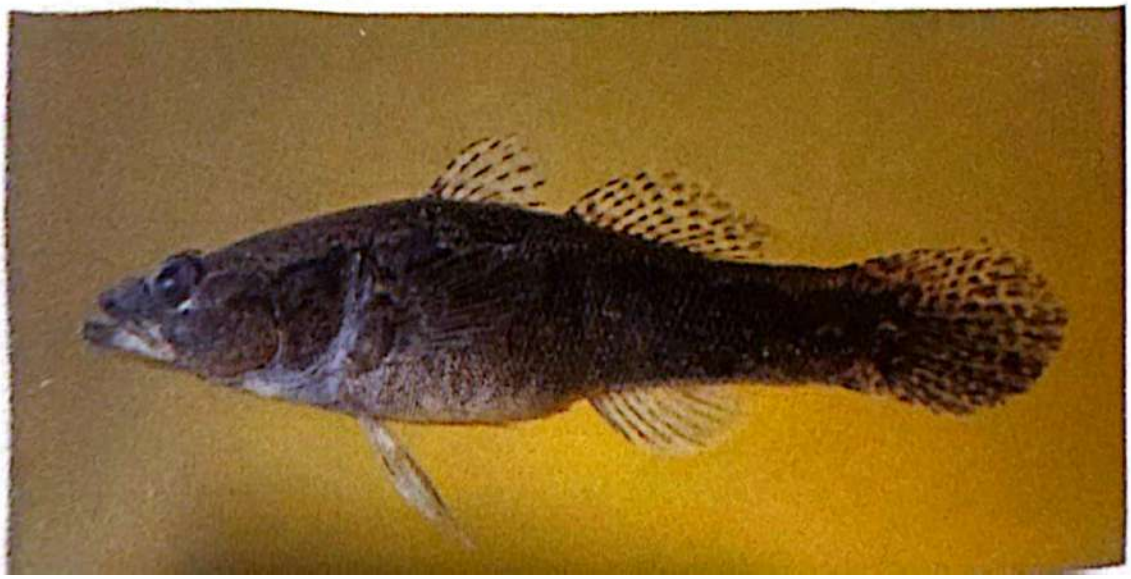
Paniai Gudgeon

Oxyeleotris wisselensis
Allen & Boeseman, 1982
(Plate 13, no. 13)

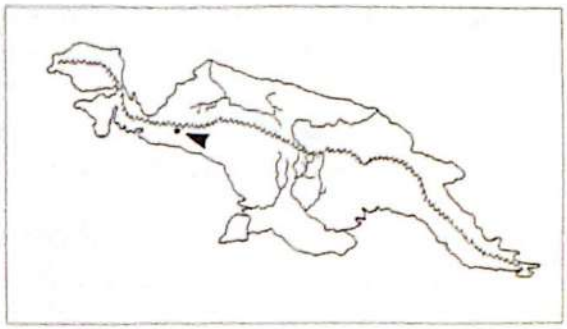
Diagnosis. - Dorsal rays VI-I,10 to 12; anal rays I,8 to 11; pectoral rays 16 to 18; midlateral scales 63-70; transverse scales 18-23; predorsal scales 25-30; brown or greyish brown, sometimes with greenish or golden suffusion; young with series of dark brown chevron markings on side and vague ocellus at base of upper caudal fin rays. Maximum size 115 mm SL.

Distribution and Habitat. - Wissel or Paniai Lakes and their tributary streams. It is found in Tage and Tigi lakes and their outlet streams as well as the Dimija River between Paniai and Tage lakes. It is apparently absent from Paniai Lake. The lakes are situated in the central range of

*Photo 27. Sleepy Cod, **Oxyeleotris lineolata**, 64 mm SL.*



Irian Jaya at elevations ranging from 1640 to 1750 m. It is apparently the only fish species in this region and is used as bait for catching crayfish, an important source of food for the local population.



Genus *Tateurndina*
Nichols, 1955

This genus contains a single species that is discussed below. It is closely related to *Mogurnda*, differing primarily in having an outer row of enlarged, widely spaced teeth in each jaw. In *Mogurnda* the teeth are only slightly larger than the inner row teeth and are closely spaced. Also *Tateurndina* usually has 5 or 6 (range 5 to 7) post-dorsal scales compared with a usual count of 9 or more (one species with 7-8) in *Mogurnda*.

Peacock Gudgeon
Tateurndina ocellicauda
(Nichols, 1955)
(Plate 14, no. 12)

Diagnosis. - Dorsal rays VII or VIII-I,13 or 14; anal rays I,13 or 14; pectoral rays 12 to 14; midlateral scales 31-33; transverse scales 9; predorsal scales 13-17; postdorsal scales 5-7; mauve with about 12 narrow orange crossbars on side; belly yellowish; a black eye-sized spot preceded by yellow vertical band at base of caudal fin; 2-3 reddish stripes across cheek; dorsal and anal fins with small reddish spots; margins of dorsal fins, caudal and anal fins yellow, except edge of anal fin of female broadly black. Maximum size to 35 mm SL.

Distribution and Habitat. - Eastern Papua New Guinea, on the north-eastern side of the Owen Stanley Range. Common in rainforest streams in the vicinity of Popondetta and Safia; forms schools that hover over the bottom.

Remarks. - Prior to spawning a pair selects and cleans a nest site,usually in a rocky crevice. The female deposits about 30 eggs and these are guarded and fanned by the male. Hatching time is about 6 days.

*Photo 28 - Peacock Gudgeon, **Tateurndina ocellicauda**, 30 mm SL.*

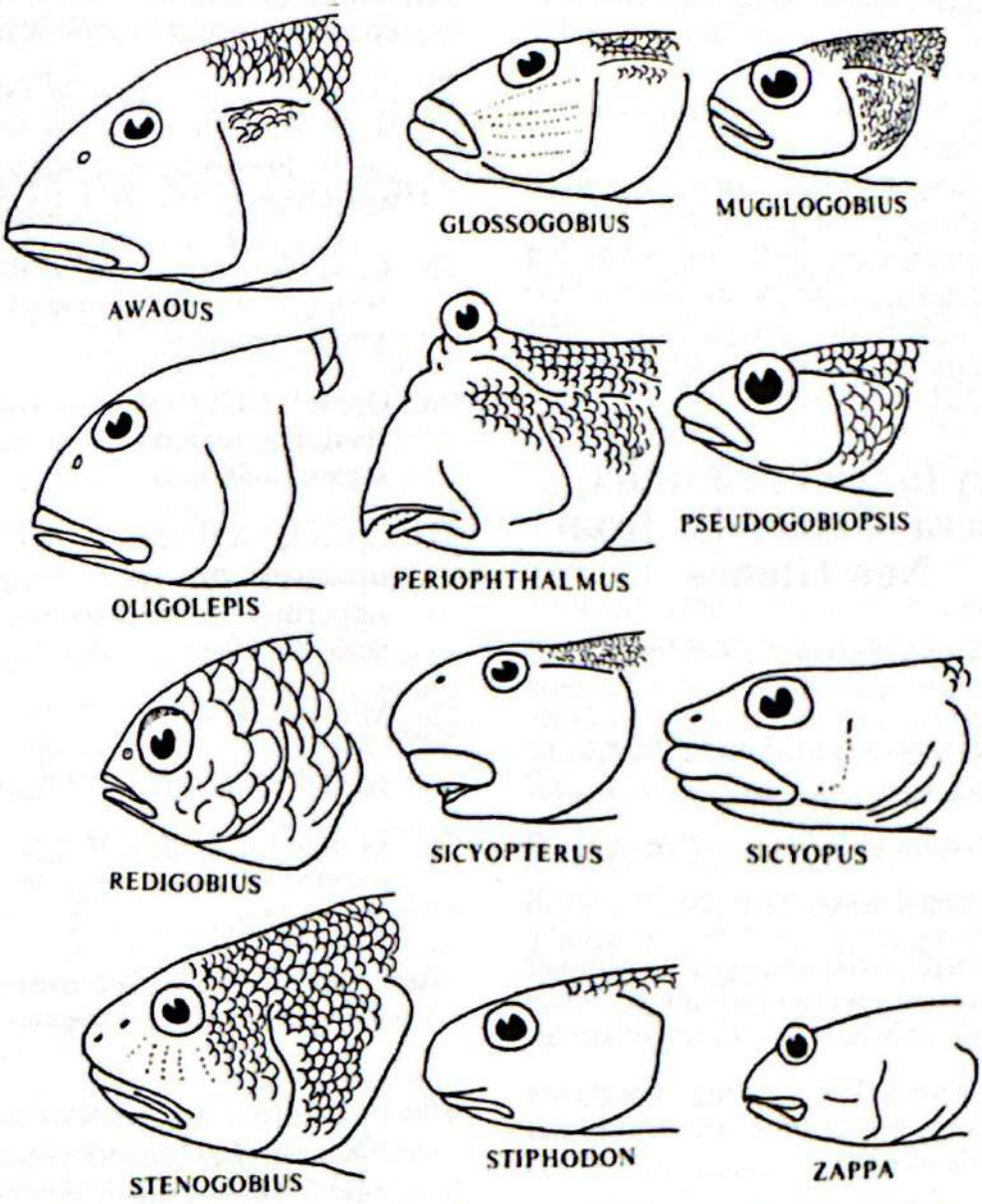


Fig. 31. Head shape and scalation of freshwater gobiid genera. The very small and numerous scales on the head of **Zappa** *are not shown.*

Gobies

Family Gobiidae

Gobies are the largest family of marine fishes and are also well represented in brackish and fresh waters. Taxonomically it is one of the most poorly known groups and the family contains numerous undescribed species. It is estimated there are about 2,000 species in over 200 genera. It is the largest family of New Guinean fishes with more than 300 species; most are associated with coral reef habitats, but at least 50 species are found in fresh waters, often well inland.

Gobies are bottom-dwelling fishes characterised by two, usually separate, dorsal fins, the first of which is composed of six spinous (although flexible) elements. Perhaps the most notable characteristic is the disc-like structure formed by the fused pelvic fins. The membrane that anteriorly connects the pelvic fin of each side is referred to as the frenum and is variously developed according to genus and species. In a few, mainly marine genera, the pelvics are separate. Many species have a somewhat flattened head, rounded snout, and bulbous cheeks that frequently lack scales (or may have inconspicuous embedded scales). Most of the New Guinean freshwater species

belong to one of three groups: *Glossogobius*, *Stenogobius*, and the subfamily Sicydiaphiinae containing *Sicyopterus*, *Sicyopus*, and *Stiphodon*. Gobies generally deposit their eggs on hard surfaces, often under rocks or beneath ledges. These are guarded by the parents until hatching. Gobies exhibit a wide range of feeding habits, but most species are carnivorous. Much of the diet is composed of crabs, prawns, smaller crustaceans (such as copepods), molluscs, worms, and small fishes.

Key to the Freshwater Genera of Gobiidae from New Guinea

1a. Total rays of second dorsal fin 24 to 29 ..... *Zappa*

1b. Total rays of second dorsal fin 8 to 12 2

2a. Midlateral scales 44 to 100 or more...3

2b. Midlateral scales 25 to 38 6

3a. Eye with well developed free lower eyelid; eyes project well above dorsal profile of head ..... *Periophthalmus*

3b. Eye without lower eyelid; eyes do not project noticeably above dorsal profile of head 4

4a. Lower jaw with one row of teeth, at least 2 canines present near middle of jaw; lower lip with a row of widely set conical teeth; upper lip with papillae or one or more clefts along margin. ..... *Sicyopterus*

4b. Lower jaw with several rows of teeth, no canines; lower lip without teeth; upper lip without papillae or clefts along margin.. 5

5a. Gill arches and gill filaments papillose; no broad dark bar or triangular marking below eye. ..... *Awaous*

5b. Gill arches and gill filaments not papillose; a broad dark bar or triangular marking below eye ..... *Stenogobius*

6a. Lower jaw with one row of teeth; operculum scaleless 7

6b. Lower jaw with several rows of teeth; operculum scaled or scaleless 8

7a. Lower lip with a row of comb-like horizontal teeth; lower jaw with a few canine-like teeth bent outwards and backwards. ..... *Stiphodon*

7b. Lower lip without teeth; lower jaw with row of slender, hooked movable teeth, no canines ..... *Sicyopus*

8a. Opercle fully covered by scales; predorsal region scaled; midlateral scales 24-38. 9

8b. Opercle scaleless or with small inconspicuous scales restricted to uppermost part; predorsal region scaled; midlateral scales 27-35 10

9a. Midlateral scales 32-38; opercle covered with numerous small scales; head pores absent ..... *Mugilogobius*

9b. Midlateral scales 25-28; opercle covered with a few large scales; head pores present. 11

10a Caudal fin lanceolate, much longer than head; predorsal region scaleless ..... *Oligolepis*

10b. Caudal fin rounded, shorter than or about equal to head length; predorsal region scaled ..... *Glossogobius*

11a. Total rays in second dorsal fin 11; total rays in anal fin 9 ..... *"Gobius"*

11b. Total rays in second dorsal fin 7 or 8; total rays in anal fin 7 or 8 12

12a Lips swollen ..... *Pseudogobiopsis*

12b. Lips relatively thin ..... *Redigobius*

Genus *Awaous*
(Valenciennes, 1837)

The genus contains at least 15 nominal species, but the actual number of valid species is problematical and there is a critical need for revision. The distribution includes freshwater streams of islands and continental areas in the tropical Indo-Pacific and Atlantic oceans. The genus is somewhat similar in

appearance to *Glossogobius*, but has more restricted gill openings, lacks raised rows of papillae on the head, and has numerous papillae in the mouth and on the gill arches.

Key to the New Guinean Species of *Awaous*

1a. Upper part of opercle and cheeks scaleless; predorsal scales usually 18-21; midlateral scales 54-58; embedded scales present on breast (area in front of pelvic fins) of males and females (southern drainages) .... *Awaous* sp. 1

1b. Upper part of opercle scaly; upper part of cheek with or without scales; predorsal scales usually 14-19; midlateral scales 48-54; embedded scales present on breast of females, this area scaleless in males (northern drainages).....2

2a. Transverse scale rows from origin of second dorsal fin to anal fin base 11-13; males and females without large black spot on posterior part of first dorsal fin; upper part of cheek scaleless in females and males. ..*Awaous melanocephalus*

2b. Transverse scale rows from origin of second dorsal fin to anal fin base 14-15; females with large black spot on posterior part of first dorsal fin; upper part of cheek scaled in females...*Awaous* sp. 2

Largesnout Goby

Awaous melanocephalus
(Bleeker, 1849)
(Plate 15, no. 14; Photo 29)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,10; pectoral rays 16 or 17; midlateral scales 50-53; transverse scale 11-13; predorsal scales 14-17; gill rakers on first arch 8 or 9; head mainly scaleless except nape and upper part of opercle; breast scaled in females, scaleless in males; brown to tan with midlateral row of about 8 irregular, dark brown blotches, and numerous brown spots and scribble-like markings on upper half of head and body; pair of slender, forward slanting brown lines below eye; dorsal fins with brown stripes and caudal fin with brown bars; a wedge-shaped brown mark on uppermost pectoral fin base; small juveniles with series of narrow bars on sides. Maximum size to at least 110 mm SL.

Distribution and Habitat. - Widespread from India and Sri Lanka to Indonesia, Philippines, and New Guinea. Reported from streams of northern Papua New Guinea between Lae and Madang. The habitat

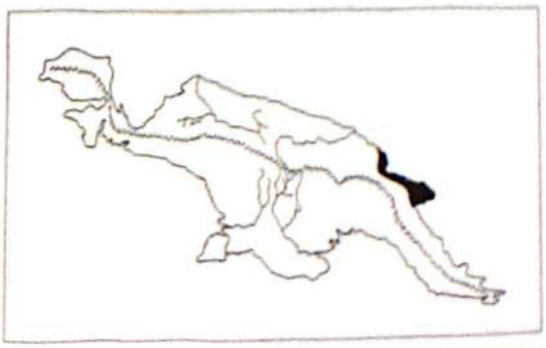


Photo 29. Largesnout Goby, ***Awaous melanocephalus,*** *60 mm SL.*

consists of clear streams, often in rainforest with mud, sand, or gravel bottoms. It is usually found within 50 km of the sea.

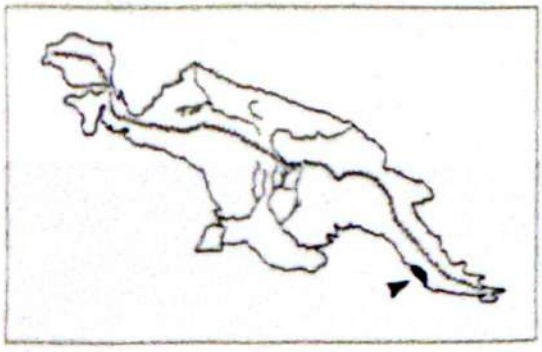
Roman Nose Goby

Awaous sp. 1

Diagnosis. - Dorsal rays VI-I,10 or 11; anal rays I,10; pectoral rays 16 or 17; midlateral scales 54-58; transverse scales 14-15; predorsal scales 19-21; gill rakers on first arch 8 or 9; head mainly scaleless except nape; embedded scales present on breast; brown to tan with midlateral row of 6-7 irregular, dark brown blotches and numerous scribble-like small brown blotches above and on head; both dorsal fins with brown stripes and caudal fin with similar brown bars; a triangular dark brown mark on upper pectoral fin base. Maximum size to 110 mm SL.

Distribution and Habitat. - Southern New Guinea and north-eastern Queensland. New Guinean specimens were collected from streams in the Port Moresby district. Occurs in rivers and rainforest tributaries over sand or gravel bottoms.

Remarks. - This species has been referred to as *A. crassilabris* (Günther), but according to R.E. Watson who plans to revise the genus, it clearly does not belong to that species and may in fact be undescribed.



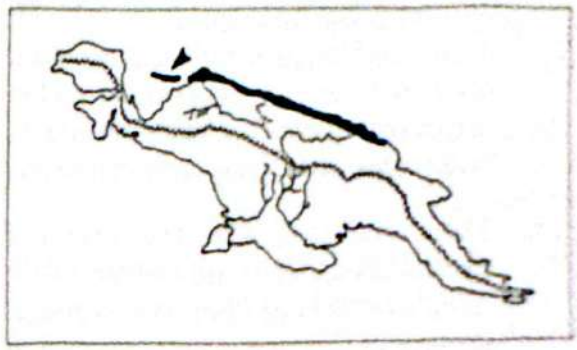
Ocellated Goby

Awaous sp. 2

(Plate 15, no. 13)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,10; pectoral rays16 or 17; midlateral scales 49-54; transverse scales 14-15; predorsal scales 16-19; gill rakers on first arch 8 or 9; nape and upper part of opercle scaled; breast and upper part of cheek scaled in females, scaleless in males; brown to tan with midlateral row of 6-8 irregular, dark brown, blotches (may be obscure); upper two-thirds of head and body covered with dense, dark brown mottling; a pair of thin brown forward slanting bars below eye; dorsal fins with brown stripes and caudal fin with brown bars; females with prominent black spot on posterior part of first dorsal fin; a dark, wedge-shaped mark at uppermost pectoral base; small juveniles may have series of narrow brown bars on side. Maximum size to at least 100 mm SL.

Distribution and Habitat. - A poorly defined species with unknown distributrional limits. New Guinean specimens are from the vicinity of Wewak, Papua New Guinea and Biak Island, Irian Jaya. It also occurs at Bougainville, in the Papua New Guinea part of the Solomon Islands.



Genus *Glossogobius*

Gill, 1862

The genus contains about 40 species and is widely distributed in the tropical Indo-Pacific. These fishes generally inhabit brackish estuaries and freshwater streams; some species occur hundreds of kilometres inland. There has been extensive radiation in fresh waters of New Guinea with 25 species thus far recorded from there. The genus is currently being studied by Dr. D.F. Hoese of the Australian Museum in collaboration with the author. We will soon publish descriptions of the 14 new species discussed on the following pages (*Glossogobius* spp. 1-14). Because of the regional distribution of most species, separate keys are provided

below for drainages on both the southern and northern sides of the Central Dividing Range.

Key to the Freshwater Species of *Glossogobius* from Southern New Guinea, Vogelkop Peninsula and Offshore Islands

(note: *G. bicirrhosus* and *G. biocellatus*, seldom found in fresh water, are excluded)

1a. Predorsal midline either scaleless or with a few scales in front of dorsal fin origin (nape scales present on either side of dorsal midline); pectoral rays 14 or 15; soft anal rays 6 or 7 (Upper Fly and Bensbach rivers) .. *Glossogobius* sp. 2

1b. Predorsal midline fully scaled; pectoral rays 14-22, 16 or more in most species; soft anal rays usually 8-10, rarely 7....2

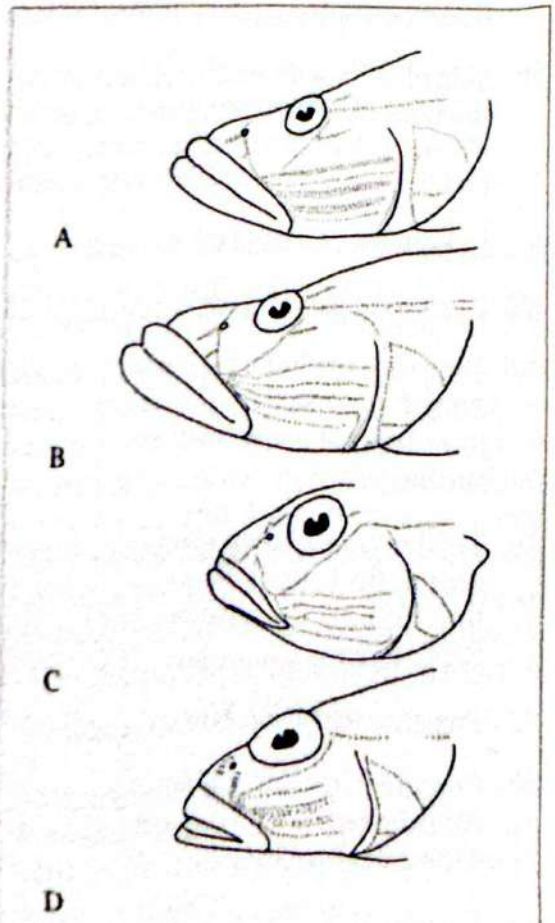


Fig. 32. Heads of certain Glossogobius showing pit-organ canal patterns: A) G. giurus; B) G. concavifrons; C) G. hoesei; D) Glossobobius sp. 4.

2a. Upper part of opercle with 1-2 rows of scales (sometimes embedded) 3

2b. Upper part of opercle scaleless. 6

3a. Cheek with some multiserial rows of papillae; (Fig. 32A) .....*G. giurus*

3b. Cheek with only uniserial rows of papillae; (Fig.32B&C) 4

4a. Predorsal scales 24 to 28. ....*Glossogobius* sp. 1

4b. Predorsal scales 13 to15 5

5a. Middle of sides with rectangular dark blotches within a pair of dark longitudinal stripes; no black spot on first dorsal fin. .....*G. celebius*

5b. Middle of sides with more or less round diffuse blotches, not situated within a pair of dark longitudinal stripes; a small black spot posteriorly on first dorsal fin....*Glossogobius* sp. 9

6a. Prepelvic area (i.e. breast) scaled ...7

6b. Prepelvic area scaleless. 12

7a. Middle of sides with about 7-9 relatively small dark blotches or dark blotches diffuse and indistinct (Central Highlands of Papua New Guinea) .8

7b. Middle of sides with about 4-6 relatively large dark blotches. 11

8a. Head relatively deep, its height at level of the preopercle margin usually greater than its width at preopercle; snout profile concave (Lake Kutubu) ....*Glossogobius* sp. 12

8b. Head less deep, its height at level of the preopercle about the same or slightly less than its width; snout profile rounded or straight. 9

9a. Side of body with indistinct or diffuse, inconspicuous markings (vicinity of Karamui, Papua New Guinea)..... . .....*Glossogobius* sp. 3

9b. Side of body with about 7-9 more or less distinct dark blotches.. 10

10a. First dorsal fin with small black spot posteriorly; spots on caudal fin not restricted to basal part of fin; cheek

without a prominent dark stripe(Lake Tebera Basin). ..*Glossogobius* sp. 13

10b. First dorsal fin without small black spot posteriorly; spots on caudal fin generally restricted to basal part of fin; cheek with a prominent dark stripe (Lake Kutubu)....*Glossogobius* sp. 8

11a. Predorsal scales 22-27; dorsal rays usually 9 (range 7 to 10); pectoral rays usually 18-20 (range 16 to 21)... .....*G. aureus*

11b. Predorsal scales 12-20; dorsal rays usually 10 or 11 (range 9 to 12); pectoral rays 14-18.. 12

12a. Pit-organ canal immediately below eye branched (Fig. 32B); head length 28-32% of SL; pectoral rays usually 17 or 18 (range 16-18) (Fly-Strickland River). .....*G. concavifrons*

12b. Pit-organ canal immediately below eye unbranched (Fig. 32C); head length 26-28% of SL; pectoral rays usually 16 (range 14-17) (Ajamaru Lakes, Vogelkop Peninsula).....*G. hoesei*

13a. Midlateral scales 25-26 (Vogelkop Peninsula) .....*Glossogobius* sp. 5

13b. Midlateral scales 31-34 14

14a. Pectoral rays 16-17; midlateral scales 31-32; transverse scales 8 (Upper Fly River). .....*Glossogobius* sp. 11

14b. Pectoral rays 18-19; midlateral scales 32-34; transverse scales 9 or 10 (Upper Kikori and Purari rivers). ....*Glossogobius* sp. 6

Key to the Freshwater Species of *Glossogobius* from Northern New Guinea

(note: *G. bicirrhosis* and *G. biocellatus*, seldom found in fresh water, are excluded.)

1a. Cheek with some multiserial rows of papillae (Fig 32A & D) 2

1b. Cheek with only uniserial rows of papillae..... 3

2a. Anal rays I,7; transverse scales 8; upper part of opercle scaleless; first dorsal fin with broad black stripe on basal half (eastern Papua New Guinea). ....*Glossogobius* sp. 4

2b. Anal rays I,8 or 9; transverse scales 9-11; upper part of opercle scaled; first dorsal fin with rows of small dark spots. .....*G. giurus*

3a. Predorsal scales 22-32 4

3b. Predorsal scales 6-18. 6

4a. Upper part of opercle scaleless; predorsal scales 22-27 .....*G. aureus*

4b. Upper part of opercle with 1-2 rows of scales (may be embedded); predorsal scales 26-32. 5

5a. Side of body with 4 very large dark blotches, covering nearly entire width of body, with saddle-like blotches along back in the spaces between them (Lake Sentani) .....*G. sentaniensis*

5b. Side of body with small, rather inconspicuous blotches (sometimes absent); without saddle- like blotches along back (Sepik and Ramu rivers)...*G. koragensis*

6a. Uppermost part of opercle scaled 7

6b. Uppermost part of opercle scaleless....8

7a. Total rays (including spine) in second dorsal fin usually 10; sides with longitudinal dark lines (coastal streams) .....*G. celebius*

7b. Total rays (including spine) in second dorsal fin usually 9; sides without longitudinal dark lines (Ramu and Sepik rivers). .....*G. coatesi*

8a. Prepelvic region (i.e. breast) scaleless...9

8b. Prepelvic region scaled (Sepik and Mamberamo rivers and Bewani Mountains). .....*G. bulmeri*

9a. Predorsal scales 6-7 (Upper Ramu River) .....*Glossogobius* sp. 14

9b. Predorsal scales 8-16 10

10a. Snout relatively narrow and conical

when viewed from above (Fig. 33A) (Sepik and Ramu rivers)...*G. torrentis*

10b. Snout relatively broad and bluntly rounded when viewed from above (Fig. 33B) (Upper Purari River. ....*G. brunnoides*

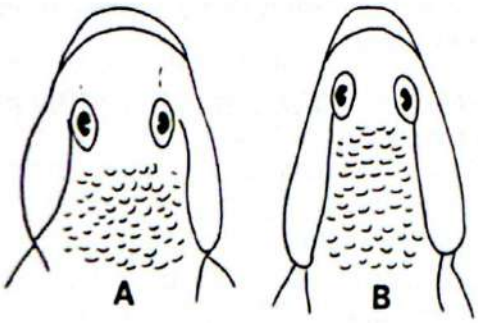


Fig. 33. Dorsal view of heads of Glossogobius: A) G. torrentis, B) G. brunnoides.

Golden Goby

Glossogobius aureus
Akihito & Meguro, 1975

Diagnosis. - Dorsal rays VI-I,7 to 10 (usually 9); anal rays I,7 to 9 (usually 8); pectoral rays 16 to 21 (usually 18 to 20); midlateral scales 29-34; transverse scales 8-12 (usually 10); predorsal scales 19-29 (usually 22-27); gill rakers on first arch 8-11; head scaleless except nape; breast scaled; dark brown on back, lighter brown on sides, and whitish or tan ventrally; series of 6 blackish saddles across back and 5 black blotches along middle of sides; several faint longitudinal dark lines on side; dark spotting on dorsal and pectoral fins; wavy transverse blackish bands on caudal fin. Maximum size to 120 mm SL.

Distribution and Habitat. - Widespread in the western Pacific including Japan, Taiwan, Philippines, Thailand, Cambodia, Malaysia, Singapore, Indonesia, northern Australia and New Guinea. The only New Guinean specimens collected thus far are from a creek near Wewak, northern Papua New Guinea. It inhabits rivers and small tributaries, in clear to turbid water over sand or gravel bottoms.

Bearded Goby

Glossogobius bicirrhosus
(Weber, 1894)
(Plate 16, no. 5)

Diagnosis. - Dorsal rays VI-I,9; anal rays I,8; pectoral rays 18 or 19; midlateral scales 30-32; transverse scales 9; predorsal scales 13-15; gill rakers on first arch 11; two barbels under chin; head mainly scaleless except nape; breast scaled; tan with midlateral row of 4 dark blackish blotches, also indistinct dark saddles across back; a black spot at base of caudal fin; dorsals and caudal fin with dark spotting. Maximum size to 60 mm SL.

Distribution and Habitat. - Indonesia, Philippines, Melanesia, and north-eastern Australia. It inhabits tidal creeks and river mouths, usually in brackish water, but occasionally penetrates fresh water.

Mangrove Goby

Glossogobius biocellatus
(Valenciennes, 1837)
(Plate 16, no. 6)

Diagnosis. - Dorsal rays VI-I,9; anal rays I,8; pectoral rays 17 to 19; midlateral scales 28-32; transverse scales 7-8; predorsal scales 14-17; gill rakers on first arch 9-10, very low and rudimentary; mottled brown with midlateral row of 5-6 blackish blotches, including one at base of caudal fin; first dorsal fin largely blackish; second dorsal and caudal fins with blackish spotting; lower edge of caudal fin with 4-5 short blackish bars; anal and pelvic fins blackish. Maximum size to 80 mm SL.

Distribution and Habitat. - India and Sri Lanka to Samoa. A coastal species that inhabits river mouths and tidal creeks, usually in brackish water.

