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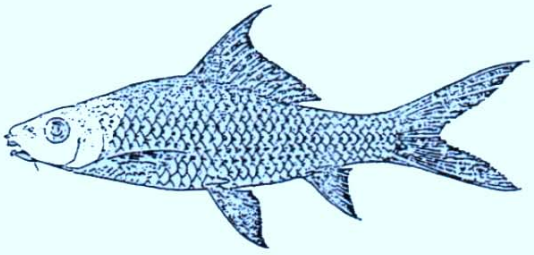
SYSTEMATIC REVISION OF SOUTHEASTERN ASIATIC CYPRINID FISH GENUS *OSTEOCHILUS* WITH DESCRIPTION OF TWO NEW SPECIES AND A NEW SUBSPECIES

by

Jaranthada Karnasuta



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ABSTRACT

The cyprinid fish genus *Osteochilus* is revised using data obtained from meristic counts, morphometric measurements, and an osteological analysis. Some cladistic techniques were used in erecting a phylogeny but the evolutionary approach was employed in translating the phylogenetic information into a classification. In those species for which specimens were not available (none of which are valid species of *Osteochilus*), data from the literature were carefully evaluated. Fifty-one nominal species have been assined to *Osteochilus* at one time or another of which 16 species are removed from the genus and three others are of uncertain status and are only provisionally retained in *Osteochilus*. Twenty-one valid species are redescribed. Two new species and one new subspecies are described, making 23 species of *Osteochilus* recognized in this study.

Osteochilus is probably derived from a *Labeo*-like ancestor, since the two genera share many common characteristics. The distinguishing features of the genera are regarded as specializations from the more generalizd condition in the subfamily. With our present knowledge it is difficult to say which genus, *Labeo* of *Osteochilus*, is the more primitive.

The center of origin, evolution, and radiation of *Osteochilus* was examined on the basis of the specimens studied and from the literature. The center of abundance of *Osteochilus* species is in the western Borneo and southern Sumatra area, where there are 13 and 12 species, respectively. The occurrence of the same species on the mainland of Southeast Asia and on the islands of Sumatra, Borneo, and Java is probably explained by the fact that these land masses were once connected during the Pleistocene when the sea level dropped by 100 metres. Some species are unevenly distributed which indicates either that some species have been extirpated regionally because of unfavorable factors, that they arose after the land masses were separated, or the more extensive field collecting activities are needed in order to reveal a more cohesive pattern of distribution. Regrettably, it is still impossbile to pinpoint a subregion of southeastern Asia as the center of oringin for the genus.

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to everyone who aided me in various ways throughout this study, and especially to the persons listed below. Dr. J. S. Nelson was foremost in support and guidance, and has been of great aid throughout my study I greatly appreciate the suggestions and criticisms offered by Dr. T. R. Roberts. who providing specimens and collection data from the Kapaus River and gave me full support and guidance. I also extend my appreciation to Dr. R. M. Bailey for suggesting the topic for my study and for his help during the initial stages of this research.

I am indebted to Dr. M. Boeseman (RMNH), Dr. R. F. lnger and Dr. D. J. Stewart (FMNH), Dr. H. Nijssen (ZMA), Mme. Marie-Louise Bouchot (MHNP), Dr. C. L. Smith and Ms. C. Huthcings (AMNH), Dr. K. C. Jayaram (ZSI), Mr. A. Wheeler and Mr. G. J. Howes (BMNH), Dr. J. Bohlke (ANSP), Dr. C. A. Lachner (NMNH), and Ms. Ellie Baker (UMMZ) for their hospitality and facilities during my visits to their museums and lso for the loan of specimens. special thank to Dr. G. M. Reid who gave me a alot of in formation of Labeine interelation-ship and thank to Dr. M. Kottelat who gave me information on some fish.

My parents were a continuous source of encouragment and gave unquestioning and steadfast support.I also heartily thank my friends who have contributed to this endeavour in many ways, and to whom I shall always be grateful.

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INTRODUCTION

This study is concerned with the comparative morphology, systematics, and zoogeography of *Osteochilus,* a genus of tropical Oriental fishes belonging to the family Cyprinidae, The world's largest family of vertebrates. Like other members of Cyprinidae they are confined to freshwater. All species of the genus are restricted to southeastern Asia. They extend from southern Burma, eastward to Thailand and Indochina, southward to Malay Peninsula and islands of the Indo-Australian Archipelago within the limits of the Southeast Asiatic contiental shelf, and northward to southern China.

Species of *Osteochilus* are mostly small to medium size fishes; the largest species reaches about 50 cm in length while the smallest species is only 6-7 cm long. They are quite common throughout their range, especially in river systems. Many species inhabit mountain streams of tropical rain forests which characterize the tropical island habitats or the mainland habitats not far from the sea. Some river (or lake) lowland species are migratory; they leave the river (or lake) to spawn in paddy fields or flooded areas during the rainy season, a time when these areas are very productive and good hiding places for young fishes. After the breeding season they generally occur in schools when migrating back to the rivers (of lakes) The natural history of the mountain stream species is poorly known.

Oteochilus, along with other freshwater fishes, is used as food by the people of Southeast Asia. Small individuals of this genus and also of other cyprinids are commonly used to make fish sauce which is an important condiment. Two or three species are actively traded as aquarium fishes, with export to Europe and North America.

Fishes of this genus were first studied by Valenciennes in Cuvier and Valenciennes (1842), followed by Bleeker (1852-1863) Both ichthyologists placed the species in the genus *Rohita* Valenciennes (1842). Gunther (1868) recognized and named the genus *Osteochilus* and regarded *Rohita* as a junior synonym of *Labeo* Cuvier (1817). After this time more species were described. fusion and multiplication of taxa occurred by later ichthyologists, but there has not been a complete revision of the genus since the time of Bleeker (1863) and Gunther (1868).

MATERIALS AND METHODS

I. List of Institutions

Facilities and specimens used in this study were provided by the following institutions.

Institutions	Abberviation
Academy of Natural Sciences of Philadelphia,U.S.A.	ANSP
American Museum of Natural History, New York,U.S.A.	AMNH
British Museum of Natural History, London, U.K.	BMNH
California Academy of Sciences, San Francisco,U.S.A.	CAS
Field Museum of Natural History, Chicago,U.S.A.	FMNH
Museum National d'Histoire Naturelle, Paris, France	MHNP
Museum of Zoology, The University of Michigan,U.S.A.	UMMZ
Museum of Zoology, University of Singapore, Singspore (Raffles Museum Collection)	NMS
Rijksmuseum van Natuurlijke Historie, Leiden, Netherland	RMNH
United States National Museum of Natural History (Smithsonian Institution), Washington, D.C., U.S.A.	USNM
Zoological Survey of India, Calcutta, India	ZSI
Zoologisch Museum, Amsterdam, Netherland	ZMA
National Inland Fisheries Institute Collection, Bangkok, Thailand, (uncatalogued)	NIFI
Kapaus collection of Dr. Tyson R. Roberts (uncatalogued)	KCTR

II. Measuring and Counting Methods

Most of the data are original counts of scales, finrays, vertebrae, gill rakers, measurements of body parts, and descriptions of osteological and other morphological features; they were supplemented where necessary from the literature. Cleared and stained specimens, using Taylor's (1967) method, were prepared and studied to assist in stying the problems of relationship.

Measurements were made in a straight line with dial calipers and recorded to the nearest millimeter. Proportions are expressed in thousandths of standard length unless otherwise stated. Most measurements and counts for this study were made following the methods recommended by Hubbs & Lagler (1958), and all are defined below

Standard length - distance form tip of snout to the posterior edge of hypural plate.

Head length - distance from tip of snout to the posterior edge of opercle. The membranous opercular flap is not included in this measurement.

Eye diameter - distance between anterior and posterior edge of eye ball. In case where the eye was damaged, measuring the orbit gives a reliable figure.

Snout length - distance from tip of snout, at midline of upper lip, to anterior rim of orbit.

Interorbital space - width at narrowest point between upper membranous rim of each orbit

Body depth - measured at deepest part of body at origin of dorsal fin.

Predorsal distance - distance between snout tip and origin of dorsal fin.

Preanal distance - same as above except to origin of anal fin.

Dorsal fin length - base length between first and last ray.

Dorsal fin height - length of fouth (the longest) simple dorsal ray

Pectoral fin length - measured from origin of fin to the tip of longest pectoral ray.

Pelvic fin length - length of first fin ray.

Anal fin height - length from the base to the tip of longest ray.

Length of the caudal peduncle - distance between end of anal base and ventral origin of caudal fin.

Depth of caudal peduncle - depth at the narrowest part of the peduncle, when caudal fin is spread.

Dorsal fin rays - number of branched rays, the last of which may be split at base. In *Osteochilus,* there are four anterior simple rays, of which tree are slender and short, and the fourth is strong and the longest The number of the simple rays is the same in all species.

Pectorasl fin rays - total number of branched rays plus the one simple ray.

Pelvic fin rays - total number of branched rays plus the one simple ray. There are nine pelvic fin rays in all species of *Osteochilus.*

Anal fin rays - number of rays in anal fin. There are typically three simple rays and five branched rays in all species of *Osteochilus.* The last branched ray is usually split near the base.

Lateral line scales - number of pored scales on body form the anterior scale in contact with shoulder girdle to hypural plate (the number of scales behind the hypural plate is given in parenthesis).

Predorsal scales - number of scales form first row on nape to origin of dorsal fin. In some species of *Osteochilus,* the predorsal scales are smaller than the body scacles, so the number of predorsal scales is counted respectively to the oblique row of body scales.

Circumferential scales - number of scale rows around the body immediately in advance of origin of dorsal fin, stated in a formula giving number above the lateral line, on the lateral line, and below the lateral line, e.g., 11/2/13.

Transverse scales - number of transverse scales form the origin of dorsal fin downward to (but excluding) lateral line, and from scale in front of the axillary pelvic scale, or that scale which touches the pelvic fin insertion, upward to (but excluding) lateral line.

Circumpeduncular scales - number of scale rows counted around narrowest part of caudal peduncle

Number of lateral line scales opposite origin of dorsal fin - number of lateral line scales from first scales behind cleithrum to vertical line from origin of dorsal fin.

Number of lateral line scales opposite the insertion of dorsal fin - same as above except to the vertical line from insertion of last dorsal ray.

Number of lateral line scales opposite origin of pelvic fin - same as above except to vertical line from insertion of pelvic fin.

Number of lateral line scales opposite origin of anal fin - same as above except to vertical line from origing of anal fin.

Number of lateral line scales opposite tip of pectoral fin - same as above except to vertical line from tip of pectoral fin.

Insertion of dorsal fin - the point at the posterior end of the base of dorsal fin.

Number of lateral line scales between the vertical line from insertion of dorsal fin to vertical line from origin of anal fin - in the descriptions a minus figure indicates the number of lateral line scales when the anal fin origin is anterior to the dorsal fin insertion.

Gill rakers - total number of gill rakers on the first gill arch on right side.

INTRODUCTION TO THE GENUS *OSTEOCHILUS*

Nomenclatural History and Problems

I. The Genus.

Gunter (1868) proposed the generic name *Osteochilus* in "Catalogue of Fishes in the British Museum", Vol. 7, p.40. which has been accepted by all subsequent workers.

The type species of the genus, *Osteochilus melanopleurus,* was designated by Jordan (1919,p.351) (first species of the genus listed in Gunther 1868).

Diplocheilichthys is an older name than *Osteochilus* but it was used only as a senior synonym by Bleeker (1860, 1863) and treated since then by Gunther (1868) and Weber and de Beaufort (1916) only, as a junior synonym of *Labeo.* Bleeker (1860) proposed the monotypic genus *Diplocheilichthys* for *Lobocheilos pleurotaenia* Bleeker (1855). Having examined the syntypes and many other specimens and the osteology of the species, I believe that it belongs to the genus *Osteochilus.* The name *Diplocheilichthys,* is not associated currently with *Osteochilus* by any ichthyologist while *Osteochilus* is well-known among ichthyologists in Asia, North America, and Europe. Therefore, I intend to appeal to the International Commission of Zoological Nomeclature to retain the name *Osteochilus* as the senior synonym and suppress *Diplocheilichthys.*

Some other species that I place in *Osteochilus* were originally described in other genera (*Rohita,* and *Dangila)* but none is a type species of those genera, consequently, there are no other synonyme for *Osteochilus.*

II . The Species.

The systematic study of the freshwater fishes of Southeast Asia started in the early nineteenth century during the period of European colonization. Species of *Osteochilus* were first described by the French ichthyologist Valenciennes (1842) in volume 16 of "Histoire Naturelle des Poissons" by Cuvier and Valenciennes. During 1852-1860 the famous Dutch ichthyologist Dr. P. Bleeker described many new species of *Osteochilus* from the East Indies (Indonesia) and in 1863 published the Atlas which included descriptions (in Latin) and illustrations of all *Osteochilus* that had been described. However, both Valenciennes and Bleeker placed the species under the genus *Rohita* Val. (1842) which also included *Labeo* Cuvier (1817) in part.

Gunther (1868) recognized and named the genus *Osteochilus* and regarded *Rohita* as a junior synonym of *Labeo.* There have been no complete monographs of the genus since Bleeker (1863) and Gunther (1868) ; at that time 14 species were recognized. In 1905, Popta described five more new species from central Borneo. A partial revision was made by Weber and de Beaufort (1916), treating the species of the Indo-Australian archipelago, and they recognized 17 species (including two new species). This is the most important work on the genus following the work of Bleeker and Gunther.

Fowler (1905) described a new species from Borneo, and during 1934-1939 he described eight new species from Thailand (only one is a valid species for *Osteochilus*) and also placed some species of *Rohita* described by Sauvage (1878) in *Osteochilus.* In 1937 he subdivided the genus into two subgenera, *Osteochilus* and *Neorohita,* based only on the size of scales (a character of little or no phylogenetic value). Hora (1934) described a new pecies from Burma, and in 1942 he proposed two new subgenera, *Osteochilichthys* and *Kantaka,* which consisted of three species of fishes not related to *Osteochilus;* therefore, they should be removed from this genus (this will be discussed in the species account section). Fowler and Hora placed many species of fishes in *Osteochilus* which are now placed in other genera such as *Cirrhinus* and *Labeo.*

Most early fish taxonomists (e.g., Cuvier & Valenciennes, Bleeker, and Sauvage) commonly employed superficial of variable characteristics including certain body proportions. Confusion and multiplication of taxa resulted when later workers (Fowler, Hora, Smith, etc.) described new species based upon specimens that differed only slightly from the de-

scription of early workers (i.e. without examining types of earlier workers). For example, Smith (1945) recognized 15 species of *Osteochilus* from Thailand, whereas my study validates the occurrence of only seven.

Diagnosis of *OSTEOCHILUS*

Osteochilus shares many features with other labeine minnows, especially with *Labeo.* Characters that distinguish *Osteochilus* from its relatives are as follows:

1. Upper lip fringed and continuous with the lower lip, forming a sucker-like structure. Lower lip fimbriate or papillate and broadly confluent with isthmus, covering an osseous part of mandible which has a hard, sharp, chisel-like transverse edge.

2. Under surface of upper lip and lateral part of lower lip consisting of several ridge-like costae (plicae), which consist of minute unicellular keratinized projections for which the name unculi has been proposed (Roberts, 1989).

3. Dorsal fin moderately long, without a spinous simple ray, and with 10-18 branched rays (generally 8-9 in Barbinae, 10-12 in *Labeo,* 8-14 in *Cirrhinus,* 8-12 in *Epalzeorhynchos,* and more than 20 in *Labiobarbus*).

Description of *OSTEOCHILUS*

Body oblong or subcylindrical and compressed. Snout conical, more or less prominent, and tubercles, if present, one to three or numereous on the anterior portion. Mouth terminal, subinferior, or conspicuously inferior and horseshoe-shaped. Skin of rostrum (rostral fold) extended, partially covering the front part of upper lip. Upper jaw curved and protrusible. The upper lip and lower lip well developed, fringed, and continuous, and forming a sucker-like structure; both jaws covered with keratinized callus sheath. Lower lip fimbriated or papillated at outer part and broadly confluent with isthmus, covering the osseous part of mandible which has a hard, sharp, chisel-like transverse edge. Ventral surface of upper lip and inner part of lower lip consisting of several ridge-like costae (plicae), which consist of a number of taste buds and minute unicellular keratinized projections called unculi. The series of unculiferous folds or costae are long and unbroken distally in some species. and divided into two, three or more mound-shape portions in other species. Two pairs of barbels, rostral and maxillary, the rostral pair usually about one half the length of the maxillary pair. Gill membranes broadly united to the isthmus about opposite hind border of preopercle. Pharyngeal teeth in three rows, 2.4.5.-5.4.2. Scales generally large (lateral line scales 27-35), but small in two species (lateral line scales 45-53), longtitudinal or radially striated. Lateral line complete, extending to the middle of the caudal peduncle, sensory tubes simple. Dorsal fin IV, 10-18; the fourthe simple ray is nonosseous and smooth on its posterior edge, consistently with 10-18 branched rays. Dorsal fin with basal scaly sheath, its origin generally slightly before the insertion of pelvic fins and ending before, above, or behind origin of anal fin. Pelvic fin with one simple ray and eight branched rays giving a formula of P2 = 9. The pectoral fin has one simple ray and 13-16 branched rays giving a pectoral fin formula of P1 = 14-17 The anal fin consistently has three simple rays which are moderately or rather weak, and five branched rays giving an anal fin formula of A-iii, 5. Caudal fin deeply forked, with equal lobes or upper lobe longer.

Distribution

Fish of the genus *Osteochilus* are restricted to Southeastern Asia. They extend from southern Burma, eastward to Thailand and Indochina, southward to Malay Peninsula and islands of Indo-Australian Archipelago within the limits of the southeast Asiatic continental shelf.

In southern Burma there is only one species, *O. hasselti.* In central Thailand there are four lowland species present (*O. melanopleurus, O. hasselti, O. schlegeli,* and *O. microcephalus*) and two forest stream species (*O. waandersi* and *O. lini*) restricted to the southeastern part. There are four lowland species present in the Mekong basin, the main river of Indochina (*O. melanopleurus, O. hasselti, O. microcephalus,* and *O. lini*). Along the coastline of Vietnam and southern China, including Hainan Island, there are only two species and both are endemic to

that area: *O. brachynotoperoides* is found in the middle part of Vietnam, and *O. salsburyi* is in north Vietnam, southern China, and Hainan. In the southern part of continental Southeast Asia, in the Malay Peninsula, there are seven species present (*O. melanopleurus, O. hasselti, O. microcephalus, O. enneaporus, O. waandersi, spilurus,* and *O. kahajanensis*). This is close to the center of diversity which is between Sumatra and Borneo. There are 12 species in Sumatra; the most diverse area is in the southern part where there are the following 12 species: *O.melanopleurus, O. hasselti, O. microcephalus, O. enneaporus, O. waandersi, O. spirulus, O. pleurotaenia, O. triporus, O. intermedius, O. kahajanensis, O. schlegeli,* and *O. borneensis.* Similarly, in western Borneo the Kapuas River with 13 species is the most diverse area on the island; there is the same fauna as in southeast Sumatra execept that *O. kappeni* is endemic to the Kapuas. The northwestern part of Borneo (Sarawak) is separated from central Borneo by a mountain range; there are five species: *O. hasselti, O. microcephalus, O. kahajenensis, O.harrisoni* and *O. sarawakensis* (the last species is endemic to mountain streams of Sarawak. In Southeastern Borneo the Mahakam is the most important drainage. It has been isolated from the western drainage for a long time but they share some species such as *O. schlegeli, O. pleurotaenia,* and *O. enneaporus,* and there are three endemic species, *O. kalabua, O.pentalineatus, and O. bellus.* Eastern Borneo is a very difficult area to collect and only a few collections exist so we have a very poor knowledge of the number of species. In northeastern Borneo (Malaysian North Borneo), the area most isolated from the rest of the fauna, only two species are present and one is endemic to the area *O. ingeri* and *O. kahajanensis (O. kahajanensis* has a shorter dorsal fin here than in other areas, and is recognized as a new subspecies, *O. kahajanensis chini,* in this study). The southern part of Borneo and Java share the same fauna because they shared the same drainage during the Pleistocene. There are seven species of *Osteochilus* present *O. melanopleurus, O. hasselti, O. microcephalus, O. pleurotaenia, O. kahajanensis, O. spirulus,* and *O. waandersi.* Only one species, *O. hasselti,* is reported from Bali which is at the southeastern end of the range of the genus. Of all the species *O. hasselti* and *O. microcephalus* have the largest range.

Remarks

The original description of *Osteochilus* given by Gunther 1868, p.40 is as follows:

"Scales rather large. Dorsal fin without osseous ray, with from thirteen to twenty one rays, commencing in advance of the ventrals. Snout obtusely rounded, maxillary region scarcely thickened, and but slightly projecting beyond the mouth. Mouth transverse, inferior or subinferior, with the lips more or less thickend, fringed or crenulated, instead of inner fold, as described in Labeo, the osseous part of the mandible forms a hard sharp transverse prominence, no symphsial tubercle. Barbels small, nearly always four Anal scales not enlarged Anal fin very short. Pharygeal teeth 5.4.2.-2.4.5. Snout sometimes with horny tubercles which periodically fall off leaving their former bases as shallow round depressions (pores)"

This old description, which lacks an accompanying illustration, is not diagnostic for the genus. Similar descriptions have been given to other related genera, especially to Labeo, and this has caused much difficulty in distinguishing these genera. Confusion of taxa resulted when later workers described new species and placed them incorrectly in various genera. Weber & de Beaufort (1916) illustrated the mouth structure of Osteochilus, but their detailed description could still apply to species of other genera I will try to clarify this problem by doing a detailed study of the oromandibular structures, which include the major characters used to separate labeine genera, in order to present a diagnosis for the genus.

Lips structure of *Osteochilus*

According to Roberts (1989), he divided *Ostcochilus* into three groups based on length and shape of the longest folds or plicae on the greatly expanded lateral portion of the upper lip. The groups are also partly distinguished by the distribution of unicellular keratinous projections or unculi and taste

buds on the plicae, and by the size and shape of the unculi. The groups seem to represent species adapted to similar feeding ecology or habitat rather than species which are phyletically related.

1) Endomorphs: Main plicae on lateral portions of upper lip divided into more or less numerous oval or mound-shaped sections. Unculi and taste buds tend to be mixed together. Unculi low-lying,polygonal, to 4-18 um long, usually present in furrows between plicae as on plicae. This includes the largest and most deepbodied members of the genus (endomorphs). Generally inhabit lakes and large rivers with slow current. Absent from mountain streams. *Osteochilus borneensis, O.hasselti, O.melanopleurus, O. schlegeli.* Maximum standard length 224-366 mm. This group includes some of the most important freshwater food fishes of southeast Asia. *Osteochilus melanopleurus* is especially noteworthy for its upturned mouth; in all other *Osteochilus* the mouth is subinferior or inferior. It is also the largest species.

2) Mesomorphs: Main plicae on lateral portions of upper lips all divided into at least two or three elongate, ridge-like segments. Taste buds generally distributed along anterior margin of unculiferous apex of plicae. Unculi intermediate size,frequently expanded distally, to 16-24 um long,generally weakly developed or absent from furrows. More or less intermediate in size and body depth. Maximum standard length 120-205 mm. Mainly inhabit lowland rivers of moderate gradient. *Osteochilus kappeni, O.triporus,* and *O.waandersi.*

3) Ectomorphs: Main plicae on lateral portions of upper lip forming very long, high, unbroken ridges. Unculi confined to summit of ridges, taste buds generally form well defined rows parallel to unculiferous portions of ridges. Unculi reltively large, to 20-27 um long, elongate. Maximum standard length 75-225 mm. tend to inhabit smaller forest streams an mountain streams with relatively strong current. *Osteochilus enneaporus, O. intermedius, O.kahajanensis, O.microcephalus, O.pleurotaenia,* and *O.spilurus.* In this group *O.pleurotaenia* and *O.spilurus* are particularly noteworthy. *Osteochilus pleurotaenia* apparently has the largest lips of any *Osteochilus* and its mouth is strongly inferior. *Osteochilus spilurus,* attaining a maximum standard length of only about 75 mm, is by far the smallest species of *Osteochilus.* Some populations apparently at much smaller sizes, and the largest adults in such populations may attain only about this length.

The above divsions can by extended to include the rest of the species of *Osteochilus.* The quality of the plicae is readily observable with a dissecting microscope or in most instances with the unaided eye. The unculi, however, are best observed by scanning electron microscope.

The different types of lips in *Osteochilus* cannot yet be correlated with differences in feeding behavior or food. *Osteochilus,* like other Labeinae, probably feed on aufwuchs. Species of forest streams presumably feed on aufwuchs growing on submerged tree trunkes or logs and roots, those of mountain streams on epilithic aufwuchs.

Fig. 1 Distribution of the genus Osteochilus

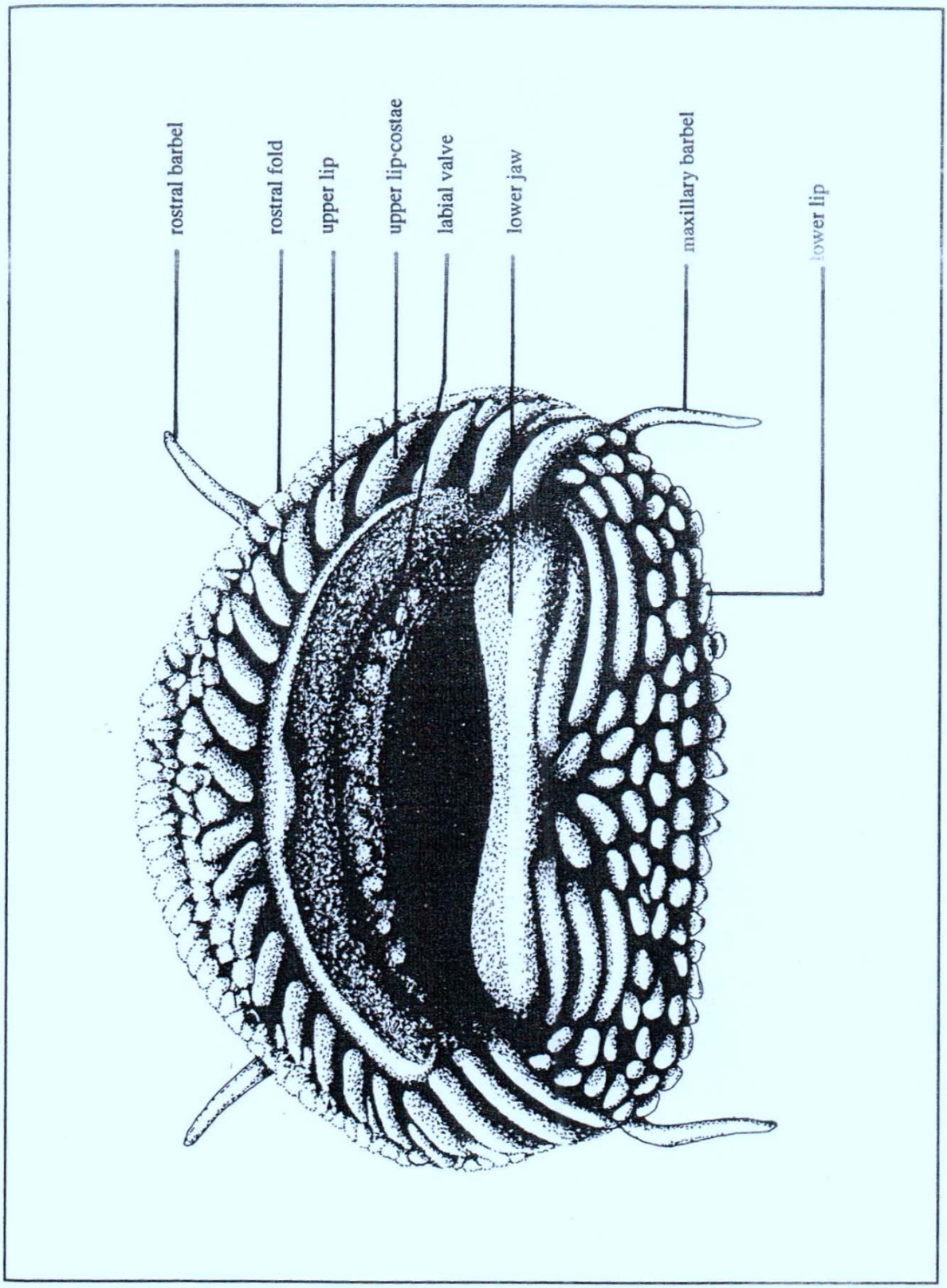
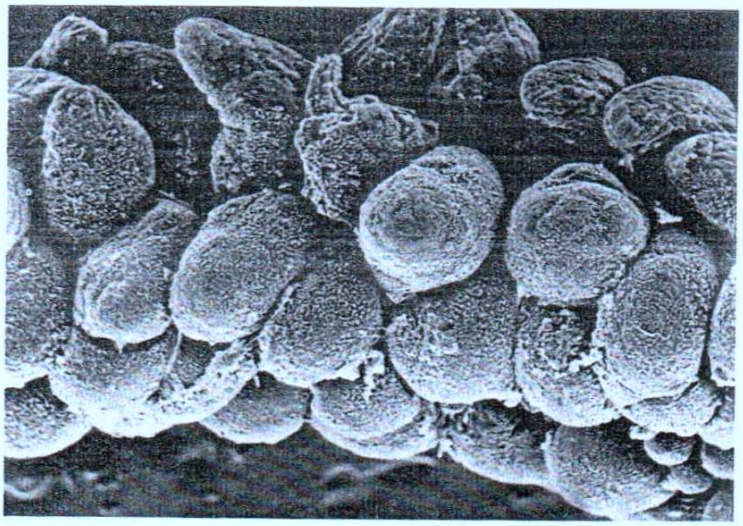
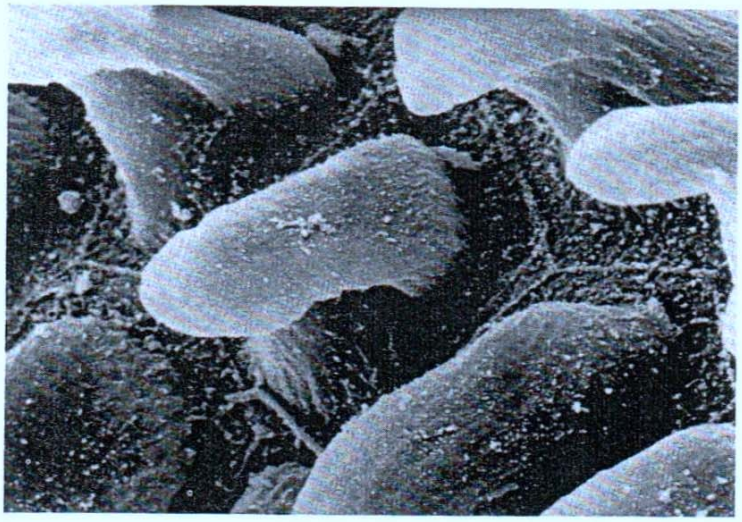


Fig. 2 Lip structure of *Osteochilus*



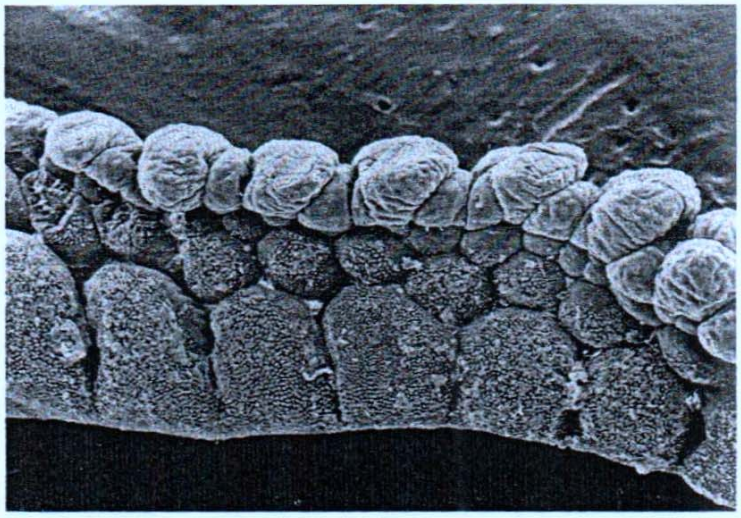
400μm

Fig. 3 Advanced condition of lip costae of *Osteochilus* which live in still or slow moving water habitat (*0 melanopleura*, NIFI uncatalogued, 141.9 mm SL).



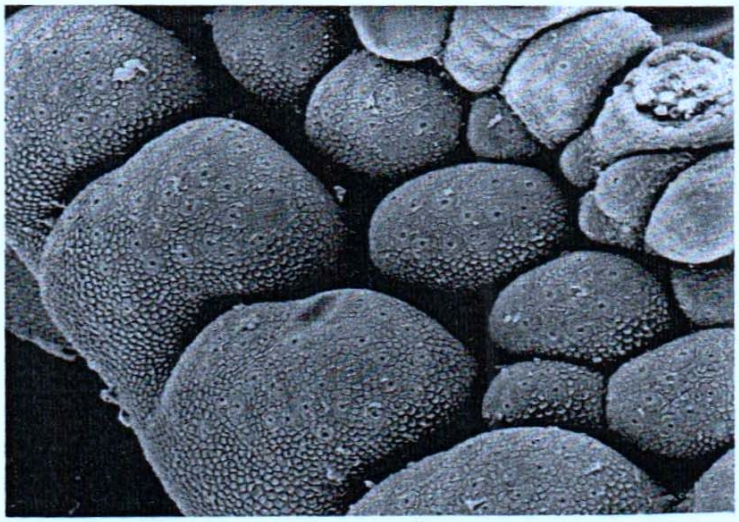
10 μm

Fig. 4 Unicellular unculi on the costae of the upper labial fold in *Osteochilus sarawakensis* (FMNH 68532, 83.4 mm SL).



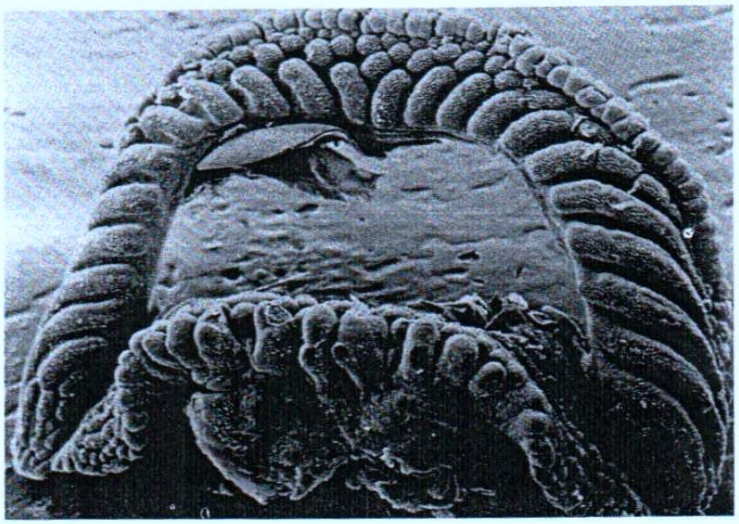
400μm

Fig. 5 The lip costae in the intermediate state (*Osteochilus hasselti*, NIFI uncatalogued, 116.8 mm SLL).



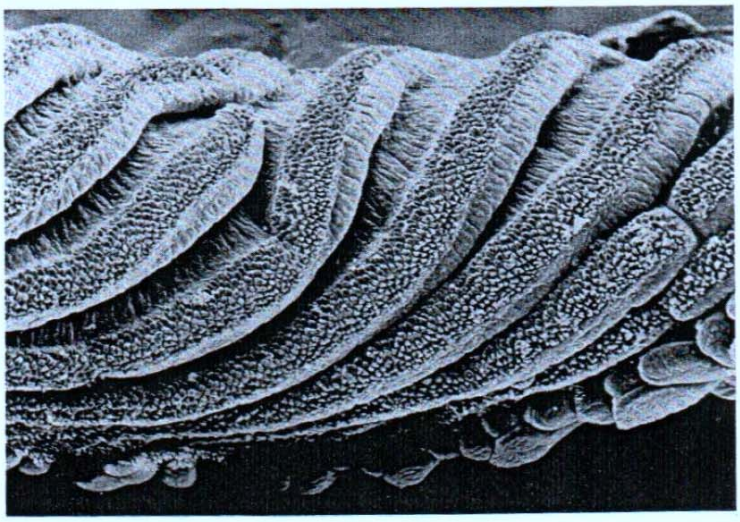
200μm

Fig. 6 Lip costae on the ventral side of the upper labial fold of *Osteochiius borneensis*, shows the taste buds on top. (NIFI uncatalogued, 57.2 mm SL)



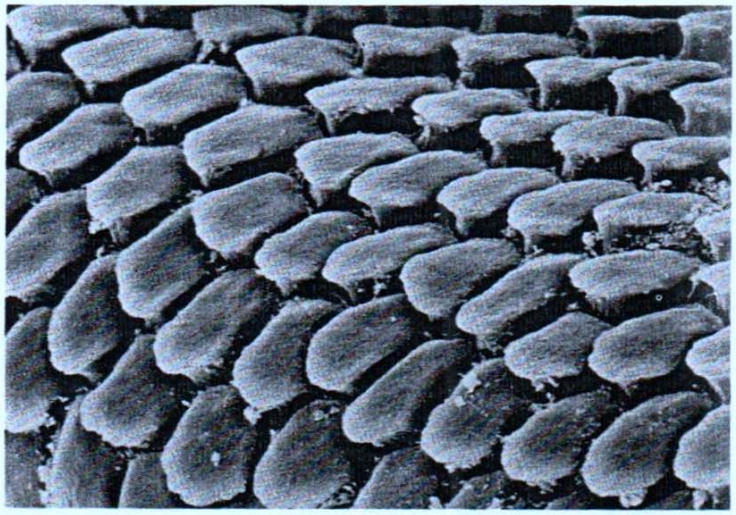
1μm

Fig. 7 Primiive condition of lip costae on the upper lip (labial fold) and trilobed papillae on the outer region of lower labial fold (*Osteochilus microcephalus*, NIFI uncatalogued, 53.5 mm SL).



400μm

Fig. 8 Advance type of lip costae in *Osteochilus* that live in fast moving water habitat (0.*waandersi*, NIFI uncatalogued, 150 mm SL).



20μm

Fig. 9 Microstructure of the callus sheath on the upper jaw of *Osteochilus spilurus* (KCTR 76-42, 47 mm SL).

SPECIES ACCOUNTS OF *OSTEOCHILUS*

1. Nominal species and subspecies of *Osteochilus* and their present identification

Nominal species	Present identification
Osteochilus bellus Popta 1904	Valid
O. borneensis (Bleeker 1857)	Valid
O. brachynotopterus Chevey 1934	Valid
O. brachynotopterus Gunther 1863 (misident.)	O. microcephalus
O. brachynotopterus Weber & Beaufort 1916 (misident.)	O. microcephalus
O. brevicauda Weber & de Beaufort 1916	O. kappeni
O. duostigma Fowler 1937	O. hasselti
O. enneaporus (Bleeker 1852)	Valid
O. harrisoni Fowler 1905	Valid
O. hasselti (Valenciennes 1842)	Valid
O. hasselti tweediei Menon 1954	O. hasselti
O. ingeri new species	
O. intermedius Weber & de Beaufort 1916	Valid
O. jentinkii Popta 1904	O. pleurotaenia
O. kahajanensis kahajanensis (Bleeker 1857)	Valid
O. kahajanensis chini new subspecies	
O. kalabau Popta 1904	Valid
O. kappeni (Bleeker 1857)	Valid
O. kuhlii (Bleeker 1868)	O. hasselti
O. lini Fowler 1935	Valid
O. melanopleurus (Bleeker 1852)	Valid
O. microcephalus (Valenciennes 1842)	Valid
O. microcephalus Inger & Chin 1962 (misident.)	O. kahajanensis chini
O. neilli Day 1868	O. hasselti
O. oligolepis Gunther 1868 (misident.)	O. spilurus
O. pentalineatus Kottelat 1981	Valid
O. repang Popta 1904	Valid
O. rostellatus (Valenciennes 1842)	O. hasselti
O. salburyi Nichols & Pope 1927	Valid
O. sarawakensis new species	
O. scapularis Fowler 1939	*O. enneaporus*
O. schlegeli (Bleeker 1851)	Valid
O. spilurus (Bleeker 1851)	Valid
O. spilurus Inger & Chin 1962 (misident.)	*O. ingeri*
O. triporus (Bleeker 1863)	Valid
O. vittatoides Popta 1904	*O. enneaporus*
O. vittatus Gunther 1863 (misident.)	*O. microcephalus*
O. vittatus Weber & de Beaufort 1916 (misident.)	*O. microcephalus*

Nominal species	Present identification
	O. waandersi
O. vittatus Smith 1945 (misident.)	*O. microcephalus*
	O. waandersi
O. vittatus Inger & Chin 1962 (misident.)	*O.sarawakensis*
O. waandersi (Bleeker 1852)	Valid

2. Species of uncertain status

O. kukenthali Ahl 1922
O. melanopterus Tirant 1929
O. vittatus (Valenciennes 1842)

3. Species which is newly placed in *Osteochilus* from genus *Labeo*

Labeo pleurotaenia (Bleeker 1855)	*Osteochilus pleurotaenia*
L. rohitoides (Bleeker 1857)	*O. pleurotaenia*

4. Species improperly assigned to *Osteochilus*

Osteochilus barbatulus (Sauvage 1878)	*Labeo chrysophekadian*
O. cephalus Day 1876 (misident.)	*L.. cephalus*
O. chalybaetus (Heckel 1843)	nomen nudum
O. lipocheilus (Valenciennes 1842)	nomen nudum
O. macrosemion Fowler 1935	*Cirrhinus macrosemion*
O. malabaricus Day	nomen nudum
O. ochrus Fowler 1935	*Labeo dyocheilus*
O. pectoralis (Sauvage 1878)	*L.. chrysophekadian*
O. prosemion Fowler 1934	*Cirrhinus chinensis*
O. simus (Sauvage 1878)	nomen nudum
O. simus Fowler 1935 (misident)	*Cirrhinus macrosemion*
O. sondhii Hora & Mukerji 1934	*Labeo dyocheilus*
O. spilopeura Fowler 1935	*Cirrhinus macrosemion*
O. tatumi Fowler 1937	*Bangana pierrei*

KEY TO THE SPECIES OF *OSTEOCHILUS*

1.a. lateral line scales 45-53 2
1.a. lateral line scales 27-35 3

2.a. mouth ascending; large blackish vertical blotch on each side of body above pectoral fin; snout entire; l.l. 45-53; D.IV, 17-18; c.f. 22/2/23-24; c.p. 22-24; g.r. 27-35 (may reach 40 cm) in very large specimens); (Wide distribution, Thailand, Maekong basin, Malay Peninsula, Indonesia; common) ..... *O. melanopleurus* (Bleeker)
2.b. mouth normal (subinferior); no large blacklish blotch above pectoral fin; snout with three tubercles; l.l. 47-49; D.IV, 16-18; c.f. 17/1/17; c.p. 22; g.r. 20-25 (Sumatra, Borneo; uncommon) ..... *O. borneensis* (Bleeker)