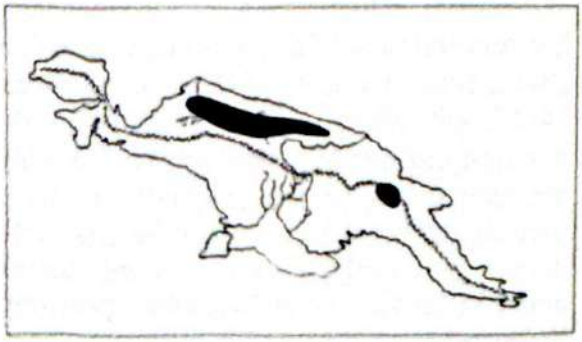
Bulmer's Goby

Glossogobius bulmeri
Whitley, 1959
(Plate 16, no. 7)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,7 or 8; pectoral rays 17 to 19; midlateral scales 32-36; transverse scales 9-11;

predorsal scales 15-18; gill rakers on first arch 6 or 7; head mainly scaleless except nape; breast scaled; light brown with darker scale margins forming network pattern; 4 irregular, large, blackish blotches along middle of side with similar, but slightly smaller blotches on back above spaces between midlateral blotches; large black spot at base of caudal fin; males with black spot on posterior part of first dorsal fin; dark stripes on dorsal fins; central part of caudal fin with brown spotting. Maximum size to 100 mm SL.

Distribution and Habitat. - Originally described from specimens collected from the Asaro River near Goroka in the Eastern Highland Province, Papua New Guinea. The Asaro is a headwater stream of the southern-flowing Purari system. All other records are from the Sepik and Mamberamo systems; also from the Bewani Mountains between the two systems. Further study of these populations is required. It is possible that more than one species is involved. It occurs in rainforest tributaries with boulder, gravel, or sand bottoms in hilly terrain between about 35 to 1070 m elevation.



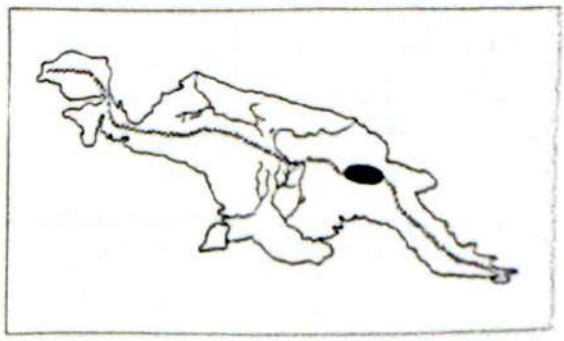
Dusky Mountain Goby

Glossogobius brunnoides
(Nichols, 1951)
(Plate 16, no. 11)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,7-9; pectoral rays 16 or 17; midlateral scales 32-34; transverse scales 10-11; predorsal scales 11-15; gill rakers on first arch 7-9 head mainly scaleless except nape; breast scaleless; basal membrane of pelvic fin relatively thick; brown to tan with dark brown scale margins; about 6-7 diffuse brown blotches or bars on sides; a yellow-edged black spot at rear of first dorsal fin; dorsals and caudal fin with brown spotting; pelvic fins dusky blackish. Maximum size to 100 mm SL.

Distribution and Habitat. - Known from mountainous headwaters of the Purari River system. Collection localities include the Asaro River near Goroka, and tributaries of the Wahgi River near Mount Hagen. Inhabits fast-flowing streams over gravel or rocky bottoms.

Remarks. - *Glossogobius asaro* Whitley is a synonym.



Celebes Goby

Glossogobius celebius
(Valenciennes, 1837)
(Plate 17, no. 15)

Diagnosis. - Dorsal rays VI-I,9; anal rays I,8; pectoral rays 17 to 20 (usually 19 or 20); mid-lateral scales 30-34; transverse scales 9-10; predorsal scales 13-16; gill rakers on first arch 10-12; head mainly scaleless except nape and upper part of opercle scaled; breast scaled; brown, lighter on sides, grading to white on belly; 5-6 diffuse blackish saddles across back and about 5 black rectangular blotches along middle of sides; several faint blackish stripes, mainly along lower sides; dark spotting may be present on dorsal, caudal, and pectoral fins. Maximum size to 120 mm SL.

Distribution and Habitat. - Widespread in the western tropical Pacific including northern Australia, New Guinea, Solomon Islands, Indonesia, Philippines, Taiwan, and Ryukyu Islands. Most New Guinean records are from northern coastal localities including Milne Bay, Oro Bay, Lae, Madang, Bogia, and Wewak. It is also known from

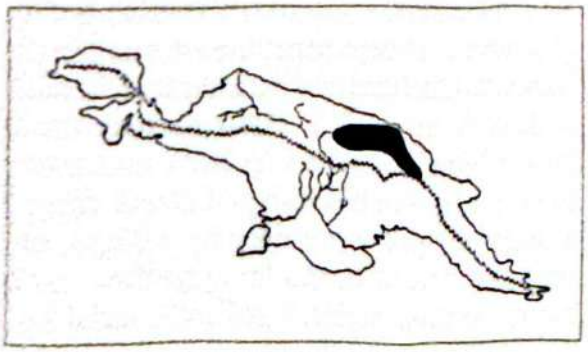
Waigeo Island, the Fly River mouth, Manus Island, New Ireland, and Bougainville. Inhabits rivers and small creeks, usually within a few kilometres of the sea.

Coates' Goby

Glossogobius coatesi
Hoese & Allen, 1990
(Plate 16, no. 9)

Diagnosis. - Dorsal rays VI-I,8; anal rays I,8; pectoral rays 19 to 21; midlateral scales 29-31; transverse scales 9-11; predorsal scales 14-17; gill rakers on first arch 9-11; head mainly scaleless except nape and upper part of opercle; breast scaled; brownish to tan with 5 large darker brown blotches on middle of side; a small black spot on posterior part of first dorsal fin (often absent in females); second dorsal and caudal fins with brown spotting. Maximum size to 100 mm SL.

Distribution and Habitat. - Middle and Lower Sepik and Ramu river systems. It inhabits main river channels and smaller tributaries in both open plain and rainforest habitats to elevations of at least 125m.

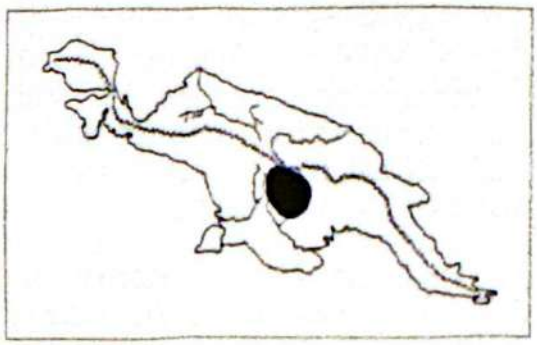


Concave Goby

Glossogobius concavifrons
(Ramsay & Ogilby, 1887)
(Plate 15, no. 4)

Diagnosis. - Dorsal rays VI-I,10 or 11; anal rays I,8 or 9; pectoral rays 16 to 18; midlateral scales 29-31; transverse scales 10; predorsal scales 12-20; gill rakers on lower limb of first gill arch 8-12; head mainly scaleless except nape; breast scaled; brown to tan with about 7 large blackish blotches along middle of sides; body scales with dark edges imparting network pattern; first dorsal fin with large black blotch posteriorly; second dorsal and caudal fins with several rows of small dark spots. Maximum size to 100 mm SL.

Distribution and Habitat. - Fly-Strickland system of Papua New Guinea and northern part of Cape York Peninsula, Australia. It is common in the Upper Fly at distances between about 800-970 km upstream from the sea. It occurs in both large turbid lowland rivers and relatively steep gradient tributaries in mountainous terrain.



Flathead Goby

Glossogobius giurus
(Hamilton, 1822)
(Plate 16, no. 10)

Diagnosis. - Dorsal rays VI-I,8 or 9; anal rays I,8 or 9; pectoral rays 17 to 22; midlateral scales 29-35; transverse scales 9-11; predorsal scales 14-24; gill rakers on first arch 8-12; cheek papillae in several longitudinal, multiserial rows; head mainly naked except nape and upper part of opercle; breast scaled; light brown grading to whitish ventrally, 5-6 large black saddles across back, and 5 large, square black blotches along middle of side; dorsal fins and pectorals with small black spots; caudal fin with wavy transverse bars. Maximum size to 120 mm SL.

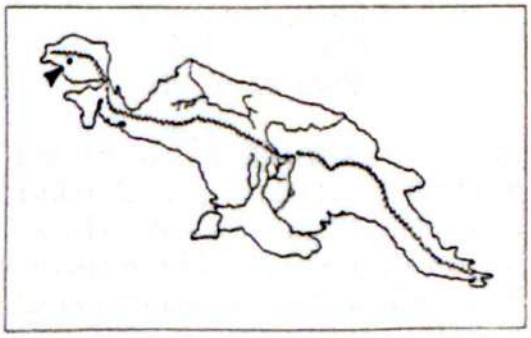
Distribution and Habitat. - Widespread in the tropical Indo-West Pacific from Pakistan to northern Australia and New Guinea. Records from New Guinea include Maiwara (extreme eastern tip of Papua New Guinea), Port Moresby district, Murnass River (near Madang), and the Lower Ramu River. Inhabits clear to turbid streams with rock, gravel, or sand bottoms.

Hoese's Goby

Glossogobius hoesei
Allen & Boeseman, 1982
(Plate 15, no. 5)

Diagnosis. - Dorsal rays VI-I,9 to 12 (usually 11); anal rays I,9 or 10; pectoral rays 14 to 17; midlateral scales 31-32; transverse scales 10; predorsal scales 15-17; gill rakers on first arch 5 or 6; head mainly scaleless except nape; breast scaled; live colours unknown, but probably overall tan to light brown; 5-6 diffuse brown blotches, about twice eye size, on middle of side; a circular brown spot at base of caudal fin; first dorsal fin with broad, blackish midlateral stripe; second dorsal fin with faint alternating dark and light stripes; caudal fin with faint, vertical brown bars. Maximum size to 70 mm SL.

Distribution and Habitat. - Known only from the Ajamaru Lakes in the centre of the Vogelkop Peninsula. Inhabits gravel or mud bottoms of the lakes and small nearby tributaries.

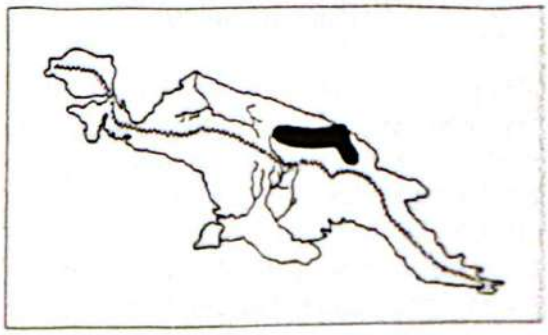


Sepik Goby

Glossogobius koragensis
Herre, 1935
(Plate 15, no. 6)

Diagnosis. - Dorsal rays VI-I,9; anal rays I,8; pectoral rays 17 to 19; midlateral scales 31-36; transverse scales 11; predorsal scales 29-32; gill rakers on first arch 8 or 9; head mainly scaleless except nape and upper part of opercle; breast scaled; light brown, sometimes with 5-6 faint dusky blotches on side; small black spot sometimes at base of caudal fin; head darker brown, opercle with bronzy sheen; faint spotting on pectoral, second dorsal, and caudal fins. Maximum size to at least 170 mm SL.

Distribution and Habitat. - Sepik and Ramu river systems. Mainly found in lakes and backwaters of the lowland plain, but also occasionally encountered in main river channels.

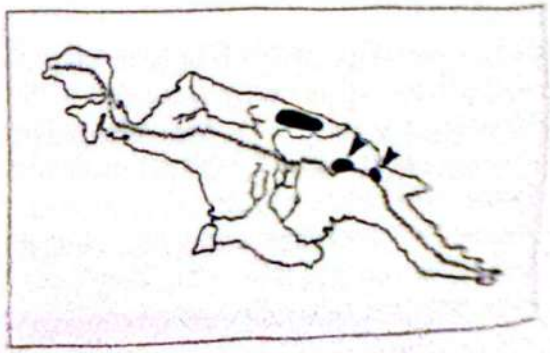


White Water Goby

Glossogobius torrentis
Hoese & Allen, 1990
(Plate 16, no. 14)

Diagnosis. - Dorsal rays VI-I,9; anal rays I,7 or 8; pectoral rays 15 to 18 (usually 16 or 17); midlateral scales 28-33 (usually 29-30); transverse scales 8-10; predorsal scales 8-16; gill rakers on first arch 5-7; head mainly scaleless except nape; breast scaleless; brown to tan, head and nape darker; scales with dark margins; about 4 diffuse dark brown blotches or bars on back and side; usually a broken blackish midlateral stripe; a blackish spot surrounded by yellow on posterior part of dorsal fin of males; dark brown spotting on dorsal fins and caudal fin.

Distribution and Habitat. - Sepik and Ramu river systems. It is known from the Torricelli Mountains and the Jimmi River in the Sepik drainage and in mountain tributaries of the Ramu River. The habitat



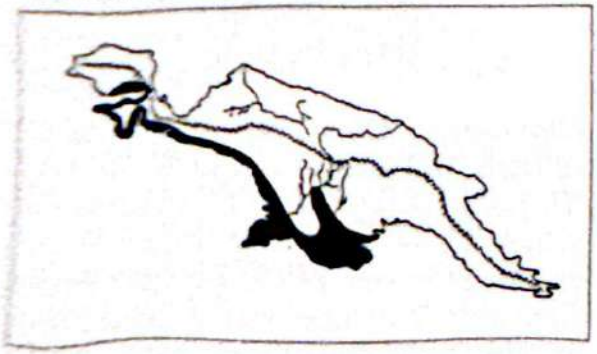
consists of relatively fast-flowing streams in hilly or mountainous terrain between about 200 and 1800 m elevation.

Munro's Goby

Glossogobius sp. 1
(Plate 16, no. 12)

Diagnosis. - Dorsal rays VI-I,9; anal rays I,8; pectoral rays 20-22; midlateral scales 31-33; transverse scales 9; predorsal scales 24-28; gill rakers on first arch 10-11; head mainly scaleless except nape and upper part of opercle; breast scaled; light tan with mid-lateral row of 5 rectangular dark brown blotches on side; series of narrow brown stripes between each horizontal scale row; a broad, brown bar from eye to upper jaw and oblique brown band across cheek; dorsals and caudal fin with brown spotting. Maximum size to 110 mm SL.

Distribution and Habitat. - An undescribed species known from southern New Guinea and northern Australia. New Guinean records include the Fly, Digul, and Bintuni rivers. Most specimens have been taken from lowland areas, including the tidal portion of rivers. However, it occurs as far as 900 km upstream from the sea in the Upper Fly. Usually inhabits turbid rivers and tidal creeks over mud or sand bottoms.

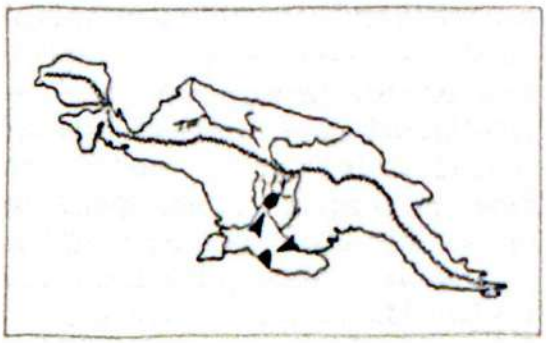


Dwarf Goby

Glossogobius sp. 2
(Plate 15, no. 1)

Diagnosis. - Dorsal rays VI-I,8; anal rays I,6 or 7; pectoral rays 14 or 15; midlateral scales 24-26; transverse scales 8; midline of nape scaleless or with only a few scales, but side of nape scaled forward to above operculum; gill rakers on first arch 8; head mainly scaleless except side of nape; breast scaleless; brown, darker on back and grading to whitish on belly; series of horizontally elongate spots along middle of side forming blackish stripe; first dorsal fin with prominent black spot posteriorly; spotting present on second dorsal and caudal fin. Maximum size to 30 mm SL.

Distribution and Habitat. - An undescribed species known only from the Upper Fly system, Bensbach River, and the northern Cape York Peninsula of Australia. In the Fly system it occurs at distances between 830-860 km upstream from the sea. The habitat consists of moderately turbid to clear waters of rivers and small creeks.

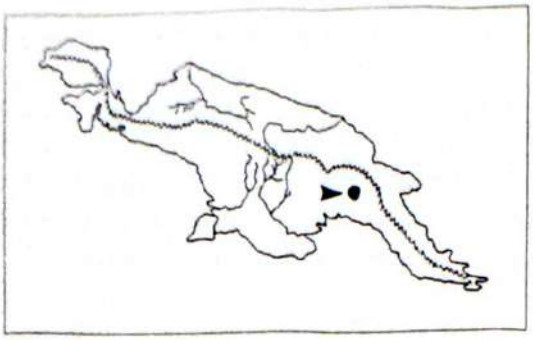


Mountain Goby

Glossogobius sp. 3
(Plate 16, no. 11)

Diagnosis. - Dorsal rays VI-I,9 or 10; anal rays I,8; pectoral rays 17 or 18; midlateral scales 30-32; transverse scales 10-11; predorsal scales 14-18; gill rakers on first arch 8; head mainly scaleless except nape; breast partly scaled; basal membrane of pelvic fin relatively thick; live colours unknown; in preservative generally brown, scales on upper half with dark margins; a diffuse brown band on snout and indistinct dark brown blotches along middle of sides. Maximum size to at least 80 mm SL.

Distribution and Habitat. - An undescribed species known only from six specimens collected in the Central Highlands of Papua New Guinea at Karamui. Habitat details are lacking, but Karamui is situated at an elevation of about 1100 m above sea level.



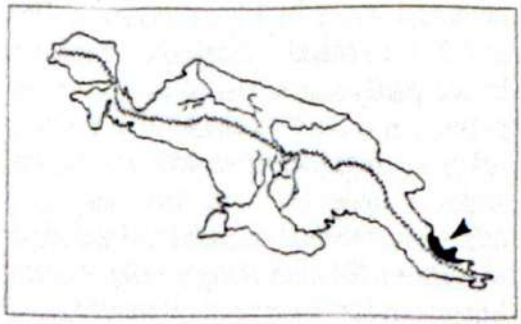
Papillate Goby

Glossogobius sp. 4

(Plate 15, no. 11)

Diagnosis. - Dorsal rays VI-I,8; anal rays I,7; pectoral rays 17 or 18; midlateral scales 29-30; transverse scales 8; predorsal scales13-15; gill rakers on first arch 8; cheek papillae in several multiserial rows; head mainly scaleless except nape; breast scaled; tan with brown scale margins; midlateral row of 5-7 blackish, eye-sized blotches; upper half of head and body strongly mottled with brown; first dorsal fin with broad black stripe on basal half; second dorsal and caudal fin with brown spotting; pelvic fins dusky blackish. Maximum size to 60 mm SL.

Distribution and Habitat. - An undescribed species known from eastern Papua New Guinea, on the north-eastern side of the Owen Stanley Range. Most specimens have been captured in the vicinity of Safia, Popondetta, and Kokoda. Found in clear rainforest creeks and shallow rivers over sand or gravel bottoms.



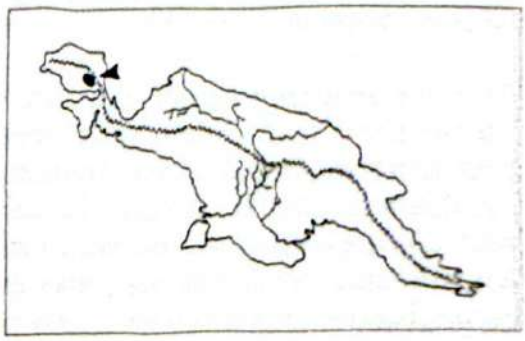
Irian Goby

Glossogobius sp. 5

(Plate 15, no. 2)

Diagnosis. - Dorsal rays VI-I,8; anal rays I,7; pectoral rays 16 or 17; midlateral scales 25-26; transverse scales 8-9; predorsal scales 10-15; gill rakers on first arch 8-9; head mainly scaleless except nape; breast scaleless; light tan with narrow dark scale margins; midlateral row of about 8 horizontally elongate, brown blotches and dark brown semicircular marking at base of caudal fin; a large dark brown spot at upper pectoral fin base and smaller spot below; dorsal fins with brown spotting; caudal fin with faint, narrow brownish bars. Maximum size to at least 50 mm SL.

Distribution and Habitat. - An undescribed species known only on the basis of 8 specimens collected in 1982 at Merdai on the Vogelkop Peninsula of Irian Jaya. The habitat consisted of a small clear, relatively slow-flowing creek in rainforest.



Twinspot Goby

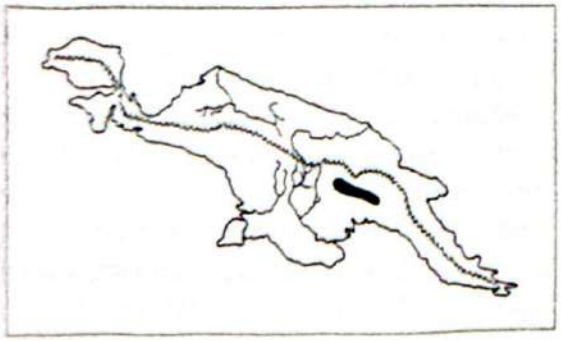
Glossogobius sp. 6

(Plate 16, no. 8)

Diagnosis. - Dorsal rays VI-I,9 or 10 (usually 10); anal rays I,7 or 8 (usually 8); pectoral rays 18 or 19; midlateral scales 32-34; transverse scales 9-10; predorsal scales 13-18; gill rakers on first arch 7-8; head mainly scaleless except nape; breast scaleless; basal membrane of pelvic fin relatively thick; light brown to tan with midlateral row of obscure brownish blotches; scale margins narrowly dusky; dorsals and caudal fin with brown spotting; pelvic fin dusky blackish. Maximum size to 100 mm SL.

Distribution and Habitat. - An undescribed species known mainly from the Upper Kikori River system in the Southern

Highlands of Papua New Guinea, but also occurs in the Purari system near Karamui. It is common in the Adjena River and its tributaries (Kikori system) in the Tari Valley. Inhabits moderately fast-flowing, clear streams over gravel or cobble bottoms. Elevations range from 800 to 1600 m above sea level.

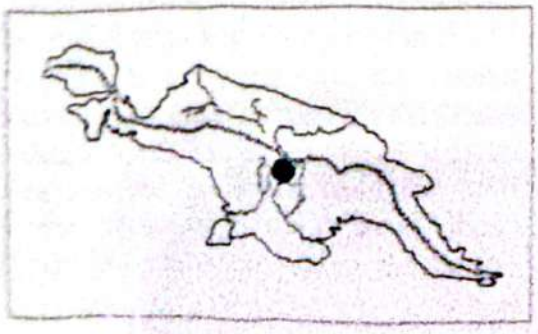


Robert's Goby

Glossogobius sp. 7
(Plate 15, no. 7)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,8; pectoral rays 18 to 20; midlateral scales 33-34; transverse scales 9-10; predorsal scales 19-24; gill rakers on first arch 6-8; head mainly scaleless except nape; breast scaled; basal membrane of pelvic fin relatively thick; brown with 4 forward-slanting black bars on side; a black spot at base of caudal fin; dorsals and caudal fin with brown spotting; pelvic fins pale to slightly dusky. Maximum size to 135 mm SL.

Distribution and Habitat. - An undescribed species known from the Upper Fly River system between about 850-970 km upstream from the mouth. It occurs in both turbid lowland rivers and small, clear, mountain tributaries between elevations of about 50-600 m.

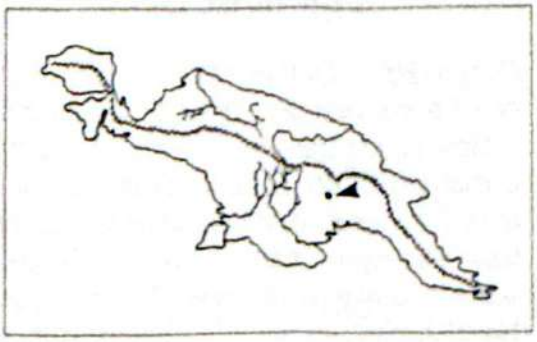


Bluntsnout Goby

Glossogobius sp. 8
(Plate 15, no. 9)

Diagnosis. - Dorsal rays VI-I,9 to 11; anal rays I,8; pectoral rays 16 or 17; midlateral scales 32-34; transverse scales 9-10; predorsal scales 14-16; gill rakers on first arch 7-9; head mainly scaleless except nape; breast scaled; tan except brown on back, scale margins dark brown; midlateral row of 8 diffuse, dark brown to blackish blotches, also a blackish spot at base of caudal fin; back and top of head with dark brown or blackish mottling; a dark brown stripe across cheek, and a second stripe from snout through eye; dorsals and caudal fin with brown spotting. Maximum size to 70 mm SL.

Distribution and Habitat. - An undescribed species known only from Lake Kutubu, Papua New Guinea. It is common around the shallow lake margin on mud, sand, and gravel bottoms.



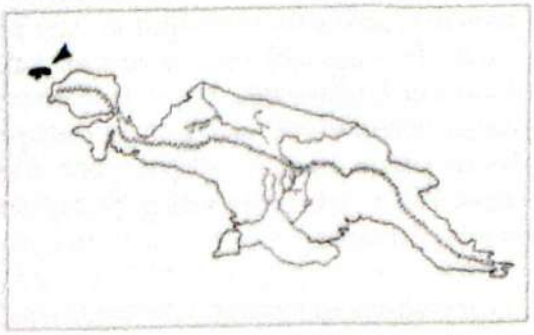
Island Goby

Glossogobius sp. 9
(Plate 17, no. 16)

Diagnosis. - Dorsal rays VI-I,9; anal rays I,8; pectoral rays 19; midlateral scales 30-31; transverse scales 9; predorsal scales 13; gill rakers on first arch 11; head mainly scaleless except nape and upper part of opercle; breast scaled; light brown to tan; midlateral row of 5 black blotches, including prominent spot at base of caudal fin; also about 4 blackish saddle-like markings on back, above spaces between midlateral blotches; head with grey to blackish mottling; a

small black spot at rear part of first dorsal fin; dorsals and caudal fin with blackish spotting; anal fin yellowish; pelvic fins dusky. Maximum size to 70 mm SL.

Distribution and Habitat. - An undescribed species known from Waigeo Island off the western end of the Vogelkop Peninsula and the Solomon Islands at Bougainville and Guadalcanal. Inhabits clear creeks in rainforest or open situations, usually within 10 km of the sea.



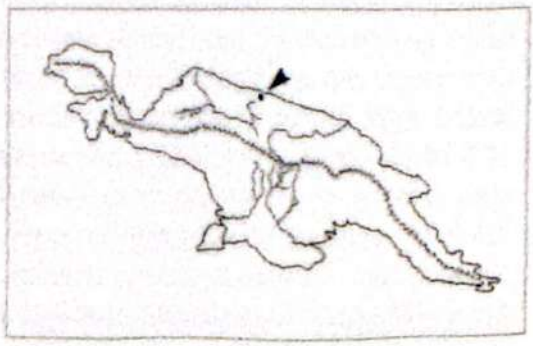
Sentani Goby

Glossogobius sp. 10

(Plate 16, no. 13)

Diagnosis. - Dorsal rays VI-I,9; anal rays I,8; pectoral rays 19 or 20; midlateral scales 33-35; transverse scales 11; predorsal scales 26-32; gill rakers on first arch 7-8; head mainly scaleless except nape and upper part of opercle; breast scaled; brown to tan with 5 very large blackish blotches along middle of side; a number of smaller blackish blotches on back; dorsals and caudal fin with brown spotting. Maximum size to 150 mm SL.

Distribution and Habitat. - An undescribed species known only from Lake Sentani, Irian Jaya. Inhabits the well-vegetated lake margin on sand and mud bottoms.



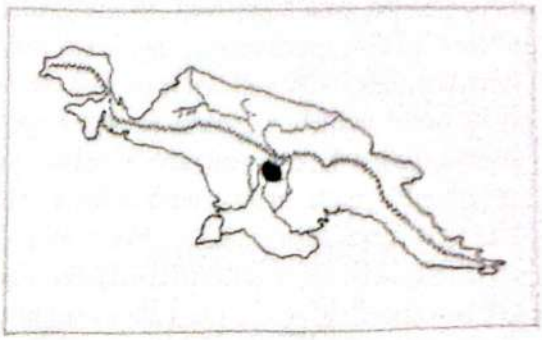
Fly River Goby

Glossogobius sp. 11

(Plate 16, no. 15)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,8 or 9; pectoral rays 16 or 17; midlateral scales 31-32; transverse scales 8; predorsal scales 12-16; gill rakers on first arch 6-7; head mainly scaleless except nape; breast scaleless; tan with midlateral row of 5-7 blackish blotches or spots; dark mottling on back and head; a prominent blackish stripe across cheek and opercle; a black spot on rear part of first dorsal fin; dorsals and caudal fin with brown spotting. Maximum size to 50 mm SL.

Distribution and Habitat. - An undescribed species known only from the Upper Fly River system. Inhabits rainforest creeks in lowland and foothill areas north of Kiunga (about 830 km upstream from the mouth).



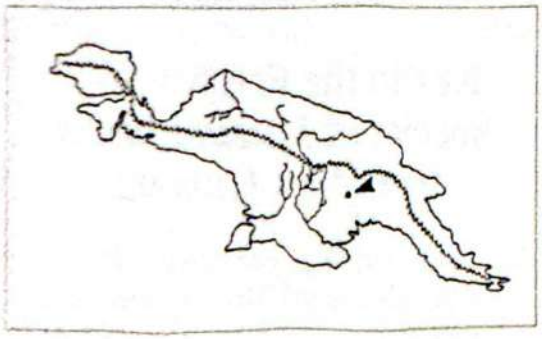
Kutubu Goby

Glossogobius sp. 12

(Plate 15, no. 10)

Diagnosis. - Dorsal rays VI-I,9 or 10 (usually 10); anal rays I,7 or 8 (usually 8); pectoral rays 18; midlateral scales 31-33; transverse scales 11; predorsal scales 15-17; gill rakers on first arch 7-9; head mainly scaleless except nape; breast scaled; tan with narrow, dark brown scale margins; midlateral row of about 8 indistinct blackish blotches; dorsals and caudal fin with brown spotting; pelvic fins slightly dusky. Maximum size to 90 mm SL.

Distribution and Habitat. - An undescribed species known only from Lake Kutubu, Papua New Guinea. The only known specimens were collected in shallow (less than 3m) water at the mouth of a small creek. The mud bottom was well vegetated.

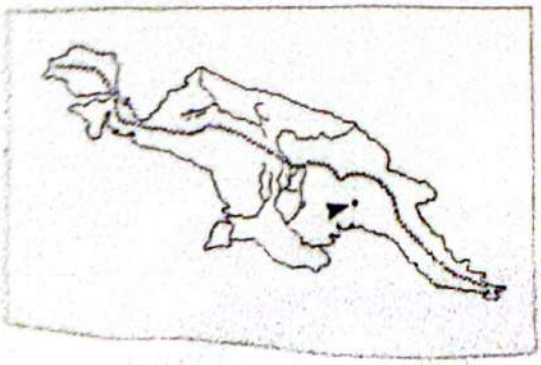


Bighead Goby

Glossogobius sp. 13
(Plate 15, no. 3)

Diagnosis. - Dorsal rays VI-I,9 or 10; anal rays I,8; pectoral rays 17 or 18; midlateral scales 31-33; transverse scales 9-10; predorsal scales 15-18; gill rakers on first arch 9-10; head mainly scaleless except nape; breast scaled; yellowish tan with narrow dark brown scale margins; brown on top of head; midlateral row of 8-9 diffuse blackish spots on side; a small black spot on rear part of first dorsal fin; dorsals and caudal fin with brown spotting. Maximum size to 75 mm SL.

Distribution and Habitat. - An undescribed species known only from Lake Tebera and streams of the surrounding lake basin in the Central Highlands of Papua New Guinea. The lake drains into the Purari River system. It inhabits the shallow lake margin and rainforest streams on mud, sand, or gravel bottoms.