3.a. circumpeduncular scales 22; c.f. 16-17/2/16-17; predorsal scales 13-14; mouth ascending; large blackish blotch above pectoral fin; l.l. 34-35; D.IV, 16; snout entire; g.r. 29-34 (central Borneo; Mahakam tributaries; three specimens known) ..... *O. kalabau* Popta
3.b. circumpeduncular scales 12-20; c.f. 9-13/2/11-15; predorsal scales 8-11 4

4.a. circumpeduncular scales 20; l.l. 32-33; D. IV, 13-14; c.f. 13/2/15; predorsal scales 10-11; snout entire; g.r. 25-35 (wide distribution, Sumatra, Borneo, Malay central Thailand, uncommon) ..... *O. schlegeli* (Bieeker)
4.b. circumpeduncular cales 12-16 5

5.a. circumpeuncular scales 12; c.f. 9/2/11; l.l. 30; five longitudianl stripes along side of body; snout entire (southern Borneo, one specimen known) ..... *O. pentalineatus* Kottalat
5.b. circumpeduncular scales 16 6

6.a. lateral line scales 27-29; D. IV, 10-11; c.f. 9/2/11; predorsal scales 9-10; snout entire; size small, not more than 70 mm; g.r. 28-30; (Sumatra, Borneo, Malaysia; common) ..... *O. spilurus* (Bleeker)
6.b. lateral line scales 30-34 7

7.a. main part of body plain,with or without blotch on the scales above pectoral fin, usually with a large round black spot on caudal peduncle 8
7.b. body with pattern of spots, rows of spots, orstripes 13

8.a. three tubercles on snout, branched dorsal rays 16; l.l. 32; c.f. 12/2/14 (River Bo, central Borneo, one specimen known) ..... *O. repang* (Popta)
8.b. no tubercles on snout (if present, small and numerous) 9

9.a. c.f. 9/2/11 body long and slender; snout entire; l.l 33-34, branched dorsal rays 10 (Lake Kontum, middle Vietnam, probably endemic to the lake; one specimen known) ..... *O. brachynopteroides Chevey*
9.b. c.f. 11-13/2/13-15 10

10.a. c.f. 13/2/15 body deep and compressed, snout entire; two small black bars on the young (many specimens of this species with rows of spots on the body, see no.22b; (central Borneo, Kapuas River; uncommon) ..... *O. kappeni* (Bleeker)
10.b. c.f. 11/2/13 11

11.a. branched dorsal rays 10; body long and slender; snout may have some small numerous tubercles or pores; mouth conspicuously inferior; lips greatly expanded g.r. 38-53 (young specimen of this species has median stripes, see no. 17a; (Sumatra, Java, Borneo; uncommon) .....*O. pleurotaenia* (Bleeker)

11.b. branched dorsal rays 10-14 (rarely 15); body oblong; snout entire; mouth subinferior, lips normal, g.r. 27-35 12

12.a. branched dorsal rays 10-12; l.l 30-32; longitudinal median lateral stripe may be present in young specimens (see no. 19.b) (Southern China, North Vietnam, Hainan Island; common) .....*O. salsburyi* Nichole & Pope

12.b. branched dorsal rays 13-14 (rarely 15); l.l 32-33; two spots on the scales on the side above pectoral fin, one above and one below lateral line (eastern Thailand, lower Mekong Basin; common).....*O. lini* Fowler

13.a. body with a median longitudinal lateral stripe, and no spots 16

13.b. body with pattern of spots or rows of spots or stripes (more than one); with or without tubercle on snout 20

13.c. body with both a median longitudinal stripe and rows of spots on the body 14

14.a. median lateral stripe thick and distinct, branched dorsal rays 10-12; usually with one or three or several small tubercles on snout 15

14.b. branched dorsal rays 11-13; snout entire; about 5-8 (5-6 distinct) rows of spots on the body, the row of spots on the lateral line more intense than others and forming a thin median lateral strip; mouth conspicuously inferior; l.l. 32-33 (this species may lack a median lateral stripe, (see no.26b) (Sarawak, and western North Borneo, common) .....*O. sarawakensis* new species

15.a. g.r. 44-45; c.f. 9/2/11; mouth conspicuously inferior; usually with three tubercles on snout but some specimens may have several additional small tubercles; median lateral stripe is distinct on posterior half of body; about 4 rows on the body, 2 above and 2 below the median lateral stripe, and also distinct on posterior half of the body; general color of body very dark. (Some specimens of this species without median lateral stripe, see no.26a) (River Bo in cental Borneo; six specimens known) .....*O. bellus* Popta

15.b. g.r. 27-35; c.f. 11/2/13; mouth subinferior; usually with one or three tubercles on snout (rarely without tubercles); median lateral stripe extending from gill opening to the end of caudal peduncle; rows of spots irregular, not distinct, (majority of specimens without rows of spots, see no. 19a) (wide distribution; Thailand, Indochina, Malaysia, and Indonesia; common) .....*O. microcephalus* (Cuv.&Val.)

16.a. g.r. 40-60 in adult fish; mouth conspicuously inferior 17

16.b. g.r. 27-35 in adult fish; mouth subinferior 19

17.a. branched dorsal rays 10-11; snout with small numerous tubercles or entire; l.l. 30-32; (median lateral stripe may be absent in adult specimens of this species, see no. 11a.) (Sumatra, Java, and Borneo; uncommon) .....*O. pleurotaenia* (Bleeker)

17.b. branched dorsal rays 11-13; snout with one or three tubercles; l.l. 31-33.....18

18.a. median lateral stripe extends from gill opening (some specimens from posterior border of eye) to the end of caudal fin rays; lower part of the body with very light color, snout rather pointed (Sumatra, Borneo, Malay Peninsular, southeastern Thailand; common).....*O. waandersi* (Bleeker)

18.b. median lateral stripe extending from gill opening to the end of caudal peduncle; general color very dark; snout blunt (Sumatra, Borneo, Malay Peninsular; common in Kapuas) .....*O. enneaporos* (Bleeker)

19.a. one or three tubercles on the snout, median lateral stripe extending from gill opening to the end of caudal peduncle (this species may have rows of spots on the body, see no. 15b) (wide distribution; Thailand, Indochina, Malaysia, and Indonesia; common) .....*O. microcephalus* (cuv.&val.)

19.b. snout entire; median lateral stripe present only in young specimens (see no. 12a.) (southern China, northern Vietnam and Hainan Island; common).....*O. salsburyi* Nichole & Pope

20.a. branched dorsal rays 15-18; snout entire 21

20.b. branched dorsal rays 10-13; snout with or without tubercles 23

21.a. branched dorsal rays 15-16, body with 9-10 longitudinal lateral stripes; each costa on the ventral part of upper lip long and undivided. (Baram River, Sarawak 4th Division, two specimens known) ..*O. harrisoni* Fowler

21.b. branched dorsal rays 15-18 (rarely 12-14); body with 6-8 rows of spots on posterior two-thirds of the body; each costa on the ventral part of upper lip short and divided into two or three portions 22

22.a. c.f. 11/2/13; rows of spots quite distinct, sometimes forming stripes on posterior half of body;fresh specimens with orange spots on body (wide distribution, from Burma to Indochina and Indonesia; common) .....*O. hasselti* (Cuv. & Val.)

22.b. c.f. 13/2/15; rows of spots less distinct, body deep and compressed (rows of spots may disappear in this species, see no. 10a) (Kapuas River, Borneo, uncommon.....*O. kappeni* (Bleeker)

23.a. a large black spot on anterior portion of dorsal fin 24

23.b. without black spot on anterior porton of dorsal fin 25

24.a. one to three tubercles on snout; each costa on upper lip divided into two or three portions, g.r. 28-31; branched dorsal rays 11-12; c.f. 11/2/11-13; dorsal fin usually falcate (Sumatra, Borneo; common in Kapuas River) .....*O. triporus* (Bleeker)

24.b. no tubercles on snout; costae on upper lip long, undivided; g.r. 37-50; branched dorsal rays 13-14; c.f. 9/2/13; dorsal fin normal (Sumatra, Borneo; uncommon) .....*O. intermedius* Weber & Beaufort

25.a. body marked by small bar on each scale pocket forming a reticulated pattern on the body, c.f. 9/2/11 (rarely 10/2/11); l.l. 30-31; g.r. 40-45; branched dorsal rays 11-12 (eastern North Borneo; common) .....*O. ingeri* new species

25.b. body marked by rows of spots which are usually distinct on the posterior half of the body 26

26.a. c.f. 9/2/11; 44-45; branched dorsal rays 10-11; three tubercles on snout (some specimen with several small tubercles); l.l. 30-31 (this spceies may have a median lateral band, see no. 15a.) (central Borneo, River Bo, six specimens known) .....*O. bellus* Popta

26.b. c.f. 11/2/13; g.r. 26-34; branched dorsal rays 11-13; l.l. 32-33; snout entire (this species may have very thin median lateral stripe, see no. 14b) (Sarawak, western North Borneo, common) ..*O. sarawakensis* new species

SPECIES DESCRIPTIONS OF *OSTEOCHILUS*

The genus *Osteochilus,* as now concieved, has 23 species with one species divided into two subspecies. The genus is divided into seven species group, based on relationships, as follows:

O. microcephalus group, with two other species; *O. salsburyi* and *O. brachynotopteroides*

O. waandersi group, with three other species: *O. enneaporus, O. bellus,* and *O. pleurotaenia*

O. kahajanensis group, consists of one species and two subspecies: *O. kahajanensis kahajanensis* and *O. kahajanensis chini*

O. spilurus group with one other species: *O. ingeri*

O. triporus group with four other species: *O. intermedius, O. sarawakensis, O. harrisoni,* and *O. pentalineatus*

O. hasselti group with four other species: *O. kappeni, O. lini, O. repang,* and *O. borneensis*

O. melanopleurus group with two other species: *O. kalabau,* and *O. schlegeli*

Osteochilus microcephalus (Valenciennes)

Rohita microcephalus Valenciennes in Cuvier and Valenciennes, 1842: Vol. 16, p.275; original description; type locality: Bantam River, Java; Syntypes dry, mounted, 2 spec.) RMNH 2115, 2116; 7 inches total length (given by Valenciennes), 150.8 mm and 151.7 mm standard length (my measurement).

Rohita (Rohita) microcephalus Bleeker 1860: Vol. 2 p. 173: description; locality: Java (Tjikao), Sumatra (Lahat). -------- 1863: Vol.3, p.66; description with color plate.

Rohita (Rohita) vittata Bleeker, 1860; Vol.2, p.178; description; locality: Java (Batavia, Lebak, Buitenzorg, Tjikao, Parongkalong, Surabaya, Gempol), Sumatra (Pangabuang, Padang, Solok, Meninju, Lahat), Borneo (Bandjermassin, Pengaron, Pontianak). -------- 1863: Vol 3, p.68; description with color plate

Rohita brachynotopterus Bleeker, 1855: p.266; original description; type locality: Sumatra (Lahat); holotype BMNH 1866.5.2.171, 90 mm total length (given by Bleeker), 66.6 mm standard length (my measurement)

Rohita (Rohita) brachynotopterus Bleeker, 1860: Vol.2, p.122; description. ---- 1863: Vol.3, p.67; description with color plate.

Osteochilus microcephalus Gunther, 1868: Vol.7, p.43; description (from Bleeker's specimen).

Osteochilus vittatus Gunther, 1863 (in part): Vol.7, p.44; description (from Bleeker's specimen).

Osteochilus brachynotopterus Gunther, 1868: Vol. 7, p.43; description (from Bleeker's specimen).

Osteochilus villatus Weber and de Beaufort, 1916 (in part), vol.3 p.131., description; locality : Sumatra (Djambi, Gimung Sahilan, Palembang), Borneo (Kapuas at Pontianak).

Osteochilus brachynotopterus Weber and de Beaufort, 1916: Vol.3, p.134; description; locality: Sumatra (Taluk, Si-Djanjung).

Osteochilus vittatus Smith, 1945 (in part): P. 216; diagnosis; locality: Chao Phya River, Thailand.

Nomenclature

Valenciennes (Valenciennes, 1842) described *O. microcephalus* from 2 dry individuals of about the same size. Valenciennes did not indicate the presence of the median lateral stripe or of any coloration in his original description (which presumably had disappeared in the dry, mounted, and vanished specimens). For this reason the specimens look similar to the type specimens of *O. hasselti* which are also dry specimens (type specimens of *O. hasselti* have a short dorsal fin which is similar to *O. microcephalus).* This fact is indicated by Valenciennes in the beginning of the original description: "I think I should place this specimen following the previous one because it resembles in form but the head is smaller, the dorsal fin taller, forked, and shorter" (translated from French). This is probably the reason why Weber & de Beaufort (1916) placed *O. microcephalus* as a junior synonym of *O. hasselti. O. microcephalus* may or may not have tubercles on the snout Bleeker, Gunther, and Weber and de Beaufort used this variable character to separate the species. They recognized *O. vittatus* (non Cuv. & Val.) as a tuberculate form, and *O. microcephalus* and *O. brachynotopterus* as a non-tuberculate form. Bleeker did not see the type specimen of *O. vittatus* and used the original description. Valenciennes's original description is too superficial to diagnose the species and he called *O. vittatus* as "Le Rohite a bandes" (=striped Rohite), (see discussion on *O. vittatus* page 185). Bleeker mistook *O. microcephalus* to be *O. vittatus* but still recognized *O. microcephalus* as the non-tuberculate species. Bleeker (1855) described *O. brachynotopterus* from a specimen with 10 branched dorsal rays (*O. microcephalus* usually has 11-13 branched dorsal rays and all Bleeker's specimens of *O. microcephalus* have 13 branched dorsal ray) the type specimens of *O. microcephalus* that I examined have three distinct tubercles at the front of the snout and other characteristics agree with what many ichthyologists recognized as *O. vittatus.*

Valenciennes's type specimen of *O. vittatus* has 14 branched rays and it was indicated by

Valenciennes that it has 9 brown stripes. For this reason I believe that Bleeker's *O. vittatus* is not conspecific with Valenciennes's species and therefore, I regard Bleeker's *O. vittatus* as a junior synonym of *O. microcephalus*. Many specimens of this species which examined have 10 branched dorsal rays; therefore,I also consider *O. brachynotopteus* to be a junior synonym of *O. microcephalus*

Diagnosis

D. IV, 10-13; l.l. 32-33; c.f. 11/2/13; c.p. 16; g.r. 27-35

O. microcephalus usually has one or three or no tubercles on the snout and a median longitudinal stripe extending from the gill opening to the end of the caudal peduncle.

O. microcephalus shares some characters with *O. waandersi* and *O. enneaporus* such as a median longitudinal stripe and tubercles on the snout. The latter two species have high gill raker counts (40-60), but *O. microcephalus* has only 27-35 gill rakers. The mouth is subinferior in *O. microcephalus* but conspicuously inferior in *O. waandersi* and *O. enneaporus*, and also the latter two species have a more slender body.

Description

Body oblong, slightly compressed, depth 276-370 (mean=345) (in thousandths of standard length). Head 210-240 (mean=225); eye 48-65 (mean=56). Snout 73-88 (mean=81), with three tubercles in the front (may be one tubercle or none), the middle one the largest and lateral one small or rudimentary; snout longer than eye diameter, shorter than interorbital space, about equal to the postorbital part of the head. Interorbital space convex 107-128 (mean=119). Mouth subinferior, two pairs of well developed barbels; maxillary barbels about equal to eye diameter, rostral barbels shorter than the maxillary ones. Ventral surface of upper lip consists of well devalopad moderately long, undivided costae. Predorsal length 406-479 (mean=439); origin of dorsal fin opposite 9th-10th scale of lateral line before mid-point between tip of snout and caudal base and also before pelvic fin insertion. Dorsal fin short but variable in height, last simple dorsal ray variably produced, 268-439 (mean=292), and the base of dorsal fin 274-305 (mean=292); the insertion of the dorsal fin opposite 20th-22nd scale of lateral line, number of scales from insertion of the dorsal fin to vertical from anal fin origin varies from one to two. Tip of pectoral fin not reaching pelvic fin insertion, opposite 9th-20th scale of lateral line. Prepelvic length 485-524 (mean=498); pelvic fin insertion opposite 11th-12th scale of lateral line. Preanal length 751-816 (mean=763), anal fin concave, third simple ray rather weak; anal fin origin opposite 21st-23rd scale of lateral line. Caudal fin deeply forked, its lobes more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 149-187 (mean=165); least depth of caudal peduncle 119-146 (mean=135), less than half of head length, and surrounded by 16 scales rows. Scales with nearly parallel longitudinal radii, predorsal scales 10; circumferential scale 11/2/13; transverse scales (to the base of pelvic fin) 5.5/1/4.5. Lateral line scales 31-34, with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 27-35 (may reach 40 in specimens over 130 mm long S.L.)

Preserved specimens are dusky on the upper two-fifths of the side; the dorsal part of head and back are darker than the rest of the body. A median lateral stripe extends from the gill opening to the end of the caudal peduncle, which may become more or less defined as the fish enters different kinds of environments (as observed in aquarium specimens), and may disappear when the fish dies. Live specimens are greyish-silver with pink or red fins, dorsal and caudal fins with melanin pigment on the membrane.

Distribution

O. microcephalus is one of the most common species of *Osteochilus* and has a wide distribution: northern Thailand extending south through the Peninsula, Sumatra, Java, and Borneo. It also common in northeastern parts of Thailand, Mekong Basin, Laos,

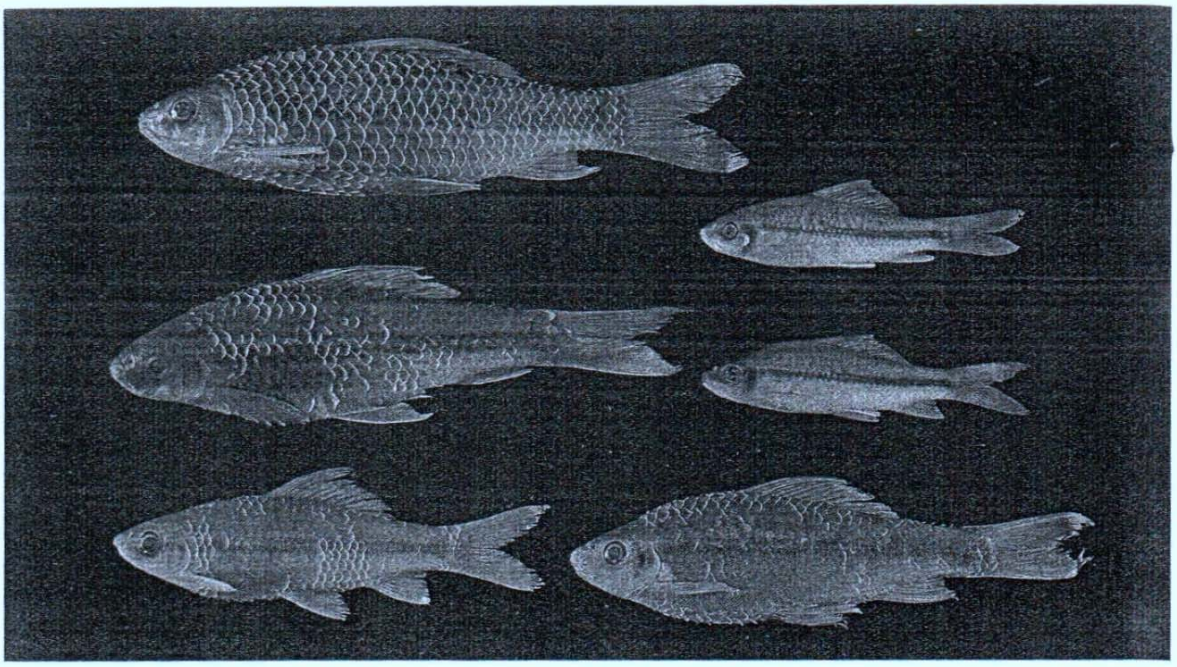


Fig. 10 *Osteochilus microcephalus* (Valenciennes), clockwise from top NIFI uncatalogued (Nongkai), NIFI uncatalogued (Payao), NIFI uncatalogued (Chao Phya River), KCTR 76-31, KCTR 76-27.

and Cambodia and probably S.Vietnam.

Habitat

O. microcephalus occurs in a wide variety of habitats but it is usually found at low elevations in large turbid rivers. The rapid parts of rivers preferred.

Material examined (276 specimens 50.0-140.0 mm standard length)

Syntypes: RMNH 2115 (150.8 mm) Bantam River, Java

RMNH 2116 (151.7 mm) Same data

Other specimen:

BMNH 1866.5.2 171 (16.6 mm type of *O. brachynotopterus*)Sumatra (Lahat)

Borneo: BMNH 1892. 10.7.27 (1 spec.) Baram River, Sarawak

FMNH 62998 (1 spec.) Niah River, Sarawak, 4th Div.

FMNH 68847 (1 spce.) Sungai Tangap, Sarawak, 4th Div.

FMNH 68849 (1 spec.) Sungai, Subis, Sarawak, 4th Div.

FMNH 69877 (2 spec.) Sakaloh, Niah, Sarawak

FMNH 63000 (1 spec.) Niah R. at Pk. Lobang, Sarawak 4th Div.

FMNH 68703 (1 spec.) Sungai Subis, Sarawak 4th Div.