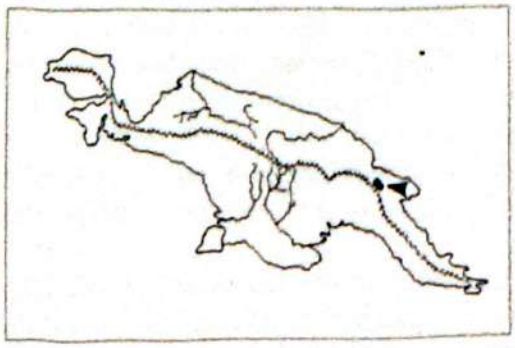


Ramu Goby

Glossogobius sp. 14

Diagnosis. - Dorsal rays VI-I,9 or 10; anal rays I,7; pectoral rays 16 or 17; midlateral scales 32-33; transverse scales 9; predorsal scales 6-7; gill rakers on first arch 7; head mainly scaleless except nape; breast scaleless; mottled brown with midlateral row of diffuse dark blotches, more distinct in young specimens; males with small black spot posteriorly on first dorsal fin; dorsals and caudal fin with brown spotting. Maximum size to 45 mm SL.

Distribution and Habitat. - An undescribed species known from a single 1988 collection in the Upper Ramu River above the Yonki Power Station. It is apparently one of two native species that occurs in the river above the power station, the other being an unidentified *Anguilla*.



Genus *Gobius*

Linnaeus, 1758

The species discussed below was described in *Gobius*, a "catch-all" group that has been used for a wide diversity of gobiids, most of which are now considered to belong to other genera. "*Gobius*" is retained here, because the generic affinities of *G. tigrellus* remain uncertain and require further study.

Tiger Goby

"Gobius" tigrellus
(Nichols, 1951)
(Fig. 34)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,8; midlateral scales 25; body elongate, the greatest depth about 4.8 in SL; head and

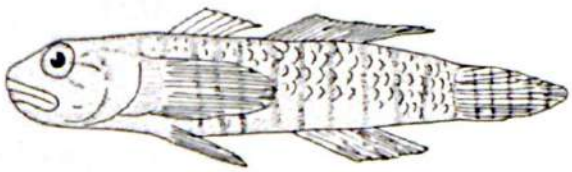
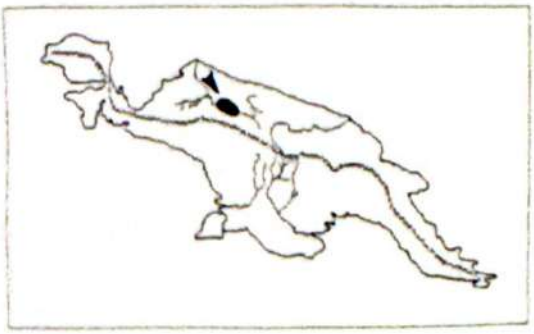


Fig. 34. Tiger Goby, "Gobius" tigrellus, 22mm SL

predorsal region scaleless, rest of body covered with large ctenoid scales; live colours unknown, but generally pale with 9-10 narrow blackish bars on side and 2 short, narrow black stripes radiating from rear of eye; dorsal fins and caudal with faint bars or spotting. Maximum size to at least 23 mm SL.

Distribution and Habitat. - Known only from 10 specimens collected in 1939 by an American expedition to the Mamberamo River, Irian Jaya. The fish were collected in the Middle Mamberamo at Bernhard Camp.



Genus *Mugilogobius*
Smitt, 1899

This Indo-West Pacific genus contains about 20-25 species including some that are undescribed. A revision by H.K. Larson is currently in progress. These fishes live primarily in brackish estuarine environments, but a few are found in rivers. Two species have been reported from New Guinean fresh water.

Key to the Freshwater Species of *Mugilogobius* from New Guinea

1a. Head with large pale spots; a pair of vertically aligned dark spots at base of caudal fin ..... *M. duospilus*

1b. Head without large pale spots; no spots at base of caudal fin ..... *M. fusculus*

Dual-spotted Goby
Mugilogobius duospilus
(Fowler, 1953)
(Photo 30)

Diagnosis. - Dorsal rays VI-I,8; anal rays I,8; pectoral rays 16; midlateral scales 33-34; transverse scales 8-9; predorsal scales 18-20; snout rounded; cheeks scaleless; small scales present on opercle; caudal fin rounded; yellowish tan with scale margin narrowly brown forming reticulated pattern; head grey with large yellowish blotches; body with diffuse grey saddles and bars, also large black blotch above pectoral fin base; a pair of vertically aligned spots at base of caudal fin; first dorsal fin with black medial stripe expanded

to form large spot on posterior half of fin; second dorsal with blackish membranes; caudal fin pale; anal fin yellowish on basal half, blackish distally with narrow white margin. Maximum size to 30 mm SL.

Distribution and Habitat. - Widespread from Indonesia to New Caledonia. Inhabits brackish estuaries and lower parts of freshwater streams.

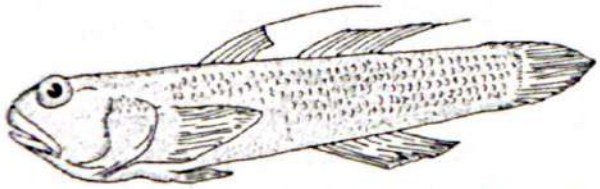


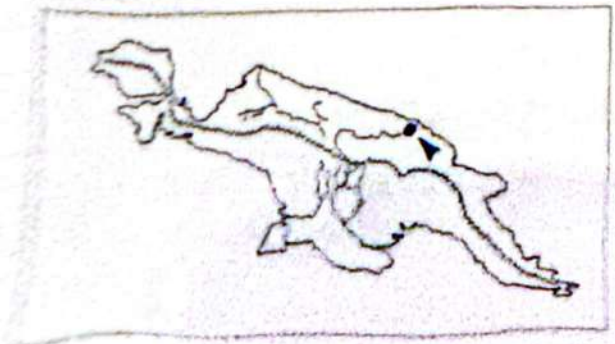
*Fig. 35. Obscure Goby, **Mugilogobius fusculus**, 31mm SL.*

Obscure Goby

Mugilogobius fusculus
(Nichols, 1951)
(Fig. 35)

Diagnosis. - Dorsal rays VI-I,8 or 9; anal rays I,8 or 9; pectoral rays 16; midlateral scales 32-38; transverse scales 8-9; predorsal scales 13-15, extending to rear of interorbital; snout rounded; cheeks scaleless; small scales present on opercle; caudal fin rounded, about equal to head length; first dorsal fin spine sometimes forming an elongate filament (possibly an adult male feature); live colours unknown, preserved specimens light brown with fine pepper-like spotting on body and fins; a blackish spot at rear of first dorsal fin; pelvic fins dusky brown; other fins mainly pale. Maximum size to 35 mm SL.

Distribution and Habitat. - Originally described on the basis of a few specimens from an unknown New Guinea locality, but has recently been collected from the Lower Sepik near Angoram.



Genus *Oligolepis*
Bleeker, 1874

The genus contains a single, widely distributed species that is discussed below.

Longtail Goby

Oligolepis acutipennis
(Valenciennes, 1837)
(Fig. 36)

Diagnosis. - Dorsal rays VI-I,10 or 11; anal rays I,10 or 11; pectoral rays 20 or 21; mid-lateral scales 27-30; transverse scales 7-8; head, including nape scaleless; interorbital space narrow, about one-half eye diameter in width; caudal fin lanceolate, longer than head; spines of first dorsal fin filamentous; whitish to pale yellow with midlateral row of 5 dark brown blotches alternating with short transverse bars; numerous brown spots or mottling on back; a narrow dark brown bar below eye; dorsal fins with brown stripes and caudal fin with similar brown bars. Maximum size to 90 mm SL.

Distribution and Habitat. - Widespread from India and Sri Lanka to Vanuatu. New Guinean records include the Oriomo River and a stream near Rabaul, New Britain. Inhabits brackish estuaries and the lower parts of freshwater streams.

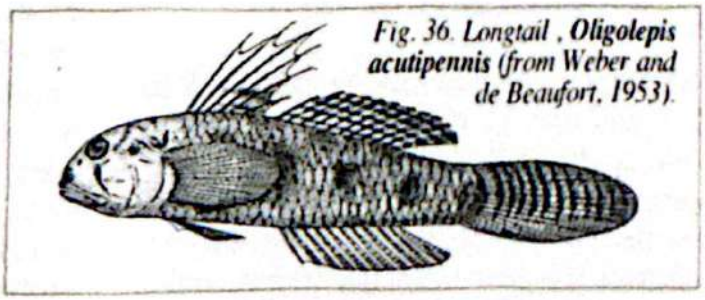


*Fig. 36. Longtail , **Oligolepis acutipennis** (from Weber and de Beaufort, 1953).*

Genus *Periophthalmus*
Bloch & Schneider, 1801

The genus contains 12 species and is widely distributed in the Indo-West Pacific region and also along the tropical West African coast. These fishes are conspicuous

inhabitants of tidal mudflats and mangrove swamps. They can remain out of water for considerable periods as long as their skin is moist.

Key to the Freshwater Species of *Periophthalmus* from New Guinea

(adapted from Murdy, 1989)

1a. Frenum uniting pelvic spines and basal membrane of pelvic fins well developed.....*P. novaeguineaensis*

1b. Frenum uniting pelvic spines lacking or only visible under magnification; basal membrane of pelvic fins absent or weakly developed.....2

2a. First and second dorsal fins joined in males; first dorsal fin of females separate, but greatly reduced, barely perceptible in some specimens; midlateral scales 46-52 .....*P. weberi*

2b. First and second dorsal fins separate in both sexes; first dorsal fin of females not reduced; midlateral scales 64-100 .....*P. argentilineatus*

Silverstripe Mudskipper

Periophthalmus argentilineatus
(Valenciennes, 1837)
(Plate 17, no. 18)

Diagnosis. - Dorsal rays XI to XVI-I,9 to 12; anal rays I,8 to 11; pectoral rays 11 to 14; midlateral scales 64-100 ($\bar{x}$ = 81); transverse scales 18-26 ($\bar{x}$ = 21); predorsal scales 22-37 ($\bar{x}$ = 29); pelvic fins lacking frenum, little or no membrane uniting medial pelvic rays; first dorsal fin of moderate height with convex to straight margin; generally grey-brown on back and sides with series of irregular forward slanting diffuse blackish bars on upper half of head and body; ventral parts white; prominent white spots on head, dorsal fins, caudal fin, and along ventral part of sides; a broad black stripe with narrow white margins on first and second dorsal fins; outer edge of second dorsal fin broadly reddish; pelvic, pectoral, and anal fins pale yellowish, sometimes with small white spots on pectorals and pelvics. Maximum size to 95 mm SL.

Distribution and Habitat. - Widespread in the tropical Indo-West Pacific region from East Africa to Samoa. It usually occurs in brackish mangrove and nipa palm areas, but occasionally in the lower sections of freshwater streams.

New Guinea Mudskipper

Periophthalmus novaeguineaensis
Eggert, 1935

Diagnosis. - Dorsal rays V to XIII-I, 11 to 13; anal rays I,10 to 12; pectoral rays 12 to 15; midlateral scales 54-78 ($\bar{x}$ = 69); transverse scales 15-21 ($\bar{x}$ = 18); predorsal scales 23-34 ($\bar{x}$ = 27); pelvic fins with a strong frenum, pelvic fins partially united medially by a membrane for at least one-half their length; first dorsal fin of moderate height, its margin rounded; generally whitish grey with black and golden yellow spots on head and body; 3 large saddle-like blotches posteriorly on upper back; first dorsal fin blackish, second dorsal with 2-3 blackish stripes; caudal fin dusky, sometimes with faint spotting; other fins pale. Maximum size to 71 mm SL.

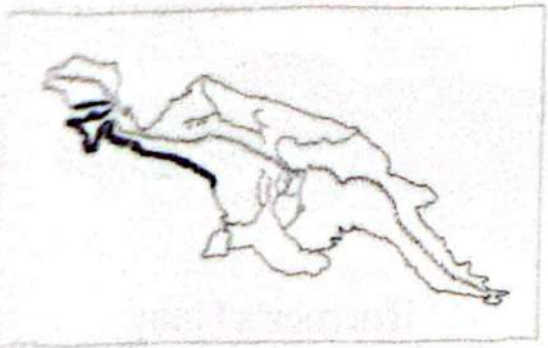
Distribution and Habitat. - Central-southern New Guinea and northern Australia. Most records are from Australia; however it was originally described on the basis of specimens from Merauke, Irian Jaya. It lives in brackish mangrove and nipa palm areas, sometimes entering the lower reaches of freshwater streams.

Weber's Mudskipper

Periophthalmus weberi
Eggert, 1935
(Plate 16, no. 17)

Diagnosis. - Dorsal rays IV to XVI-I,10 to 13; anal rays I,8 to 11; pectoral rays 12 to 16; midlateral scales 46-52 ($\bar{x}$ = 50); transverse scales 12-17 ($\bar{x}$ = 14); predorsal scales 18-24 ($\bar{x}$ = 22); pelvic fins lacking frenum or very weakly developed; first dorsal fin of males moderate in height, its margin nearly straight; first dorsal fin of females poorly developed, represented by only a few short spines; overall dark grey, light brown on uppermost part of head and back, whitish on ventral parts; lips with bright blue margin and blue flecks scattered on head and body; first dorsal fin of males mainly black with narrow wavy, oblique stripes of yellow or bright blue, margin of fin broadly white; second dorsal and caudal fins mainly dusky or blackish with pale spotting and broad red, outer margin; female fins mainly dusky to blackish with reddish-brown spotting or barring on second dorsal and caudal fins; outer margin of second dorsal fin of females broadly whitish. Maximum size to 85 mm SL.

Distribution and Habitat. - Southern New Guinea and northern Australia. New Guinean records are from the Noord, Lorentz and Bintuni rivers of Irian Jaya. It appears to be restricted to tidal fresh waters in areas of mangrove and nipa palms.



Genus *Pseudogobiopsis*

Koumans, 1935

The genus contains a few species that mainly inhabit rivers and estuaries in the Indonesian and Philippine archipelagos.

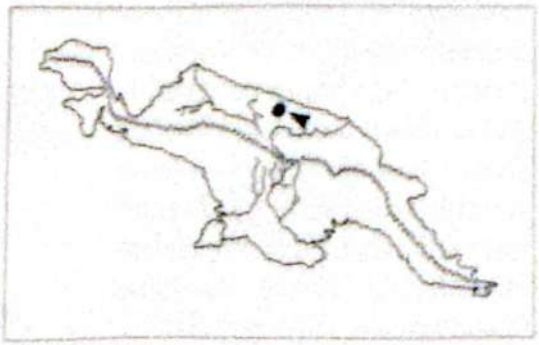
Red-spotted Goby

Pseudogobiopsis sp.
(Plate 15, no. 12)

Diagnosis. - Dorsal rays VI-I,7 or 8; anal rays I,7 or 8; pectoral rays 16; midlateral scales 25 or 26; transverse scales 6-7; predorsal scales 8 or 9; cheeks scaleless; upper lip swollen; whitish or slightly tan, scales of back with narrow brown margins giving reticulated appearance; 2-3 longitudinal rows of small red brown spots on sides; small red spots on dorsals and caudal fin; anal fin reddish; pelvic fin dusky blackish. Maximum size to 30 mm SL.

Distribution and Habitat. - Apparently an undescribed species known from only 8 specimens collected in 1982 from a small creek in the Bewani Mountains on the north coast of Papua New Guinea near the Irian Jaya border.

Remarks - The fin-ray and scale counts given above were taken from a photograph as the specimens were unavailable. The counts should therefore be regarded as only approximations.



Genus *Redigobius*

Herre, 1927

The genus contains approximately 15-20 species and is mainly distributed in the Indo-Australian Archipelago and surrounding regions. These small gobies inhabit estuaries and the lower parts of rivers and small freshwater creeks.

Key to the Freshwater Species of *Redigobius* from New Guinea

1a. First dorsal fin with prominent black spot posteriorly; midlateral scales 25.....*R. chrysosoma*

1b. First dorsal fin without black spot; midlateral scales 26-28.....2

2a. Ventralmost part of side with 4-5 short dark bars between anus and caudal fin base .....*R. bikolanus*

2b. Ventralmost part of side without short dark bars between anus and caudal fin base .....*R. romeri*

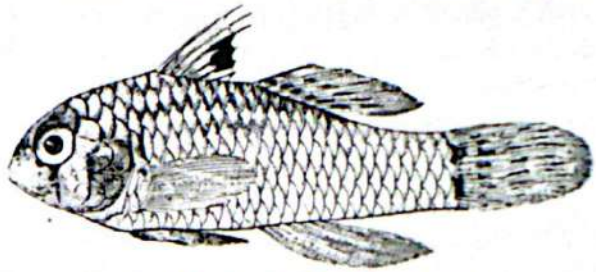


*Fig. 37. Spotfin Goby, **Redigobius chrysosoma** (from Weber and de Beaufort 1953).*

Speckled Goby

Redigobius bikolanus
(Herre, 1927)
(Plate 15, no. 15)

Diagnosis. - Dorsal rays VI-I,6 or 7; anal rays I,6 or 7; pectoral rays 15 to 17; midlateral scales 26-28; transverse scales 7; predorsal scales 6-8; snout blunt, rounded; maxillary reaching to below middle of eye; interorbital space narrow, its width less than one-half eye diameter; opercle and body scaled, cheeks scaleless; light brown or tan with irregular darker brown spots and blotches; about 3 faint brown bars on head; dorsal and caudal fins spotted; anal fin dusky with 4-5 short brown bars immediately above its base. Maximum size to 35 mm SL.

Distribution and Habitat. - Widespread along the western margin of the tropical Pacific from Japan southward to the Philippines, Indonesia, New Guinea and northern Australia. It is found throughout coastal areas of New Guinea, either in creeks and rivers or in brackish estuaries. The farthest inland it has been taken was at Angoram, about 120 km upstream from the mouth of the Sepik.

Spotfin Goby

Redigobius chrysosoma
(Bleeker, 1875)
(Fig. 37)

Diagnosis. - Dorsal rays VI-I,6; anal rays I,6; pectoral rays 17; midlateral scales 25; transverse scales 7; predorsal scales 7; snout blunt, rounded; maxillary reaching to below middle of eye; opercle and body scaled, cheeks scaleless; whitish with narrow dusky brown scale margins; a narrow blackish bar below eye; opercle with dusky black smudge; first dorsal fin with yellow-rimmed black spot; brown stripes and/or spotting on second dorsal and caudal fins. Maximum size to 35 mm SL.

Distribution and Habitat. - Indonesia, Philippines, New Guinea and northern Australia. Inhabits brackish estuaries and tidal creeks and rivers.

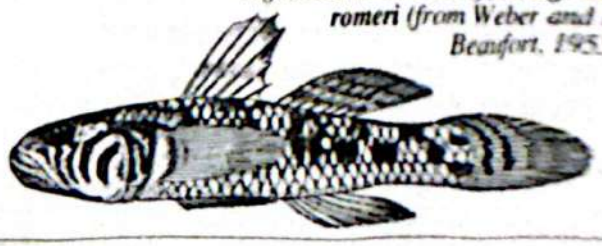


*Fig. 38. Roemer's Goby, **Redigobius romeri** (from Weber and de Beaufort, 1953).*

Roemer's Goby

Redigobius romeri
(Weber, 1911)
(Fig. 38)

Diagnosis. - Dorsal rays VI-I,6 or 7; anal rays I,6; pectoral rays 15 to 18; midlateral scales 26-28; transverse scales 7-8; predorsal

scales 7-8; snout blunt, rounded; lips somewhat enlarged; maxillary reaches to behind eye in males, to middle of eye in females; inter-orbital space narrow; opercle and body scaled, cheeks scaleless; yellowish or tan with midlateral row of large double spots and pair of spots aligned vertically at base of caudal fin; scale margins narrowly dark, forming reticulated pattern; males with curved, brown transverse bands on side of head and brownish stripes on dorsal fins, also brownish bars on caudal fin; females with small spots on head and body, also with spotting on second dorsal and caudal fin. Maximum size to 35 mm SL.

Distribution and Habitat. - Widely distributed from Andaman Sea to the Fiji Islands. In New Guinea it has been collected at Waigeo Island, Aru Islands, and Merauke. Inhabits estuaries and lower (tidal) reaches of freshwater streams.

Genus *Sicyopterus*
Gill, 1860

The genus contains at least 12 species and is distributed throughout Indonesia, Philippines, and northern New Guinea; it also ranges north to Japan and eastward to Polynesia. The typical habitat is fast-flowing streams near the coast, often in hilly terrain.

Key to the Species of *Sicyopterus* from New Guinea

1a. Upper lip with deep median cleft and a lateral cleft on each side; first dorsal fin pointed; the third ray elongated....2

1b. Upper lip without deep median cleft, its edge may be papillose or have a lateral

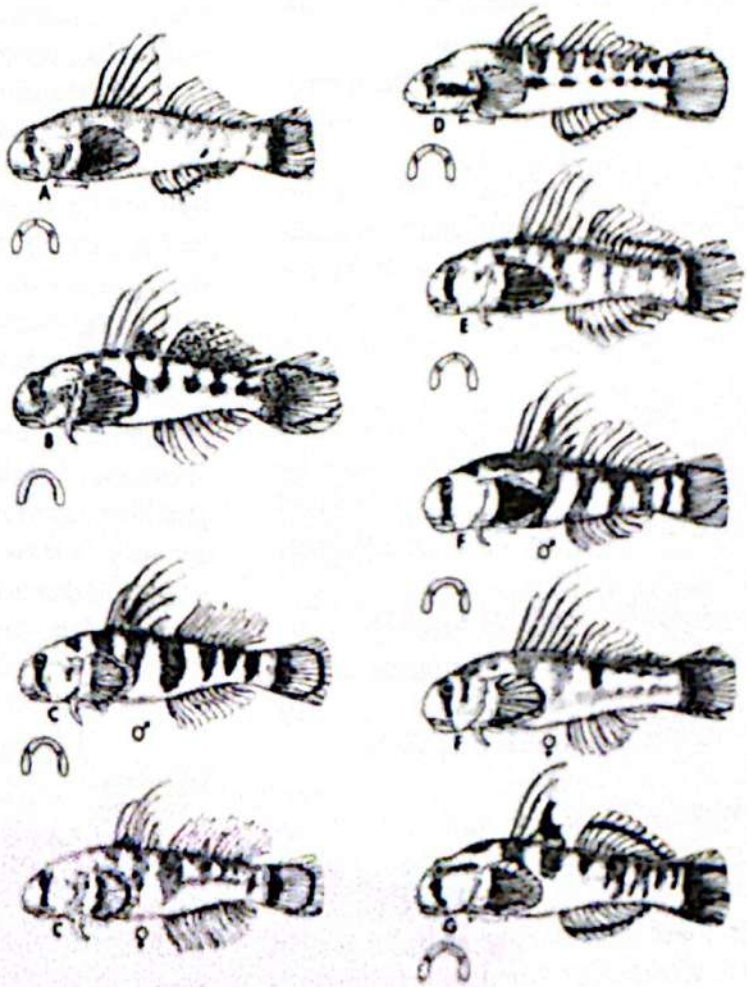


Fig. 39.
New Guinean species of ***Sicyopterus*** *showing general colour pattern features and outline of upper lip:*
A) S. cyanocephalus;
B) S. hageni;
C) S. longifilis;
D) S. micrurus;
E) S. ouwensi;
F) Sicyopterus sp. 1;
G) Sicyopterus sp 2.

cleft on each side; first dorsal fin usually filamentous 5

2a. Scales very small, about 75 in midlateral series .....*S. cyanocephalus*

2b. Scales larger, about 55-65 in midlateral series 3

3a. Scales on anterior part of body larger than those posteriorly; about 55-60 midlateral scales .....*S. micrurus*

3b. Scales on anterior part of body smaller than those posteriorly; about 60-65 midlateral scales 4

4a. First dorsal fin with large black spot posteriorly. .....*Sicyopterus* sp. 1

4b. First dorsal fin without black spot. ... .*S. ouwensi*

5a. Upper lip papillose along margin with deep cleft on each side 6

5b. Upper lip papillose along margin without deep cleft on each side....*S. hageni*

6a. First dorsal fin of males with median black spot; females with black vertically elongate spot on upper side below anterior part of second dorsal fin ....*Sicyopterus* sp. 2

6b. First dorsal fin of males without black spot; females without black spot on upper side, usually with series of dark bars or saddles .....*S. longifilis*

Cleft-Lipped Goby

Sicyopterus cyanocephalus
(Valenciennes, 1837)
(Plate 15, no. 22; Fig. 39A)

Diagnosis. - Dorsal rays VI-I,11; anal rays I,10; pectoral rays 21 to 23; midlateral scales about 75-80; transverse scales 17; predorsal scales about 35; scales on anterior part of body much smaller than those of middle of body; edge of upper lip smooth with a deep median cleft and additional cleft on middle part of each side (total of 3 clefts on upper lip); first dorsal fin pointed with 3rd spine filamentous; dark grey to deep violet, olive on back and orange ventrally; blackish bar below eye; 6-7 dark oblique bars on sides, sometimes indistinct; dorsal fins and anal fin orange; second dorsal fin may have small dark spots. Maximum size to 130 mm SL.

Distribution and Habitat. - Indonesia, Philippines, and New Guinea. Reported from creeks near Kokoda and Wewak, Papua New Guinea. Inhabits fast-flowing streams with cobble and boulder bottoms. It occurs at least as far as 50-60 km upstream from the sea.

Hagen's Goby

Sicyopterus hageni
Popta, 1921
(Plate 16, no. 2; Fig. 39B)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,10; pectoral rays 19; midlateral scales about 66-68; transverse scales 19; predorsal scales about 25; scales on anterior part of body smaller than those posteriorly; edge of upper lip papillose and without deep clefts; spines of first dorsal fin extremely filamentous; light grey, except golden yellow on upper back; 6-8 irregular forward-slanting blackish bars on back and upper half of sides, bars near junction of first and second dorsal fin sometimes jointed to form semicircular marking. Maximum size to 75 mm SL.

Distribution and Habitat. - Indonesia (Lombok, Sumbawa, Wetan and Timor) and New Guinea. The only New Guinean locality is from the Prafi River system near Manokwari, Irian Jaya. The habitat consists of moderate to fast-flowing streams with cobble and boulder bottoms.

Threadfin Goby

Sicyopterus longifilis
de Beaufort, 1912
(Plate 15, no. 23; Fig. 39C)

Diagnosis. - Dorsal rays VI-I, 10; anal rays I,10; pectoral rays 19; midlateral scales about 66; transverse scales 17; predorsal scales about 25; scales on anterior part of

body smaller than those posteriorly; edge of upper lip papillose, with a deep cleft on middle of each side (total of 2 clefts on upper lip); 2nd to 4th spines of first dorsal fin of males extremely filamentous, slightly filamentous in females; generally greyish to brown, paler below, with 7-8 darker bars on sides, often indistinct, especially in females; sometimes a blackish midlateral stripe on side; black bar below eye; fins dusky, fine spotting on second dorsal, and broad pale margins on pectoral and caudal fins. Maximum size to 75 mm SL.

Distribution and Habitat. - Indonesia, Philippines, and New Guinea. Reported from northern New Guinea in the Gogol and Nabire rivers, also from a creek near Wewak. Inhabits coastal streams with moderate to fast flow. Usually seen in small, clear creeks, often in rainforest, within about 50 km of the sea.

Clinging Goby

Sicyopterus micrurus
(Bleeker, 1853)
(Plate 16, no. 1; Fig. 39D)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,10 or 11; pectoral rays 18 or 19; midlateral scales 55-60; transverse scales 15-16; predorsal scales about 24; scales on anterior part of body larger than those posteriorly; edge of upper lip smooth with a deep median cleft and additional cleft on middle part of each side (total of 3 clefts on upper lip); first dorsal fin pointed, 3rd spine is longest; olivaceous green on back, yellowish on sides, and whitish below; back and sides with about 8 blackish bars, also a midlateral row of blackish blotches corresponding with bars may be present; a black bar below eye; a blackish circular marking on caudal fin. Maximum size to 75 mm SL.

Distribution and Habitat. - Widespread in the western and central Pacific from Indonesia and the Philippines to the Society Islands. The only New Guinean record is from Mandi Stream near Wewak; this is a fast-flowing creek in hilly terrain about 15 km from the sea.

Ouwen's Goby

Sicyopterus ouwensi
Weber, 1913
(Plate 16, no. 3; Fig. 39D)

Diagnosis. - Dorsal rays VI-I,10 or 11; anal rays I,10; pectoral rays 21; midlateral scales about 60; transverse scales 18; predorsal scales about 22; scales on anterior part of body smaller than those posteriorly; edge of upper lip smooth with a deep median cleft and additional cleft on middle part of each side (total of 3 clefts on upper lip); first dorsal fin pointed, middle rays prolonged; dark greyish with 7-8 broad, dark (may be faint) bars on sides; a black bar below eye; a blackish circular marking on caudal fin. Maximum size to 100 mm SL.

Distribution and Habitat. - Indonesia (Sumba, Flores, and Wetar), New Guinea, Bougainville, and Marquesas Islands. It seems likely that the Marquesas fish may represent a different species. The New Guinean record is from a stream near Jayapura, Irian Jaya. It inhabits coastal creeks with gravel and boulder bottoms.

Nuru Goby

Sicyopterus sp. 1
(Fig. 39F)

Diagnosis. - Dorsal rays VI-I,11; anal rays I,10; pectoral rays 20-22; midlateral scales about 65; transverse scales 16-17; predorsal midline scaled nearly to rear of interorbital; scales on anterior part of body smaller than those on posterior part; edge of upper lip smooth with a deep median cleft and additional cleft on middle part of each side (total of 3 clefts on upper lip); first dorsal fin pointed with 3rd spine filamentous; generally grey, lighter ventrally with up to about 8 diffuse darker grey bars on side and black bar below eye; fins dusky with broad pale margins on pectorals and caudal; a prominent black spot on rear part of first dorsal fin; second dorsal and anal fins with blackish submarginal stripe. Maximum size to 45 mm SL.

Distribution and Habitat - Possibly an

undescribed species known thus far only from the Nuru River, a tributary of the Gogol River, about 25 km southwest of Madang, Papua New Guinea. The habitat consists of a fast-flowing, clear stream punctuated with numerous rapids and deeper (1-2 m) pools. The bottom is mainly cobbles and boulders with patches of gravel and no vegetation.

Blackspot Goby

Sicyopterus sp. 2
(Plate 16, no. 4; Fig. 39E)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,10; pectoral rays 19 to 21; midlateral scales about 60-65; transverse scales 16-17; predorsal midline scaled nearly to rear of interorbital; scales on anterior part of body about same size or slightly smaller than those on posterior part; edge of upper lip papillose with deep cleft laterally on each side; spines of first dorsal fin moderately filamentous, filaments slightly longer in males; generally grey with black bar below eye; males with 6-7 forward-slanting darker grey bars on sides and black spot on first dorsal fin; females without bars, but with black blotch on upper side below anterior part of second dorsal fin; fins generally dusky, edges of pectoral and caudal fin broadly pale; females with small dark spots on second dorsal fin and dark submarginal stripe on anal fin. Maximum size to at least 50 mm SL.

Distribution and Habitat - Apparently an undescribed species known thus far from only 9 specimens collected from the Tekan River on Bougainville Island. This locality consisted of a clear, rapid-flowing stream (about 3 m wide) with sand and gravel bottom. The water was fresh, but within 2-3 km of the sea.