FMNH 68846 (2 spec.) Sokakaloh, Niah, Sarawak. 4th Div.

FMNP 68848 (1 spec.) Niah, Sarawak, 4th Div.

MHNP 85-177-44-9 (2 spec.) No speeific locality

KCTR 76-16 (3 spec.) Sungai Tekam, small forest streams where it enters the right side of the Kapuas main stream about two km upstream from Sanggau

KCTR 76-27 (2 spec.) Rocky channel in mainstream of Sungai Pinoh, 37 km S. of Nangapinoh

KCTR 76-29 (3 spec.) Rocky channel in main stream of Sungai Pinoh at Nanga Saian, 45 km south

of Nanggapinoh

KCTR 76-31 (5 spec.) Bar in mouth of Sungai Malawi at Sintang

KCTR 76-37 (8 spec.) Small forested stream, where it flows into Sungai Mandai, 2-3 km upstream from its confluence with Kapuas mainstream

RMNH 233688 (1 spec.) Bandijermassin

RMNH 7963 (3 spec.) Sintang

ZMA 116.070 (1 spec.) no specific locality

ZMA 116.072 (1 spec.) Sintang

ZMA 116.073 (5 spec.) Poetoes Sibau

Indochina: MHNP 85-177-44-13 (1 spec.) Annam (Vietnam)

MHNP 85-177-44-12 (1 spec.) Tonkin

MHNP 85-177-5-1 (1 spec.) Cochinchina

UMMZ 181152 (1 spec.) Tributary from east Tonle Sap River, 15 km NW of Pnhom Penh, Cambodia

Malaysia (continental):

BMNH 1922.5.19.64-66 (3 spec.) Tahan River

NMS 1894 (1 spec.) Sadili River, Johore

NMS 620 (1 spec.) Ulu Jelei, Pahang

NMS 623 (1 spec.) Kuala Tahan, Pahang

NMS 624 (2 spec.) Kuala Tahan, Pahang

NMS 1897 (2 spec.) no specific locality (mixed with two spec. of *O. waandersi*

Sumatra: AMNH 9505 (1 spec.) Djambi

RMNH 5011 (2 spec.) Sockadana

RMNH 26910 (3 spec.) Sockadana

UMMZ 155575 (3 spec.) Singkarak

UMMZ 155576 (1 spec.) Moesi River, Palembang

ZMA 116.090 (2 spec.) Talock

ZMA 116.089 (1 spec.) Sidjoengdjoeng

ZMA 116.091 (1 pwc.) no specific locality

ZMA 116.097 (16 spec.) Batang Hari River at Djambi

ZMA 116.064 (1 spec.) Gunung Sahilan

ZMA 116.066 (2 spec.) Palembang

ZMA 116.065 (1 spec.) Palembang

Thailand: ANSP 58046-48 (3 spec.) Chiengmai

ANSP 58051 (1 spec.) Chiengmai

ANSP 58049 (1 spec.) Chiengmai

ANSP 97249 (2 spec.) Kemarat

ANSP 87249 (5 spec.) Bangkok

FMNH 50812 (3 spec.) Kam Pang Pet

MHNP 85-177-44-4 (2 spec.) no specific locality

NMNH 108055 (1 spec.) Bangkok

NMNH 108044 (1 spec.) Chao Phya River at Bangsai

NMS 687 (1 spec.) Chong Mek, Pibulmangsaharn, Ubol

UMMZ 201082 (1 spec.) Mun River at Ban Dan, Ubol

UMMZ 201084 (1 spec.) Mun River at Ban Dan, Ubol

UMMZ 201089 (4 spec.) Mun River 13 km downstream from Ubol

UMMZ 201090 (2 spec.) Huay Kwang, o.3 km from Mun River

UMMZ 201088 (1 spec.) Mun River, 1 km upstream from Ubol

UMMZ 201081 (1 spec.) Creek at Ban Tha Mai, Ubol

UMMZ 201087 (6 spec.) Huay Phai, Ubol

UMMZ 201085 (1 spec.) Mun River at Ban Dan, Ubol

UMMZ 201083 (1 spec.) North shore of Mun River at Ubol

UMMZ 192984 (1 spce.) Nam Pong River at Nongwai

UMMZ 195467 (5 spec.) Mekong River, 10 km upstream from Nong Khai

UMMZ 19275 (6 spec.) Meklong River at Rajburi

UMMZ 195678 (12 spec.) Market at Ubol

UMMZ 195865 (1 spec.) Meklong River at Ban Pong

UMMZ 195603 (1 spce.) Mekong River, 6 km upstream from Nakorn Panom

UMMZ 195096 (1 spec.) Chao Phya River, flood water 20 km north of Nakorn Sawan

UMMZ 195712 (12 spec.) Mun River, 5 km downstream from Ubol

NIFI (uncatalogued, 3 spec.) Cheingmai

NIFI (uncatalogued, 14 spec.) Mekong River at Nong Khai

NIFI (uncatalogued, 24 spec.) Mun River at Ubol

NIFI (uncatalogued, 18 spec.) Sri Sawat, Kwai Yai River

NIFI (uncatalogued, 15 spec.) Pattani River at Yala

NIFI (uncatalogued, 17 spec.) Meklong River at Rajburi

NIFI (uncatalogued, 14 spec.) Chao Phya River at Nakorn sawan

NIFI (uncatalogued, 5 spec.) Chao Phya River at Ayuthya

Osteochilus salsburyi Nichols and Pope

Osteochilus salsburyi Nichols and Pope, 1927: p348, fig 18; original dscription; type locality: Nodoa, Hainan; holotype AMNH 8371, 85mm standard length (given by Nichols and Pope), 83.7 mm (my measurement).

Osteochilus baramense Koller, 1927:p 30; Hainan; (not seen)

Osteochilus salsburyi Nichols and Pope, 1943:p67, fig. description; locality: Kwangtung and Hainan.

Nomenclature

Osteochilus salsburyi was described by Nichole and Pope in 1927, and *Osteochilus baramense* was described by Koller in the same year, the specimens also from Hainan. Nichols and Pope (1943) considered Koller's species to be a junior synonym of *O. salsburyi*. I have not seen either type specimen nor the publication of Koller (1927), but agree with Nichols and Pope that there is only one species of *Osteochilus* on Hainan Island.

Diagnosis

D. IV, 11 (rarely 10); l.l. 30-32; c.f. 11/2/13; c.p. 16

Osteochilus salsburyi has no tubercles on the snout, and has a short dorsal fin (usually 11 branched rays). A median lateral stripe is usually present in young specimens and traces of it can be seen in some adults on the posterior part of the body.

O. salsburyi is very similar to *O. microcephalus*. but the latter species has one or three tubercles on the snout, and a distinct median lateral stripe extends from the head to the end of the caudal peduncle.

Description

Body oblong, and slightly compressed; depth 291-368 (mean=323) (in thousandth of standard length), Head 220-233 (mean=227), eye 48-54 (mean=51), large fish with relatively small eye. Snout 67-91 (mean=280); entire, without tubercles or pores; longer than eye diameter, shorter than interorbital space, usually shorter than the postorbital part of the head. Interorbital space slightly convex, 111-123 (mean=114). Mouth subinferior, two pairs of well developed barbels; maxillary barbels longer than eye diameter, rostral barbels usually shorter than the maxillary ones. Ventral surface of upper lip consists of well developed, moderately long, undivided costae. Predorsal length 411-432 (mean=427); origin of dorsal fin opposite 9th scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin short with normal height, its fourth simple ray shorter than the base of dorsal fin, the length of fourth simple ray 230-242 (mean=238), and the base of dorsal fin 241-289 (mean=261); branched dorsal rays 11-12 (usually 11). The insertion of the dorsal fin opposite 18th-19th scale of lateral line, number of scales from insertion of the dorsal fin to vertical from anal fin origin varies from three to four. Tip of pectoral fin not reaching the pelvic fin insertion, usually opposite 8th-9th scale of lateral line. Prepelvic length 491-519 (mean=506); pelvic fin insertion opposite 11th (rarely 10th) scale of lateral line. Preanal length 731-782 (mean=762); anal fin concave, third simple ray rather weak; anal fin origin opposite 21st-22nd scale of lateral line Caudal fin deeply forked. Its lobes more or less acute, upper lobe slightly longer than the lower lobe. Length of

caudal peduncle 117-141 (mean=129); least depth of caudal peduncle 132-142 (mean=137), surrounded by 16 scale rows. Scales with parallel radii in the central part and radiating laterally; predorsal scales 9-10; circumferential scales 11/2/13, transverse scales (to the base of pelvic fin) 5.1/1/4.5 Lateral line scale 31-32, with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly; its scales with simple tubes Gill rakers on the first gill arch 28-34.

Preserved specimens are dark brown, and the dorsal part of head and back are darker than the lower part of the body. Body with plain uniform coloration, except that young specimens have a median lateral stripe which is distinct on the posterior half of the body and disappears in adults. All fins are plain.

Distribution

O. salsburyi is restricted to southern China to the province of Kwangtung and to Hainan Island; it probably occurs in N. Vienam.

Habitat

Unknown

Material Examined (193 specimens, 54.3 mm-130.5 mm standard length)
Holotype: AMNH 8371; Nodoa Hainan; Kwangtung Prov.

Other specimens:

AMNH 17745: (1 spec.), Kwangtung, near Canton
AMNH 10613: (1 spec.), Nodoa, Hainan
AMNH 10624: (12 spec.), Nodoa, Hainan
AMNH 10605: (40 spec.), Nodoa, Hainan
AMNH 10604: (35 spec.), Nodoa, Hainan
AMNH 10617: (14 spec), Nodoa, Hainan
AMNH 10618: (18 spec.), Nodoa, Hainan
AMNH 10604 (22 spec.), no locality
AMNH 10609: (43 spec.), Nodoa, Hainan
NMNH 14861: (1 spec.), Nanning, Kwangsi
CAS 31763; (3 spec.), China
CAS 31791: (1 spec.), China
CAS 31792: (1 spec.), China

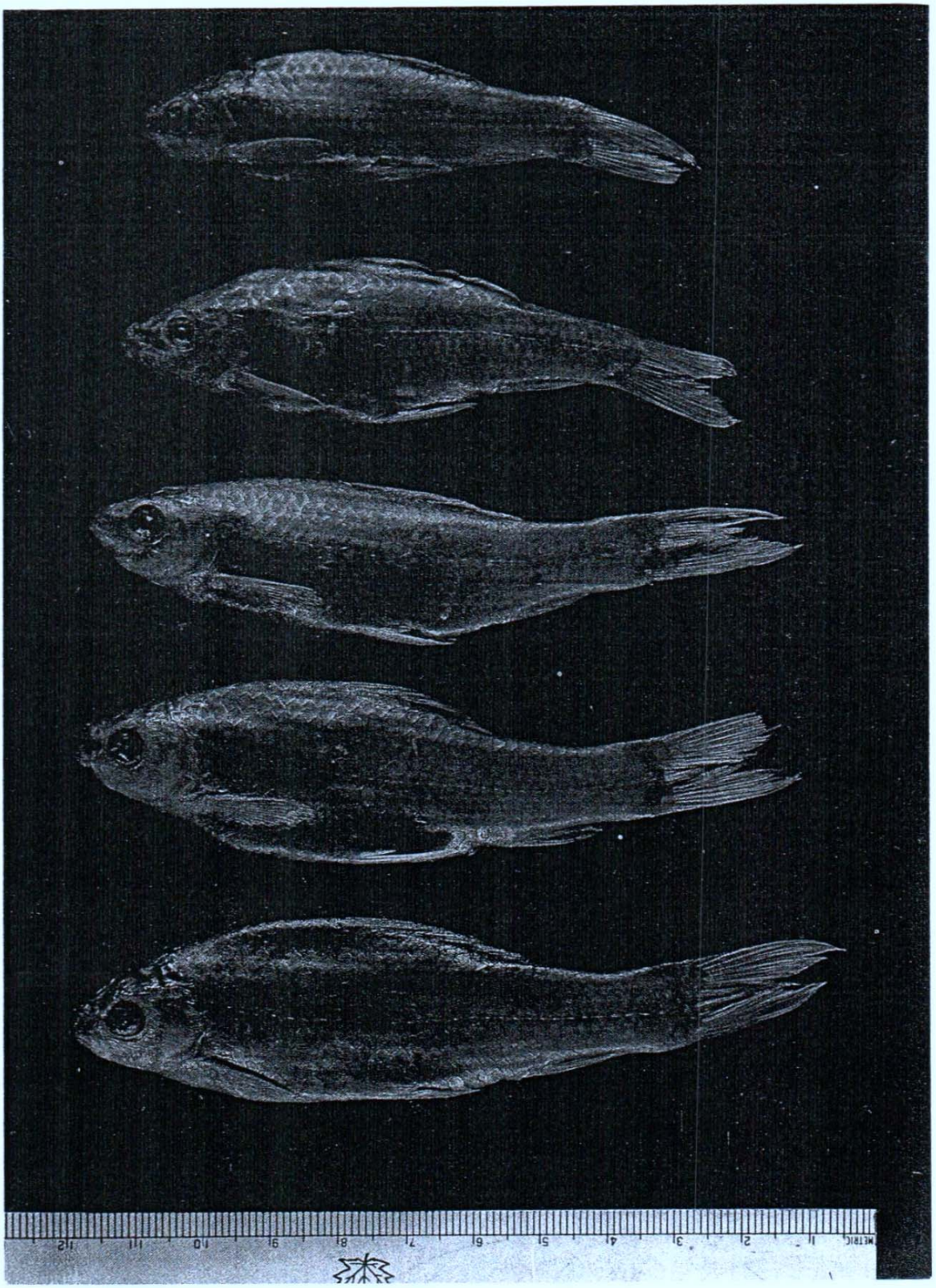


Fig. 11 *Osteochilus salsburyi* Nichols & Pope AMNH 10609

Osteochilus brachynotopteroides Chevey

Osteochilus brachynotopteroides Chevey, 1934: p34-35; original description (in French); type locality: Lake Kontum, Vietnam; no type specimen.

Nomenclature

Chevey (1934) described and illustrated *O. brachynotopteroides* from specimens indicated in his paper as "13 cm. 50, and 14 cm. 50." This means he had two specimens, 13.5 and 14.5 cm. but I have failed to locate any of his specimens (they do not exist in either Vietnam or France). There is a single specimen in the British Museum no. BMNH 1933.8. 19.30, labeled as *Osteochilus sp.*, Kontum, Annam; Delacour-Lowe, no collecting date; this specimen fits Chevey's description well. Since the specimen was cataloged in the British Museum in 1933, one year before Chevey's publication and was collected from the same localtiy, there is a strong possibility that this fish came from the collection of Chevey. Therefore, at this time, the specimen BMNH 1933.8. 19.30 is the only known specimen of this species.

Diagnosis

D. IV, 10; l.l. 33-34; c.f. 9/2/11; c.p. 16

O. brachynotopteroides is similar to *O. salsburyi,* but has a longer and more slender body. The dorsal fin has only 10 branched rays (usually 11 in *O. salsburyi),* circumferential scale 9/2/11 (11/2/13 in *O. salsburyi*), lateral line scales 33-34 (31 in *O. salsburyi*), and body plain.

Description

Body oblong, slender and slightly compressed, depth 282 (in thousandths of standard length). Head 214; eye 53, snout 78; no tubercles; snout longer than eye diameter, shorter than interorbital space, about equal to the postorbital part of the head. Interorbital space convex, 116. Mouth subinferior, two pairs of well developed barbels; maxillary barbels about equal to eye diameter, rostral barbels shorter than the maxillary ones. Ventral surface of upper lip consists of well deveoped moderately long undivided costae. Predorsal length 429; origin of dorsal fin opposite 11th scale of lateral line before mid-point between tip of snout and caudal base and also before pelvic fin insertion. Dorsal fin small and short, its fourth simple ray 236, and the base of dorsal fin 216; branched dorsal rays 10. The insertion of dorsal fin opposite 18th scale of lateral line, number of scales from posterior base of dorsal fin to vertical from anal fin origin is 5. Tip of pectoral fin not reaching pelvic fin insertion, opposite 12th scale of lateral line. Prepelvic length 532; pelvic fin insertion opposite 14th scale of lateral line. Preanal length 789, anal fin concave third simple ray rather weak; anal fin origin opposite 23 rd scale of lateral line. Caudal fin forked, its lobes more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 149; least depth of caudal penducle. 139, less than half of head length, and surrounded by 16 scale rows. Scales with nearly parallel longitudinal radii, predorsal scales 10; circumferential scales 9/2/11; transverse scales 4.5/1/3.5 (to the base of pelvic fin), lateral line scales 34, with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tube. Gill rakers on the first gill arch 31.

The specimen observed is very old and was not well preserved. It has plain yellowish coloration. According to Chevey's original description the back is greenish brown, yellowish-white below and a black spot on caudal penducle. The fins are all plain.

Distribution

Probably an endemic species of Lake Kontum, province of Pleiku, Vietnam.

Habitat

Accarding to Chevey (1934) Lake Kantum was formed in a crater of an extinct volcano at an altitude of 500 m above sea level. The greatest depth of this lake is 25 m. Oligochetes and insect larvae are abundant. Only three species of fish exist in the lake and two of them are endemic (Chevey, 1934).

Material Examined (1 specimen, 104.3 mm in standard length)
BMNH 1933.8. 19.30 (1 spec.) Kontum, Vietnam.

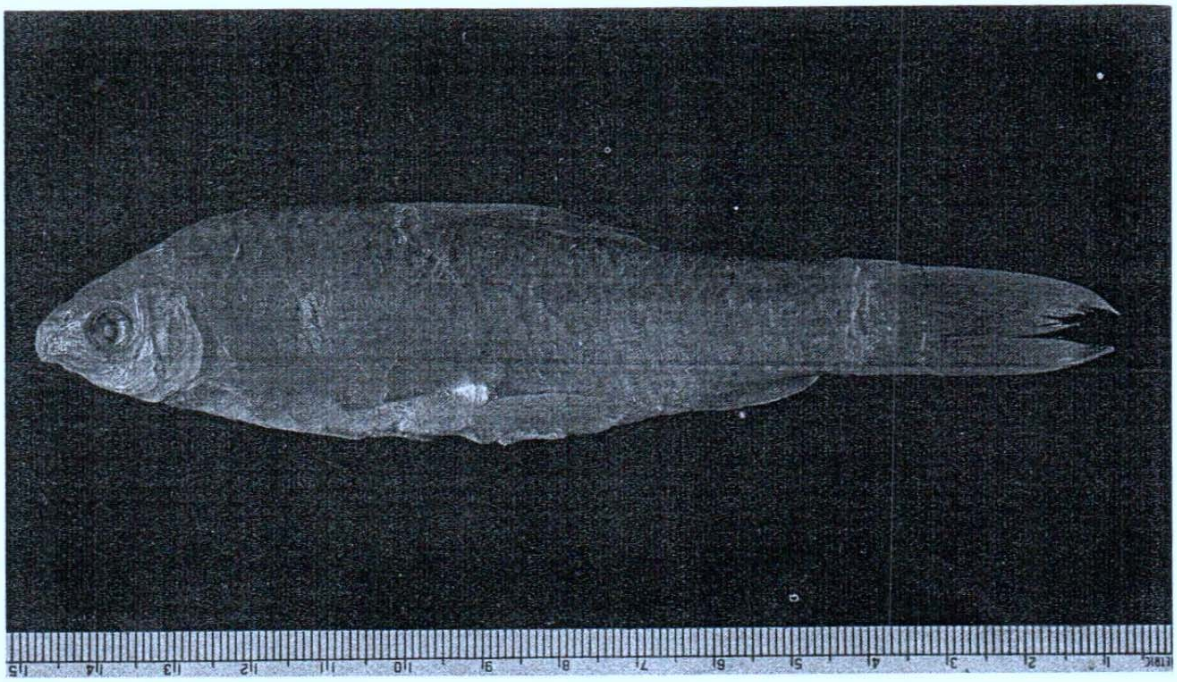


Fig. 12 *Osteochilus brachynotopteroides* Chevey BMNH 1933.8. 19.30

Osteochilus waandersi (Bleeker)

Rohita waandersi Bleeker, 1852: p.733; original description; type locality: Toboali, Banka; holotype: BMNH 1866: 5.2.169, 198 mm total length (given by Bleeker), 150.4 mm standard length (my measurement).

Rohita (Rohita) waandersi Bleekre, 1860: vol.2, p.166; description;..... 1863: vol.3, p.63; description with color plate (refers to the same specimen as in original description)

O. waandersi Gunther, 1868: vol.7, p.43; description (same specimen as Bleeker)

O. waandersi Weber and de Beaufort, 1961: vol 3, p.136; description (after Bleeker).

O. vittatus Weber and de Beaufort, 1961 (in part): vol 3, p.131; description; locality: Sumatra: Lake Sinkarah, Si-Djundjung, Solok; Borneo: Mendalan River.

O. Vittatus Smith, 1945 (in part): p.216, plt. 6.

Nomenclature

Bleeker described *Osteochilus waandersi* in 1852 from a single specimen. Bleeker's type specimen is quite peculiar in having circumferential scales 13/2/13 which are abnormal from the usual specimens which have 11/2/13 scales (the type specimen is the only specimen of this species I have seen which has the former number of circumferential scales). Later ichthyologists always identified specimens of this species as *O. microcephalus* because the circumferential scale number did not fit Bleeker's original description and *O. waandersi has* a median lateral stripe similar to those of *O. microcephalus* or *O. vittatus* (non Valenciennes). Most ichthyologists (after Bleeker's time such as Popta, Weber & de Beaufort, Fowler, Voltz, Smith, etc.) did not recognize that *O. waandersi* has a stripe that extends to the end of the mid-caudal rays while in *O. microcephlus* the stripe extends to end of caudal peduncle (they thought that this was variation within one species). I have examined these two forms carefully from a large number of specimen and I believe they are different species as stated further in the diagnosis.

Diagnosis

D. IV, 12-13; l.l. 32-33; c.f. 11/2/13; c.p. 16; g.r. 40-60

O. waandersi has one or three tubercles on the snout, if three, the middle one is the largest. A distinct median lateral stripe on the body extends from the posterior border of the eye (or gill opening) to the end of caudal fin.

O. waandersi is very similar to *O. enneaporus* by sharing many characters such as: median lateral stripe, inferior mouth, number of scales, and number of branched dorsal rays. *O. waandersi* differs from *O. enneaporus* by the body coloration (almost white on the bottom half). The median lateral stripe extends to the end of the caudal fin rays, while in *O. enneaporus* the stripe extends only to the end of the caudal peduncle. The third simple anal ray is shorter than the pectoral and pelvic fins in *O. waandersi,* but longer in *O. enneaporus. O. enneaporus* also has rather blunt snout, but rather pointed in *O.waandersi.*

O. waandersi also shares some characters such as median lateral stripe and tubercles on the snout with *O. microcephalus.* However, *O. microcephalus* has fewer gill rakers (not more than 35 vs 40-60 in *O. waandersi*), and the stripe is extended to only the end of the caudal peduncle.

Description

Body oblong, slender, and slightly compressed; depth 299-334 (mean=308) in thousandths of standard length). Head 218-241 (mean=227); eye 43-60 (mean=51), large fish with relatively small eye. Snout 79-101 (mean=91); usually with three pointed tubercles at the front, the middle one the largest and lateral ones small or rudimentary. Some specimens have only tubercle at the tip of the snout or all may be absent in young specimens. Snout longer than eye diameter, about equl to or shorter than interorbital space, usually longer than the postorbital part of the head. Interorbital space slightly convex, 97-122 (mean=111) Mouth conspicuously inferior; two pairs of well developed barbels; maxillary barbels longer than eye diameter, rostral barbels usually shorter than the maxillary ones. Ventral surface of upper lip consists of well developed long costae, some of which are divided into two unequal portions. Predorsal length 398-442 (mean=427); origin of dorsal fin opposite 9th scale of lateral line; before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin short with normal height, its fourth simple ray usually shorter (it may be about equal to or a little longer) than the base of the dorsal fin, the length of the fourth simple ray 243-270 (mean=261), and the base of dorsal fin 261-306 (mean=270); branched dorsal rays 12-13 The insertion of the dorsal fin opposite 19th -20th scale of lateral line, number of scales from insertion of the dorsal fin to vertical from the origin of the anal fin varies from two to three. Tip of pectoral fin not reaching the pelvic fin insertion, usually opposite 9th-10th scale of lateral line. Prepelvic length 469-517 (mean=488); pelvic fin insertion opposite 11th-12th scale of lateral line. Preanal length 708-763 (mean=737); anal fin concave, third simple ray rather

weak; anal fin origin opposite 21st-23rd scale of lateral line. Caudal fin deeply forked. Its lobe more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 124-159 (mean=140); least depth of caudal peduncle 113-136 (mean=122), usually about equal to half of head length, and surrounded by 16 scale rows. Scales with nearly parallel longitudinal radii, predorsal scales usually 10 (rarely 11); circumferential scales 11/2/13 and transverse scales (to the base of pelvic fin) 5.5/1/4.5. Lateral line scales 32-33, with two additional scales on the caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 40-60.

Preserved specimens are dusky on the upper two-fifths of the side, the dorsal part of the head and back are darker; the lower half of body whitish. A median longitudinal stripe on the body extends from the head to the end of the caudal rays. All fins are pinkish during life but hyaline in preserved specimens.

Distribution

Osteochilus waandersi ranges from central Thailand to Malay Peninsula, Sumatra, Java, and western Borneo.

Habitat

Forest streams and rivers with fast moving water swift current, water may be clear or turbid.

Material Examined (123 specimens 58.5-204.8 mm standard length)

Holotype: BMNH 1866.5.2. 169, Tobali Province, Banka

Other specimens:

Borneo: BMNH 1881.3.21.11-12 (1 spec.) Sarawak
RMNH 2596 (2 spec.) no specific locality
ZMA 116.071 (1 spec.) Mendalam River
KCTR 76-36 (1 spec.) Kapuas River, 6 km west of Putussibau
KCTR 76-6 (7 spec.) Sungai Paklehung, low-lying hill stream, tributary of Sangai Mempawah, 48 km NNW from Pontianak.

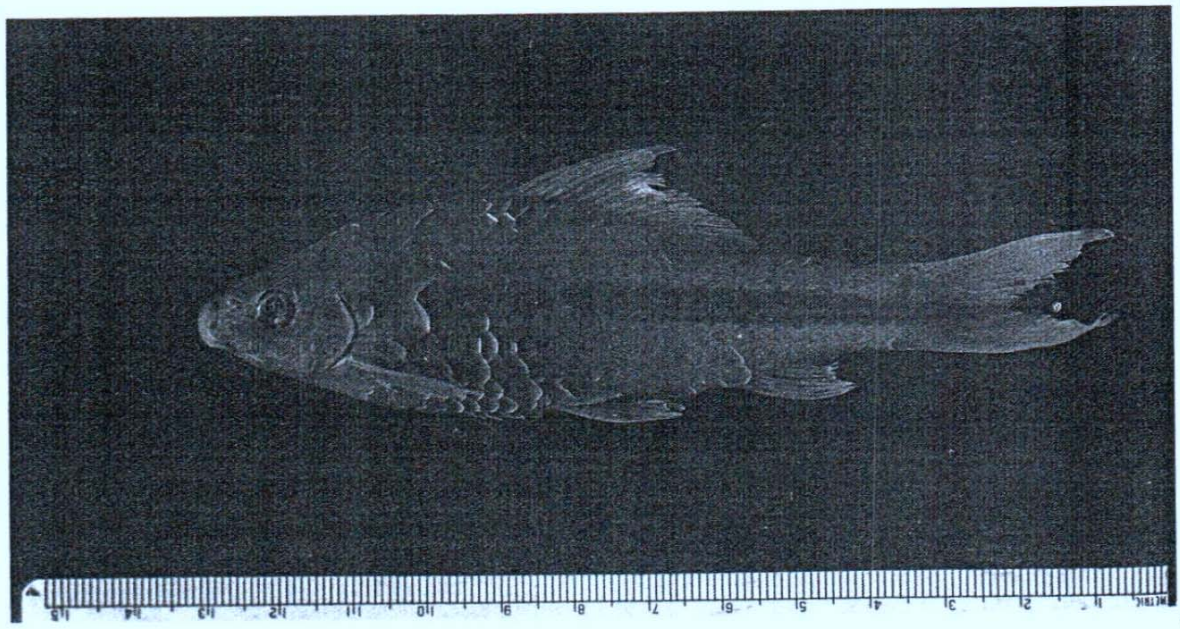


Fig. 13 *Osteochilus waandersi* (Bleeker) NIFI uncatalogued, Pattani River

Biliton Island: ZMA 116.075 (3 spec.) no specific locality

Malaysia: AMNH 13820 (1 spec.) no specific locality
BMNH 1922.5. 19.59-63 (5 spec.) Tahan River
BMNH 1931.8.21.16 (1 spec.) River Jelai, Kuala Pilak, Negri Sembilan
BMNH 1932.5.19. 15-16 (3 spec.) Tahan River Pahang
BMNH 1960.3.8.13 (1 spec.) Chegar Sirch, Tehan River, Pahang
CAS 36366 (1 spec.) no specific locality
CAS 34702 (1 spec.) Johore
CAS 34703 (1 spec.) no specific locality
NMNH 101228 (1 spec.) Mawai Region, Johore
ZMA 116.076 (2 spec.) Bukit Merah reservoir
NMS 2309 (3 spec.) Sungai Tembeling, Kuala Tahan, Pahang
NMS 1889 (1 spec.) Bukit Meran Reservior, Perak
NMS 1894 (3 spec.) Sedili River, Johore

Sumatra: RMNH 26904 (1 spec.) Deli
RMNH 29909 (5 spec.) Sockadana
RMNH 5009 (4 spec.) Sockadana
RMNH 5010 (4 spec.) Sockadana
ZMA 116.067 (2 spec.) Lake of Singkrah
ZMA 116.068 (1 spec.) River at Solok
ZMA 116.069 (2 spec.) Sidjoeungdjoeng
ZMA 116.077 (5 spec.) Patang Pangion, and Patang Somo

Thailand: ANSP 85835 (2 spec.) Khao Phanom Bencha
ANSP 76840 (1 spec.) Waterfall at Trang
ANSP 87833 (1 spec.) Old. Cheing Sen, N.Siam
ANSP 76839 (6 spec.) Waterfall at Trang
AMNH 14578 (1 spec.) Klong Chawang, East Bandon
BMNH 1934.12.18.16 (1 spec.) Chanthaburi
NMNH 108054 (1 spec.) Pakjong, head water of Manam Mun.
NMNH 103255 (2 spec.) Chanthabun River, southeast Thailand
NMNH 103256 (1 spec.) Klong Chawang, near Kao Nong, Bandon
NMNH 109785 (1 spec.) Mekong River
NMNH 191528 (1 spec.) no specific locality
NIFI (uncatalogued) (5 spec.) Kanjanburi
NIFI (uncatalogued) (3 spec.) Kanjanaburi
NIFI (uncatalogued) (10 spec.) Surathani
NIFI (uncatalogued) (5 spec.) Chumporn
NIFI (uncataloued) (8 spec.) Kao Saming River, Trad
NIFI (uncatalogued) (9 spec.) Punnang Star, Yala.

Osteochilus enneaporus (Bleeker)

Rohita enneaporos Bleeker, 1852: p.596; original description; type locality: Padang, Sumatra; holotype BMNH 1866.5.2.172, 191.9 mm standard length (my measurement)

Rohita (Rohita) enneaporos Bleeker, 1860: vol2, p.184; description ..... 1863: Vol3, P.70; description (with color plate).

Osteochilus vittatus Gunther (in part) 1868: vol.7, p.44; placed the species as a junior synonym of *O. vittatus*

Osteochilus vittatoides Popta, 1904: p195; original description; type locality: Howang River; head water of Mahakam, Borneo; syntypes (9 spec.), 93-116 mm total length (given by Popta). 80.5-89.2 mm standard length (my measurement) .....1906: p94, fig 20; description, locality: Kajan River, eastern Borneo.

Osteochilus vittatus Weber & de Beaufort (in part) 1916: vol 3, p.131; placed the species as a junior synonym of *O. vittatus*.

Osteochilus scapularis Fowler, 1939: p69, fig. 17-18; original description; type locality: waterfall at Trang. S. Thailand; holotype ANSP 68505, 138 mm total length (given by Fowler) 97.1 mm standard length (my measurement).

Osteochilus scapularis Smith, 1945: p213; description (after Fowler).

Nomenclature

Osteochilus enneaporus was described by Bleeker (1852) on the basis of a single specimen. In 1868, Gunther considered the species a junior synonym of *O. vittatus* (none Cuv. & Val.) because they have a similar median lateral stripe. Popta described *O. vittatoides* in 1904 from eastern Borneo; this differs from *O. enneaporus* by not having tubercles on the snout (this may be only a geographic variant; eastern Borneo is quite isolated from the rest of the fauna). Weber and de Beaufort (1916) considered both *O. enneaporus* and *O. vittatiodes* to be junior synonyms of *O. vittatus* (nonValenciennes). He probably did not see the types of the three species since he stated: " The above description is in accordance with that of Bleeker given for *Rohita vittatus".* My examination of the type specimens of these species and few other specimens of *O. eneaporus* strongly suggests that *O. eneaporus* is a valid species.

Diagnosis

D. IV, 11-13; l.l. 31-32; c.f. 11/2/13; c.p. 16; g.r. 40-60

O. enneaporus has either one or three tubercles on the snout (if three the middle one is the largest). There is a median lateral stripe along side of the body which is usually distinct on posterior half of the body. Body covered with darked melanin pigment.

O. enneaporus is very closely related to *O. waandersi* and shares characters such as: median lateral stripe, conspicuously inferior mouth, number of scales, and number of branched dorsal rays. *O. enneaporus* differs from *O. waandersi* by having darker body coloration (ususally very dark on the anterior and dorsal part of the body) and a rather blunt (truncate) snout while in *O. waandersi* the snout is quite pointed. The median lateral stripe extends only to the end of the caudal peduncle or diffusely into the middle of the caudal fin, but extends to the end of the caudal rays as a sharp, distinct band in *O. waandersi.*

Description

Body oblong, slender, and slightly compressed; depth 289-344 (mean=319) (in thousandths of standard length). Head 207-262 (mean=229); eye 45-64 (mean=52), large fish with relatively small eye. Snout 79-105 (mean=94); usually with one pointed or three tubercles or pores at the front, the middle one the largest and lateral ones small or rudimentary; snout longer than eye diameter in adult fish, shorter than interorbital space, longer than the postorbital part of head. Interorbital space slightly convex, 108-123 (mean=113). Mouth conspicuously inferior, two pairs of well developed barbels; maxillary barbels longer than eye diameter. rostral barbels shorter than the maxillary one. Ventral surface of upper lip consists of well developed, long, undivided costae. Predorsal length 425-452 (mean=435); origin of dorsal fin opposite 8th-9th scales of lateral line before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin usually falcate, its fourth simple ray usually longer than the base of dorsal fin, length of the fourth simple ray 293-376 (mean=329), base of dorsal fin 259-292 (mean=279), and branched dorsal rays 11-12. The insertion of the dorsal fin opposite 19th-20th scale of lateral line, number of scale from insertion of the dorsal fin to vertical from the anal fin origin varies from one to two. Tip of pectoral fin not reaching the pelvic fin insertion, usually opposite 10th-12th scale of the lateral line. Prepelvic length 498-530 (mean=509); pelvic fin insertion oposite 11th scale of lateral line. Preanal length 730-751 (mean=743); anal fin concave, third simple ray rather weak; anal fin origin opposite 21st-22nd scales of lateral line. Caudal fin deeply forked, its lobe more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 126-146 (mean=137); least depth of caudal peduncle 128-138 (mean=132), usually less than half of head length, and surrounded by 16 scale rows. Scales with nearly parallel longitudinal radii, predorsal scales usually 10 (rarely 9); circumferential scales 11/2/13, and transverse scales (to the base of pelvic fin) 5.5/1/4.5 Lateral line scales 31-32, with two additional pored scales on caudal base. Lateral line

somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 40-60

Preserved specimens with dark body, upper part of side and head darker than the lower part A median longitudianl stripe extends from head to the end of caudal peduncle, more distinct on posterior half of body. This stripe may be diffuse in the middle part of caudal fin in large specimens. Dorsal and caudal fins dusky, other fins plain. Live specimens have bright red fins.

Distribution

The distribution of *O. enneaporus* is restricted to Malay Peninsula, Sumatra, and Borneo.It is quite common in the Kapuas River and in Sarawak. Only a few specimens are avalialbe from Sumatra and Malay Peninsula.

Habitat

Small or large forest streams with swift or moderate current, usually found in clear water; bottom sand, gravel, stones, and logs.

Material Examined (46 specimens, 61.1-191.9 mm standard length)

Holotype: BMNH 1866.5.2.172; Padang Sumatra

Other specimens:

RMNH 7575 (9 spec.) (syntypes of *O. vittatiodes)* Howang River

ANSP 68505 (1 spec.) (holotype of *O. scapularis*) waterfall at Trang Thailand

Borneo : BMNH 1978.3.20.112 (1 spec.) S. Malinau, Sarawak

BMNH 1978.3.20.113-114 (2 spec.) S.Lansat, Sarawak

BMNH 1978.3.20.115 (1 spec.) S. Berar, Sarawak

BMNH 1978.3.20.116 (1 spec.) S. Melinau, Sarawak

BMNH 1894.6.30.185 (1 spec.) Padas River

BMNH 1906.10.29.5-6 (2 spec.) head of Baram River

KCTR 76-29 (4 spec.) Rocky channel in mainstream of Sungai Pinoh at Nahga Saian, 45 km south of Nanga Pinoh

KCTR 76-6 (7 spec.) Sungai Pukleung, low-lying forest hill stream, tributary of Sungai Menpawah, 48 km NW from Pontianak, 9km NE of Andjongan.

KCTR 76-27 (6 spec.) rocky channel in mainstream of Sungai Pinoh, 37 km S of Nangapinoh.

KCTR 76-24 (1 spec.) main stream, Sungai Pinoh 20-60 km upstream from Nangapinoh

RMNH 7576 (4 spec.) Kajan River

Sumatra: BMNH 1915.8.24.11 (1 spec.) Sungai Pinoh, Korinchi

Malay Peninsula: NMS 1890 (2 spec.) Ulu Jelai, Pahang, Malaysia

NMS 2656 (1 spec.) River Jalai, Kuala Pilah, Negri Sembilan, Malaysia.

NIFI uncatalogued (1 spec.) Patani River at Yala, Thailand.

Fig. 14 *Osteochilus enneaporus* (Bleeker) KCTR 76-6

Osteochilus bellus Popta

Osteochilus bellus Popta, 1904:p.197; original description; type locality: Borneo (Bo River); Syntype, RMNH 7580, six specimens: 80-112 mm total length (given by Popta), 61.5-84.9 mm standard length (my measurements).

Osteochilus bellus Popta, 1906: p.104; redescription of the same specimens.

Osteochilus bellus Weber & de Beaufort, 1916: vol.3, p.134; description refering to Popta's specimens.

Nomenclature

Popta described *O. bellus* from six specimens collected from River Bo in 1904. Since then no additional specimens have been collected. The six syntypes demonstrate intraspecific variations in colour pattern and snout tubercles. I do not intend to designate a lectotype.

Diagnosis

D. IV, 10-11; l.l. 31; c.f. 9/2/11; c.p. 16

Ostechilus bellus has about six longitudinal rows of spots on the body and a median lateral stripe on the posterior half of the body which is less distinct in some specimens. Mouth conspicuously inferior lower lips with well developed long costae. Gill rakers on the first gill arch 43-45.

O. bellus has a body proportion similar to *O. sarawakensis* but it has fewer circumferentail scales, a shorter dorsal fin, and tubercles on the snout. It also shares some characters with *O. enneaporus* such as the median lateral stripe, tubercles on the snout, and mouth structure and position. *O. bellus* has fewer circumferntial scales, a shorter dorsal fin, and a less distinct lateral stripe than *O. enneaporus*. Also, *O. enneaporus* does not have rows of spots on the body.

Description

Body oblong, slender and slightly compressed, depth 249-304 (mean=284.3) (in thousandths of standard length). Head 217-241 (mean=234); eye 54-66 (mean=61). Snout 84-109 (mean=97); usually with three pointed tubercles in the front, the middle one the largest; in some specimens many small tubercles present. Snout longer than eye diameter in adult fish, slighty shorter than interorbital space, slightly convex; length 100-108 (mean=104). Mouth conspicuously inferior, two pairs of well developed barbels; maxillary barbels longer than eye diameter, rostral barbels shorter than the maxillary ones. Ventral surface of upper lip consists of well developed long undivided costae. Predorsal length 402-446 (mean=418); origin of dorsal fin opposite 8th-9th scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic insertion. Dorsal fin falcate, its fourth simple rays moderately produced, longer than the base of dorsl fin. The length of the fourth simple ray 273-300 (mean=290), and the base of dorsal fin 241-270 (mean=259); branched dorsal rays 10-11. The insertion of the dorsal fin opposite 18th-19th scale of lateral line, number of scales from insertion of the dorsal fin to vertical from anal fin origin varies from two to three. Tip of pectoral fin usually not reaching the pelvic fin insertion, opposite 10th scale of lateral line. Preanal length 729-764 (mean=743); anal fin concave, third simple ray rather than week; anal fin origin opposite 21st scale of lateral line. Caudal fin deeply forked, its lobes more or less acute, upper lobe slightly longer than lower lobe. Length of caudal peduncle 124-148 (mean=137); least depth of caudal peduncle 119-127 (means=124), usually about half of the head length, and surrounded by 16 scale rows. Scales with parallel radii, predorsal scales usually 9 (10 in one species); circumferential scales 9/2/11 (one specimen 10/2/11) (4.5/1/3.5 in transverse series to the base of the pelvic fin); lateral line scales 31 with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly its scales with simple tubes. Gill rakers on the first gill arch 43-45.

Preserved specimens are dark with pigment, the dorsal head and back are very dark. Body with median longitudinal strip on posterior half of body

more or less distinct; 5-6 rows of spots along side of the body (situated in the pocket of each scale), three below, two above, and one on the lateral line; the middle 4 rows are more distinct than the outer two. Dorsal fin and caudal fins with melanin pigment, other fin hyaline. Coloration of fresh or live specimens according to Popta (1906); is violet above, pinkish-violet below; the dorsal and caudal fins are grayish-pink, other fins hyaline-pink.

Distribution

Only six specimens are known and all are from River Bo, left branch of the superior Mahakam, Central Borneo.

Habitat

Popta (1906) states that it occurs in a mountain stream about 150 metres above sea level.

Material Examined (6 specimens, 61.5 mm-84.9 mm. standard length)

RMNH 7580 (syntypes): River Bo, Central Borneo.