Genus *Sicyopus*
Gill, 1863

The genus contains about 4 or 5 species and is mainly confined to Indonesia, Philippines, and Melanesia, although at least one species ranges northward to the Ryukyu Islands. The typical habitat is fast-flowing coastal streams.

Key to the Species of *Sicyopus* from New Guinea

1a. Midlateral scales about 32; males with several irregularly spaced dark bars .....*S. zosterophorum*

1b. Midlateral scales about 35; males without bars, but with golden stripe from snout to upper caudal fin base .. ..*S. balinense*

Bali Goby

Sicyopus balinense
(Bleeker, 1856)
(Plate 15, no. 21)

Diagnosis. - Dorsal rays VI-I,9; anal rays I,9; pectoral rays 17 or 18; midlateral scales 35; transverse scales 8-9; predorsal scales 7; head and anterior part of nape scaleless; body covered with ctenoid scales; edge of lips without papillae or clefts; series of slender, hooked, movable teeth in each jaw, also teeth may be present on lower lip; males mainly dark grey on head and anterior two-thirds of body and bright red posteriorly, except dorsal surface of head and body tan; a prominent golden stripe from snout to upper caudal fin base; females off white with pair of dusky blackish stripes with white area between on middle of sides. Maximum size to 40 mm SL.

Distribution and Habitat. - Indonesia (Bali, Nias), Bismarck Archipelago (New Hanover), and Bougainville. Occurs in small, steep-gradient creeks, usually within 20 km of the sea. Several specimens were collected from a torrential stream cascading down the side of a steep mountain near Arawa, Bougainville. The fish were only a few kilometres from the sea, but at an elevation of 500 m.

Ornate Goby

Sicyopus zosterophorum
(Bleeker, 1856)
(Plate 15, no. 20)

Diagnosis. - Dorsal rays VI-I,9; anal rays I,9; pectoral rays 15; midlateral scales 32;

transverse scales 8-9; predorsal scales about 9; head and much of nape scaleless; body covered with ctenoid scales; edge of lips without papillae or clefts; series of slender, hooked, movable teeth in each jaw; males and females with different colour patterns; anterior half of males mainly dark grey, except reddish on dorsal most part of head and body; posterior half of body, including median fins bright red with a pair of dark grey bars below second dorsal fin and a similar bar across base of caudal fin; females yellowish tan, somewhat transparent with scale edges narrowly dark, ventral parts whitish and fins clear. Maximum size to 35 mm SL.

Distribution and Habitat. - Indonesia (Nias, Bali, and Ceram), Philippines, and New Guinea. The only New Guinean record is from a small rocky creek at Oro Bay, near Popondetta, Papua New Guinea.

Genus *Stenogobius*
Bleeker, 1874

The genus contains 23 species and is widely distributed from East Africa to the Hawaiian and Marquesas islands. The species are commonly found in brackish estuaries and coastal freshwater streams. The genus is currently being revised by Ronald Watson and the fishes referred to below as spp. 1-3 will soon be described by him.

Key to the Freshwater Species of *Stenogobius* from New Guinea

1a. Midlateral scales 52-62; soft rays in dorsal and anal fins usually 10 (total rays in both fins 11).....2

1b. Midlateral scales 44-50; soft rays in dorsal and anal fins usually 11 (total rays in both fins usually 12)...4

2a. Predorsal midline usually fully scaled; 3rd and 4th spines of first dorsal fin often filamentous 3

2b. Predorsal midline usually interrupted by scaleless patches; spines of first dorsal fin not filamentous (coastal plain of southern Papua New Guinea) .....*Stenogobius* sp. 3

3a. Dark bars on side of body of males 5-10, usually 7-8; maximum size 90 mm SL (Vogelkop Peninsula)....*S. lachneri*

3b. Dark bars on body 10-12, but often faint or absent in specimens greater than about 100-120 mm SL; maximum size 200 mm SL (Sepik and Ramu rivers) .....*S. laterisquamatus*

4a. Predorsal midline fully scaled; first dorsal fin no filamentous 5

4b. Predorsal midline interrupted by scaleless patches; first dorsal fin somewhat filamentous in males (Admiralty Islands, Bismarck Archipelago, and Solomon Islands)...*Stenogobius* sp. 2

5a. First dorsal fin with medial dark band (New Britain) .....*Stenogobius* sp. 1

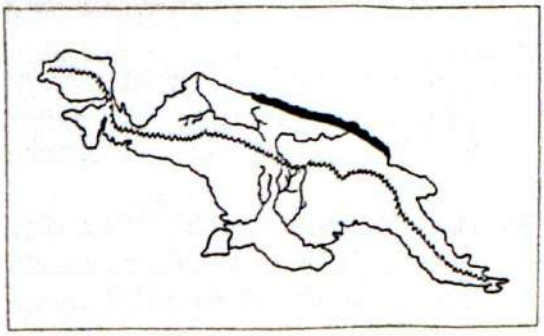
5b. First dorsal fin with scribble-like markings or brown spotting (northern coast of mainland New Guinea)....*S. beauforti*

Beaufort's Goby
Stenogobius beauforti
(Weber, 1908)

Diagnosis. - Dorsal rays VI-I,11; anal rays I,11; pectoral rays 14 to 16 (usually 15); midlateral scales 45-50; transverse scales 11-13; predorsal scales 13-19; spines of first dorsal fin not filamentous; predorsal midline fully scaled; cheek and anterior part of belly scaleless; opercle either scaleless or with up to 8 scales; breast scaleless or with a few embedded scales; light grey or tannish with 3-12 narrow brown bars on side and a prominent black bar below eye; both dorsal fins of males with scribble-like markings, those of females with 2 rows of small dark spots. Maximum size to 50 mm SL.

Distribution and Habitat. - Coastal streams

of northern New Guinea between Madang and Jayapura. It occurs in sand or gravel-bottom creeks flowing through rainforest; usually within about 20 km from the sea.

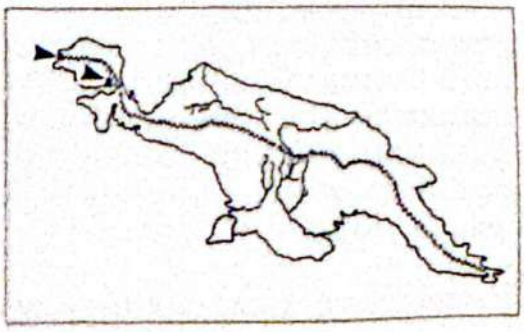


Bintuni Goby

Stenogobius lachneri
Watson, 1990
(Plate 16, no. 19)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,10; pectoral rays 16; midlateral scales 52-59; transverse scales 13-15; predorsal scales 20-31; spines of first dorsal fin filamentous; predorsal midline fully scaled; cheek, opercle, breast, and belly scaled; tan with black bar below eye and 5-10 slightly angled, dusky brown bars on side (females with 0-5 bars); both dorsal fins with series of black stripes, the basal pair on first dorsal fin darker than others; faint black spotting on upper portion of caudal fin; caudal, anal, and pelvic fins dusky; a prominent black spot on upper pectoral base. Maximum size to 100 mm SL.

Distribution and Habitat. - Known thus far only from the Vogelkop Peninsula in the Bintuni River and a small rainforest creek near Sorong. It mainly inhabits turbid river channels and small tidal creeks on mud and sand bottoms; occasionally found in clear rainforest streams.

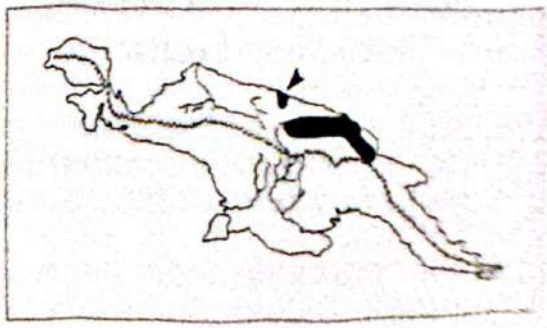


River Goby

Stenogobius laterisquamatus
(Weber, 1908)
(Plate 15, no. 16)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,10; pectoral rays 15 or 16 (usually 16); midlateral scales 52-62; transverse scales 14-16; predorsal scales 22-32; 3rd and 4th spines of first dorsal fin often filamentous; predorsal midline usually fully scaled; cheek, opercle, breast, and belly generally scaled, scalation increases with growth; light brown or olive on back, light grey to pale tan on sides; scales of upper sides with narrow brown margins; juveniles to small adults usually with about 10-12 narrow brown bars on sides, but these inconspicuous or absent in large adults (particularly from the Sepik); sometimes markings reduced to series of midlateral blotches; side of head often silvery; a triangular blackish mark below eye, sometimes obscure in adults; a pair of narrow black stripes medially on first dorsal fin and several longitudinal rows of small black spots on second dorsal fin; caudal fin with faint transverse banding; a prominent black spot on upper pectoral fin base. Maximum size to 200 mm SL.

Distribution and Habitat. - Northern rivers of New Guinea and their lowland tributaries, including the Ramu, Gogol, Sepik, and Mosso. Also probably occurs in the Mamberamo system. An inhabitant of alluvial plains, occurring in large turbid rivers, lakes, lagoons, backwaters, and smaller "blackwater" tributaries. Found on soft mud bottoms.



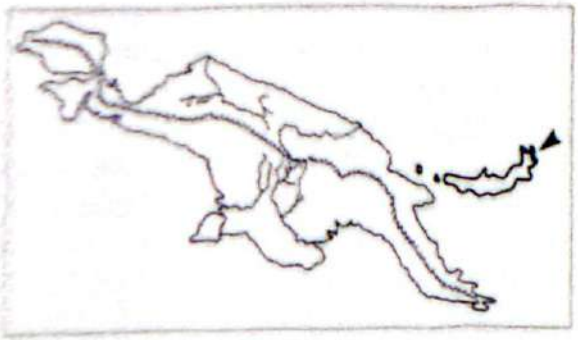
Allen's Goby

Stenogobius sp. 1

Diagnosis. - Dorsal rays VI-I,11; anal rays

I,11; pectoral rays 15; midlateral scales 47-49; transverse scales 10-12; predorsal scales 2-18; spines of first dorsal fin not filamentous; predorsal midline usually fully scaled, but sometimes scales are in patches; cheek, belly, and anterior part of breast scaleless; opercle scaleless or with up to about 5 scales; generally pale grey with 7-10 faint, narrow dark bars on sides of males and 2-5 bars on females; broad black bar below eye; first dorsal fin with medial dark band; second dorsal fin of males with dusky bars between rays, female with 2-3 longi-tudinal rows of dark spots. Maximum size to 40 mm SL.

Distribution and Habitat. - An undescribed species known thus far from only 10 specimens collected in a beachside stream at Tavarua Plantation, near Rabaul, New Britain. It is probably widespread in coastal streams of New Britain. The habitat at Tavarua Plantation (Photo 7) consisted of a quiet, clear creek that was bordered with coconut palms, *Nypa*, tall grass, and other terrestrial vegetation. The fish were in fresh water, but only 500 m from the sea.



Admiralty Goby

Stenogobius sp. 2

(Plate 16, no. 18)

Diagnosis. - Dorsal rays VI-I,10 to 12 (usually 11); anal rays I,11 or 12 (usually 11); pectoral rays 15 or 16 (usually 15); midlateral scales 44-49; transverse scales 11-13; predorsal scales 4-18; 3rd and 4th spines of first dorsal fin somewhat filamentous in males; predorsal midline usually interrupted by scaleless patches; cheek, breast, and anterior part of belly usually scaleless; opercle usually scaleless, sometimes with up to 4 scales; generally tan with 3-10 narrow brown bars on sides and broad, black bar below eye; dorsal fins of male with scribble-like markings; first dorsal fin of female with a dark midlateral band, second dorsal with 2-3 rows of small dark spots. Maximum size to 61 mm SL.

Distribution and Habitat. - Admiralty Islands, Bismarck Archipelago, and Solomon Islands. Collection localities include Manus Island, New Ireland, Bougainville, and Guadalcanal. An undescribed species that generally occurs in small, clear creeks flowing through dense terrestrial vegetation, including rainforest. Nearly all specimens have been collected within 5 km of the sea.

Barcheek Goby

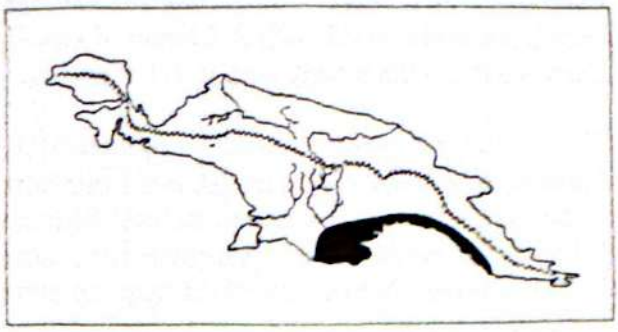
Stenogobius sp. 3

(Plate 15, no. 17)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,10; pectoral rays 15 or 16 (usually 16); midlateral scales 52-59; transverse scales 11-16 (usually 13-15); predorsal scales 2-25; spines of first dorsal fin not filamentous; predorsal midline usually interrupted by scaleless patches, seldom fully scaled; cheek, opercle, breast, and belly usually at least partly scaled, sometimes fully scaled; generally light grey with slight yellowish hue with 6-9 faint crescentic bars on sides and prominent black bar below eye; a pair of blackish stripes on middle of first dorsal fin and 3-4 rows of spots or stripes on second dorsal. Maximum size to 100mm SL.

Distribution and Habitat. - An undescribed species found on coastal plains of southern Papua New Guinea from the Kemp Welsh River, westward to the Fly River. It has been taken 265 km upstream from the mouth of

the Fly River. The habitat consists of turbid or clear rivers and smaller tributaries, usually in backwaters or rocky pools.



Genus *Stiphodon*
Weber, 1895

The genus contains at least 3 species, but the group is in need of study. There may be additional species occurring on various Pacific islands. The distribution extends from Indonesia to the Society and Marquesas islands. These fishes generally inhabit fast-flowing coastal streams.

Key to the Species of *Stiphodon* from New Guinea

1a. Midlateral scales 33-35; males electric pale green above and charcoal below; females tan or golden with pair of black stripes on head and sides ...*S. semoni*

1b. Midlateral scales 30-32; males red with golden-yellow stripe from snout to upper caudal fin base; female colours unknown .....*Stiphodon* sp.

Neon Goby
Stiphodon semoni
Weber, 1895
(Plate 15, no. 18)

Diagnosis. - Dorsal rays VI-I,9; anal rays I,10; pectoral rays 15; midlateral scales 33-35; transverse scales 8-9; predorsal scales about 14; head (except nape) scaleless, predorsal scales cycloid, body scales ctenoid; edge of lips without papillae or clefts; lower lip with a row of small teeth; jaw teeth includes 3-4 canines in lower jaw; males and females with different colour patterns: females tan to golden with a pair of black stripes, one from snout to caudal fin base and the other from in front of eye to upper edge of caudal fin base; males electric pale green on upper half of head and body and charcoal below. Maximum size to 35 mm SL.

Distribution and Habitat. - Indonesia, Philippines, and New Guinea. All New Guinean records are from northern coastal streams. It is common in small rainforest creeks, often in hilly terrain, but usually within 30 km of the sea.

Remarks. - This fish is often referred to as *S. elegans*, which is apparently a different species from Polynesia.

Red and Gold Goby
Stiphodon sp.
(Plate 15, no. 19)

Diagnosis. - Dorsal rays VI-I,10; anal rays I,10; pectoral rays 14; midlateral scales 30-32; transverse scales 9; predorsal scales 12-13; 3rd spine of first dorsal fin filamentous in males; head (except nape) scaleless; predorsal scales cycloid, body scales ctenoid; edge of lips without papillae or clefts; lower lip with a row of small teeth; jaw teeth include a pair of laterally curved canines on each side of lower jaw symphysis; overall bright red with golden-yellow stripe from snout to upper caudal fin base; first dorsal and anal fins reddish with yellow spotting; second dorsal fin jet black with median row of white spots and narrow white margin. Maximum size to at least 30 mm SL.

Distribution and Habitat. - An undescribed species known from a few specimens collected at Vanuatu and near Wewak, Papua New Guinea. It occurs in small coastal creeks with rocky and gravel bottoms.

Genus *Zappa*
Murdy, 1989

The genus contains the single species that is discussed below.

Slender Mudskipper

Zappa confluentus
(Roberts, 1978)
(Plate 16, no. 16)

Diagnosis. - Dorsal rays VI-I,24 to 29; anal rays I,23 to 28; pectoral rays 18 to 21; scales embedded, small, and cycloid, difficult to detect and impossible to accurately count; pelvic fins with a well developed frenum; dorsal and anal fins relatively short, second dorsal and anal fins long-based; caudal fin lanceolate; generally grey, slightly darker on back and lighter ventrally; small black spots scattered on dorsal half of head and side (mainly anteriorly); fins clear. Maximum size to 73 mm SL.

Distribution and Habitat. - Known only from the lower parts of the Fly, Ramu, and Bintuni rivers. The habitat consists mainly of tidal mudflats adjacent to turbid, brackish rivers. A 73 mm SL specimen was taken from fresh water in the Lower Ramu.

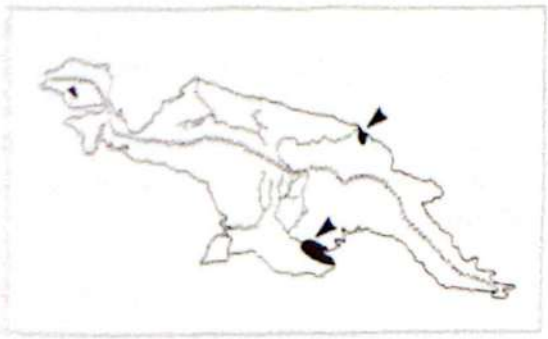


*Fig. 40. Worm Gobies: 1) **Taenioides anguillaris**, 2) **T. cirratus**, 3) **Brachyamblyopus urolepis** (from Day, 1875-1878; and Weber and de Beaufort, 1953).*

Worm Gobies

Family Gobioidae

These unusual eel-like fishes are found on soft, muddy bottoms, and are adept burrowers. The family contains about 20 species in eight genera and occurs mainly along continental margins in all tropical seas, also entering brackish and fresh waters. Diagnostic features include an upturned mouth with small sharp teeth, small rudimentary eyes, pelvic fins forming an adhesive disc, and long-based dorsal and anal fins that are often confluent with the lanceolate to rounded caudal fin. Because of their cryptic habits they are seldom seen unless flushed from the bottom with chemical ichthyocides.

Key to the Freshwater Genera of Gobioididae from New Guinea

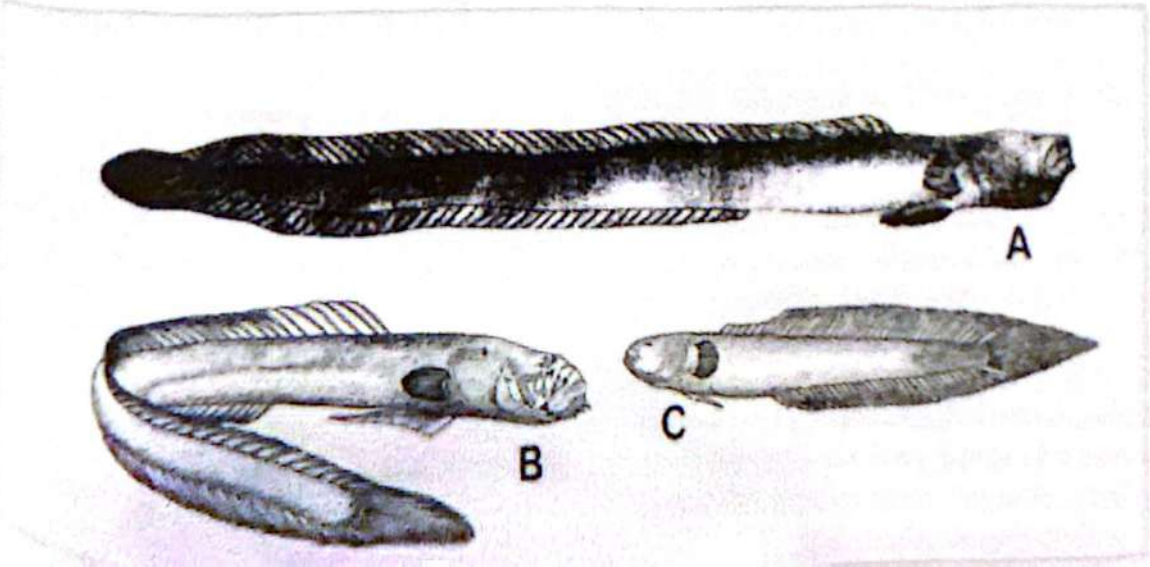
1a. Needle-like canine teeth present in both jaws; chin barbels present or absent .. .. *Taenioides*

1b. Needle-like canine teeth absent; chin barbels absent ..... *Brachyamblyopus*

Genus *Brachyamblyopus*

Bleeker, 1874

The genus contains about five species and is distributed from the Persian Gulf eastward to Micronesia.



Scaleless Worm Goby

Brachyamblyopus urolepis
(Bleeker, 1852)
(Fig. 40C)

Diagnosis. - Dorsal rays VI,32; anal rays I,33; pectoral rays 18; cycloid scales present only on posterior part of body, head and most of body scaleless; eyes very small; mouth oblique, lower jaw prominent; dorsal and anal fins connected to caudal fin; overall reddish pink. Maximum size to 80 mm SL.

Distribution and Habitat. - India to Indonesia, Philippines, and New Guinea. Found on mud bottoms of estuaries, and tidal parts of rivers and creeks. Recorded in New Guinea from the Ramu, Fly, Oriomo and Bintuni rivers.

Genus *Taenioides*

Lacepède, 1798

This genus is confined to the Indo-West Pacific and contains about 10 species.

Key to the New Guinean species of *Taenioides*

1a. Barbels present on chin; papillae of head forming elaborate raised ridges 2

1b. Barbels absent; papillae of head not forming elaborate raised ridges, ridges absent or scarcely evident except for a few low ridges on chin....*Taenioides* sp.

2a. Canine teeth in outer row of upper jaw 7-8 .....*T. anguillaris*

2b. Canine teeth in outer row of upper jaw 5 .....*T. cirratus*

Eel Worm Goby

Taenioides anguillaris
(Linnaeus, 1758)
(Fig. 40C)

Diagnosis. - Dorsal rays VI,40 to 47; anal rays I,37 to 44; pectoral rays 15; head and body covered with minute, rudimentary scales; eye vestigal, hidden under skin; mouth oblique, lower jaw prominent; about 7 canine teeth on each side of upper jaw and 4-5 canines on each side of lower jaw, a band of smaller teeth behind canines in both jaws; about 6 short barbels on ventral surface of head; overall reddish pink. Maximum size to 310 mm SL.

Distribution and Habitat. - India to New Guinea. Known in New Guinea from two specimens, one collected near Manokwari, Irian Jaya, and the other from the stomach contents of a seasnake captured in the Lower Ramu River. Found in shallow coastal waters, estuaries, and rivers.

Bearded Worm Goby

Taenioides cirratus
(Blyth, 1860)
(Fig. 40B)

Diagnosis. - Dorsal rays VI,43 to 49; anal rays I,42 to 47; pectoral rays 13; head and body scaleless; eyes vestigal, hidden under skin; mouth oblique, lower jaw prominent; about 5 canine teeth on each side of upper jaw and 4 canines on each side of lower jaw, a band of smaller teeth behind canines in both jaws; about 6 short barbels on chin; overall reddish pink. Maximum size 300 mm SL.

Distribution and Habitat. - East Africa to New Guinea and Australia. Known in New Guinea from the Lower Fly and near Manokwari, Irian Jaya. Found in shallow coastal waters, estuaries, and rivers.

Fly River Worm Goby

Taenioides sp.
(Photo 31)

Diagnosis. - Dorsal rays VI,28; anal rays I,25; pectoral rays16; spinous portion of dorsal fin separate from soft portion; dorsal and anal fins joined to caudal fin by a low membrane; head and body scaleless; eyes vestigal; mouth oblique, lower aw prominent; 5 or 6 canine teeth on each side of upper jaw and 3 canines on each side of lower jaw, a band of smaller teeth with dark brown tips behind canines in both jaws

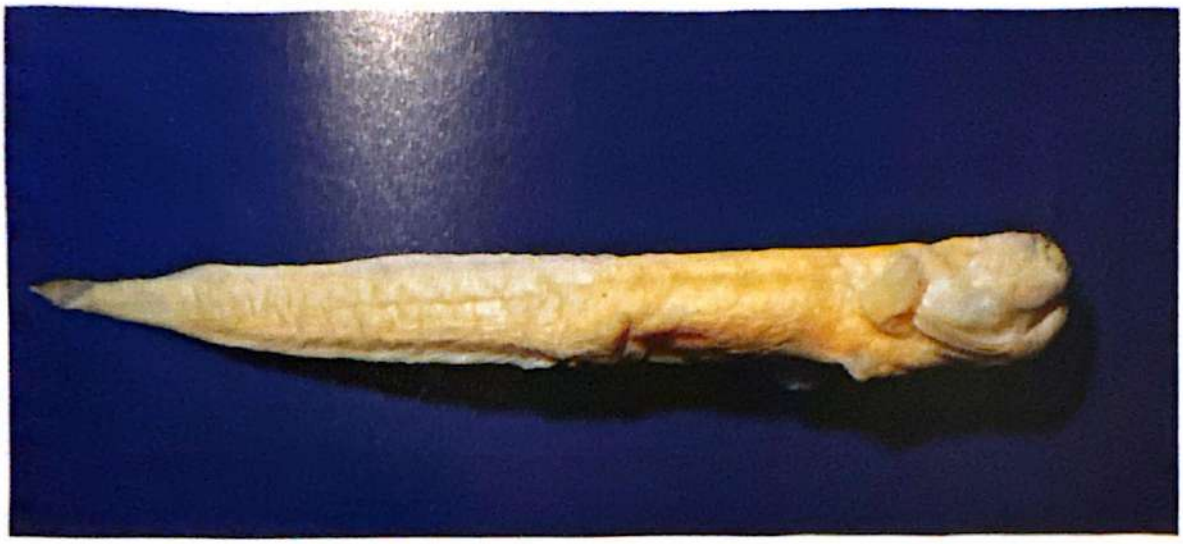
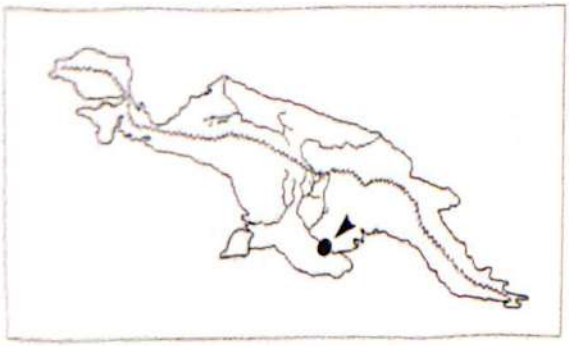


Photo 31. Fly River Worm Goby ***Taenioides sp.*** *(preserved specimen), 117 mm SL.*

chin barbels absent; live colour unknown, but probably reddish pink. Maximum size to at least 117 mm SL.

Distribution and Habitat. - This apparently undescribed species is known from a single specimen collected near Burei Junction, about 200 km upstream from the mouth of the Fly River. The river is fresh at this point, but is influenced by tidal fluctuations.



Nurseryfishes

Family Kurtidae

The family Kurtidae contains a single genus, *Kurtus*, with two species. They are peculiar looking fishes with a highly compressed body and prominent hump on the forehead. Males develop a curved protuberance on the occipital bone that is used for carrying eggs. The habitat consists of rivers and brackish estuaries.

Genus *Kurtus*

Bloch, 1786

The genus contains two species: *K. indicus* of India and southeast Asia, and *K. gulliveri* from New Guinea and northern Australia.

Nurseryfish

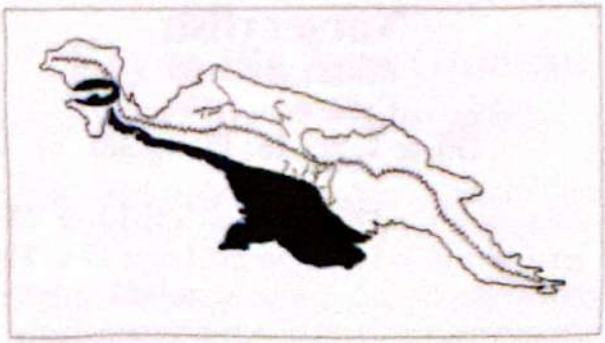
Kurtus gulliveri
Castelnau, 1878
(Plate 1, no. 16; Photo 32)

Diagnosis. - Dorsal rays VII,14 or 15; anal rays II,44 to 47; pectoral rays 17 to 19; body depth 2.2-2.6 in standard length; mouth reaches level of eye in young, farther back in older fish; lateral line short, poorly developed; prominent hump or hook-like process on forehead; body strongly compressed laterally, long and slender posteriorly; young whitish or semi-transparent; older fish silvery, sometimes dull yellowish brown; fins clear to yellowish. Maximum size to about 500 mm SL.

Distribution and Habitat. - Central-southern New Guinea and northern Australia. Most New Guinean records are from the Fly Delta region, but it extends westward to at least Bintuni Bay. It occurs as far upstream as 830 km from the mouth of the Fly River. The habitat consists of mangrove-nipa swamps, brackish estuaries, and slow-flowing turbid rivers.

Photo 32. Nurseryfish ***Kurtus gulliveri***, *male*.

Remarks. - There is little information on the biology of this peculiar fish. Mature males have a hooked process on the forehead that is used to carry a grape-like cluster of relatively large eggs during the breeding season. The eggs apparently remain in this position until hatching. Nurseryfishes feed on small fishes, shrimp, and crayfish.



Spinefeet or Rabbitfishes

Family Siganidae

Spinefeet are mainly marine fishes that are common on coral reefs and surrounding weed beds. They also occur in estuaries, and at least one species commonly enters fresh water. There are 28 species in the family, all from the Indo-Pacific region, and all are included in the genus *Siganus*. They are distinguished from all other fishes by having a spine on both ends of the pelvic fins with three soft rays between them. There are also sharp spines associated with the dorsal and anal fins. All spines are venomous and wounds from them are very painful. These fishes are diurnal and mainly herbivorous, feeding on benthic algae and seagrasses. Most of the reef-dwelling species are seen in pairs; others occur in schools that graze over seagrass and algal flats. Spinefeet, in general, are regarded as good food fishes, in spite of their relatively small size. Some have been considered for aquaculture because of their herbivorous food habits and rapid growth.

Genus *Siganus*
Forsskål, 1775

The genus is primarily marine and contains 28 species that are distributed in the Indo-West and Central Pacific region. A single species occurs in New Guinea fresh waters.

Vermiculated Spinefoot
Siganus vermiculatus
(Valenciennes, 1835)
(Plate 17, no. 14)

Diagnosis. - Dorsal rays XIII,10; anal rays VII,9; pectoral rays 16 or 17; scales very small, skin somewhat smooth; gill rakers on first arch 5 + 16; greatest body depth 2.0-2.4 in SL; caudal emarginate in juveniles, becoming deeply forked in adults;

brownish with fine blue lines on head and body; lines numerous and convoluted in adults, fewer and more or less longitudinal in juveniles; caudal fin with brown spotting. Maximum size to 350 mm SL.

Distribution and Habitat. - Widespread from India to the Society Islands. It inhabits coastal marine waters, frequently entering estuaries. Juveniles are sometimes encountered in river mouths or a short distance upstream in freshwater creeks.