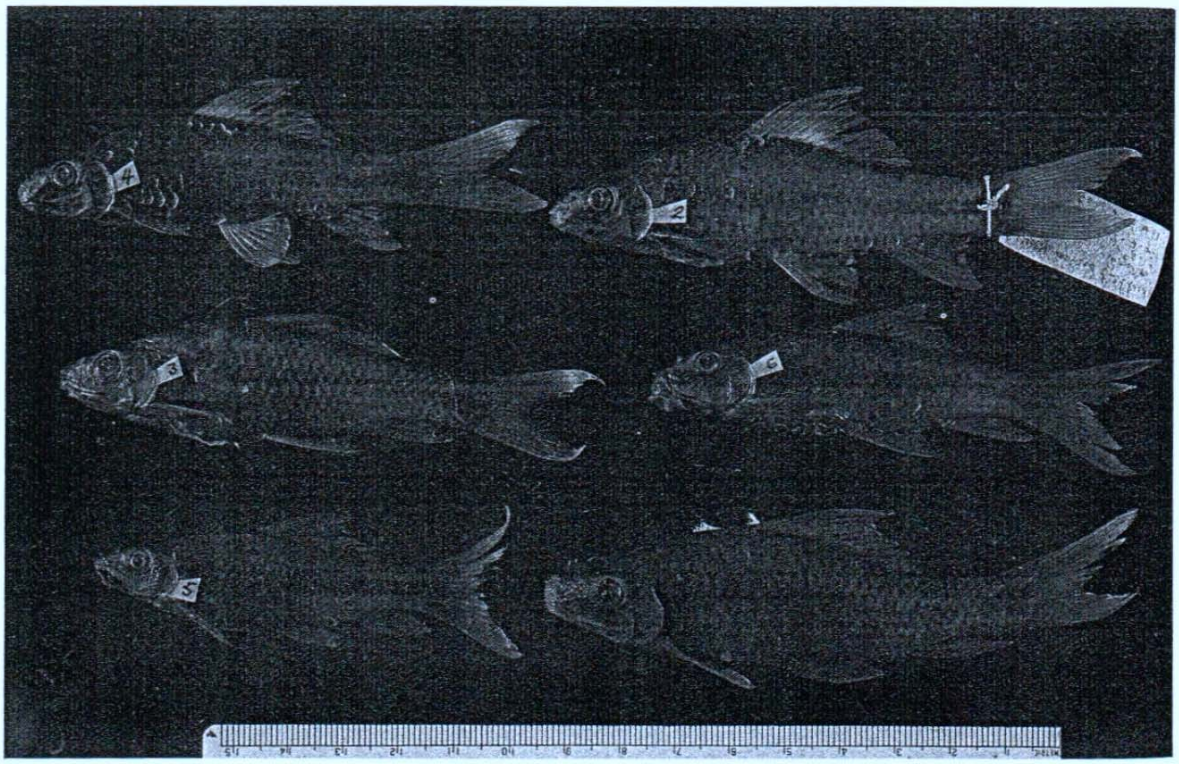


Fig. 15 *Osteochilus bellus* Popta Syntypes RMNH 7580

Osteochilus pleurotaenia (Bleeker)

Lobochilus pleurotaenia Bleeker, 1855: p.267; original description; type locality; Lahat, Sumatra; syntypes, BMNH 1866.5.2.105 (1 spec.) RMNH 6998 (1 spec.), 145 mm and 216 mm. total length (given by Bleeker), 103.0 and 150.2 mm standard length (my measurements).

Lobochilus rohitoides Bleeker, 1857: p.363; original description; type locality; Krawang, Batavia (Java); Holotype, BMBH 1866.6.2.163, 68 mm total length (given by Bleeker), 46.1 mm standard length (my measurement).

Diplocheilichthys pleuortaenia Bleeker, 1860: p.143; description of new generic name; type species *Lobocheilos pleurotaenia* Bleeker.

Labeo (Diplocheilos) rohitoides Bleeker, 1863: Vol.3, p.55; description with color plate.

Labeo pleurotaenia Gunther, 1868: Vol.7, p.58; description, synonymized *Labeo (Diplocheilos) rohitoides* Bleeker under *Labeo pleurotaenia* (Bleeker)

Osteochilus jentinkii Popta, 1904: p.194; original description; type locality: Bongon River (Borneo); syntypes, RMNH 7574 (2 spec.) 181 mm, and 194 mm. total length (given by Popta), 131.2 mm and 135.8 mm (my measurements)

Osteochilus jentinkii Popta, 1906: p.91; redescription with plate.

Labeo (Labeo) rohitoides Weber & de Beaufort, 1916: Vol.3, p.214; description; locality: Sumatra (Sidjungjung); synomyzed *Osteochilus jentinkii* under this name.

Labeo (Labeo) pleurotaenia Weber & de Beaufort, 1916: Vol. 3 p. 215; description; locality: Borneo, middle and upper part of River Kapuas.

Nomenclature

Bleeker described *Osteochilus pleurotaenia* under the name *Lobocheilos pleurotaenia* in 1855 from two specimens from Sumatra and in 1857 he described *Lobocheilos rohitoides* from a single specimen from Batavia. In these descriptions there are only minor differences. In 1860, Bleeker proposed the new generic name *Diplocheilichthys* for *Lobochilos pleurotaenia* (monotypic form) and placed *Lobochei los rohitoides* under *Labeo (Diplocheilos) rohitoides.* Gunther (1868) synonymized these two species and placed them under *Labeo.* He did not recognized the subgenera of Bleeker. In 1904, Popta described *Osteochilus jentinki* from two specimens collected from Bongan, Central Borneo, which were synonymized in *Labeo rohitoides* by Weber & de Beaufort (1916). Weber and de Beaufort (1916) recognized *Labeo pleurotaenia* and *Labeo rohitoides* as separate species by the difference of the lateral part of the upper labial fold which they called the lateral lobe of snout, based on comparing type specimens of *Osteochilus jentinki* (representing *Labeo rohitoides*), with seeing the type of *Lobocheilos rohitoides,* and the type specimen of *Lobochilos pleurotaenia* in RMNH. I have examined type specimens of these three species and agree with Gunther, in part, that *Lobocheilos pleurotaenia* and *Lobocheilos rohitoides* are the same species and that *Osteochilus jentinki* is also a synonym of this species. The shape of the labial folds in this species resembles those of *Labeo* but when the detailed structure of the costae labial folds and the osteological structures are carefully studies, it is evident that this belongs to *Osteochilus.* Placement of this species in *Osteochilus* courses a nomenclatural problem since *Osteochilus pleurotaenia* is a type species for the genus *Diplocheilichthys* which is an older name than *Osteochilus.* However, the name *Diplocheilicht hys,* almost forgotten, had been used only by Bleeker in 1860 and 1863. *Osteochilus* is a well known genus for ichthyologists who study cyprinids. Therefore, I intend to appeal to the International Commision of Nomenclature to stabilize the name *Osteochilus* and suppress the name *Diplocheilichthys.*

Diagnosis

D. IV, 10-11; l.l. 30-31; c.f. 11/1/13; c.p. 16

O. pleurotaenia has 10 branched dorsal rays. Mouth is conspicuously inferior. Upper labial fold (upper lip) expanded to form a large sucking mouth.

Ventral part of upper lip with well developed, long, and undivided costae. Snout without major tubercle but with numerous fine tubercles or entire. Gill rakers on the first gill arch numerous, 40-60

O. pleurotaenia shares many characters with *O. enneaporus* but *O. pleurotaenia* has only 10-11 branched dorsal rays while *O. enneaporus* usually has 12-13 (rarely 11). *O. enneaporus* has three tubercles on snout, which are lacking in *O. pleurotaenia*. The median lateral band is more distinct in *O. enneaporus* but always disappears in adult specimens of *O. pleurotaenia*. The lips are more expanded in *O. pleurotaenia*.

Description

Body long, slender, and slightly compressed, depth 253-307 (mean=270) (thousandths of standard length). Head 195-302 (mean=251); eye 54-78 (mean=62), larger fish with relatively small eye. Snout 89-130 (mean=105); without major tubercles but with numerous fine granulated tubercles or entire; snout longer than eye diameter in adult fish, shorter than interorbital space, about equal to the postorbital part of the head. Interorbital space slightly convex, 105-125 (mean=113). Mouth conspicuously inferior, two pairs of well developed barbels; maxillary barbels usually shorter than or equal to eye diameter, rostral barbels shorter than the maxillary ones. Lips expanded, forming a sucking mouth; ventral surface of upper lip consists of well developed long undivided costae. Predorsal length 455-503 (mean=474); origin of dorsal fin opposite 8th or 9th (usualy 9th) scale of lateral line, before mid-point between tip of snout and caudal base, and also before the pelvic fin insertion. Dorsal fin usually falcate, its fourth simple ray greatly produced, longer than the base of dorsal fin, the length of the fourth simple ray 230-291 (mean=260,), and the base of dorsal fin 200-230 (mean=211); branched dorsal rays 10-11. The insertion of the dorsal fin lies opposite the 16th-18th scale of the lateral line; number of scales from insertion of the dorsal fin to vertical from anal fin origin varies from four to five. Tip of pectoral fin not reaching the pelvic fin insertion, usuallay opposite 8th-10th scale of lateral line. Prepelvic length 547-578 (mean=562); pelvic fin insertion opposite 11th-12th scale of lateral line. Preanal length 773-801 (mean=787); anal fin concave, third simple ray rather weak; anal fin origin opposite 22nd-23rd scale of lateral line. Caudal fin deeply forked, its lobes more or less acute, upper lobe slight longer than the lower lobe. Length of caudal peduncle 124-174 (mean=143); least depth of caudal peduncle 106-135 (mean=116), usually slightly longer than half of head length, shorter than its length, and surrounded by 16 scale rows. Scale with nearly parallel longitudinal radii, predorsal scales 10-11; circumferential scales 11/2/13 (5.5/1/4.5 in transverse series to the base of pelvic fin); lateral line scales 30-31, with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 28-31.

Preserved specimens are dusky on the upper two-fifths of the side; the dorsal part of head and back are darker than the rest of the body. A median lateral stripe runs from the gill opening to the end of caudal peduncle, usually more distinct in younger specimens and may be absent in adults. All fins are plain. According to Bleeker's description, body color is green dorsally and silver ventrally, dorsolateral scales with dark triangular spots. Fins are orange-pink.

Distribution

O. pleurotaenia is not a common species, the distribution is limited to Sumatra, Java, and Borneo.

Habitat

Unknown, probable large streams at high elevation with fast running water.

Material Examined (19 specimens; 43.4-224.7 mm. standard length)

Syntypes: BMNH 1866.5.2.105 (1 spec.), Lahat, Sumatra

RMNH 6998 (1 spec.), Lahat, Sumatra

Other type specimens:

BMNH 1866.6.2.163, Holotype *of Lobocheilos rohitoides;* Krawang, Batavia, Java.

RMNH 7574, syntypes (2 spec.) of *Osteochil us jentinkii;* Bongan River, Central Borneo.
Other specimens:
Borneo: RMNH 1683-86 (5 spec.), 3 specimens from Putussibau, Kapuas River; 2 specimens from Mandai River, tributary of Kapuas at Nangaraun.

Sumatra: UMMZ 169799 (6 spec.), Moesi River at Moeara Klingi.
No locality: RMNH 16587 (3 spec.) from Dr. Bleeker's collection.

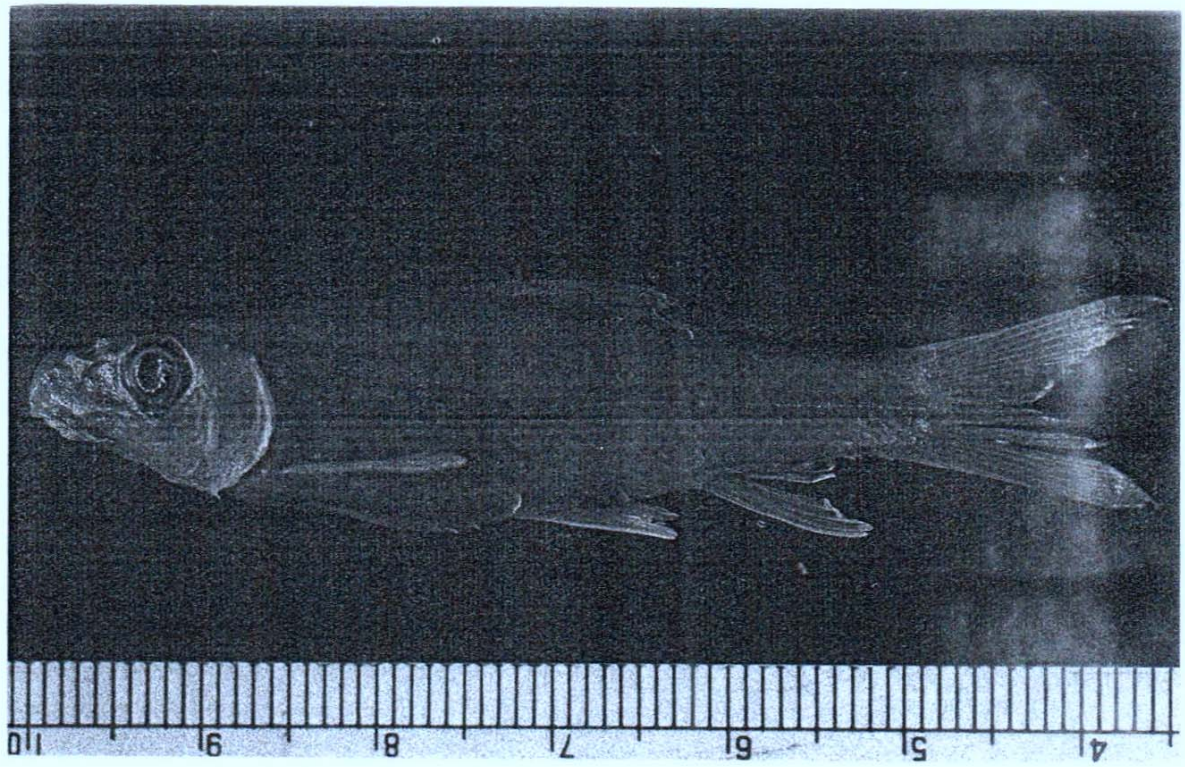


Fig.16 *Osteochilus pleurotaenia* (Bleeker) UMMZ 169799

Osteochilus kahajanensis kahajanensis (Bleeker)

Rohita kahajanensis Bleeker, 1957: p.18; original description; type locality: Kahajan River, Southern Borneo; holotype specimen RMNH 4980, 76 mm total length (given by Bleeker) 53.9 mm standard lenth (my measurement).

Rohita (Rohita) kahajanensis, Bleeker 1860: vol 2, p180; description; refers to the same specimen. 1863: vol.3, p69; description; one additional specimen of 106 mm total length from Lahat, Sumatra (BMNH 1866-5-2-175, 78.7 mm SL.)

Osteochilus kahajanensis Gunther, 1868: vol.7, p.44; description; reference to Bleeker's specimen.

Osteochilus kahajanensis Popta, 1906: p.98; description; locality: Bo River, tributary of Mahakam, Central Boneo.

Osteochilus kahajanensis Weber & de Beaufort, 1916: vol3, p130; description; locality: Kapuas River at Putus Sibau.

Nomenclature

Osteochilus kahajenensis was described from a single specimen by Bleeker in 1857. The type specimen is 76 mm long (total length, stated by Bleeker. Gunther (1868) claimed that the specimen BMNH 1866.5.2.175 (78.7 mm andard length) purchased from Bleeker's collection, is a type of the species. The specimen at the BMNH is probably the second specimen that Beeker had in his 1863 Atlas, which he indicated was 106 mm (total length) long. The specimen RMHN 4980 (53.9 mm S.L.) indicated as a syntype agrees with the total length that Bleeker gave in the original description, and therefore this specimen is probably the holotype, while the specimen at the BMNH would not be a type.

Diagnosis

D. IV, 15-17 (rarely 14); l.l. 31-32; c.f. 11/2/13; c.p. 16

O. kahajenensis is the only species of *Osteochilus* that has two well developed tubercles on the snout (one on each side) (there is usually one or three or more in some other species). A diffuse median longitudinal stripe along the side of the body (unlike the distinct median lateral stripe found in the *O. microcephalus* and *O. waandersi* groups). There is geographical variation in the number of branched dorsal rays and body proportions between the populations in most regions (D. IV, 15-16) and in the populations in the isolated area of northeastern Borneo (D. IV, 12-14). The latter form is described as a new subspecies *O. kahjenensis chini* in this study (see page 84).

Description

Body oblong and compressed; depth 322-394 (mean=347) (in thousandths of standard length). Head 201-262 (mean=220); eye 39-71 (mean=49), large fish with relatively small eye. Snout 77-93 (mean=85); with two tubercles or pores in front, snout longer than eye diameter in adult fish, shorter than interorbital space. Interorbital space slightly convex 103-119 (mean=111). Mouth subinferior, two pairs of well developed barbels; maxillary barbels longer than eye diameter, rostral barbel usually shorter than the maxillary ones. Ventral surface of upper lip consists of well developed moderately long undivided costae. Predorsal length 425-456 (mean=438); origin of dorsal fin opposite 8th or 9th (usually 9th) scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin moderately long and normal in height, the length of its fouth simple ray 209-337 (mean=240), and the base of

Fig.17 *Osteochilus kahajanensis kahajanensis* (Bleeker) KCTR 76-17

dorsal fin 333-394 (mean=365); branched dorsal rays 15-16 (rarely 14), Insertion of the dorsal fin opposite 22nd-23rd scale of lateral line, number of scales from insertion of the dorsal fin to vertical from anal fin origin varies from zero to one. Tip of pectoral fin not reaching the pelvic fin insertion, usually opposite 7th-11th scale of lateral line. Prepelvic length 489-521 (mean=506), pelvic fin insertion. opposite 11th-12th scale of lateral line. Preanal length 753-782 (mean=768), anal fin concave, third simple ray rather weak; and fin origin opposite 22nd-24th scale of lateral line. Caudal fin deeply forked, its lobes more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 105-128 (mean=121); least depth of caudal peduncle 126-146 (mean=134), usually less than half of head length, and surrounded by 16 scale rows. Scales with nearly parallel longitudinal radii, predorsal scales usually 10 (rarely 9); lateral line scale 31-32 with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly; its scales with simple tubes. Gill rakers on the first gill arch 33-46 (mean=39.8).

Preserved specimens are dusky on the upper part of the side, the dorsal part of head and back are darker. An intense dark spot occurs behind the upper part of the gill opening. A wide diffuse median lateral stripe which is wider at the anterior part and tapers posteriorly extends from the gill opening to the end of the caudal peduncle. A large round black spot is on the middle part of caudal peduncle. Membranes of dorsal and anal fin are dusky; other fins plain.

Distribution

O. kahajenensis kahajenensis occurs only in eastern of Malay Penninsula, Southern Sumatra, Java and Western Borneo.

Habitat

Small or large streams at low altitude, current moderate to swift, water usually turbid, muddy or sandy bottom.

Material Examined (14 specimens. 53.9-219.2 mm S.L.)

Holotype: RMNH 4980 Kahajan River, Borneo

Other specimens:

BMNH 1866-5-2-175 no locality, from Bleeker's collection, probably Lahat, Sumatra.

RMNH 17760 (1 spec.) Bleeker's collection, no locality.

Borneo: BMNH 1895.7.2.59-60 (3 spec.) Baram District, Sarawak.

BMNH 1978.9.5.44 (1 spec.) S. Lansat River, Sarawak

BMNH 1978.3.20.111 (1 spec.) S.Melinau Paku, Sarawak

BMNH 1978.3.20.110 (1 spec.) Melinau River, Sarawak

KCTR 76-17 (1 spec.) small forest stream where it flows into Kapaus main stream about 10 km upstream from Sanggau.

ZMA 116.082 (1 spec.) Putus Sibau.

Sumatra: ZMA 116.083 (1 spec.) Kurintji

Malaysia: BMNH 1922.5.19.75-76 (2 spec.) Tahan River

Osteochilus kahajanensis chini new subspecies

Osteochilus microcephalus Inger & Chin, 1962:p91, fig 43

Diagnosis

D. IV, 12-14; l.l. 31-32; c.f. 11/2/13; c.p. 16

O. kahajanensis chini can be recognized as having 2 tubercles on the snout (one on each side) and a short dorsal fin (branched dorsal rays 12-14 (usually 13). *O. kahajanensis kahajanensis* and *O. kahajanensis chini* can be separated by the number of branched dorsal rays, (*O. kahajanensis kahajanensis* has 15-16, rarely 14) and by the depth of body (320-360 in *O.*

kahajanensis kahajanensis and 350-380 in adult *O. kahajanensis chini*). The melanin pigment on the body is also very light in the new subspecies but heavy in the former subspecies.

Description

Body oblong and compressed; depth 350-380 (mean 363) (in thousandths of standard length). Head 207-248 (mean=230); eye 47-63 (mean=54), large fish with relatively small eye. Snout 77-92 (mean=84); with two tubercles in front (one on each side); snout longer than eye diameter in adult fish, shorter than interorbital space, about equal to the postorbital part of the head. Interorbital space slightly convex, 105-131 (mean=121) Mouth subinferior, two pairs of well developed barbels; maxillary barbels longer than eye diameter, rostral barbels shorter than the maxillary ones. Ventral surafce of upper lip consists of well developed long undivided costae. Predorsal length 405-473 (mean=443); origin of dorsal fin opposite 9th (rarely 8th) scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin rather short with normal heigth, its fourth simple ray shorter than the base on dorsal in the lengtn of fourth simple ray 260-303 (mean=283); and the base of dorsal fin 309-371 (mean=333) branchad dosal rays 12-14 (usually 13). The posterior base of dorsal fin opposite 20th-23rd scale of lateral line, number of scales from insertion of the dorsal fin to vertical from anal fin origin varies from -1 to 1. Tip of pectoral fin not reaching the pelvic fin insertion, usually opposite 9th-10th scale of lateral line. Prepelvic length 491-531 (mean=513), pelvic insertion opposite 10th-11th scale of lateral line. Preanal length 742-791 (mean=770); anal fin concave, third simple ray rather weak; anal fin origin opposite 21st-22nd scale of lateral line. Caudal fin deeply forked, its lobes more of less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 114-152 (mean=136); least depth of caudal peduncle 129-148 (mean=138), longer than half of head length, and surrounded by 16 scale rows. Scales with radii parallel medially and radiating laterally predorsal scales 9-10 (rarely=11); circumferential scales 11/2/13; transverse scales to the base of pelvic fin 5.5/1/4.5 Lateral line scales 31-32, with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 28-41 (mean = 35.8).

Preserved specimens light brown, dorsal of head and back is darker. Diffuse median lateral stripe present in young, faint or absent in adults. Dorsal and caudal fins with dark melanophores on the membrane, other fins plain.

Distribution

The distribution of *O. kahajenenesis chini* is restricted the eastern parts of the State of North Borneo.

Habitat

Turbid streams or rivers.

Etymology

The subspecific name is given for Mr. Chin Khuikong of Department of Agriculture, State of North Borneo, for his efforts to collected these specimens.

Material examined (150 specimens; 49.8-143.9 mm standard length)

Holotype : FMNH 68230; 127.8mm standard lenth, type locality: Kinabatangan District, Kinabatangan River at Deramakot, North Borneo; collected by R.F. Inger & Mr.Chin.

Paratype : FMNH 68230 (1 spec.) 116.7 mm standard length (same data)

Additional paratype : all from State of North Borneo, Malaysia.

FMNH 68231 (1 spec.) 143.9 mm; Kinabatangan District, Deramakot

FMNH 68237 (49 spec.) 50.9-92.0 mm; Kinabatangan District, Deramakot hill stream.

FMNH 44746 (2 spec.) 100.1-130.2 mm; Lahat Datu District

FMNH 98239 (1 spec.) 65.4 mm; Kinabatangan District

FMNH 68236 (1 spec.) 65.8 mm; Kinabatangan District

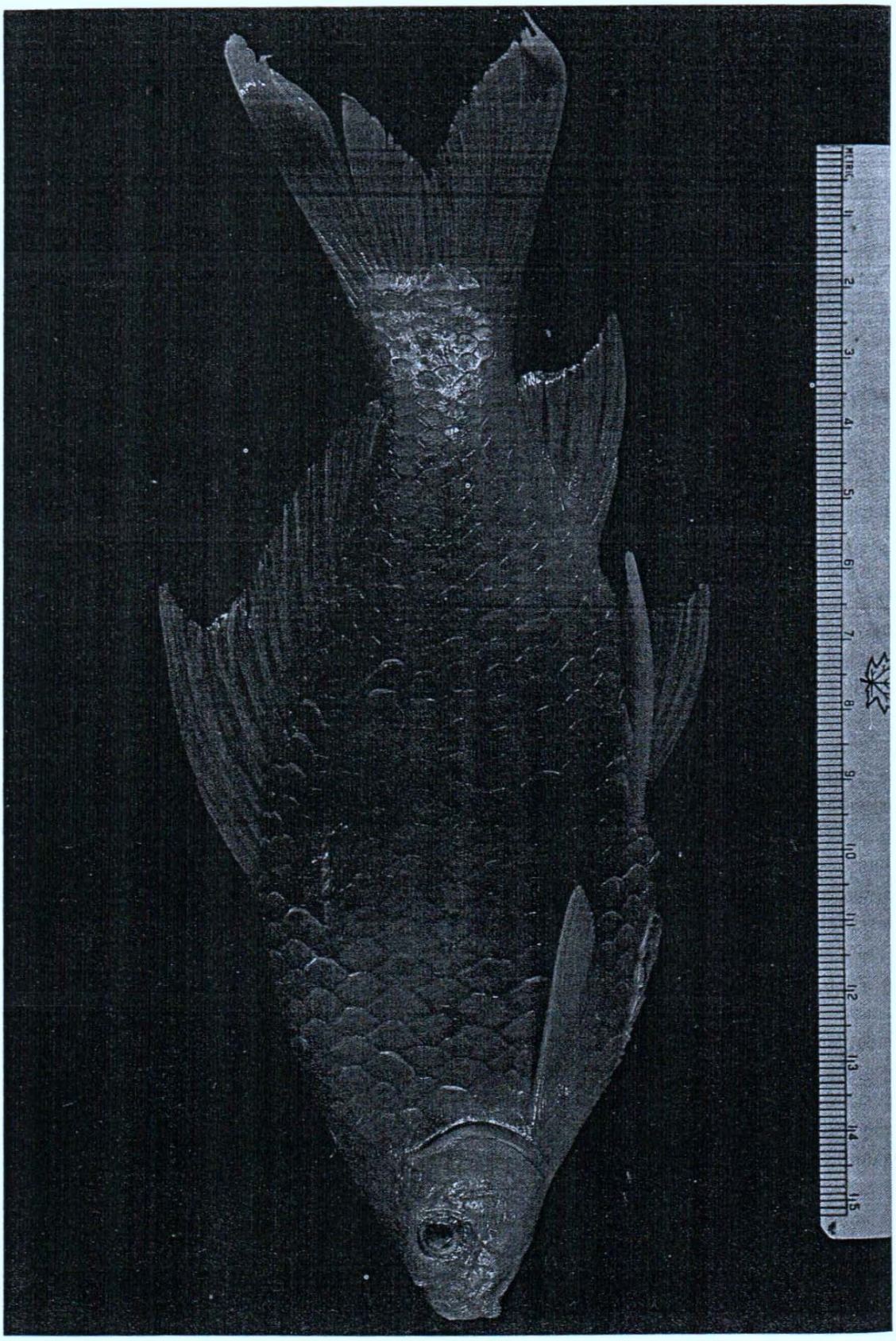


Fig. 18 *Osteochilus kahajanensis chini* new subspecies Holotype 68230

FMNH 44740 (1 spec.) 72.2 mm; Kinabatangan District

FMNH 68235 (1 spec.) 57.5 mm; Kinabatangan District

FMNH 68233 (1 spec.) 49.8 mm; Kinabatangan District, Deramakot;

FMNH 44742 (1 spec.) 50.6-93.5 mm; Kinabatangan District; Deramakot, hill stream.

FMNH 68234 (10 spec.) 33.6-65.3 mm; Kinabatangan District

Osteochilus spilurus (Bleeker)

Dangila spilurus Bleeker, 1851: p.272; original description; type locality: Bandjermassing, Borneo; holotype BMNH 1866.5.2.78, 75 mm total length (given by Bleeker), 61.0 mm standard length (my measuremnt).

Rohita oligolepis Bleeker, 1853: p.191; original description; type locality: Marawang, Banka; syntype: BMNH 1866.5.2.167, and RMNH 4962, 103 and 100 mm total length (given by Bleeker), 74.3, and 72.0 mm standard length (my measuremnt).

Dangila spilurus Bleeker, 1860: vol.2,p.206; description; .....1863: vol.3, p.48; description.

Rohita oligolepis Bleeker, 1860: vol.2, p.185; description; .....1863: vol.3,p.71; description, with color plate.

Osteochilus oligolepis Gunther, 1868: vol.7, p.45; description.

Ostecohilus spilurus Gunther, 1868: vol.7, p.45; description.

Osteochilus spilurus Weber & de Beaufort, 1916: vol.3, p.139; description; locality: Sumatra: Taluk, Ringat, and Gunang Sahilan.

Nomenclature

Bleeker described *Dangila spilurus* (1 specimen) in 1851 and *Rohita oligolepis* in 1853 (2 specimens). The *Dangila spilurus* type and one of the *Rohita oligolepis* type specimens were purchased by the British Museum. The other type specimen of *Rohita loigolepis* remained in Holland. Gunther (1868) examined both type specimens in BMNH and placed both species under *Osteochilus* but still recognized both as valid species. Weber and de Beaufort (1916 synonymized the two species and recognized *O. spilurus* as the senior synonym. I have examined all the type specimens and I agree with Weber and de Beaufort (1916).

Diagnosis

D. IV, 10-111; l.l. 27-29; c.f. 9/2/11; c.p. 16

Osteochilus spilurus is the smallest species of *Osteochilus*, with adult specimen rarely exceeding 70 mm in standard length. The lateral line scale count of 27-29 is unique among *Osteochilus;* some scales of the sides have a dark bar, forming an irregular arrangement of small bars on the side of the body. There is a black blotch on the scale immediately above and below the fifth scale of the lateral line.

Circumferential scales 9/2/11 and short dorsal fin (10-11 branched dorsal rays) (shared with *O. branchynopteroides, O. bellus,* and *O. ingeri). O. bellus,* and *O. ingeri* have a high gill raker count (40-47, against 28-30) and more lateral line scales (30-31). *O. brachynotopteroides* has 33-34 scales in the lateral line and a more slender body.

Description

Body oblong, deep, and compressed; depth 307-349 (mean=325) (in thousandths of standard length.) Head 233-260 (mean=246), eye 51-63 (mean=57), large fish with relatively small eyes. Snout 72-101 (mean=89); entire, without tubercles or pores; snout longer than eye diameter, shorter than interorbital space, usually shorter than the postorbital part of the head. Interorbital space slightly convex, 113-135 (mean=121). Mouth subinferior, two pairs of well developed barbels; maxillary barbels longer than eye diameter, rostral barbels shorter than the maxillary ones. Ventral surface of upper lip with well developed, moderately long, undivided, costae. Predorsal length 414-469 (mean=440); origin of dorsal fin opposite 8th scale of lateral line; before mid-

point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin with normal height, its fourth simple ray slightly shorter than the base of dorsal fin, the length of the fourth simple ray 221-275 (mean=250), and the base of dorsal fin 277-308 (mean=295); branched dorsal rays 11-12 (rarely 10). The insertion of the dorsal fin opposite 18th-19th scale of lateral line, number of scales from insertion of the dorsal fin to vertical from anal fin origin varies from one to two (usually one). Tip of pectoral fin not reaching the pelvic fin insertion, usually opposite 7th-8th scale of lateral line. Prepelvic length 509-539 (mean=525), pelvic fin insertion opposite 9th-11th scale of lateral line. Preanal length 741-805 (mean=767); anal fin truncate, third simple ray rather weak; anal fin origin opposite 19th-20th scale of lateral line. Caudal fin deeply forked, its lobes more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 106-155 (mean=123); least depht of caudal peduncle 145-156 (mean=150), usually more than half of head length and surrounded by 16 scale rows. Scales with few radii nearly parallel; predorsal scales 8-9 (usually); circumferential scale 9/2/11, transverse scales (to the base of pelvic fin); 4.5/1/4-4.5. Lateral line scale 26-29 (usually 28) with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 25-28.

Preserved specimens are yellowish-brown to dark brown, dorsal part of head and back darker than the body. Dark bar on some of the scales on the side forming an irregular pattern, some specimens with a small black blotch above pectoral fin. Dorsal fin with stripe on the middle portion of the fin membrane, caudal fin dusky, other fins plain.

Distribution

O. spilurus is restricted to the southern range of the genus: southern part of Malay Peninsula, southern Sumatra, western and southern Borneo, Java, Island of Bangka, and Island of Billiton.

Habitat

Samll forest streams with swift current, clear or brown tinted.

Material examined (129 specimens ; 20.2-74.4 mm standard length)

Holotype: BMNH 1866.5.2.78; Bandjermassing, Borneo

Syntype of Rohita loigolepis

: BMNH 1866: 5: 2: 167; Marawang, Bangka

: FMNH 4962; Marawang Banka

Other specimens:

Biliton Island

: ZMA no ca. no. (6 spec.); Biliton (or Belitung)

Sumatra & Java

: ZMA 116.093 (1 spec.); Ringgat, Sumatra

: ZMA 116.096 (4 spec.); Taluk, Sumatra

: ZMA 116.095 (6 spec.); Gunung Sahilan, Sumatra

: ZMA 116.101 (4 spec.); Djember Sungei, Legi, Java

Borneo

: KCTR 76-46 (27 spec.); Sungai Gentu flows into Kapuas mainstream, 55 km, N.E. of Sintang, .

: KCTR 76-42 (46 spec.); Sungai Sering, forested tributary of Sungai Palin, 5-10 m wide and 2 m. deep, 37 km W. of Putussibau, 3-5 km up Sungai Palin from Kapuas mainstream

: KCTR 76-16 (3 spec.) Sungai Tekam, small forest stream where it enters right side of Kapuas main stream about 5-6 km from Sanggau

Malaysia

: NMNH 101208 (4 spec.); Ayer Hitam, Johore,

: CAS 31985 (3 spec.) Malaysia

: CAS 31181 (6 spec. with 1 *O. hasselti*) Johore

: BMNH 1938.12.1.105-6 (2 spec.), Mawai District, Johore

: NMS 1887, coll. Mawai District, Johore

: CAS 34756 (14 spec.) Malaysia

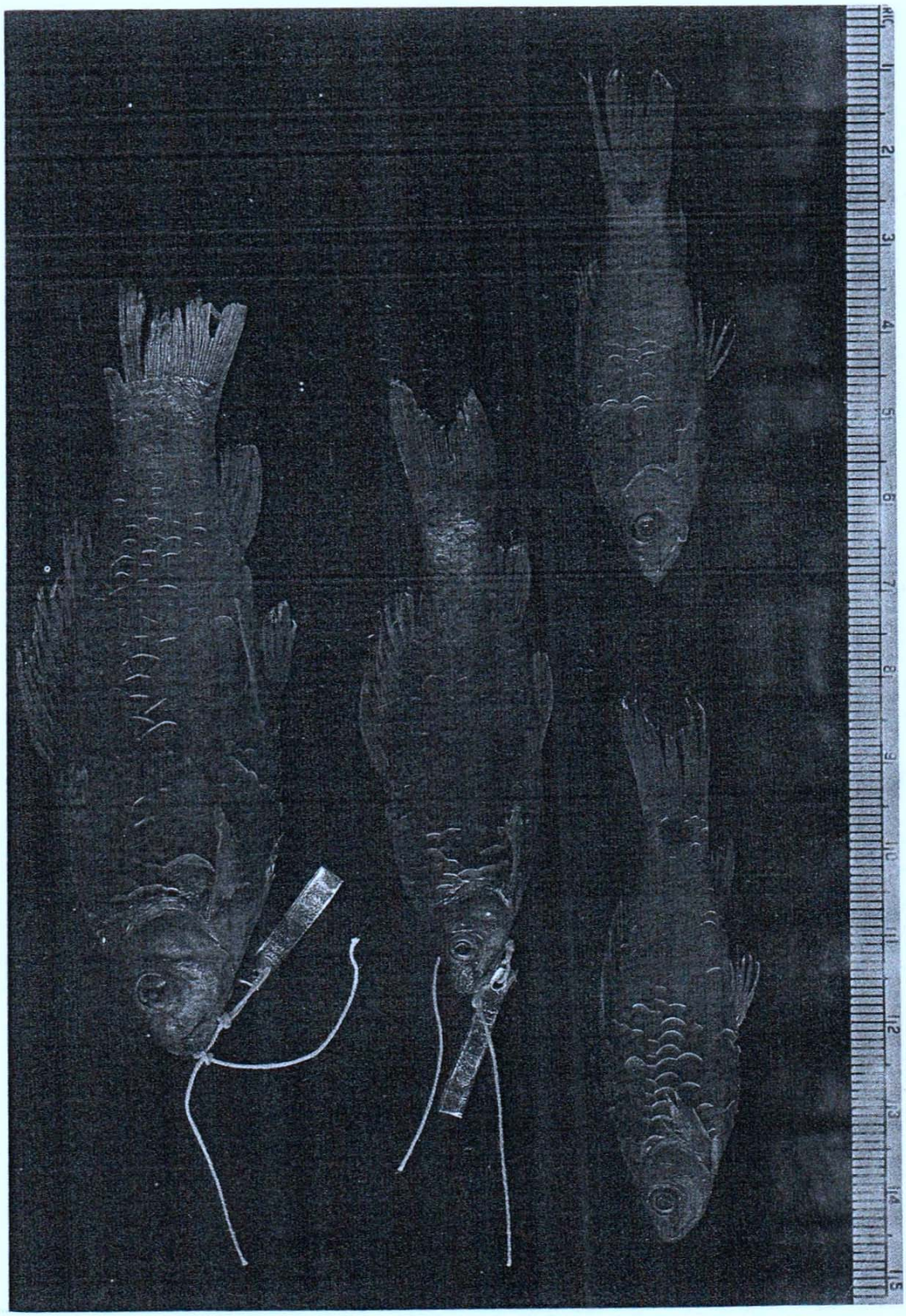


Fig. 19 *Osteochilus spilurus* (Bleeker) Above (2) CAS 31181 Below (2) KCTR 76-46

Osteochilus ingeri new species

Osteochilus spilurus Inger and Chin, 1962: p 90

Diagnosis

D. IV, 11-12; l.l. 30-31; c.f. 9/2/11; c.p. 16

Osteochilus ingeri is unique and easy to recognize. It has a dark rectangular bar in the pocket of each scale foming a reticulated pattern on the body. Gill raker on the first gill arch 40-45, upper labial fold with long undivided costae.

It shares a circumferential scale number of 9/2/11 with a few species such as: *O. spilurus, O. bellus,* and *O. brachinotyperoides,* but the reticulated pattern on the body stated above is unique to *O. ingeri. O. spilurus* is the most closely related species, and it has fewer lateral lines scales (27-29), fewer gill rakers (28-30), and is very small in size (specimens exceeding 70 mm are rare, but *O. ingeri* are well over 100 mm). *O. bellus differs* from *O. ingeri by* having tubercles on the snout and a different pattern of spots on the body (see description of *O. bellus,* page 64).

O. brachynotopteroides has a long slender body (oblong in *O. ingeri*), fewer gill rakers (31), and a plain body.

Description

Body oblong, and slightly compressed, depth 286-364 (mean=325) (in thousandths of standard length), Head 195-243 (mean=214); eye 38-54 (mean=46); large fish with relatively small eye. Snout 67-96 (mean=83); entire, without tubercles or pores; snout longer than eye diameter in adult fish, shorter than interorbital space. Interorbital space slightly convex, 101-129 (mean=115). Mouth inferior, two pairs of well developed barbels; maxillary barbels longer than eye diameter, rostral barbels shorter than the maxillary ones. Ventral surface of upper lip consists of well developed, long, undivided, costae. Predoral length 383-472 (mean=432); origin of dorsal fin opposite 9th-10th scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin somewhat facate, its fourth simple ray about equal to or longer than the base of dorsal fin, length of fourth simple ray 261-343 (mean=298), and the base of dorsal fin 221-291 (mean=264); branched dorsal rays 10-11 (rarely 12). The insertion of the dorsal fin is opposite 18th-19th scale of the lateral line, number of scale from insertion of the dorsal fin to vertical from anal fin origin varies from one to two (usually two). Tip of pectoral fin not reaching the pelvic fin insertion, usually opposite 9th-10th scale of lateral line. Prepelvic length 463-529 (mean=497); pelvic fin insertion opposite 11th scale of lateral line. Preanal length 733-779 (mean=749); anal fin concave, third simple ray rather weak; anal fin origin opposite 20th-21st scale of lateral line.Caudal fin deeply forked. Its lobes more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 135-167 (mean=148), least depth of caudal peduncle 123-149 (mean=136), longer than half of head length, and surrounded by 16 scale rows. Scales with radii parallel medially and radiating laterally; predorsal scales 9-10 (rarely 11); circumferential scales 9/2/11-12 (rarely 11/2/11-12); tranverse scales to the base of pelvic fin 4.5/1/3.5 (rarely 5.5/1/3.5). Lateral line scales 30-31, with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 40-43.

Preserved specimens olive brown above, lighter below, the dorsal region of the head and the back are darker. At the pocket of each scale is a vertical rectangular bar forming a reticulated or checkered pattern on the body; a large round black spot on the caudal peduncle Membrane of dorsal fin dark; other fins plain. According to Inger & Chin (1962), live specimens have red spots on the anterior scales.

Distribution

O. ingeri is an endemic species to eastern North Borneo. It can be found in the following area: Kinabatangan District, Lahat Datu District, and Tawau District, Kalabakam.