Soles

Family Soleidae

Soles are highly flattened, ovate fishes characterised by having the eyes on the right side of the body, a concealed preopercular margin (at least in the New Guinean freshwater species), and the pectoral fin is reduced or absent. Soles, like other flatfishes, have normal fish-like larvae with an eye on each side of the head, but with increased growth one eye migrates to the other side. This large family contains about 120 species in approximately 31 genera and occurs worldwide. Nearly all are marine or estuarine dwellers, but a few species are found in fresh water. Life history information for the New Guinean species is scant, and it is not known for certain if breeding occurs in fresh water.

Photo 33 - Estuary Sole, ***Achirus poropterus***, 55 mm SL.

Key to the Freshwater Genera of Soleidae from New Guinea

1a. Pectoral fin absent; caudal fin separate from dorsal and anal fins 2

1b. Pectoral fin present; caudal fin joined to dorsal and anal fins ..... *Synaptura*

2a. Pelvic fins short based, nearly equal in size ..... *Aseraggodes*

2b. Pelvic fins unequal, the right pelvic with a long base connected to anal fin.. ..... *Achirus*

Genus *Achirus*

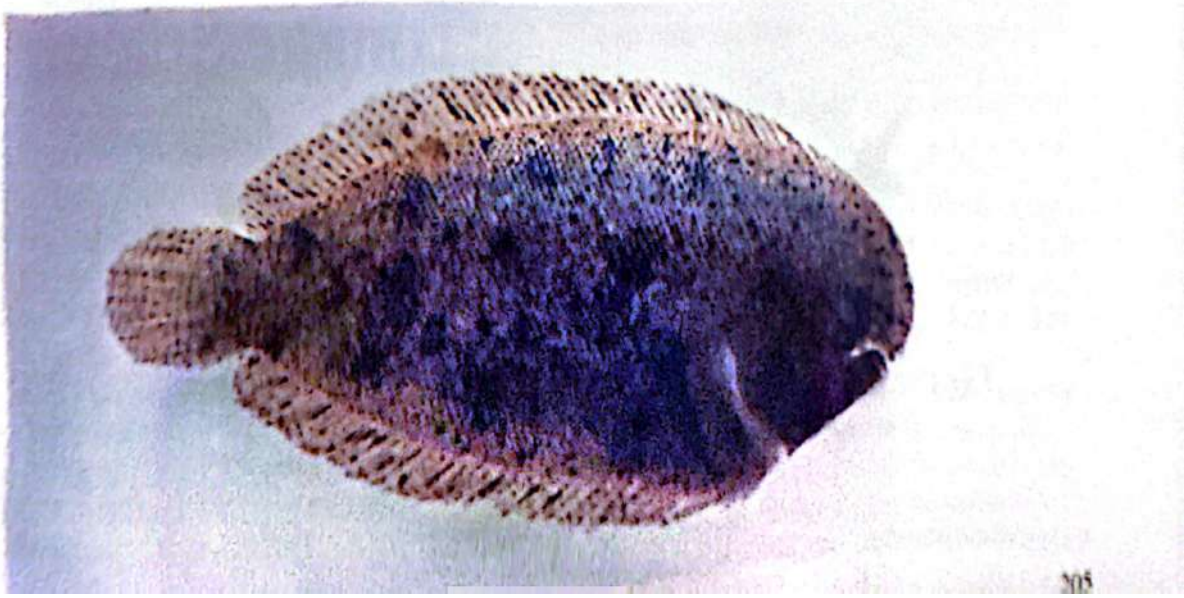
Lacepède, 1802

The genus contains at least 15, mainly marine species that are distributed in the Indo-Pacific and Atlantic oceans.

Estuary Sole

Achirus poropterus
Bleeker, 1851
(Photo 33)

Diagnosis. - Dorsal rays 62 to 72; anal rays 45 to 49; caudal fin separate from dorsal and anal fins; lateral-line scales 63 to 72; pectoral fins absent; generally light brown with numerous small dark brown spots on body and fins, white on ventral surface. Maximum size to 70 mm SL.



Distribution and Habitat. - Indonesia, New Guinea, and northern Australia. New Guinean records include Waigeo Island and Madang. It inhabits estuaries and the lower sections of freshwater streams, usually within 1-2 km of the sea.

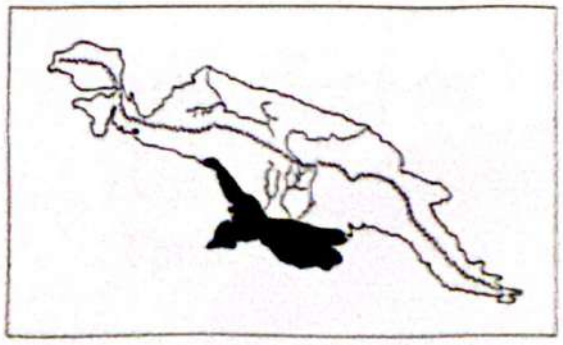
Genus *Aseraggodes*
Kaup, 1858

The genus contains at least 12, mainly marine species and is distributed in the Indo-West Pacific from the Arabian Sea to the islands of Oceania.

Tailed Sole
Aseraggodes klunzingeri
(Weber, 1908)
(Plate 12, no. 18)

Diagnosis. - Dorsal rays 69 to 75; caudal rays 18; anal rays 53 to 55; caudal fin separate from dorsal and anal fins; lateral-line scales about 80 to 85; pectoral fins absent; light brown with dark brown spots and blotches, white on ventral surface. Maximum size to 85 mm SL.

Distribution and Habitat. - Central-southern New Guinea and northern Australia. New Guinean records are from the Fly, Bensbach, Merauke, Digul, Mappi, and Lorentz rivers. In the Fly River it occurs as far as about 300-350 km upstream from the mouth. The habitat consists of turbid river channels with soft mud or fine sand bottoms.



Genus *Synaptura*
Cantor, 1839

This genus contains about 10 species and is distributed in the Indo-West Pacific region. Most representatives are marine or estuarine, but one species in New Guinea occupies freshwater habitats.

Velvety Sole
Synaptura villosa
Weber, 1908
(Plate 12, no. 17)

Diagnosis. - Dorsal rays 65 to 69; anal rays 52 to 55; pectoral fin small, with 5 or 6 rays; pelvic rays 5; right pelvic fin larger than left one and connected to anal fin; lateral-line scales 66 to 80; brown with irregular dark brown spots and mottling, white on ventral surface. Maximum size to 105 mm SL.

Distribution and Habitat. - Known only from fresh waters of central-southern New Guinea including the Fly, Merauke, Lorentz, and Mimika rivers. It penetrates well upstream in the Fly system, at least 900 km from the mouth. The habitat consists of turbid main river channels and swampy backwaters.

Tongue Soles
Family Cynoglossidae

This family is easily distinguished from other flatfish groups by the combination of an elongate tongue-shaped body, long hooked flap-like snout, absence of pectoral fins, and a hidden preopercular margin. The family contains about 110 species and occurs in all tropical and temperate seas. The species inhabit coastal seas and estuaries along sandy or muddy shores. Three species of the genus *Cynoglossus* are known to enter freshwater

streams. They are bottom-dwelling predators of fishes and small invertebrates. Their cryptic camouflage colouration and habit of burrowing into bottom sediments are useful adaptations for avoiding large predators and catching their own prey off guard.

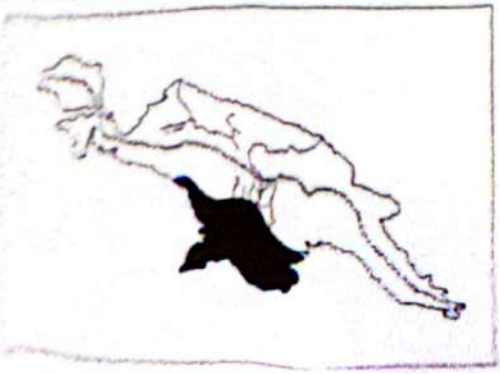
Genus *Cynoglossus*
Hamilton, 1822

The genus contains 49 species, of which all but four eastern Atlantic species are distributed in the Indo-West Pacific region from East Africa to Australia-New Guinea and northward to Japan.

Freshwater Tongue Sole
Cynoglossus heterolepis
Weber, 1910
(Plate 12, no. 19)

Diagnosis. - Dorsal rays 110 to 116; anal rays 85 to 89; pelvic rays 4, only left pelvic developed and it is connected to the anal fin; 3 lateral lines on dorsal surface, midlateral line with 100-120 scales, 15-16 scales between middle and upper lateral line; no lateral line on ventral surface; uniformly brown or with narrow dark brown crossbars, generally narrower than interspaces (in which rows of dark patches or incomplete crossbars may be visible); white on ventral surface. Maximum size to 235 mm SL.

Distribution and Habitat. - Known only from rivers of northern Australia (Arnhem Land) and central-southern New Guinea including the Fly, Oriomo, Digul, Lorentz, and Oetoemboewe river systems. In the Fly system it has been found in salt water at the mouth and also as far as 900 km upstream near Ningerum. It lives in main river channels and tributaries on soft mud or fine sand bottoms.



Puffers or Toadfishes
Family Tetraodontidae

Puffers are specialised bony fishes that derive their common name from the ability to swallow air or water causing the body to swell or puff up to a size considerably larger than normal. This mechanism serves as a deterrent to predators, also the flesh or viscera of many puffers is toxic. Other diagnostic features include a tough, scaleless skin, beak-like dental plates with a median suture, a slit-like gill opening in front of the pectoral fin base, no fin spines, a single shortbased dorsal fin and a comparable anal fin, no pelvic fins, and no ribs. The family contains about 120 species, but the generic classification remains unstable. In recent works the number of genera assigned to this family ranges from about 10 to 25. They occur in all tropical and temperate waters; most species are marine, but several enter estuaries and others live only in fresh water.

Key to the Freshwater Genera of Tetraodontidae from New Guinea

1a. Nasal organ a depression surrounded by a low rim, produced into a posterior and an anterior flap ..... *Chelonodon*

1b. Nasal organ a short tube or flattened papilla 2

2a. Nasal organ a short tube ending in two rounded or triangular lobes; skin fold along ventral part of body absent. ..... *Tetraodon*

2b. Nasal organ a short flattened papilla with two widely separated openings; skin fold present on ventral part of body from behind pectoral fin to base of caudal fin. ..... *Marilyna*

Genus *Chelonodon*
Müller, 1839

The genus contains four species and is distributed in the Indo-West Pacific from East Africa to Melanesia.

Milk-spotted Toadfish
Chelonodon patoca
(Hamilton, 1822)
(Plate 17, no. 20)

Diagnosis. - Dorsal rays 9 to 11; anal rays 8 to 10; pectoral rays 16 to 18; nostril forming a depression with a narrow anterior and broad posterior skin flap, the flaps sometimes joined basally by a low fringe; 2 lateral lines, upper and lower sections joined above the anal fin; brown on back and sides with numerous close-set whitish spots, the spots on the back may have a central brown blotch; ventral part of head and body white, often separated from brown area above by a yellow-orange band. Maximum size reported to 330 mm SL, but New Guinean specimens usually less than 100 mm SL.

Distribution and Habitat. - India to New Guinea and northern Australia. In New Guinea it occurs on both northern and southern coasts, usually around the mouths of rivers or in brackish mangrove estuaries. It sometimes penetrates fresh water, but is never found more than a few km from the sea.

Genus *Marilyna*
Hardy, 1982

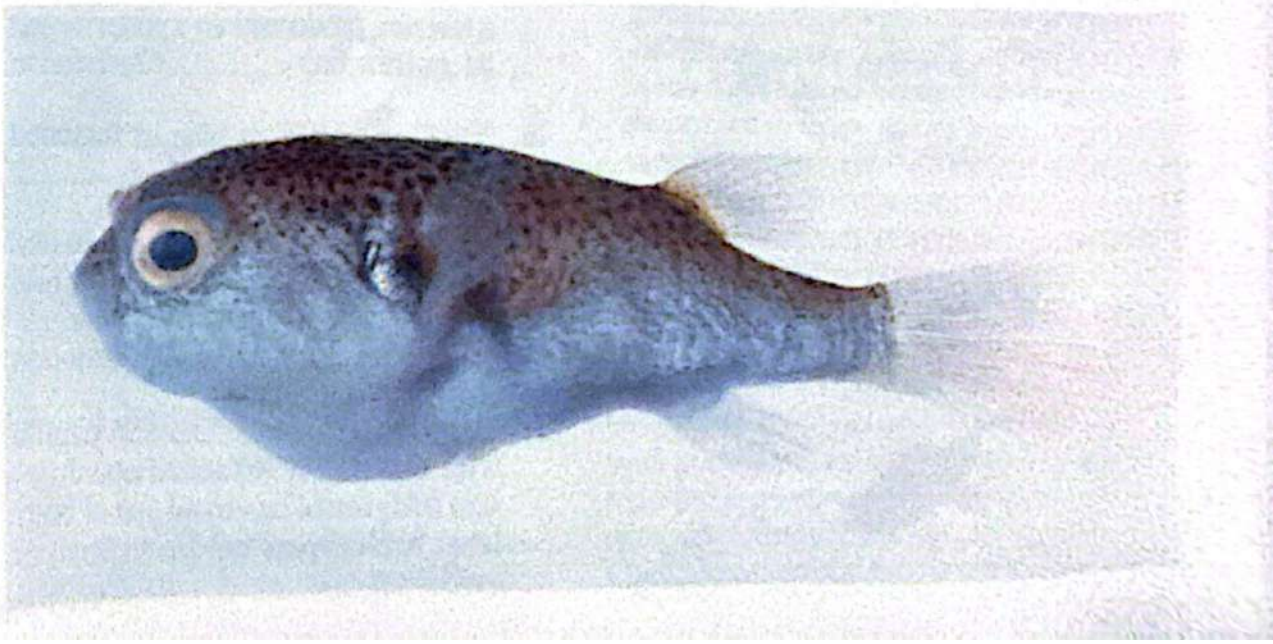
The genus contains three species and is distributed in northern Australia and southern New Guinea. The species are mainly estuarine dwellers that sometimes penetrate fresh water.

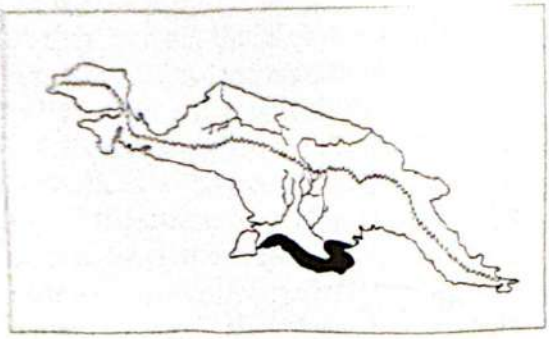
Merauke Toadfish
Marilyna meraukensis
(de Beaufort, 1955)
(Photo 34)

Diagnosis. - Dorsal rays 10 or 11; anal rays 9 to 11; pectoral rays 17 to 20; nasal organ a short, flattened papilla with 2 widely separated openings; 2 lateral lines, upper and lower sections joined above the anal fin; greyish or grey brown, grading to white ventrally; dorsal surface of head and body with dense covering of small, irregular brown spots; a dark brown spot on pectoral fin base. Maximum size to 170 mm SL.

Distribution and Habitat. - Central-southern New Guinea and northern Australia. New Guinean records include the Merauke and Oriomo rivers, but probably widespread in the Fly Delta. Inhabits brackish estuaries, sometimes penetrating tidal freshwater creeks and rivers.

Photo 34 - Merauke Toadfish ***Marilyna meraukensis*** *, 50 mm SL.*





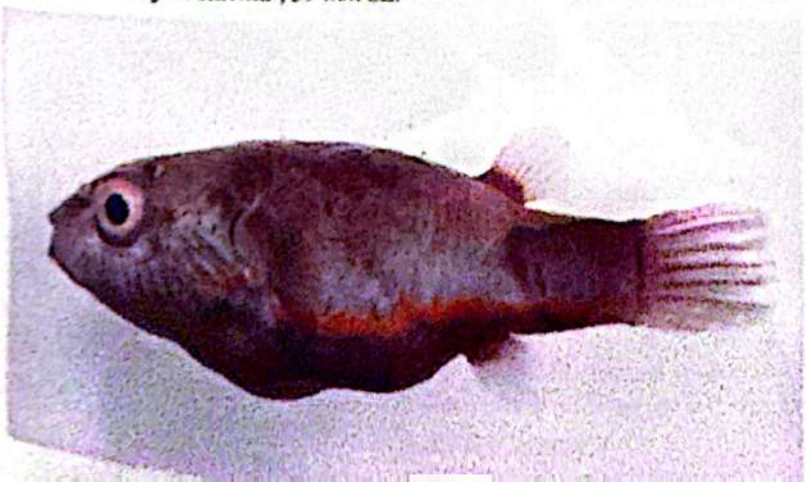
Genus *Tetraodon*
Linnaeus, 1758

The generic divisions within the Tetraodontidae are poorly defined and vary considerably depending on the author. Numerous species have been placed in the genus *Tetraodon*, the type species of which is from Africa. Dekkers (1975) redefined the genus and recognised 14 species from fresh waters of Asia, but the precise number of species occurring outside this region remain uncertain.

Red-striped Toadfish
Tetraodon erythrotaenia
Bleeker, 1853
(Photo 35)

Diagnosis. - Dorsal rays 7 or 8; anal rays 8; pectoral rays 16 or 17; nostril forming a short tube with a pair of rounded or triangular lobes; lateral line inconspicuous; back and sides grey brown, belly whitish; these colours separated by a red stripe from snout to caudal peduncle that is often broken into spots or vertical lines, especially on head. Maximum size to 60 mm SL.

Photo 35 - Red-striped Toadfish ***Tetraodon erythrotaenia*** *, 59 mm SL.*



Distribution and Habitat. - Sulawesi, Ambon, Kai Islands, Aru Islands, and New Guinea. Extremely common in some mangrove areas. Usually found in brackish water but also occurs in freshwaters of tidal creeks and rivers.

Introduced Fishes

Unfortunately a number of exotic fish species from other parts of the world have been introduced to fresh waters of New Guinea. In Papua New Guinea at least 22 species have been introduced since 1949, most of which have been unsuccessful or were never released into the wild. Glucksman et al. (1976) gave details of these introductions. Only the species that have established wild populations are included in the species section that follows. Most introductions have been by well meaning fishery agencies, but with one exception, have had a negligible impact either as food fishes or in the control of mosquitos (in the case of *Gambusia*). The only possible exception is the African Tilapia (*Oreochromis mossambica*) that is now an important food source for people along the Sepik and Ramu rivers and their major lowland tributaries. Most of the introductions have had a negative impact, either by competing for space and limited food resources, or by feeding on native species (including their eggs and fry). Even the popular Tilapia has adversely affected the environment, creating turbid conditions in formerly clean lakes, and badly over-crowding the indigenous fauna due to its prolific breeding. Several species, including Tilapia, Walking Catfish, Carp, and Climbing Perch appear to be undergoing rapid population increases

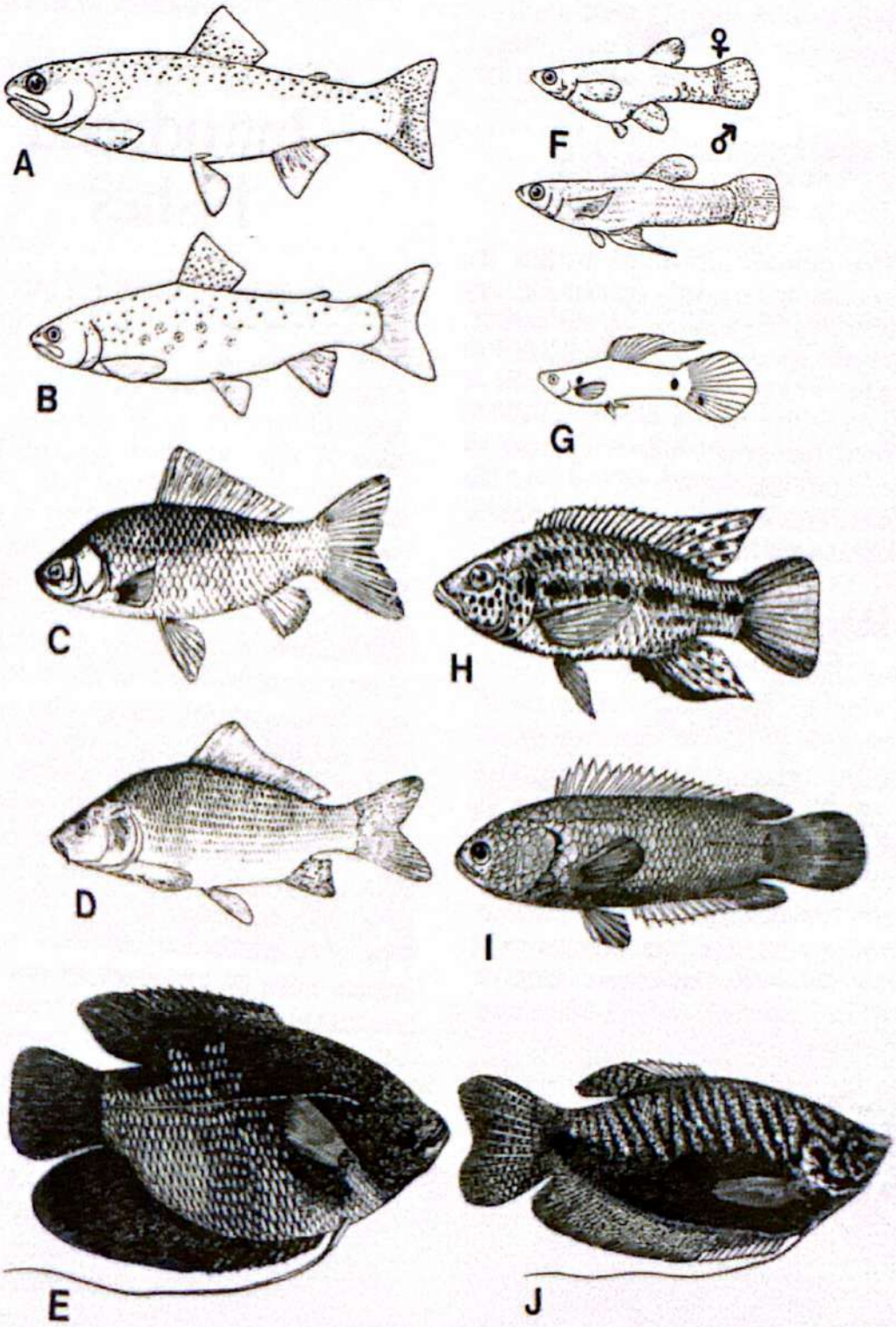


Fig. 41. Introduced fishes of New Guinea: A) ***Oncorhynchus mykiss***; B) ***Salmo trutta***; C) ***Crassius auratus***; D) ***Cyprinus carpio***; E) ***Osphronemus goramy***; F) ***Gambusia affinis***; G) ***Poecilia reticulata***; H) ***Oreochromis mossambica***; I) ***Anabas testudineus***; J) ***Trichogaster trichopterus*** *(from McDowall, 1980; Weber and de Beaufort, 1922).*

and thus pose a threat to native fishes. On the positive side, the number of established introductions is relatively few and great river systems such as the Fly and Mamberamo appear to be free of introductions. The special uniqueness of New Guinea's fish fauna dramatically sets it apart from the Indonesian Archipelago lying west of "Weber's Line." Therefore, it is particularly sad to witness the introduction of fishes from the Indonesian side of the Line. The natural barrier of deep oceanic water forming the Molucca and Banda seas have been an effective isolating mechanism for millions of years. But now in the span of a few short years man's introductions are seriously threatening the natural integrity of the region. Particularly annoying in this regard are the introductions of Walking Catfish, Climbing Perch, gouramies and the Striped Snakehead. Hopefully responsible government officials, particularly fishery departments of Irian Jaya and Papua New Guinea, will place a ban on future introductions. New Guinea has an exciting, highly unique fauna and flora that must be given all necessary protection.

Carps

Family Cyprinidae

GOLDFISH

Crassius auratus
Linnaeus, 1758
(Fig. 41C)

Diagnosis. - Dorsal rays III or IV,15 to 19; anal rays II or III,4 to 7; pectoral rays 16 to 18; lateral-line scales 26-31; head large, broadly triangular, and scaleless; mouth small and protrusible, no barbels; pelvic fins abdominal; pectoral fins low and well forward of pelvics; olive bronze to deep gold, sometimes with black blotches; silvery white on belly; fins usually same colour as body. Maximum size to 350 mm SL.

Remarks. - Native to eastern Asia. Introduced to the Lake Sentani region of Irian Jaya, but the date of introduction and its present status are unknown. It generally inhabits quiet backwaters of rivers, swamps, and lakes. The flesh is not regarded as good eating.

Common Carp

Cyprinus carpio
Linnaeus, 1758
(Fig. 41D)

Diagnosis. - Dorsal rays III or IV,17 to 23; anal rays III,5 or 6; pectoral rays 15 to 18; lateral-line scales 34 to 40; head moderate sized, triangular, and scaleless; mouth relatively small, no teeth; 4 barbels, a long one at each corner of mouth and a short one at each end of the upper lip; pelvic fins abdominal; pectoral fins low and well forward of pelvics; colour variable, olive green, yellow green, to golden on dorsal surface; brassy yellow or greenish yellow on sides; silvery yellow on belly. Maximum size to 120 cm, but usually less than 300-400 mm SL.

Remarks. - Native to fresh waters of Eurasia. Introduced to Papua New Guinea in 1959 as a possible food fish. It is common in a few isolated localities such as the upper Baliem River (Irian Jaya), Lake Kopiago, and the Lower and Middle Sepik and Ramu river systems. Carp have an adverse influence on the environment because of their prolific breeding habits and their sucking-mode of feeding which greatly disturbs the substratum causing turbidity. They also compete for available food resources in the form of crustaceans, insects, molluscs, worms, and algae.

*Fig. 42. Walking Catfish, **Clarias batrachus** (from Weber and de Beaufort, 1913).*

Airbreathing Catfishes

Family Clariidae

Walking Catfishes

Clarias batrachus
(Linnaeus, 1758)
(Fig. 42)

Diagnosis. - Dorsal rays 60 to 76; anal rays 47 to 58; pectoral rays I,8 to 11; pelvic rays 6; 4 pairs of barbels around mouth; body long and slender; caudal fin rounded, not joined to dorsal and anal fins; dark grey to brownish, whitish on belly. Maximum size to at least 400 mm SL, but usually under 200 mm SL.

Remarks. - Native to south-eastern Asia from India and Sri Lanka eastward to Lombok, Indonesia. First introduced to the Lake Sentani region (date unknown), but now also found in the Vogelkop Peninsula on the Prafi Plain near Manokwari and in the Sorong district. This fish has an accessory air-breathing organ and is thus able to survive for long periods out of water or in oxygen poor water. It can also make overland forays in search of food.

Trout

Family Salmonidae

Rainbow Trout

Oncorhynchus mykiss
(Walbaum 1792)
(Fig. 41A)

Diagnosis. - Dorsal rays 10 to 12; anal rays 8 to 12; pectoral rays 14 to 16; lateral-line scales 115-150; total gill rakers on first arch 17-22; vertebrae 61-66; adipose fin well developed; caudal fin forked to truncate; greenish olive or dark steel blue on back, lower parts silvery white; numerous round, dark spots on upper sides; often a rosy-pink stripe along side and across gill cover. Maximum size to 110 cm, but New Guinean specimens usually under 400 mm SL.

Remarks. - This popular angling species, formerly known as *Salmo gairdneri*, is native to northeast Asia and the Pacific coast of North America from Alaska to Mexico. It was introduced to the Central Highlands of Papua New Guinea in 1952 as a food and angling fish. There are apparently a few isolated self-sustaining populations present in highland areas of Papua New Guinea. It is present in the upper Strickland system, but apparently is not utilised for food by local people. Trout have proven to be destructive to native fish faunas in Australia, because they feed on the eggs and young of other species and compete for food. However, in New Guinea their impact seems minimal as there are few, often no, native fishes above about 2000 m elevation, where most trout introductions have taken place. There is a government trout hatchery presently operating at Kegasugl, Simbu Province at the beginning of the walk-track to Mt. Wilhelm.

Brown Trout

Salmo trutta
Linnaeus, 1758
(Fig. 41B)

Diagnosis. - Dorsal rays 12 to 14; anal rays 10 to 12; pectoral rays 13 or 14; lateral-line scales 110-120; total gill rakers on first arch 14-17; vertebrae 56-61; adipose fin well developed; caudal fin slightly forked or truncate; olive to dark brown on back, silvery on sides; indistinct dark spots on sides including some red spots that are surrounded by pale halos. Maximum size to 140 cm SL.

Remarks. - Native to European fresh waters. Introduced to the Central Highlands of Papua New Guinea. Its present status is unknown.

Livebearers

Family Poeciliidae

Mosquitofish

Gambusia affinis
(Baird & Girard, 1853)
(Fig. 41F)

Diagnosis. - Dorsal rays 7 to 9; anal rays 9 or 10; pectoral rays 10 to 14; pelvic rays 6; midlateral scales 29-32; females with prominent rounded belly profile and normal anal fin; males more slender than females with anal fin modified to form gonopodium; olive or golden with silvery head and belly region; scales of upper side with narrow brown margins; dorsal and caudal fins with fine spotting; a dark blotch above anus, more pronounced in females. Maximum size of females to 50 mm SL, males to 30 mm SL.

Remarks. - Native to Gulf of Mexico drainages of North America from Alabama to Texas. Introduced to Irian Jaya in 1930 and later in Papua New Guinea. This fish is now found in the Sepik and Ramu systems, Lake Kutubu, and around major population centres of Papua New Guinea such as Port Moresby, Lae, and Madang. There is no information about its current status in Irian Jaya. It was introduced to help control mosquitoes, as it feeds on their aquatic larvae and pupae. However, its impact on New Guinea mosquitoes has been minimal and there are native species such as rainbowfishes that are as good or better for destroying mosquitoes. This fish is a prolific breeder and often takes over, crowding out the native species. It also eats fish eggs and young fish and attacks larger fish, nipping their fins. In Australia it is considered a noxious species and its possession is prohibited.

Guppy

Poecilia reticulata
Peters, 1959
(Fig. 41G)

Diagnosis. - Dorsal rays 7 or 8; anal rays 8 or 9; pectoral rays 13 or 14; pelvic rays 5; midlateral scales 26-28; females with prominent rounded belly profile and normal anal fin; males more slender than females with anal fin modified to form gonopodium; olive to yellowish tan with narrow, dark scale outlines; colour of males highly variable, but those from New Guinea (Port Moresby district) usually with round black spot at base of caudal fin and one or more similar spots on the sides (often there is one just above the pectoral fin base). Maximum size of females 50 mm SL, males to 25 mm SL.

Remarks. - Native to north-eastern South America and some West Indian islands. Introduced to the Port Moresby district of Papua New Guinea in about 1967, possibly for mosquito control. It is now very common in some parts of the Goldie River and its smaller tributaries. Considered a pest to native fauna because of its prolific breeding habits. In some streams around Port Moresby it is the only fish present.

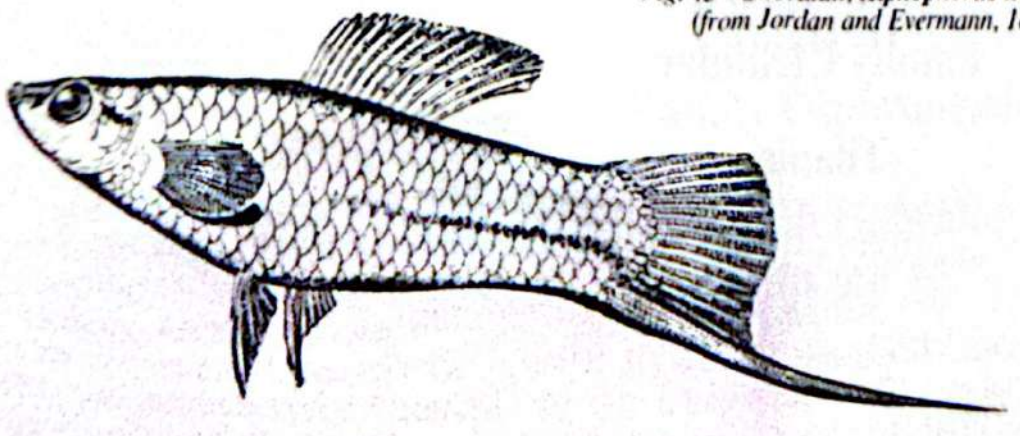


*Fig. 43 - Swordtail, **Xiphophorus helleri** (from Jordan and Evermann, 1896).*

Swordtail

Xiphophorus helleri
Heckel, 1848
(Fig. 43)

Diagnosis. - Dorsal rays 11 to 14; anal rays 8 to 10; pectoral rays 12 or 13; pelvic rays 6; midlateral scales 26-30; females with prominent rounded belly profile, and normal anal fin; males more slender than females with anal fin modified to form gonopodium; lower lobe of caudal fin of males greatly extended, forming sword-like filament; colour variable according to locality, those from New Guinea either of the "green" variety or "tuxedo" vareity; green variety is olive on back, whitish ventrally with a diffuse reddish midlateral stripe and diffuse narrow brown bars on the anterior part of the body, sword of males prominently outlined with black; tuxedo variety is fawn or light brown on back with broad black area (with mottled edges) covering most of sides, ventral parts silvery white, and sword of males outlined with black. Maximum size of females 100 mm SL, males to 70 mm SL, but New Guinean specimens usually much smaller.

Remarks. - Native to Central America. Introduced to the Wau-Bulolo district of Papua New Guniea (date unknown). It was abundant in streams near Wau in 1981. The source of this introduction is unknown, but it was probably released by an aquarist, as it is a highly popular aquarium fish.

Cichlids

Family Cichlidae

Tilapia

Oreochromis mossambica
(Peters, 1852)
(Fig. 41H)

Diagnosis. - Dorsal rays XV to XVII, 10 to 13; anal rays III,7 to10; pectoral rays 14 or 15; lateral-line scales 29-33; gill rakers on lower limb of first arch 17-19; greenish above, silvery on sides, and greyish white on belly; 3 blackish spots usually visible on side; breeding males black with white breast, edges of median fins scarlet; juveniles silvery with black spot on dorsal fin. Maximum size to about 300 mm SL.

Remarks. - Native to fresh waters of eastern Africa, but widely introduced to other parts of the world. First introduced to Papua New Guinea in 1954 and now abundant in the Lower Ramu and Middle and Lower Sepik rivers. It has become the most important food fish in the Sepik region. However, no studies have been undertaken to determine its effect on the native fish fauna. In some other countries it is regarded as a pest because of its prolific breeding habits. Also these fish may be destructive to the environment due to their habit of grazing on the bottom algae in large schools, thus causing increased turbidity levels as they stir up the bottom while feeding. Also breeding males build volcano-like nests which in some lakes may occupy virtually all the available bottom space.

Climbing Perches

Family Anabantidae

Climbing Perch

Anabas testudineus
(Bloch, 1795)
(Fig. 41I)

Diagnosis. - Dorsal rays XVI to XIX,7 to 10; anal rays IX to XI,8 to 11; pectoral rays 14 to 16; lateral-line scales 26-31 lateral line interrupted below posterior part of spinous dorsal fin; transverse scales 12-15; head bluntly rounded, body elongate; caudal fin rounded; generally brown or

dark greenish brown; juveniles with dark bars on rear part of body and tail and a dark stripe below eye, also a large white-edged ocellus at base of caudal fin and a smaller one at rear of operculum. Maximum size to 200 mm SL.

Remarks. - Native to south-eastern Asia from India and Sri Lanka to Indonesia, Philippines, and China. It was first introduced to Irian Jaya, possibly in the Merauke area, but its date of introduction is unknown. It has now spread eastward across the border into Papua New Guinea as far as the Morehead River. This is an extremely hardy fish that possesses an accessory air-breathing organ. It can therefore survive long periods out of water, possibly up to six days. It apparently uses its highly mobile suboperculum and strong fin spines to pull itself along when out of water. Supposedly this fish can migrate long distances overland in search of better living conditions.

Gouramies

Family Belontiidae

Snakeskin Gourami

Trichogaster pectoralis
(Regan, 1910)

Diagnosis. - Dorsal rays VII or VIII,10 or 11; anal rays XI or XII,33 to 38; pectoral rays 9 or 10; longitudinal scale series above lateral line 55-63; first ray of pelvic fin forming a greatly prolonged filament; brown on top of head and on nape; about 12-15 brown bars on side with narrow whitish interspaces; a dark brown mid lateral stripe from snout to caudal fin base, usually broken along sides where brown bars are interrupted by pale interspaces; a large dark brown spot at base of caudal fin. Maximum size about 200 mm SL.

Remarks. - Native to the Malay Peninsula, Thailand, and Cambodia. Introduced to Papua New Guinea in 1957, and several years earlier in Irian Jaya. It was present in the Ajamaru Lakes, Irian Jaya in the 1950s, but its current status is uncertain. The same can be said for Papua New Guinean populations introduced in the Western Highlands, Central, and Gulf districts. This species is cultivated in ponds as a food fish in south-eastern Asia.

Threespot Gourami

Trichogaster trichopterus
(Pallas 1777)
(Fig. 41J)

Diagnosis. - Dorsal rays VI to VIII,8 or 9; anal rays X to XII,33 to 38; pectoral rays 9 or 10; longitudinal scale series above lateral line 40-52; first ray of pelvic fin forming a greatly prolonged filament; whitish or tan with numerous narrow, brown bars, often with irregular branching, forming a maze-like pattern; a pair of large black, white-edged spots on side, one in middle of body and the other at base of caudal fin; median fins faintly spotted. Maximum size to 90 mm SL.

Remarks. - Native to south-eastern Asia from China to the Malay Peninsula and western Indonesia. Introduced as an aquarium fish to the Port Moresby area in about 1970. It is common in a few streams near Port Moresby.

Giant Gouramies

Family Osphronemidae

Giant Gourami

Osphronemus goramy
Lacepède, 1802
(Fig. 41E)

Diagnosis. - Dorsal rays XII or XIII,11 to

13; anal rays IX to XI,19 to 21; pectoral rays 15 or 16; lateral-line scales 30-33; transverse scales 18-20; first ray of pelvic fin forming elongate filament; brownish or olive above and silvery or yellowish below; young with about 8 brown cross-bars and 1-2 ocellated spots above rear part of anal fin, and blackish spot covering pectoral fin base. Maximum size to 500 mm SL.

Remarks. - Native to Sumatera, Borneo, and Java, but widely introduced to islands and continental regions bordering the Indian Ocean. Introduced in 1957 to a number of districts in Papua New Guinea, but most of these introductions appear to have been unsuccessful. This fish is capable of aerial respiration and is mainly herbivorous, feeding on both terrestrial and aquatic vegetation. It is considered good eating.

Snakeheads

Family Channidae

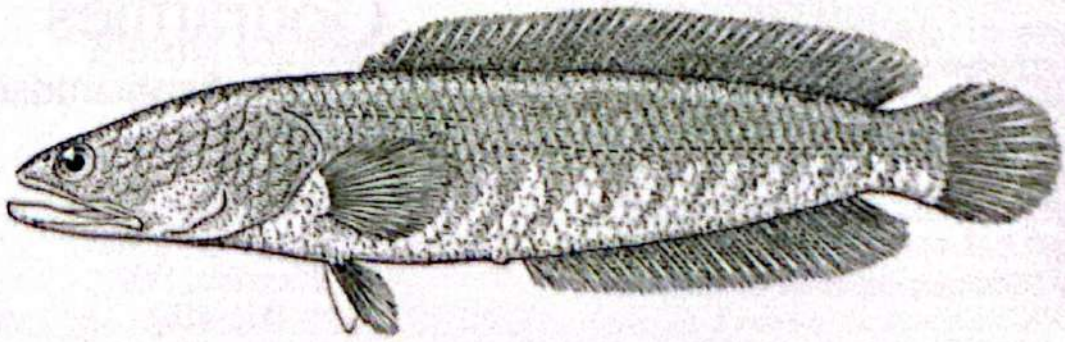
Striped Snakehead

Channa striata
(Bloch, 1793)
(Fig. 44)

Diagnosis. - Dorsal rays 38 to 43; anal rays 23 to 27; pectoral rays 15 to 17; pelvic rays 6; lateral-line scales 52-57; transverse scales 13-16; scales very large and shield-like on head; head triangular or wedge-shaped, body elongate with long-based dorsal and anal fins; caudal fin rounded; greenish to brown or blackish above, white or silvery below; dark streaks and blotches on sides, forming chevron pattern; a dark stripe from corner of mouth to lower edge of operculum; lower surface of head and belly freckled with brown; juveniles may have a black ocellus at the rear of the dorsal fin. Maximum size to 900 mm SL.

Remarks. - Native to south-eastern Asia from India and Sri Lanka to China, Indonesia, and the Philippines. This fish was previously unknown from New Guinea, but was collected in streams near Bintuni on the Vogelkop Peninsula, Irian Jaya by the author in 1989. It has no doubt been introduced by Indonesian migrants as the fish is common throughout Indonesia west of Weber's Line. It grows to a large size and is considered a good food fish. The Striped Snakehead has an accessory breathing organ and can survive without water for months buried in the mud. It is a voracious predator of fishes, crustaceans, frogs, snakes, and insects.

Fig. 44. Striped Snakehead, ***Channa striata***



Gazetteer

Irian Jaya

Aitinjo Lake	01° 26'S, 132° 14'E
Ajamaru Lakes	01° 17'S, 132° 06'E
Alkmaar	04° 40'S, 138° 44'E
Aru Islands	06° 00'S, 134° 30'E
Baliem Valley	04° 04'S, 138° 55'E
Batanta Island	00° 50'S, 130° 50'E
Bernhard Camp	03° 30'S, 139° 20'E
Bintuni	02° 07'S, 133° 31'E
Bintuni Bay	02° 20'S, 133° 30'E
Bintuni River	02° 07 S, 133° 31'E
Bomberai Peninsula	03° 00'S, 133° 00'E
Bomberai River	02° 52'S, 133° 00'E
Cenderawasih Bay (=Geelvink Bay)	02° 30'S, 135° 30'E
Danau Bira (Lake Holmes)	02° 29'S, 138° 00'E
Danau Romberai	01° 53'S, 137° 54'E
Digul River	06° 05'S, 140° 18'E
Djarua River	02° 50'S, 133° 28'E
Doorman River	03° 26'S, 138° 27'E
Etna Bay	04° 11'S, 134° 37'E
Fruata	02° 59'S, 133° 32'E
Humboldt Bay	02° 35'S, 140° 50'E
Idenburg River (=Taritatu River)	03° 24'S, 139 00'E
Jayapura	02° 36'S, 140° 40'E
Kais River	01° 30'S, 132° 27'E
Kamundan River	02° 00'S, 132° 39'E
Karabra River	01° 06'S, 131° 40'E
Kladuk River	01° 02'S, 131° 57'E
Lake Anggi Gigi	01° 22'S, 133° 54'E
Lake Anggi Gita	01° 24'S, 133° 58'E
Lake Jamur	03° 39'S, 134° 58'E
Lake Kamakawiar	03° 45'S, 134° 13'E
Lake Kurumoi	02° 10'S, 134° 05'E
Lake Sentani	02° 42'S, 140° 30'E
Lake Tage	02° 58'S, 136° 19'E
Lake Tigi	04° 04'S, 136° 15'E
Lorentz River	04° 34'S, 138° 42'E
Mamberamo River	02° 15'S, 138° 00'E
Manokwari	00° 52'S, 134° 05'E
Mappi River	06° 54'S, 139° 12'E
Merauke River	08° 20'S, 140° 40'E
Mimika River	04° 30'S, 136° 32'E
Misool	02° 10'S, 130° 10'E
Mosso River	02° 41'S, 141° 02'E
Nabire	03° 23'S, 135° 30'E
Noord River	04° 40'S, 138° 44'E
Otoemboewe River (=Utumbuwe River)	05° 23'S, 138° 18'E
Otsjia River	04° 00'S, 135° 02'E
Otakwa River (=Utakwa River)	04° 35'S, 137° 15'E
Paniai Lakes	03° 55'S, 136° 20'E
Pionierbiwak	02° 15'S, 138° 00'E
Prafi River	00° 51'S, 133° 52'E
Prauwenbiwak	03° 15'S, 138° 40'E
Rabiai River (Waigeo Island)	00° 34'S, 131° 00'E
Sabang	04° 54'S, 138° 44'E
Salawati Island	01° 00'S, 130° 50'E
Samson River Basin	01° 10'S, 131° 30'E
Sebjar River	02° 00'S, 133° 01'E
Sekanto River	02° 45'S, 140° 43'E
Senopi	00° 50'S, 132° 56'E
Sermowai River	02° 47'S, 140° 00'E
Serui, Japen Island	01° 52'S, 136° 14'E
Setakwa River	04° 40'S, 137° 19'E
Sorong	00° 51'S, 131° 13'E
Tami River	03° 00'S, 140° 46'E
Tanah Merah	06° 05'S, 140° 18'E
Taritatu River	03° 24'S, 139° 00'E
Tawarin River	02° 38'S, 139° 34'E
Timoforo River	01° 40'S, 133° 05'E
Vogelkop Peninsula	01° 30'S, 133° 00'E
Wagani River	03° 24'S, 135° 00'E
Wagieo Island	00° 30'S, 133° 00'E
Wai Meniel, (Waigeo Island)	00° 22'S, 130° 42'E
Waoedoe River (=Urema River)	03° 39'S, 134° 50'E
Yakati River	02° 10'S, 134° 03'E
Yapen Island	01° 46'S, 136° 30'E

Papua New Guinea

Adjena River	05° 50'S, 142° 55'E
Angoram	04° 05'S, 144° 04'E
Aramia River	07° 56'S, 143° 00'E
Arawa, Bougainville	06° 13'S, 155° 34'E
Asaro River	06° 15'S, 145° 15'E
Baiyer River Valley	05° 33'S, 144° 09'E
Balimo	08° 01'S, 142° 57'E
Balimo Lagoon	08° 03'S, 142° 58'E
Bensbach River	08° 57'S, 141° 15'E
Bewani Mountains	03° 10'S, 141° 10'E
Binaturi River	09° 09'S, 142° 56'E
Bogia	04° 17'S, 145° 00'E
Brahman Mission	05° 45'S, 145° 20'E
Bristow Island	09° 07'S, 143° 15'E
Brown River	09° 11'S, 147° 14'E
Bulolo	07° 15'S, 146° 42'E
Burei	08° 12'S, 142° 01'E

Cape Ward Hunt	08° 05'S, 148° 05'E
Chambri Lakes	04° 16'S, 153° 11'E
Daru Island	09° 05'S, 143° 12'E
Dinawa	08° 56'S, 147° 20'E
Dyke Ackland Bay	09° 00'S, 148° 45'E
Embi Lakes	08° 49'S, 148° 21'E
Erap River	06° 28'S, 146° 44'E
Fly River	08° 22'S, 142° 40'E
Gogol River	05° 19'S, 145° 47'E
Goldie River	09° 15'S, 147° 20'E
Goroka	06° 05'S, 145° 25'E
Ialibu	06° 16'S, 143° 56'E
Inawi	08° 28'S, 146° 37'E
Jimmi River	05° 20'S, 144° 20'E
Josephstal	04° 44'S, 145° 01'E
Kairiru Island	03° 21'S, 143° 35'E
Karamui	06° 27'S, 144° 47'E
Kavieng, New Ireland	02° 35'S, 150° 48'E
Kegasugl	05° 50'S, 145° 04'E
Kemp Welsh River	09° 47'S, 147° 43'E
Kikori River	07° 10'S, 144° 09'E
Kiunga	06° 08'S, 141° 18'E
Kokoda	08° 58'S, 147° 45'E
Kubuna River	08° 42'S, 146° 43'E
Lae	06° 46'S, 147° 01'E
Lake Kopiago	05° 23'S, 142° 33'E
Lake Daviumbu	07° 35'S, 141° 18'E
Lake Kutubu	06° 25'S, 143° 19'E
Lake Murray	07° 00'S, 141° 30'E
Lake Tebera	06° 45'S, 144° 40'E
Lake Wanam	06° 39'S, 146° 46'E
Laloki River	09° 23'S, 147° 14'E
Logatyu River	05° 11'S, 142° 23'E
Lorengau River, Manus Island	02° 02'S, 147° 16'E
Luap Creek	02° 59'S, 141° 11'E
Lumi	03° 29'S, 142° 02'E
Madang	05° 13'S, 145° 50'E
Malas Creek	03° 37'S, 142° 56'E
Mandi Stream	03° 38'S, 143° 43'E
Manus Island	02° 05'S, 147° 00'E
Maprik	03° 37'S, 143° 00'E
Maram Stream	04° 33'S, 144° 59'E
Markham River	06° 35'S, 146° 25'E
May River	04° 17'S, 141° 52'E
Mendi	06° 08'S, 143° 38'E
Milne Bay	10° 24'S, 150° 32'E
Morehead River	08° 42'S, 141° 39'E
Mt. Hagen	05° 53'S, 144° 14'E
Mt. Lamington	09° 00'S, 148° 21'E
Musa River	09° 25'S, 148° 50'E
Nomad River	06° 18'S, 142° 14'E
Nuru River	05° 28'S, 145° 30'E
Ok Mart River	05° 53'S, 141° 15'E
Ok Tedi River	06° 10'S, 141° 08'E
Omei Creek	06° 14'S, 143° 38'E
Omsis River	06° 42'S, 146° 48'E
Oriomo River	08° 52'S, 143° 10'E
Oro Bay	08° 54'S, 148° 29'E
Owen Stanley Range	09° 30'S, 148° 00'E
Pahoturi River	09° 15'S, 142° 43'E
Palmer River	06° 51'S, 141° 34'E
Pie River	07° 30'S, 144° 50'E
Pima River	06° 25'S, 144° 49'E
Pimaga	06° 31'S, 143° 31'E
Popondetta	08° 45'S, 148° 15'E
Port Moresby	09° 29'S, 147° 09'E
Pual River	02° 55'S, 141° 20'E
Purari River	07° 46'S, 145° 10'E
Rabaul, New Britain	04° 12'S, 152° 10'E
Ramu River	04° 02'S, 144° 41'E
Rumginae	05° 54'S, 141° 16'E
Safia	09° 35'S, 148° 40'E
Sepik River	03° 40'S, 143° 45'E
Sirinumu Reservoir	09° 30'S, 147° 27'E
Sogeri Plateau	09° 27'S, 147° 28'E
Snake River	07° 03'S, 146° 36'E
Soro River	06° 22'S, 143° 16'E
Strickland River	06° 19'S, 142° 04'E
Tabubil	05° 17'S, 141° 13'E
Talasea, New Britain	05° 20'S, 150° 02'E
Tari Valley	05° 52'S, 142° 56'E
Tekan River, Bougainville	05° 57'S, 152° 20'E
Telefomin	05° 07'S, 141° 38'E
Torricelli Mountains	03° 30'S, 142° 00'E
Tua River	06° 25'S, 144° 50'E
Vanimo	02° 41'S, 141° 17'E
Wahgi River	05° 45'S, 144° 30'E
Wankipe Village	05° 11'S, 142° 23'E
Wau	07° 20'S, 146° 45'E
Wewak	03° 34'S, 143° 38'E
Whege River	05° 45'S, 145° 20'E
Yonki	06° 15'S, 145° 59'E
Yuat River	05° 02'S, 144° 00'E
Yungkiri Stream	02° 58'S, 141° 08'E

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Glossary

Abdomen : refers to the belly region, generally situated between the pelvic and anal fins.

Accessory air-breathing organ : a chamber or pouch that can store air and is richly supplied with blood vessels. It is generally associated with the pharynx or gill chamber and allows fishes such as *Clarias*, *Anabas*, and *Channa* to survive for long periods out of water.

Accessory lateral process : refers to a protuberance on the premaxilla other than the large median one.

Adipose eyelid : an immovable transparent outer covering or partial covering of the eye of some groups of bony fishes, such as mullets and trevallies, which performs protective and streamlining functions.

Adipose fin : a small fleshy fin without rays found on the back behind the dorsal fin of some primitive teleost fishes such as the catfishes.

Anus : the posterior external opening of the digestive tract from which wastes are voided; sometimes called the vent.

Auxiliary scales : small extra scales on the basal portion of the normal head or body scales.

Axil : the acute angular region between a fin and the body; usually used in reference to the underside of the pectoral fin toward the base. Equivalent to the armpit of humans.

Axillary scale process : a modified scale that is generally elongated and is situated in either the pectoral or pelvic fin axil (see axil).

Band : an oblique or irregular marking (compare 'bar' below).

Bar : an elongate colour marking of vertical orientation, the sides of which are usually more-or-less straight (although they need not be parallel).

Barbel : a slender tentacle-like protuberance of sensory function which is often seen on the chin and around the lips of some fishes such as catfishes.

Basal membrane : a sheet of skin that forms the anterior part of the fused pelvic disc of some gobioid fishes.

Bifurcate : divided or fork-shaped.

Body rings : the bony segments of a pipefish that are usually well differentiated by visible sutures.

Branchiostegal : bony rays supporting the gill membranes behind the lower jaw.

Canine : a prominent slender sharp-pointed tooth.

Carnivore : a flesh-eating animal.

Caudal fin : the tail fin. The term tail alone generally refers to that part of a fish posterior to

Caudo-dorsal fin : the combined dorsal and caudal fins that are continuous with the anal fin in plotosid catfishes. Also called dorsal procurrent caudal rays.

Cephalic shield : the large bony dorsal covering on the head of fork-tailed catfishes (Ariidae).

Ciguatera : a marine fish toxin, dangerous to man, but only found in isolated tropical localities.

Circumpeduncular scales : the transverse series of scales that completely encircle the base of the tail.

Compressed : laterally flattened; often used in reference to the shape of the body - in this case deeper than wide.

Copepods : a group of tiny crustaceans common in both fresh and salt water.

Crustacean : an animal of the Class Crustacea of the Phylum Arthropoda; includes crabs, lobsters shrimps, and copepods.

Crenulate : having the edge, for example of a scale, slightly scalloped.

Ctenoid scales : scales of bony fishes which have tiny tooth-like projections along the posterior margin and part of the exposed portion. Collectively these little teeth (or ctenii) impart a rough texture to the surface of the scales.

Cycloid scales : scales of bony fishes, the exposed surfaces and edges of which lack any small tooth-like projections; they are, therefore, smooth to the touch.

Dendritic organ : a soft fleshy protuberance composed of numerous filaments that is situated just behind the anus in some plotosid catfishes.

Depressed : dorsoventrally flattened. The opposite in body shape of compressed.

Depth : a vertical measurement of the body of a fish; most often employed for the maximum height of the body excluding the fins.

Dorsal : toward the back or upper part of the body; the opposite of ventral.

Dorsal fin : a median fin along the back which is supported by rays. There may be two or more dorsal fins, in which case the most anterior one is designated the first.

Dorsal procurrent caudal rays : the combined dorsal and caudal fins that are continuous with the anal fin in plotosid catfishes (see caudo-dorsal fin).

Electrophoretic analysis : a laboratory technique that is used for evaluating the protein similarities (or dissimilarities) of species.

Elongate : extended or drawn out.

Emarginate : concave; used to describe the posterior border of a caudal fin which is inwardly curved.

Esca : the bait or lure of lophiiform fishes (see illicium).

Euryhaline : having a wide tolerance to different salinities. This condition is typical of many estuarine fishes.

Family : a major entity in the classification of animals and plants which consists of a group of related genera. Family names end in 'idae', an example being Gobiidae for the goby family; when used as an adjective, the 'ae' is dropped, hence gobiid fish.

Forked : inwardly angular; used in describing the shape of a caudal fin which is divided into two equal lobes, the posterior border of each of which is relatively straight.

Frenum : a thickened fold of skin that unites the bases of the pelvic fins in many gobioid fishes.

Gape : an opening. Generally used to refer to the mouth opening in fishes.

Genus : a group of closely related species; the first part of the scientific name of an animal or plant. The plural is genera.

Gill arch : the bony support for the gill filaments and gill rakers. Normally there are four pairs of gill arches in bony fishes.

Gill filaments : the thread-like structures on the posterior edge of each gill arch. They contain a network of blood vessels that facilitate the exchange of gases between the blood and external environment.

Gill opening : the opening posteriorly and often also ventrally on the head of fishes where the water of respiration is expelled. Bony fishes have a single such opening on each side whereas cartilaginous fishes (sharks and rays) have five to seven. The gill openings of sharks and rays are called gill slits.

Gill rakers : stout protuberances of the gill arch on the opposite side from the red gill filaments which function in retaining food organisms. They vary greatly in number and length and are important in the classification of fishes.

Gonads : reproductive organs.

Head length : the straight-line measurement of the head taken from the front of the upper lip to the membranous posterior end of the operculum.

Herbivore : a plant-feeding animal.

Hypural : fan-shaped bone forming base of the caudal fin.

Illicium : the 'fishing pole' and 'lure' of lophiiform (pediculate) fishes which is used to attract prey close to the mouth of these fishes.

Inferior tail ridge : a bony ridge along the lower edge of the tail in pipefishes.

Inferior trunk ridge : a bony ridge along the lower edge of the anterior part of the body in pipefishes.

Interdorsal ridge : a tough fold of skin that runs along the middle of the back between the dorsal fins of some sharks.

Interdorsal scales : refers to the scales on the dorsal midline between the first and second dorsal fin.

Intermaxilla : the anterior bone in the upper jaw and situated between the maxilla.

Interopercle : one of the bones comprising the operculum; bordered anterodorsally by the preopercle and posterodorsally by the opercle and subopercle.

Interorbital space : the region on the top of the head between the eyes; measurements may be taken of the least width, either fleshy (to the edges of the orbits) or bony (between the edges of the frontal bones which rim the orbits).

Inter-radial membrane : the soft membrane between fin rays.

Invertebrate : an animal lacking a vertebral column; includes the vast majority of animals on earth such as the corals, the worms, and the insects.

Isthmus : the narrow fleshy forward projection of the body separating the gill openings on each side.

Keel : a bony lateral strengthening ridge.

Lanceolate : lance-shaped, hence gradually tapering to a point; used to describe a caudal fin with very long middle rays. An unusual fin shape most often seen among the gobies.

Lateral : referring to the side or directed toward the side; the opposite of medial.

Lateral line : a sensory organ of fishes which consists of a canal running along the side of the body and communicating via pores through scales to the exterior; functions in perceiving low frequency vibrations, hence provides a sense which might be termed 'touch at a distance.'

Lateral-line scales : the pored scales of the lateral line between the upper end of the gill opening and the base of the caudal fin. The count of this series of scales is of value in the description of fishes. Also of value at times is the number of scales above the lateral line (to the origin of the dorsal fin) and the number below the lateral line (to the origin of the anal fin).

Lateral scales : see midlateral scales.

Lateral trunk ridge : a bony ridge along the middle part of the anterior body of pipefishes.

Leptocephalus : the elongate, highly compressed, transparent larval stage of some primitive teleost fishes such as the tarpon, bonefish and eels.

Lower limb : generally refers to the number of gill rakers on the first gill arch below and including the one at the angle.

Maxilla : a dermal bone of the upper jaw which lies posterior to the premaxilla. On the higher fishes the maxilla is excluded from the gape, and the premaxilla bears the teeth.

Maxillary barbel : the tentacle-like protuberance attached to each end of the upper lip in catfishes.

Medial : toward the middle or median plane of the body; opposite of lateral.

Median fins : the fins in the median plane, hence the dorsal, anal, and caudal fins.

Mental barbels : the slender tentacle-like protuberances on the chin of catfishes.

Midlateral scales : refers to the longitudinal series of scales from the upper edge of the operculum or upper pectoral base to the base of the caudal fin. Generally used for fishes without a lateral line such as gobies and gudgeons.

Molariform : shaped like a molar, hence low, broad, and rounded.

Mollusc : an animal of the Phylum Mollusca; unsegmented with a muscular 'foot' and visceral mass; often protected by one or two shells; includes gastropods (snails and nudibranchs), pelecypods (bivalves such as clams and oysters), cephalopods (such as squids and octopuses), and amphineurans (chitons).

Multiserial : arranged in more than one row.

Nape : the dorsal region of the head posterior to the occiput.

Nasal spine : a small sharp to blunt spine on the snout region of some chandids (Glass Perchlets).

Ocellus : an eye-like marking with a ring of one colour surrounding a spot of another.

Omnivore : an animal which feeds on both plant and animal material.

Opercle : the large bone which forms the upper posterior part of the operculum; often bears one to three backward-directed spines in the higher fishes.

Operculum : gill cover; comprised of the following four bones; opercle, preopercle, interopercle, and subopercle.

Orbital : referring to the orbit or eye.

Order : a major unit in the classification of organisms; an assemblage of related families. The ordinal word ending in the animal kingdom is 'iformes'.

Origin : the beginning; often used for the anterior end of the dorsal or anal fin at the base.

Ovoviviparous : producing eggs which hatch within the body of the mother; the mode of reproduction of most sharks and rays.

Palate : bone on the roof of the mouth lying between the vomer and the upper jaw; the presence or absence of teeth on this bone is of significance in the classification of fishes.

Papilla : a small fleshy protuberance.

Pectoral fin : the fin usually found on each side of the body behind the gill opening; in primitive fishes such as herrings, this pair of fins is lower on the body than in more advanced forms.

Pelagic : pertaining to the open sea (hence not living inshore or on the bottom); oceanic.

Pelvic fin : one of a pair of juxtaposed fins ventrally on the body in front of the anus; varies from abdominal in position in primitive fishes such as herrings to the more anterior locations termed thoracic or jugular in advanced fishes. It is sometimes called the ventral fin.

Pit-organ canal : a row of tiny sensory structures, usually indicated by lines of raised protuberances (papillae). Their pattern is highly diagnostic in gobiioid fishes.

Plankton: a collective term for pelagic animals and plants that drift with currents; though many are motile, they are too small or swim too feebly or aimlessly to resist the sweep of the current. By contrast the animals of the nekton are independent of water movement.

Plicate: pertaining to being folded.

Postdorsal scales : the scales on the mid-dorsal line between the last dorsal fin ray and the caudal fin.

Postpelvic : behind the pelvic fins.

Posttemporal : a bone on the roof of the skull that forms part of its rear margin. It is generally located a short distance above the gill cover.

Preanal length : the measurement from the snout tip to the origin of the anal fin.

Predorsal midline : centre of the head between the snout and beginning of the dorsal fin.

Predorsal scales : the series of scales along the mid-dorsal line between the snout and origin of the dorsal fin.

Premaxilla : the more anterior bone forming the upper jaw. In the higher fishes it extends backward and bears all of the teeth of the jaw. It is this part of the upper jaw which can be protruded by many fishes.

Preopercle : a boomerang-shaped bone, the edges of which form the posterior and lower margins of the cheek region; it is the most anterior of the bones comprising the gill cover. The upper vertical margin is sometimes called the upper limb, and the lower horizontal edge the lower limb; the two limbs meet at the angle of the preopercle.

Preopercular notch : an indentation found on the lower margin of the preopercle.

Preoral length : measurement used for sharks taken between the snout tip and middle of the upper jaw.

Preorbital : the first and usually the largest of the suborbital bones; located along the ventro-anterior rim of the eye. Sometimes called the lachrymal bone.

Prepelvic region : area just in front of the pelvic fins. Sometimes called the breast.

Protrusible : capable of projection as in some jaws.

Pterygiophore : a bone that supports a fin spine.

Ray : the supporting bony elements of fins; includes spines and soft rays.

Rounded : refers to a caudal fin in which the terminal border is smoothly convex.

Rudiment: a structure so deficient in size that it does not perform its normal function; often used in reference to the small nodular gill rakers at the ends of the gill arch.

Scute : an external bony plate or enlarged scale.

Scutella : refers to small, rounded plate-like structures on the body rings of pipefishes.

Segmented rays : the soft rays of the fins which bear cross striations, at least distally.

Serrae : small spine-like projections present on the head bones of many fishes.

Serrate : notched along a free margin; like the edge of a saw.

Snout : the region of the head in front of the eye. Snout length is measured from the front of the upper lip to the anterior edge of the eye.

Soft ray : a segmented fin ray which is composed of two closely joined lateral elements. It is nearly always flexible and often branched.

Spatulate : flattened, sometimes used to describe tooth shape.

Species : the fundamental unit in the classification of animals and plants consisting of a population of individuals which freely interbreed with one another. The word "'species' is both singular and plural.

Spine : an unsegmented bony process consisting of a single element which is usually rigid and sharply pointed. Those spines which support fins are never branched.

Spiracle : an opening between the eye and the first gill slit of sharks and rays which leads to the pharyngeal cavity.

Standard length : the length of a fish from the front of the upper lip to the posterior end of the vertebral column (the last element of which, the hypural plate, is somewhat broadened and forms the bony support for the caudal fin rays).

Stripe : a horizontal straight-sided colour marking.

Subdorsal trunk rings : the trunk body segments that are situated immediately below the dorsal fin of pipefishes (see trunk rings).

Subopercle : an elongate flat dermal bone which is one of the four comprising the operculum; lies below the opercle and forms the ventroposterior margin of the operculum.

Supramaxilla : a flattened bone attached just above the main jaw bone (maxilla). Its shape is often diagnostic in clupeoid fishes.

Supraorbital : the region bordering the upper edge of the eye.

Supraorbital ridge : a bony crest above the eye.

Supraorbital spine : a small bony protuberance situated above the eye.

Supratemporal : a bone on the roof of the skull located between the dorsal mid-line and the upper margin of the gill cover. It is sometimes referred to as the pterotic.

Synonym : an invalid scientific name of an organism proposed after the accepted name.

Tail : refers to the rear portion of the body posterior to the anus.

Tail rings : body segments of a pipefish located between the anus and the base of the caudal fin.

Total length : the length of a fish from the front of whichever jaw is most anterior to the end of the longest caudal ray.

Transverse scales : series of scales in a vertical row, often counted between the dorsal and anal fin bases.

Truncate : square-ended; used to describe a caudal fin with a vertically straight terminal border and angular or slightly rounded corners.

Trunk : the portion of the body between the rear edge of the head and the anus.

Trunk rings : body segments of a pipefish located between the pectoral fin and the anus.

Uniserial : arranged in a single row.

Ventral : toward the lower part of the body; the opposite of dorsal.

Vertebrae : the bones that constitute the main or central supporting structure of the body. The total number, detected by x-rays, is often a useful feature for differentiating closely related species.

Vertical scale rows : see midlateral scales.

Vomer : a median unpaired bone toward the front of the roof of the mouth, the anterior end of which often bears teeth.

Index

C

D

E

M

N

O

P

Q

R

S

Colour Plate Section

(Paintings by Roger Swainston)

Plate I - Miscellaneous Fishes

Plate II - Fork-Tailed Catfishes

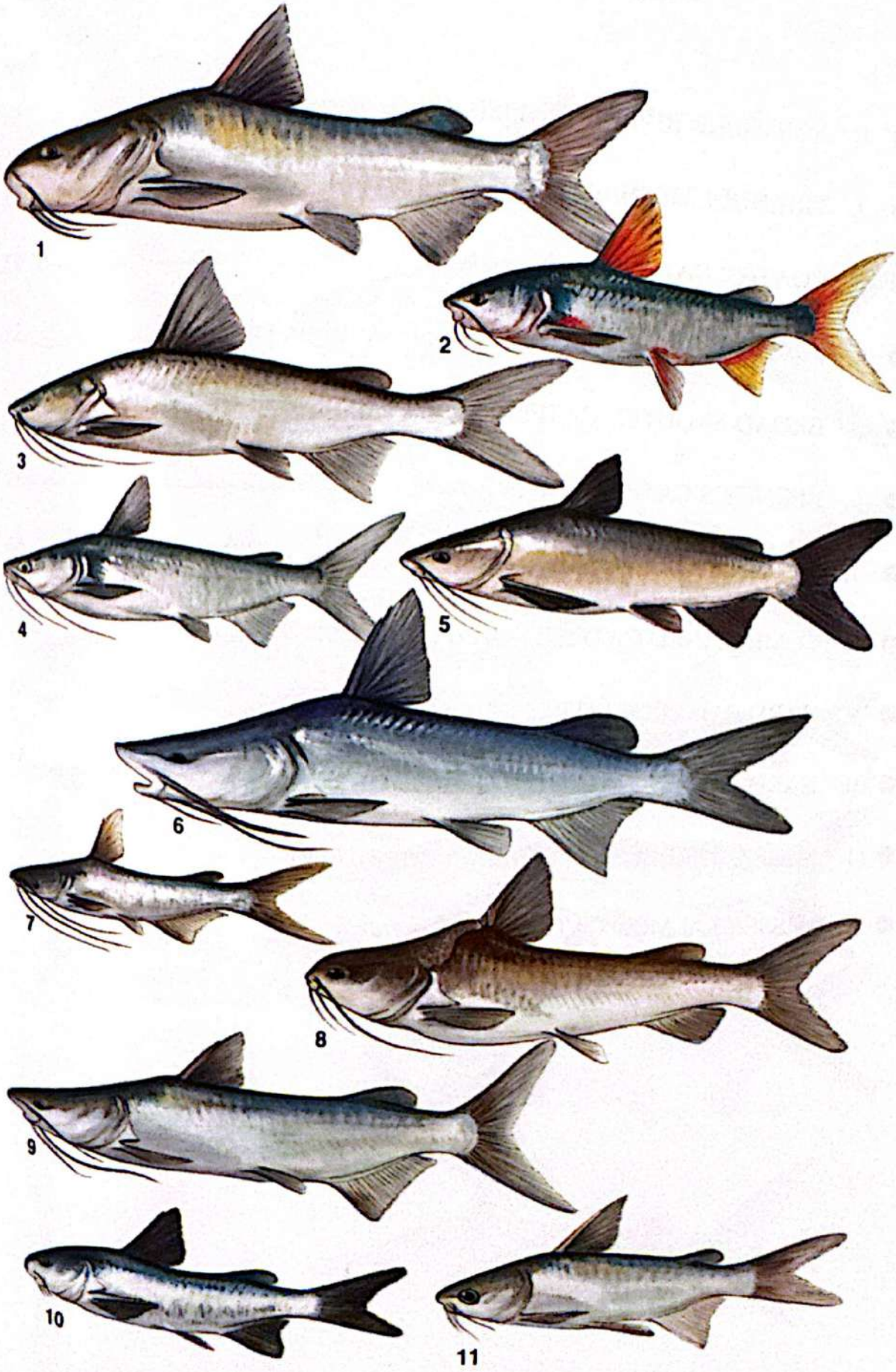


Plate III - Fork-tailed Catfishes

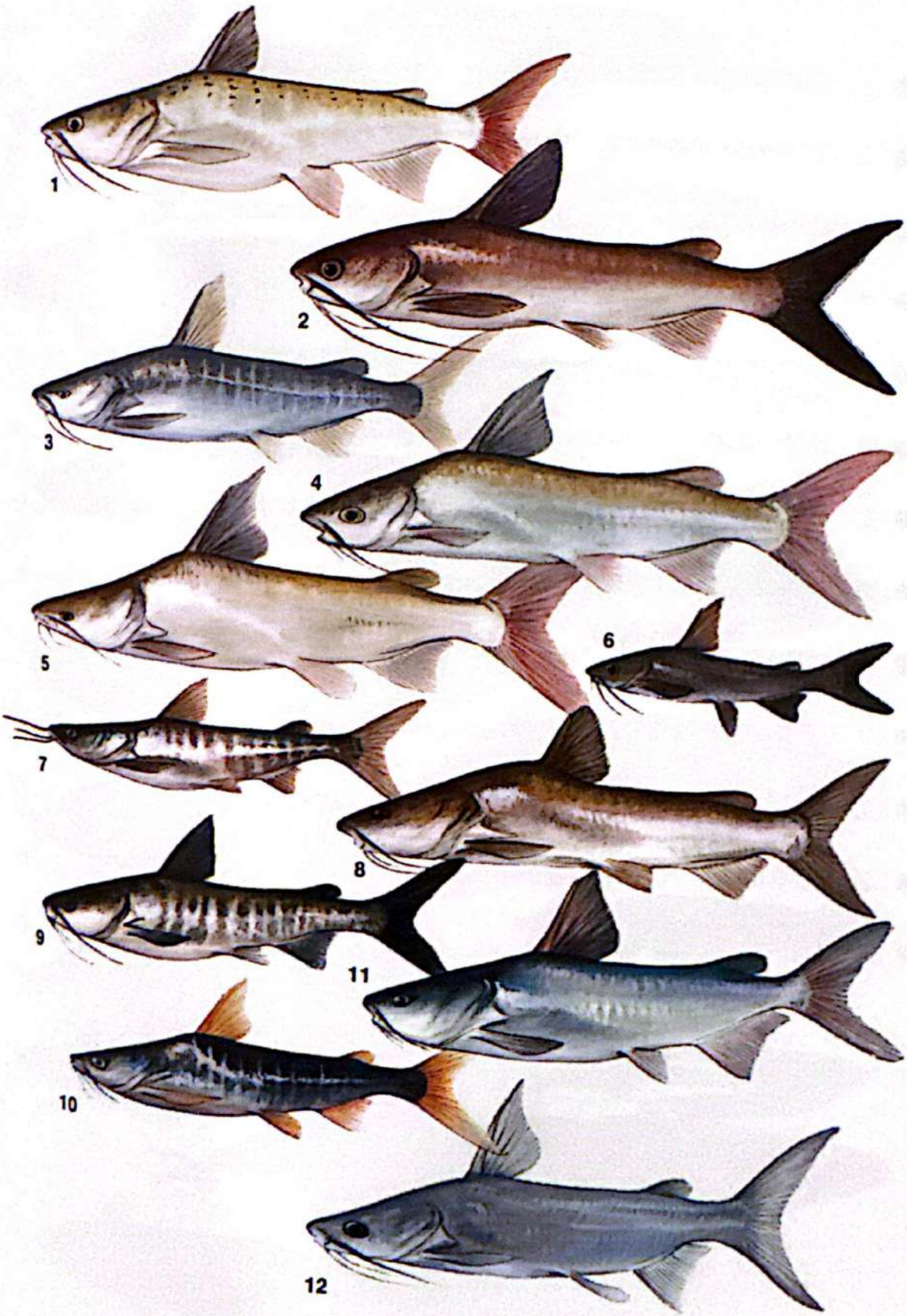


Plate IV - Eel-Tailed Catfishes

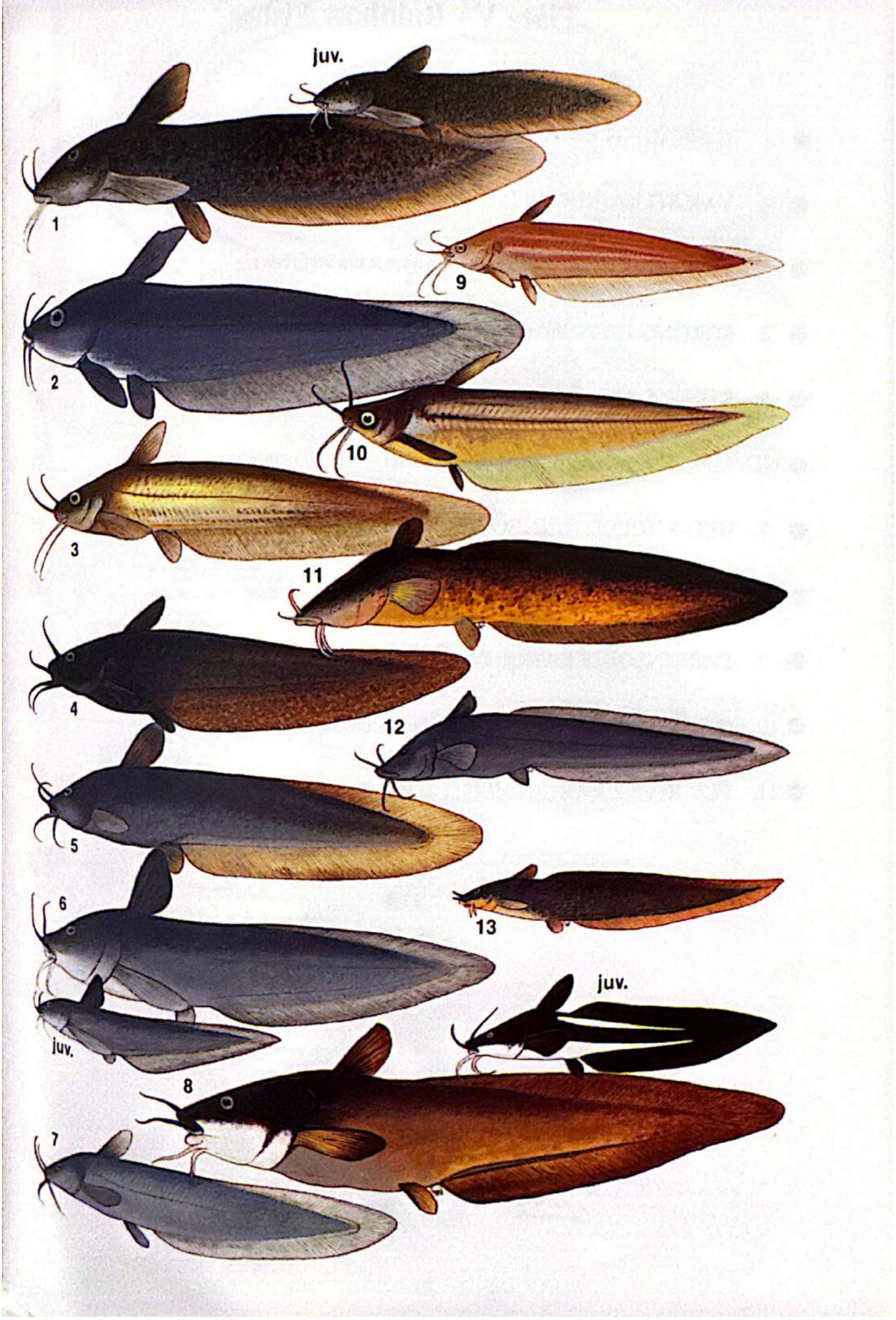
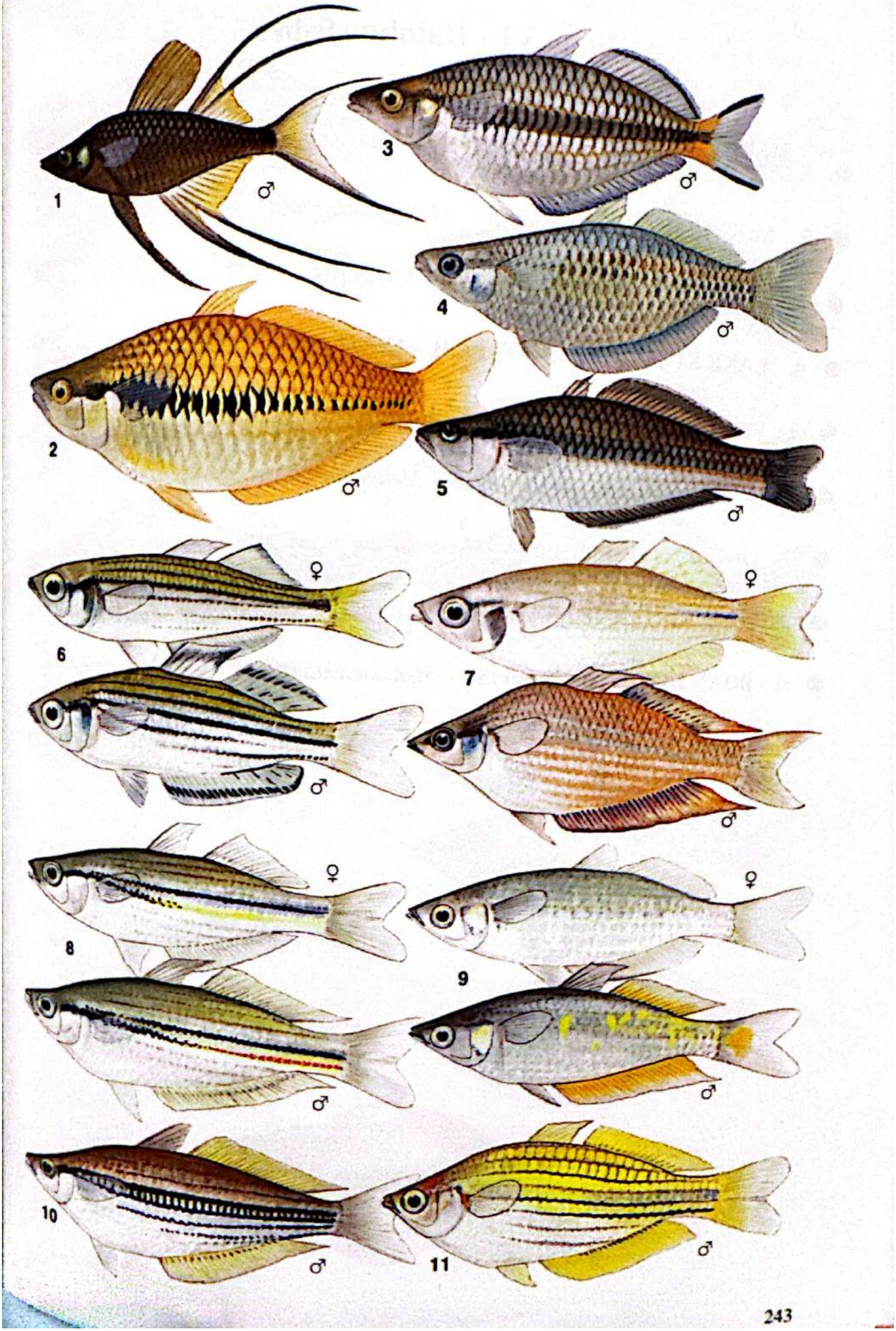


Plate V - Rainbow Fishes



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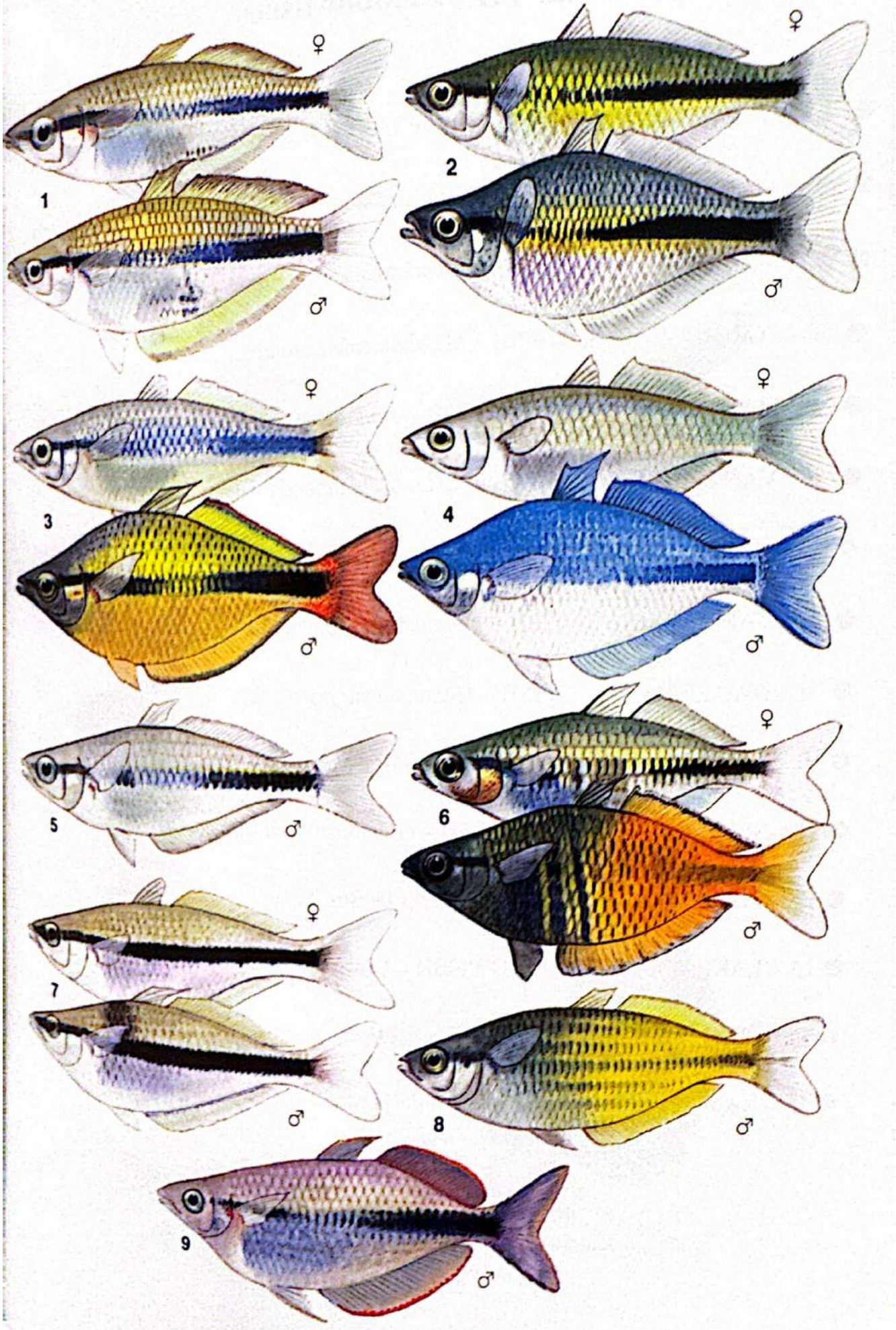

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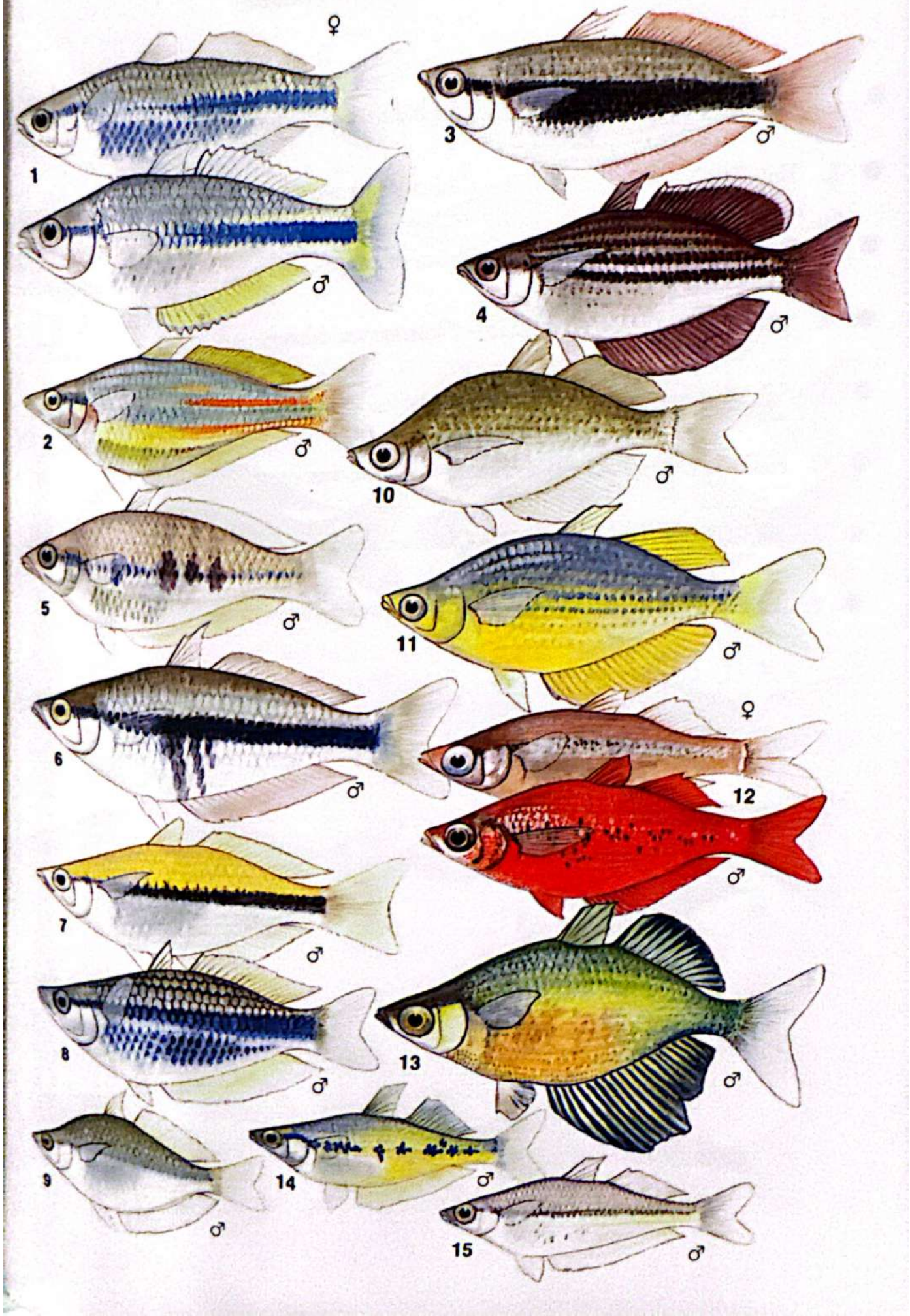
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Plate VIII - Rainbowfishes

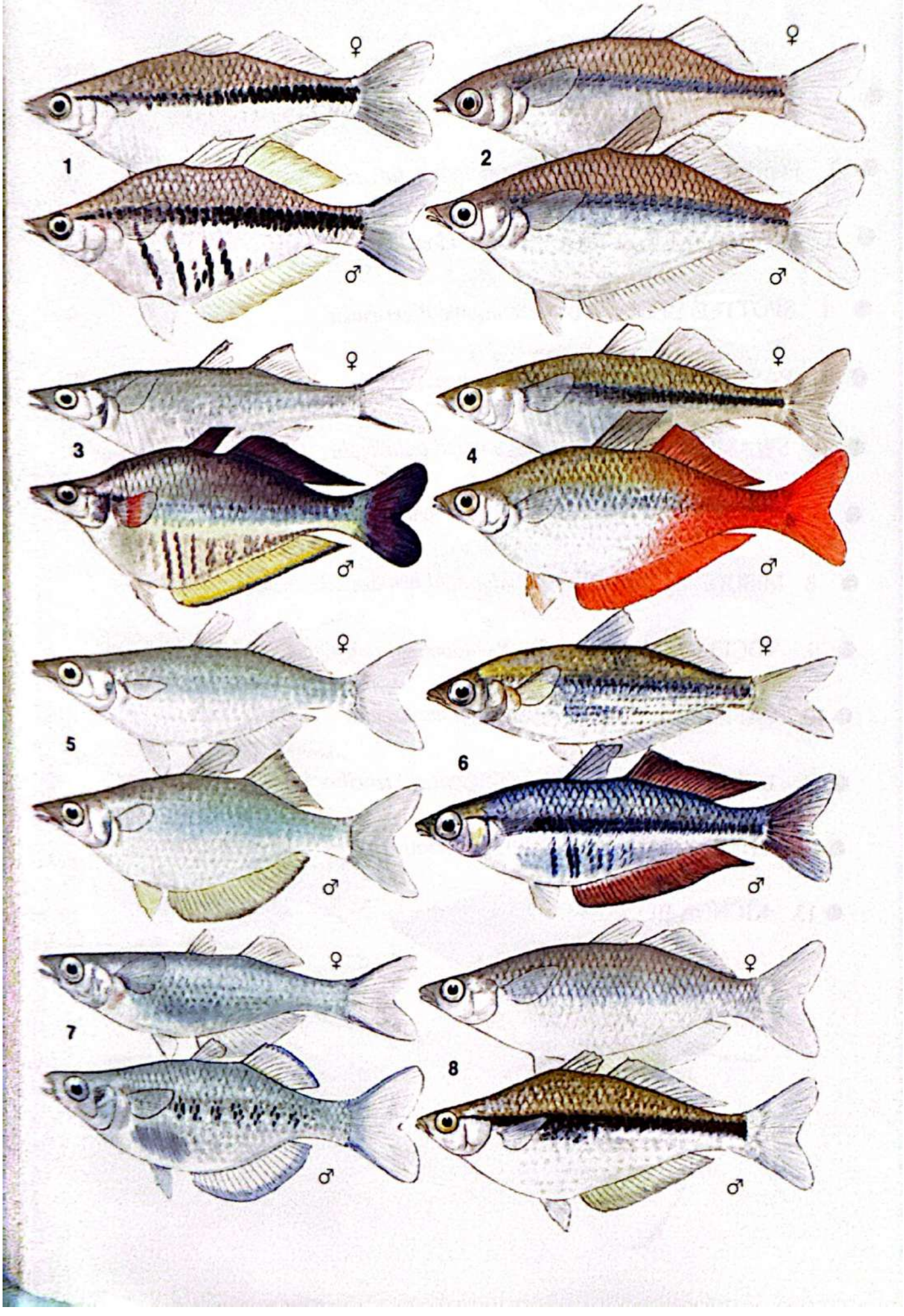

Plate IX - Blue-Eyes


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Plate X - Glass Perchlets

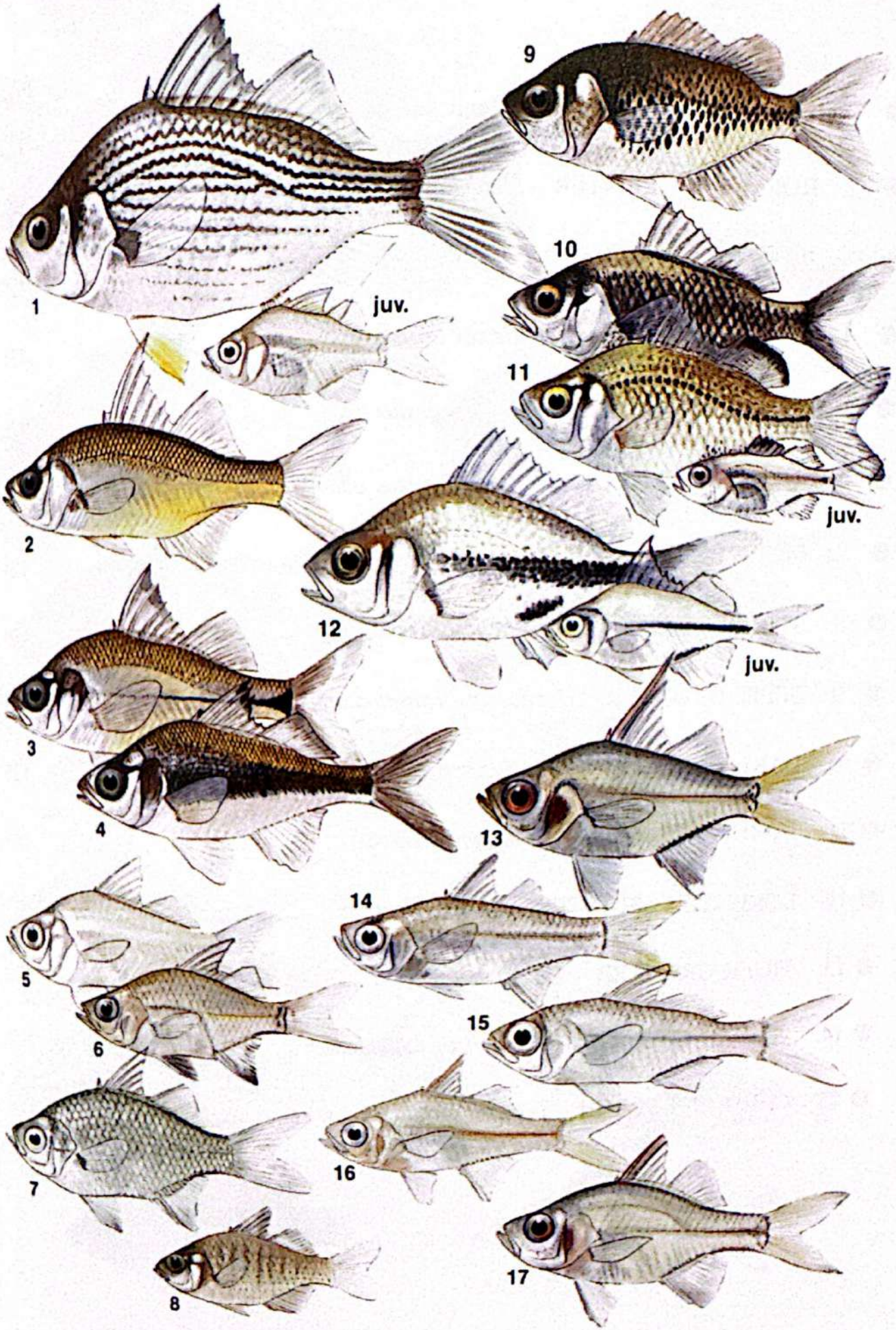

Plate XI - Grunters

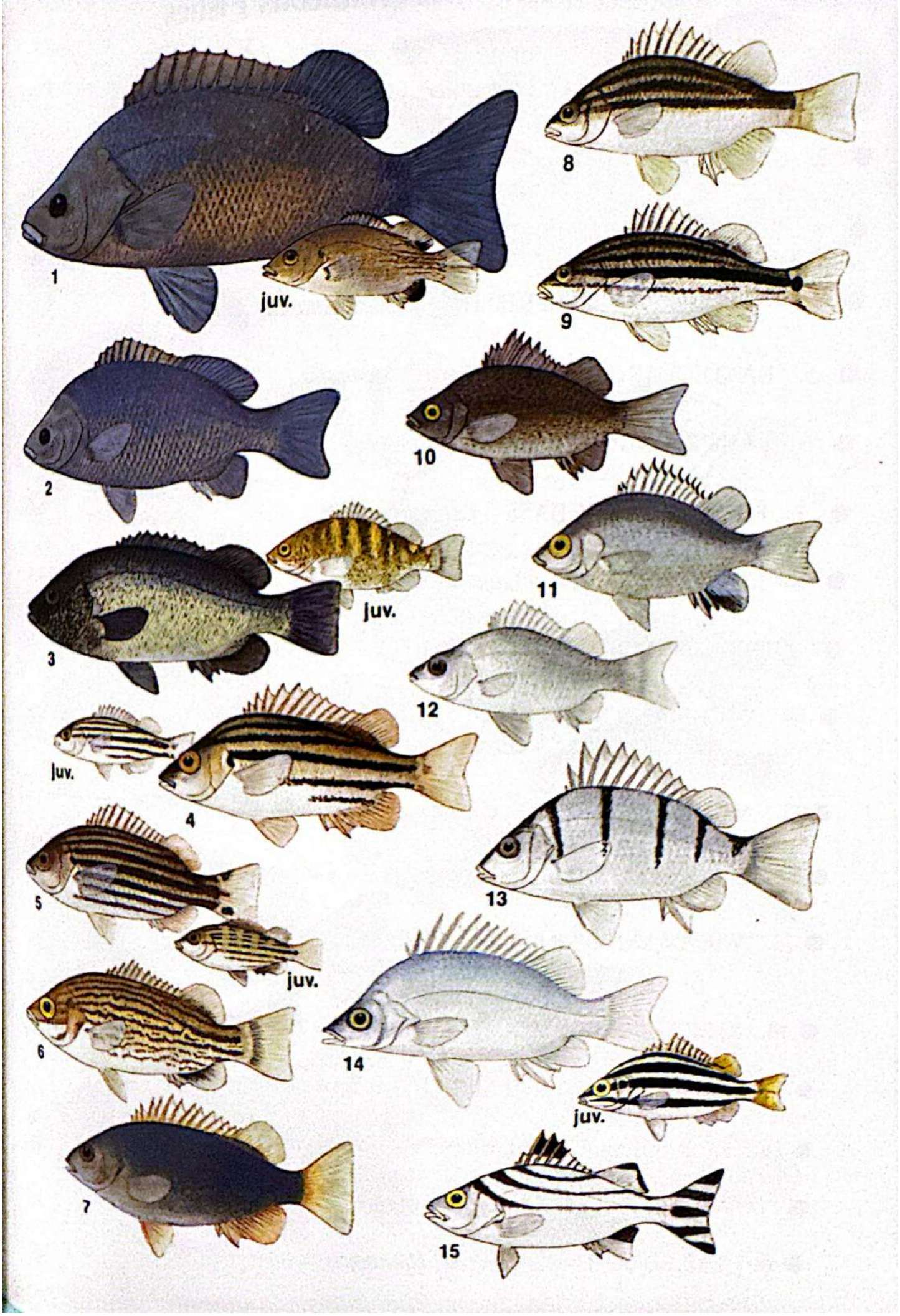
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PLATE XII - Miscellaneous Fishes

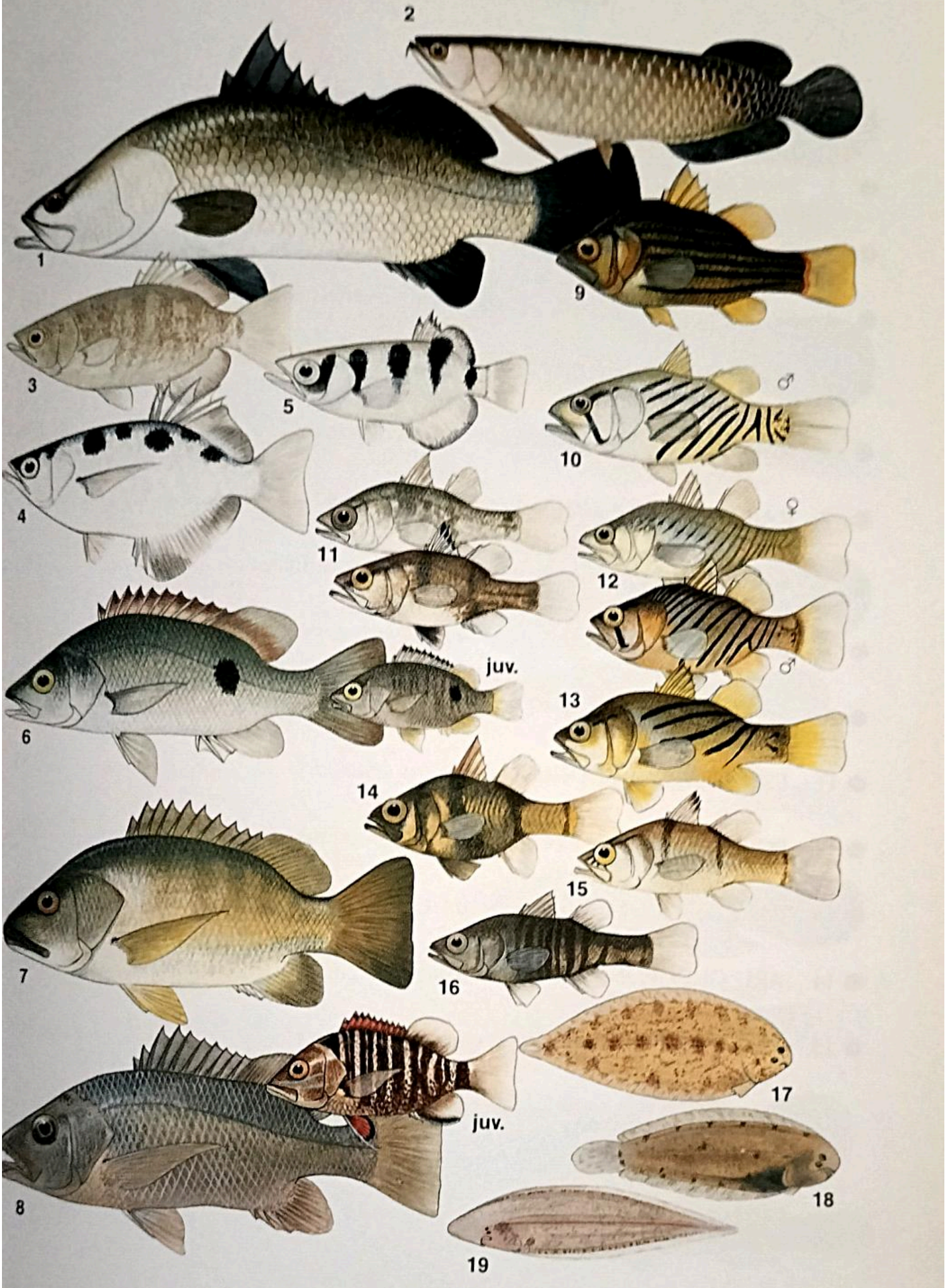
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Plate XIII - Gudgeons


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Plate XIV - Gudgeons

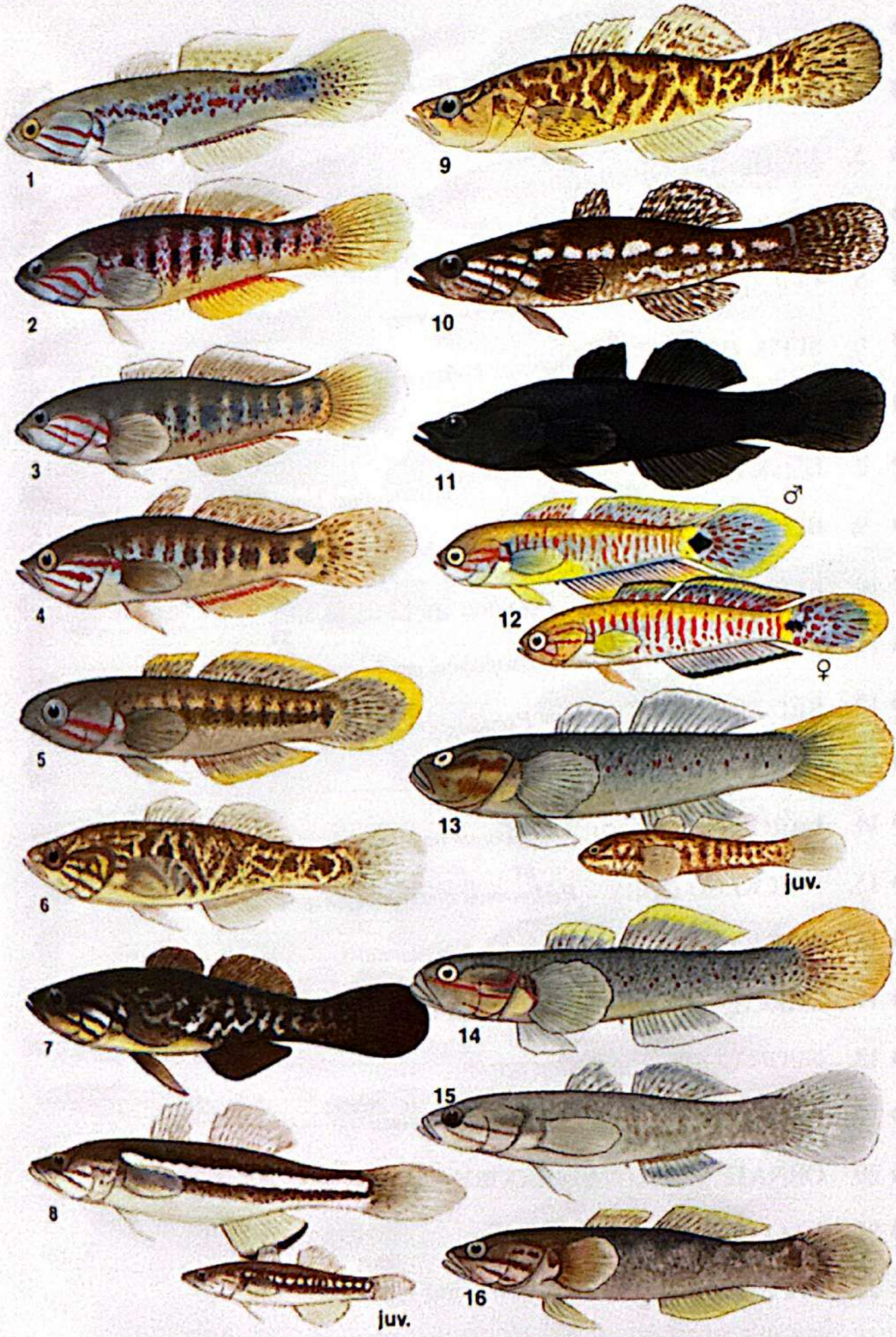

Plate XV - Gobies

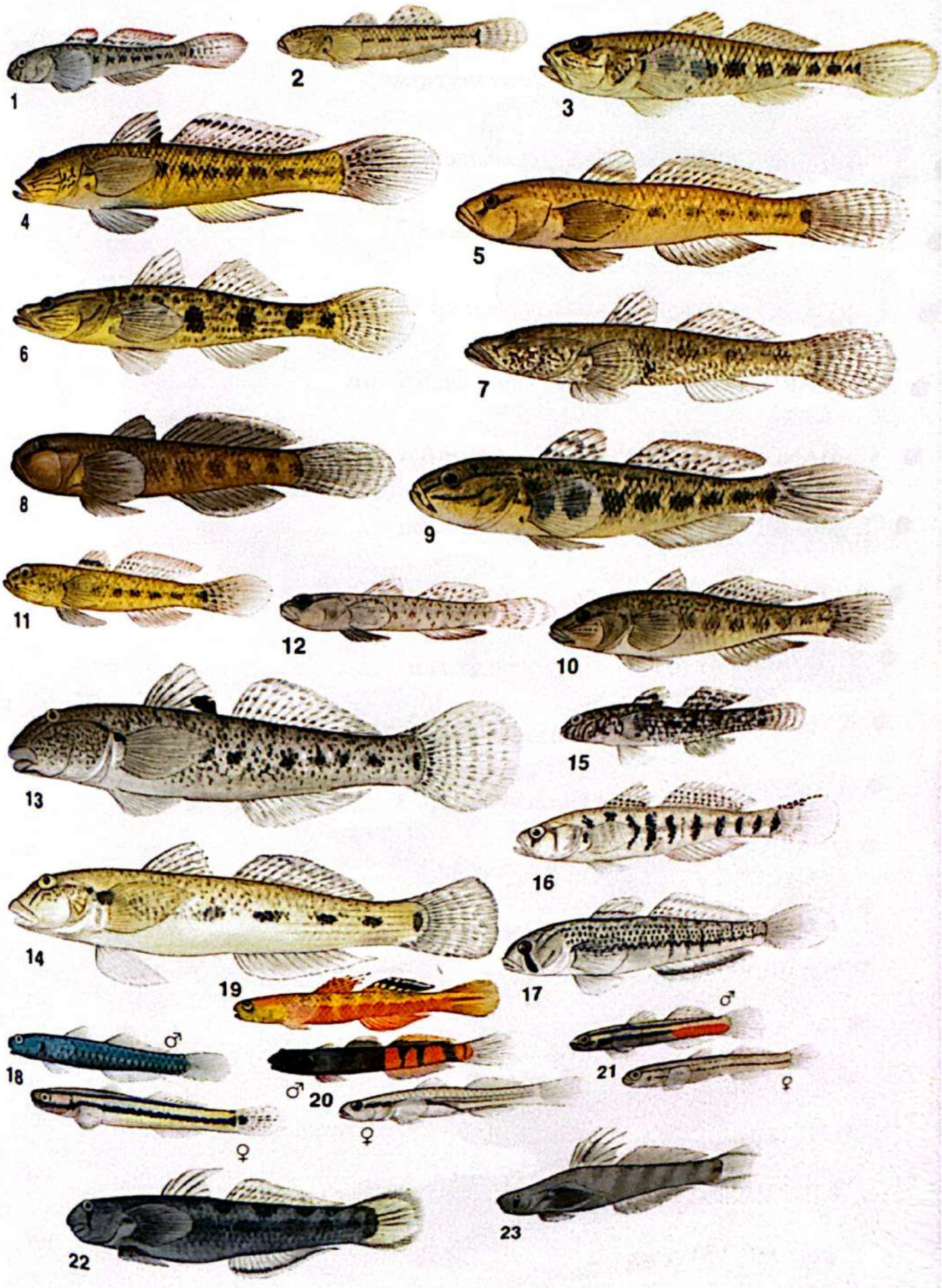
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Plate XVI - Gobies

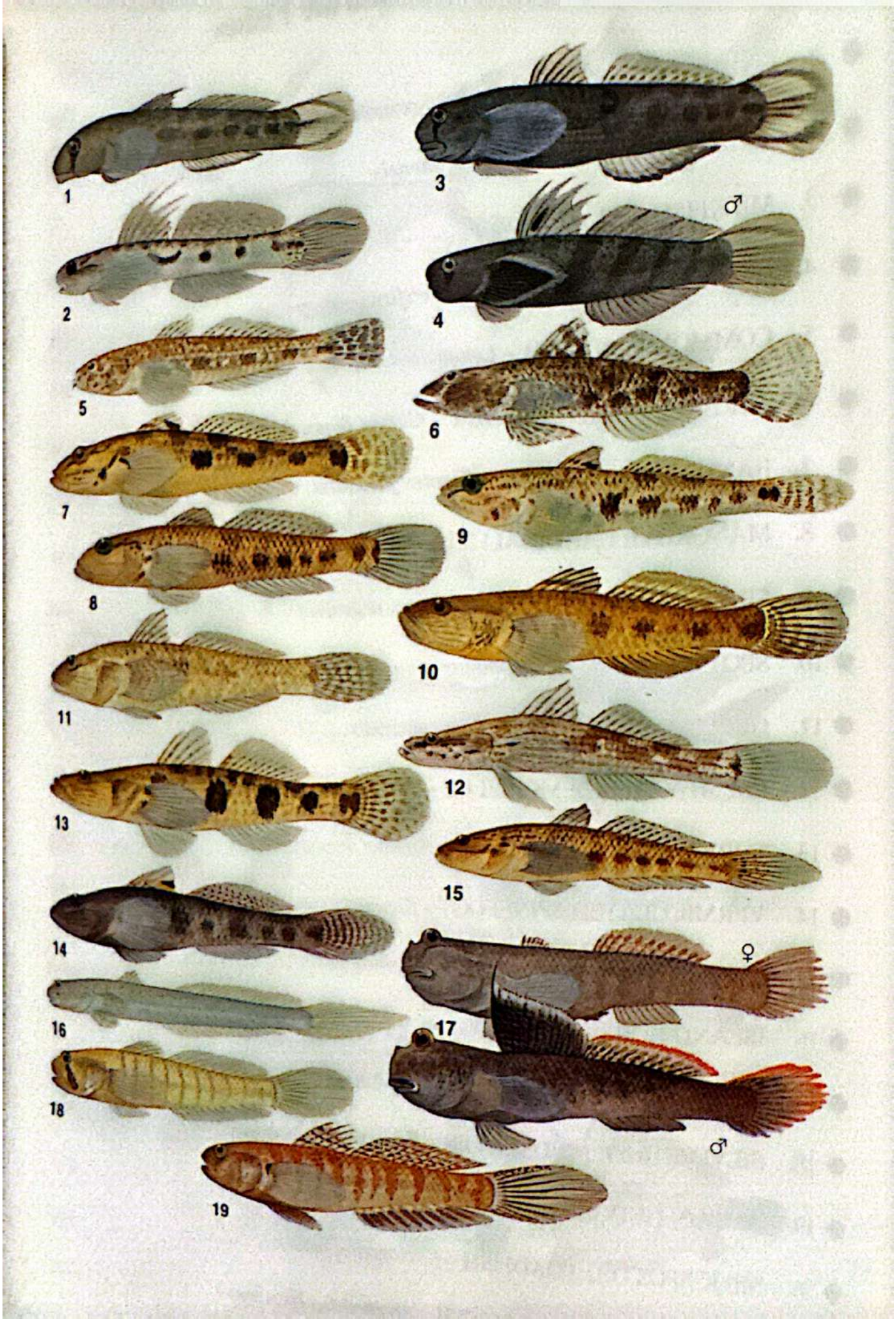


Plate XVII - Estuarine Fishes

Page

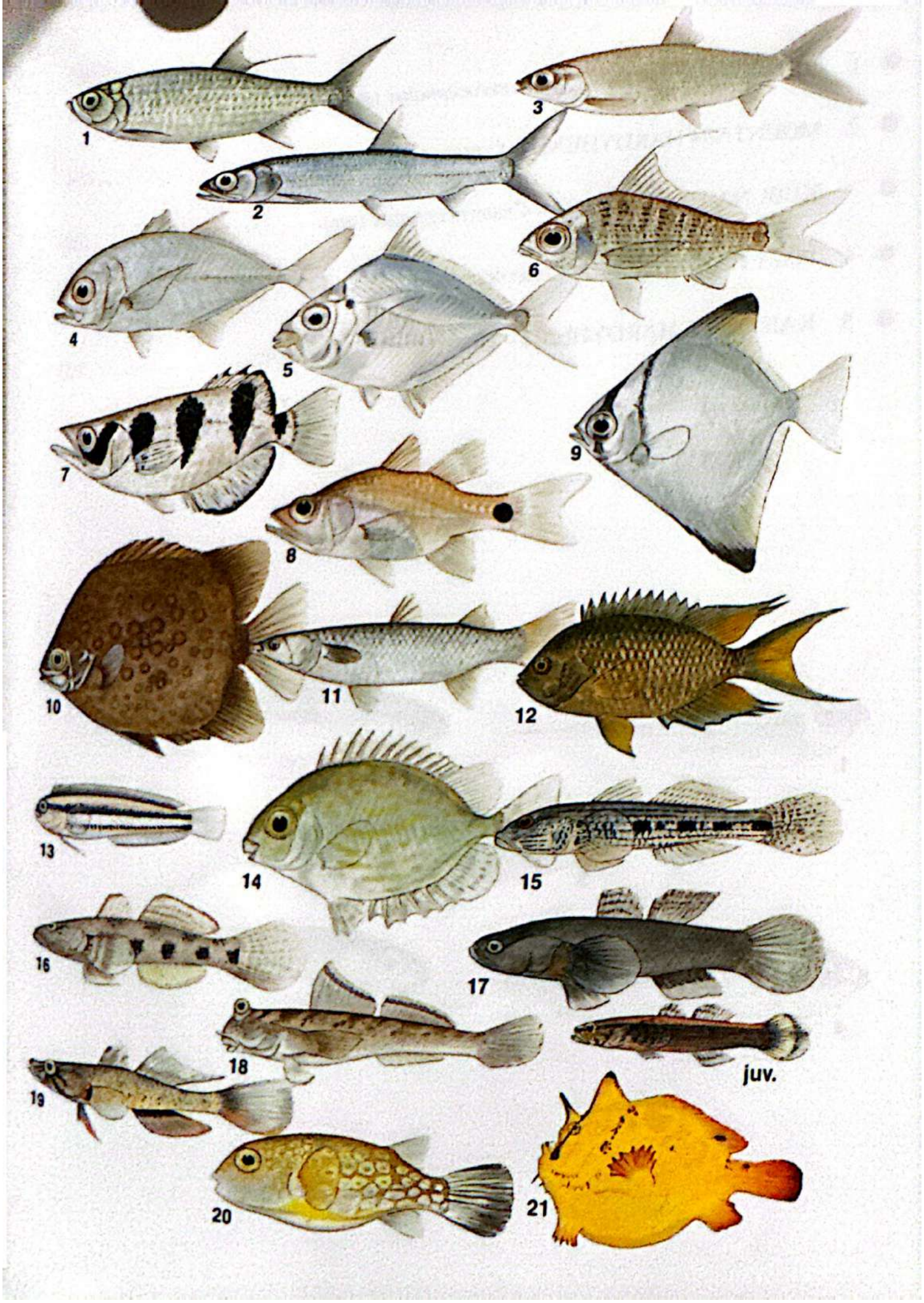
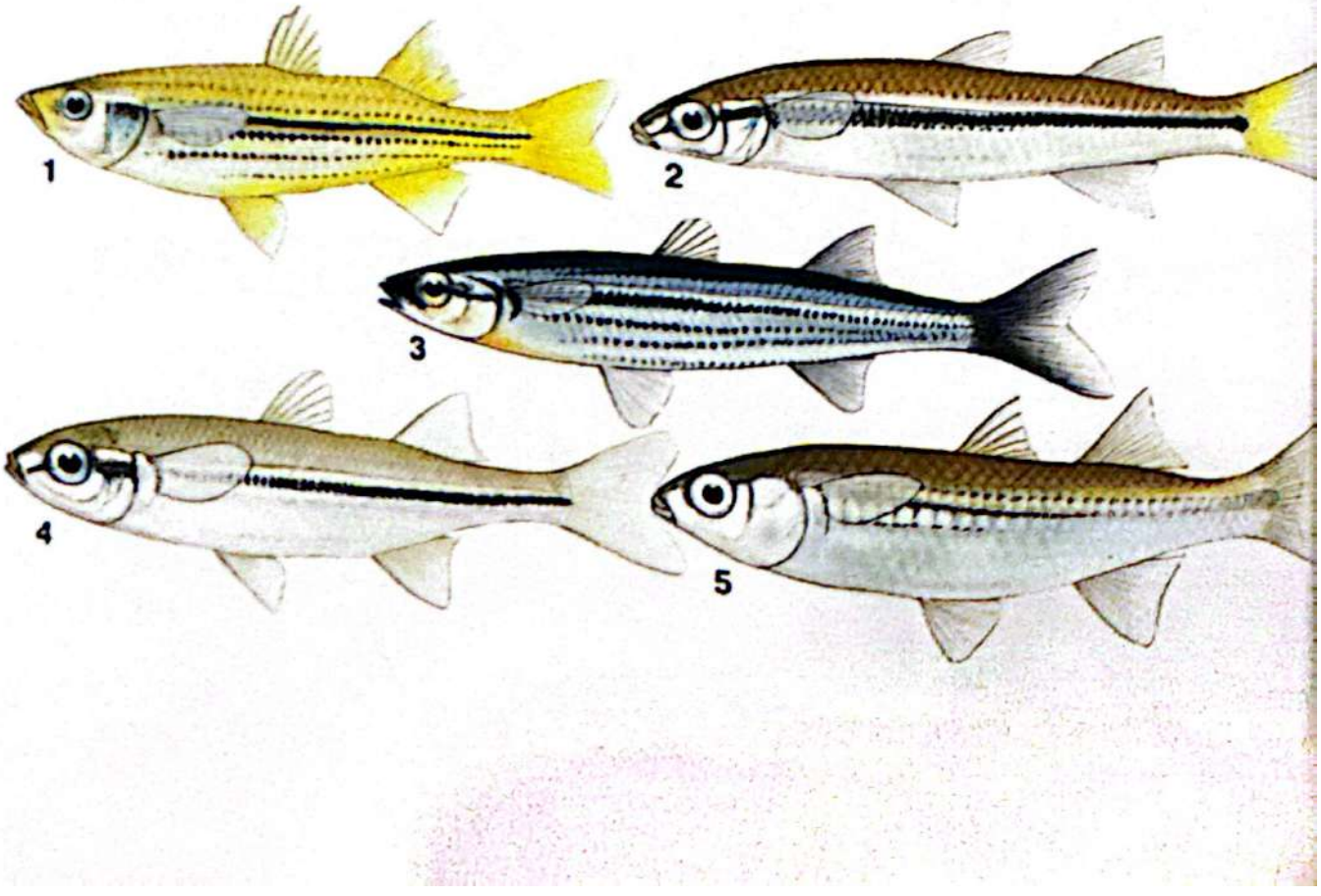
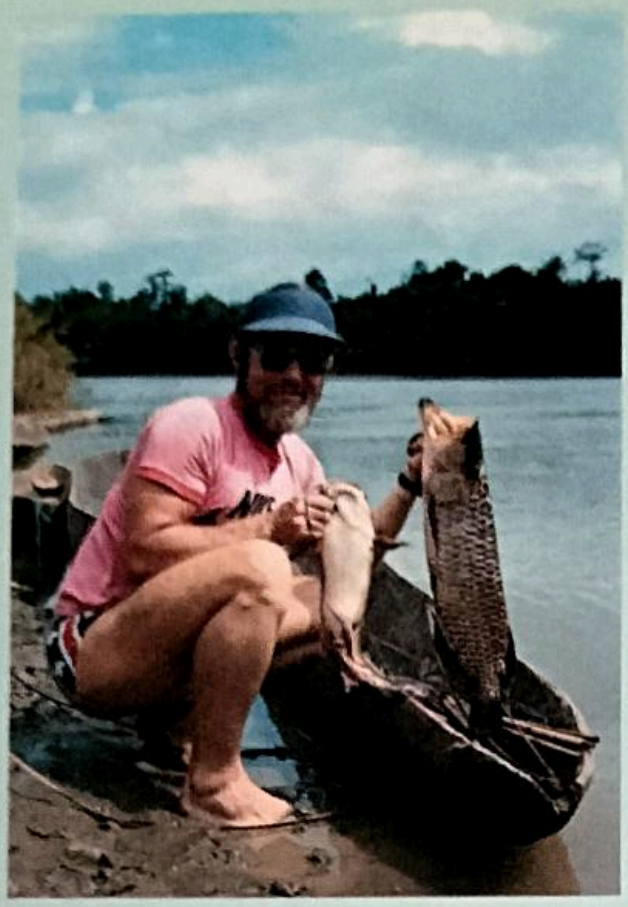


Plate XVIII - Hardyheads





About the Author -
Dr. Gerald R. Allen

The author of more than 160 scientific articles and 15 books, Dr. Allen is an internationally recognised authority on the freshwater fishes of the Australia-New Guinea region and the classification of Indo-Pacific coral reef fishes. He has been Head Curator in the Department of Ichthyology at the Western Australian Museum in Perth since 1974. Dr. Allen first visited New Guinea in 1972. Since then he has returned for 10 visits and lists New Guinea as his favourite worldwide travel destination. Dr. Allen lives with his wife Connie, and two sons Tony and Mark in Roleystone, a scenic Perth suburb.