Habitat

According to Inger & Chin (1962), this species

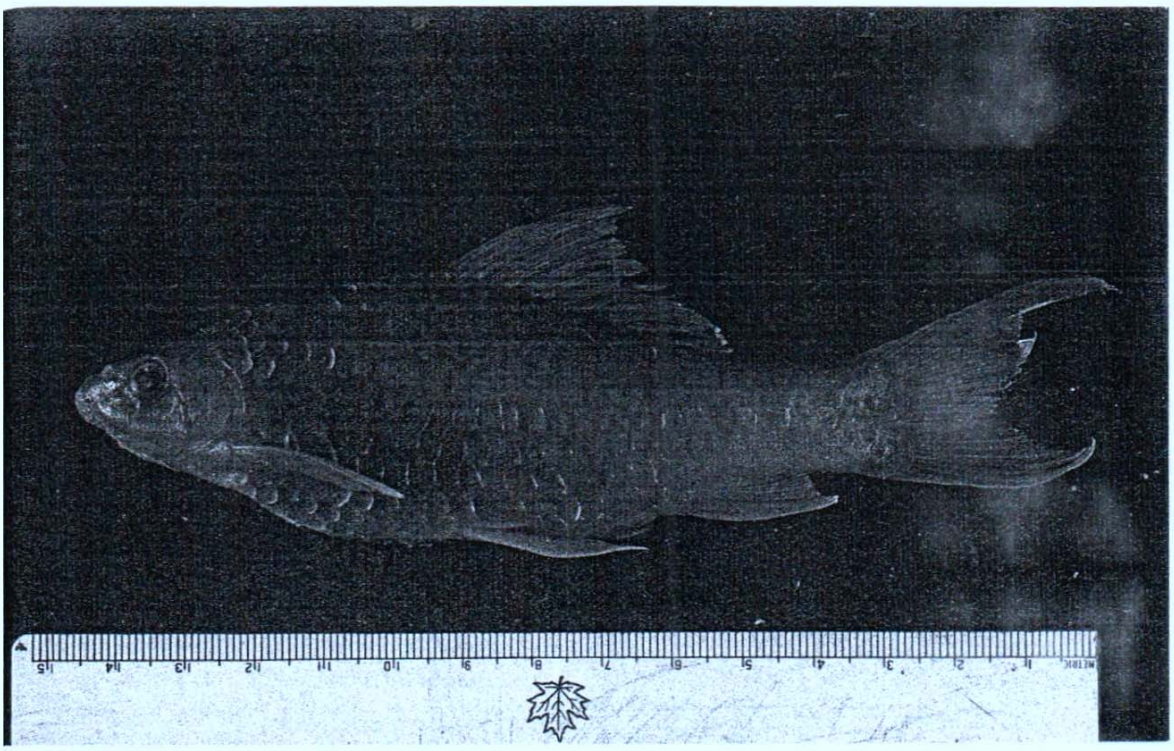


Fig. 20 *Osteochilus ingeri* new species Holotype

is found in small clear streams having sand and gravel bottoms which are coverd with dead leaves in the quiet pools.

Discussion

Specimens of this species were collected by Dr.R.F. Inger of Field Museum of Natural history in a Borneo Zoological Expedition (1950 and 1956). The species was identified as *O. spilurus* and was published as such in "The fresh-water fishes of North Borneo" by Inger and Chin (1962). However, there are various characters that differ from *O. spilurus* and the species is apparently an undescribed one.

Etymology

The specific name of this species is in honor of Dr. Robert F. Inger (of the Field Museum of Natural History) who collected the type specimens.

Material Examined (108 specimens, 8.6-127 mm standard length)

Holotype: FMNH 68540; 111.8 mm standard length

Paratypes: FMNH 68540 (21 spec.); 88.4-121.9 mm standard length type locality: Sungai Tawan, Kalabagan Tawau District, North Borneo. Collected in June 6, 1956 by Dr.R.F. Inger

Additional paratypes:

FMNH 51607 (50 spec.); 8.6-127.3 mm; East coast Residency, Kinabatangan District, North Borneo.

FMNH 51606 (17 spec.); 84.3-103.0 mm; East coast Residency, Kinabatagan District, North Borneo.

FMNH 44739 (4 spec.); 96.2-114.7 mm; Lahad Datu District, North Borneo.

FMNH 68541 (15 spec.); -111.5 mm; Sungai Tawau, Kalabatangan, Tawai District, North Borneo.

CAS 32814 (1 spec.); 79.1 mm; North Borneo.

Osteochilus triporus Bleeker

Rohita triporus Bleeker (not *O. triporus*), 1852: p.598; original description; type locality: Sumatra (Palembang); type of Bleeker (1952) BMNH 1866.5.2.164; 130 mm. total length (given by Bleeker), 94.5 mm. standard length (my measurement).

Rohita (Rohita) triporus Bleeker, 1863: vol.70; description locality: Sumatra (Palembang), Borneo (Pontianak); neotype RMNH 4963; with color plate.

Osteochilus triporus Gunther, 1868: p.44; description (based on Bleeker's 1852 specimen).

Osteochilus triporus Weber & de Beaufort, 1916: Vol.133; description, locality: Sumatra (Djambi).

Nomenclature

Bleeker (1852) described the species from a single specimen from Palembang, Sumatra (130 mm. TL). Gunther (1868) claimed that specimen no. BMNH 1866.5.2.164 is the holotype. My measurements and counts of this specimen agree with Bleeker's description, except that the coloration was not recognizable as the fish was not well preserved. Based on Bleeker's original description, the specimen had a diffuse longitudinal median lateral stripe from the head to the caudal fin. When Bleeker published his Atlas in 1863, he redescribed *O. triporus* in vol. 3,p.70 with one additional specimen (TL 154 mm) from Borneo (Pontianak) (RMNH 4963). The description is based on both specimens but the illustration is based on the second specimen. In describing the coloration he indicated that there were rows of spots on the body as well as a spot near the origin of the dorsal fin which he did not mention in the original description; he also mentioned that the median lateral stripe is more distinct in the smaller specimen (the first specimen) I presume that the new characters (rows of spots on body and the dark spot near the origin of dorsal fin) were based on the second specimen only. From my examination of these two specimens. I feel that they are certainly different species, the first specimen belonging to *O. microcephalus* (Cuv. & Val.) and the second specimen representing the *O. triporus* recognized by most ichthyologists, based on Bleeker's illustration (1863). Rather than make *O. triporus* a junior synonym of *O. microcephalus* and adopt a new name for a species wellknown as *O. triporus*, I intend to suppress the original type (BMNH 1866.5.2.164) and designate the specimen no.RMNH 4963 as a neotype of *O. triporus* (Bleeker).

Weber & de Beaufort (1916) felt that *O. triporus* agreed quite well with the description of *O. vittatus* (=*microcephalus*) and he described *O. intermedius* on the basis of one character which distinguishes it from *O. triporus* (c.f 11/2/11 in *O. triporus* and 9/2/13 in *O. intermedius*). Hardenberg (1936) stated that *O. triporus* is different from *O. vittatus*, but felt that the difference between *O. triporus* and *O. intermedius*, as described by Weber & de Beaufort, was very small and probably only variation within the species. In studying these two forms I have found that there are many characters that separate them and they are different species as stated in the diagnosis.

Diagnosis

D. IV, 11-12; l.l. 29-30; c.f. 11/2/11-13; c.p. 16

Osteochilus triporus has a distinct large black spot near the origin of the dorsal fin and rows of spots along side of the body which are usually less distinct on the upper half of the body than the lower half. Circumferential scales usually 11/2/11 (rarely 11/2/13). Mouth subinferior, ventral part of upper lip with long costae which are divided into two or three portions. Gill rakers on the first gill arch 27-32.

Osteochilus triporus shares many characters with *O. intermedius* such as the black spot on the dorsal fin and the rows of spots on the body; it also shares some characters with *O. microcephalus* such as three tubercles on snout, branched dorsal ays, and rows of partially developed spots in some specimens (but there is a median lateral stripe on the side of body which may be faded after death or long preservation as in *O. microcephalus*). *O. microcephalus* also has more lateral line scales (32-33) (29-31 in *O. triporus*). *O. intermedius* is separated from *O. triporus* by having 13-14 branched dorsal rays, 37-50 gill rakers on the first gill arch, no tubercles on the snout, circumferential scales 9/2/13, and long undivided costae on the ventral part of the upper lip.

Description

Body oblong, slender, and compressed, depth 257-349 (mean=295) (in thousandths of standard length). Head 217-282 (mean=239); eye 49-81 (mean=59), larger fish with relatively small eye. Snout 64-99 (mean=85); usually with three pointed tubercles in the front, the middle one is the largest and the lateral ones are small or rudimentary; snout longer than eye diameter in adult fish, shorter than interorbital space, about equal to the postorbital part of the head. Interorbital space slightly convex, 91-114 (mean=108). Mouth subinferior, two pairs of well developed barbels; maxillary barbels longer than eye diameter, rostral barbels usually shorter than the maxillary one. Ventral surface of upper lip consists of well developed moderately long costae, most of which are divided into two or three unequally portions. Predorsal length 404-474 (mean=440); origin of dorsal fin opposite 8th-9th scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin usually falcate, its fourth simple ray usually greatly produced, longer than the base of dorsal fin, the length of the fourth simple ray 241-366 (mean=300), and the base of dorsal fin 238-333 (mean=252); branched dorsal rays 11-12. The insertion of the dorsal fin is opposite 18th-20th scale of lateral line, number of scales from insertion of dorsal fin to vertical from anal fin origin varies from one to three. Tip of pectoral fin not reaching the pelvic fin insertion, usually opposite 8th-9th scale of lateral line. Prepelvic length 453-537 (mean=502); pelvic fin insertion opposite 10th-11th scale of lateral line. Preanal length 760-793 (mean=771); anal fin concave, third simple ray rather weak; anal fin origin opposite 20th-22th scales of lateral line. Caudal fin deeply forked, its lobe more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 105-156 (mean=127); least depth of caudal peduncle 117-137 (mean=123), usually less than half of head length and surrounded by 16 scale rows. Scales with nearly parallel longitudinal radii, predorsal scales usually 10 (rarely 9); circumferentail scales 11/2/11 (rarely 11/2/13) and 4.5/1/3.5-4 in transverse series to the base of the pelvic fin; lateral line 29-31 with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 27-32.

Preserved specimens are dusky on the upper two fifths of the side, the dorsal part of head and back darker. Anterior portion of dorsal fin with a large black spot near the base; a dark stripe along the mid-portion of the fin membrane behind the large black spot. Posterior margin of dorsal fin dark, other fins clear. The rows of spots present along side of the body, at the basal pocket of each scale, are usually more distinct on lower half of the body. In fresh or live specimens the side is gray with a bluish-green hue, under part whitish silver. Dorsal fin densely pigmented with dark melanophores forming pattern as stated above, other fins pinkish and plain.

Distribution

The distribution of *O. triporus is* limited. There is only one record from eastern Sumatra, but it is possible that they are widespread in this poorly collected area. It is quite common in western Borneo (Kapuas Basin). It may occur in Malaysia as reported by Herre & Myers (1937) from Ayer Hitam, Johore, Tirant (1929) reported this species from Hue, Vietnam (I have not seen the specimen). The number of lateral line scales (34) given by Tirant is more likely to be that of *O. microcephalus* than *O. triporus.*

Habitat

Small or large streams at low altitudes, current swift. water clear; bottom brown or dark brown, sandy or pebbled, pH 5.5-6.5

Material Examined (21 specimens, 44.7-118.8 mm standard length).

Neotype: RMNH 4960, Pontianak, Borneo

Other specimens:

Sumatra: ZMA 116.080 (2 spec.) Gunung Sahilan

Borneo: MHNP 85-177-40-1 (2 spec.) no specific locality (one specimen belongs to *O. intermedius*)

: KCTR 76-42 (6 spec.) Sungai Seriang tributary of Kapuas.

: KCTR 76-19 (6 spec.) Sintang Market.

: KCTR 76-20 (4 spec.), Sungai Kabian, tributary of Kapuas.

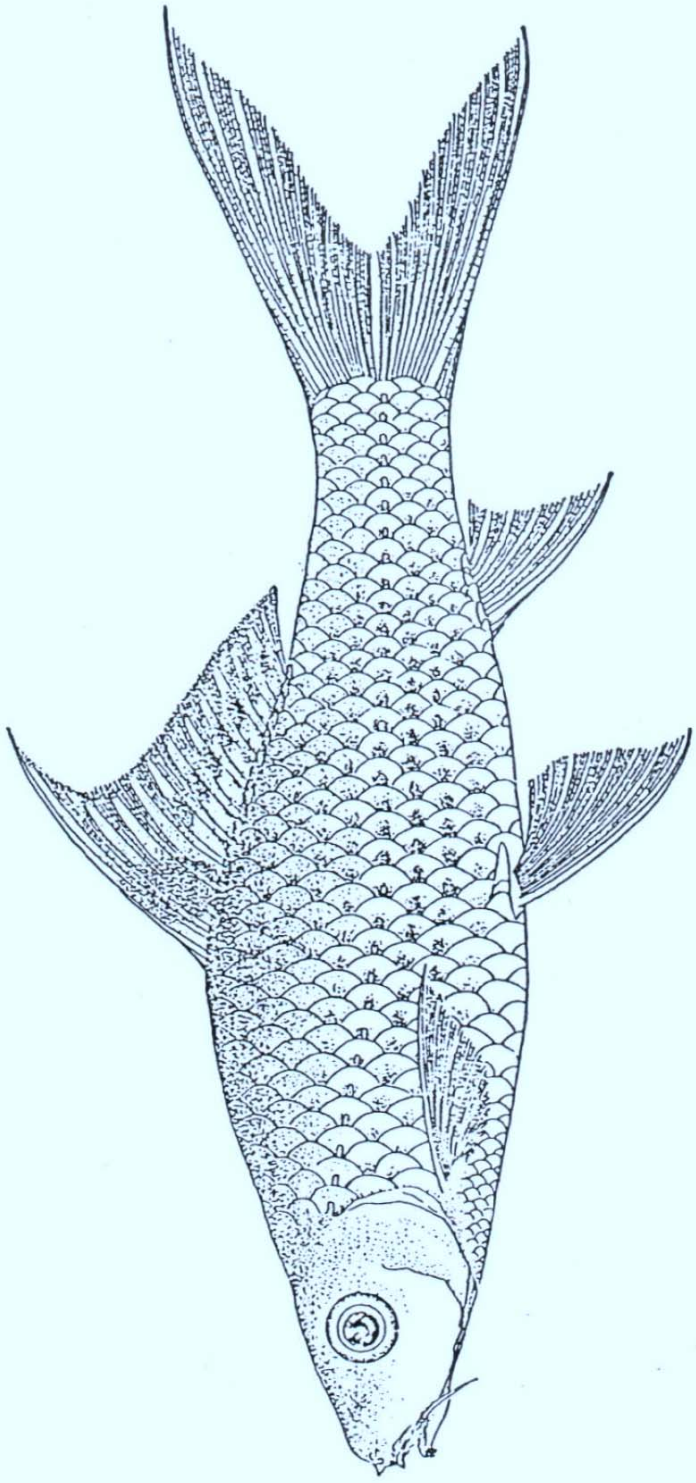


Fig. 21 *Osteochilus triporus* (Bleeker) KCTR 76-42, 84.8 mm SL

Osteochilus intermedius Weber and de Beaufort

Osteochilus intermedius Weber & de Beaufort, 1916; vol.3, p.113-34; original description; type locality; Sumatra (Djambi); syntype: 9 specimens, ZMA 112.610 (8 spec.) standard length 61.8-99.3 mm.; AMNH 9289 (1 spec.) 82.0 mm. standard length.

Osteochilus intermedius Hardenberg, 1936: p.237; description: locality: middle course of Kapuas (Borneo).

Nomenclature

Weber and de Beaufort were not sure about the validity of this species when they described it in 1916. They gave a very poor description. In comparing it with *O. triporus,* they. stated that the two differed by only one transverse scale and by the presence and absence of black bands on the outer upper and lower margins of the caudal fin. Hardenberg (1936) felt that *O. intermedius* might be only a variety of *O. triporus.* In studying these two forms I have found that there are many characters that separate them and confirm the validity of this species.

Diagnosis

D. IV, 13-14; l.l 30-32; c.f. 9/2/13; c.p. 16.

Osteochilus intermedius has a distinct large black spot near the origin of the dorsal fin; and rows of spots along the side of the body, which are usually distinct on the lower part of the body. Mouth subinferior, ventral part of upper lip with long undivided costae, gill rakers on the first gill arch 39-49.

O. intermedius share many characters with *O. triporus* as stated above. The differences between these two species were indicated previously in the diagnosis of *O. triporus* on page 100.

Description

Body oblong, slender and compressed, depth 266-394 (mean=330) (in thousandths of standard length). Head 221-286 (mean=251); eye 48-72 (mean=66), large fish with relatively small eye. Snout 71-99 (mean=87); entire, no tubercles on the front; snout longer than eye diameter in adult fish, shorter than interorbital space, about equal to postorbital part of the head. Interorbital space slightly convex, 103-128 (mean=115). Mouth subinferior, two pairs of well developed barbels; maxillary barbels longer than eye diameter, rostral barbels usually shorter than the maxillary ones. Ventral surface of upper lip consists of well developed, moderately long, undivided costae. Predorsal length 440-480 (mean=447); origin of dorsal fin opposite 8th-9th scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin usually of normal height, its fourth simple ray shorter than the base of dorsal fin, the length of the fourth simple ray 223-277 (mean=252), and the base of dorsal fin 310-381 (mean=334); branched dorsal rays 13-15 (usually 14). The insertion of the dorsal fin opposite 21st-22nd scales of lateral line, number of scales from insertion of the dorsal fin to vertical from anal fin origin varies from zero to one. Tip of pectoral fin not reaching the pelvic fin insertion, usually opposite 9th-10th scale of lateral line. Prepelvic length 520-564 (mean=541); pelvic fin insertion opposite 11th scale of lateral line. Preanal length 787-815 (mean=796); anal fin concave, third simple ray rather weak; anal fin origin opposite 21st-23 scales of lateral line. Caudal fin deeply forked, its lobes more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 102-141 (mean=131), usually about half of head length, and surrounded by 16 scale rows. Scales with relatively few radii radiating from the center, predorsal scales usually nine (rarely eight), circumferential scales 9/2/13 (4.5/1/4-4.5 in transverse series to the base of pelvic fin); lateral line scales 31 (rarely 30), with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 35-49.

Preserved specimens are dusky on the top two-fifths of the body; the dorsal part of head and back are darker. Anterior portion of dorsal fin with a large black spot near the base; a dark stripe along the mid-portion of the fin membrane behind the large black

Fig. 22 *Osteochilus intermedius* Weber & de Beaufort KCTR above 76-42 below (left) 76-42 (right) 76-47

spot. Caudal fin with a diffuse black longitudinal band on the outer upper and lower margin of the fin lobe, the band on the lower lobe usually more distinct. Other fin transparant and plain. Six rows of spots present along side of the body, one on lateral line, three below, and two above; the four middle rows are more distinct than the outer rows. Each spot of the rows formed in a scale pocket is more distinct on the lower half of the body than on the upper (the spots may disappear in specimens preserved for a long time). Coloration of fresh or live specimens unknown.

Distribution

Only known from two localities: Kapuas River, Borneo and Batan Hari River at Djambi, Sumatra.

Habitat

Small or large forest streams; current swift; clear water, with brown tint; pH 6.0-6.5 (according to collecting data of Dr. Tyson Roberts).

Material Examined (20 specimens, 47.4-154.0 mm in standard length)

Syntype:ZMA 112.609 (8 spec.) Batang Hari River, Djambi Sumatra.

: AMNH 9289 (1 spec.) Batang Hari River, Djambi, Sumatra.

Other specimens:

Borneo: ZMA 112.610 (2 spec.) Kapuas River at Putussibau

: KCTR 76.42 (3 spec.) Sungai Seriang. 37 km West of Putussibau

: KCTR 76-43 (1 spec.) small oxbow lake cut off from Kapuas 124 km NE of Sintang.

: KCTR 76-47 (1 spec.) small forest stream flowing to Kapuas NE of Gunung Setunggul, 53 km NW of Sintang.

: KCTR 76-43 (3 spec.) samll oxbow lake complete cut off from Kapuas Mainstream opposite Empangau, 124 km NE of Sintang.

No locality

: MHNP 95-177-40-1 (1 spec.) mix with 2 spec. of *O. triporus*).

Osteochilus sarawakensis new species

Osteochilus vittatus Inger & Chin, 1962: p. 93- 94

Diagnosis

D. IV, 11-13; l.l.31-33; c.f. 11/2/13; c.p. 16

Osteochilus sarawakensis has 5-8 (5-6 distinct) rows of spots on the posterior two thirds of the body. In large specimens the spots may form longitudinal stripes. Dorsal fin with 12-13 (rarely 11) branched rays; 32-33 scales on lateral line. Snout entire without tubercles or pores; gill rakers on the first gill arch 26-34.

O. sarawakensis and *O. harrisoni* share many features such as the body form and longitudinal stripes. *O. harrisoni* has about 9-10 longitudinal stripes on the body which are extended from the back of the head to the caudal peduncle and the stripes are more distinct than in *O. sarawakensis*. *O. harrisoni* also has 15-16 branched dorsal rays while *O. sarawakensis* has only 12-13.

Description

Body oblong, and slightly compressed, depth 235-340 (mean=295) (in thousanths of standard length); eye 39-68 (mean=51), large fish with relatively small eye. Snout 71-101 (mean=85), entire, without tubercles or pores; snouts longer than eye diamter in adult fish, slightly shorter than interorbital space, about equal to postorbital part of the head. Interorbital space slightly convex, 92-114 (mean=100). Mouth subinferior, two pairs of well developed barbels; maxillary barbels longer than eye diameter, rostral barbels shorter than the maxillary ones. Ventral surface of upper lip consists of well developed moderately long undivided costae. Predorsal length 415-474 (mean=446); origin of dorsal fin opposite 9th-10th scale of lateral line; before mid-point between tip of snout and caudal base and also before pelvic fin insertion. Dorsal fin with normal height, its fourth simple ray slightly shorter than the base of dorsal fin, the length of the fourth simple ray 214-277 (mean=247), and the base of dorsal fin 238-297 (mean=273); branched dorsal rays 12-13 (rarely 11). The posterior base of dorsal fin opposite 20th-21st scale of lateral line, number of scales from posterior base of dorsal fin to vertical from anal fin origin varies from one to three. Tip of pectoral fin not reaching the pelvic fin insertion, usually opposite 9th-10th scale of lateral line. Prepelvic length 481-555 (mean=515), pelvic fin insertion opposite 12th (rarely 11th) scale of lateral line. Preanal length 729-796 (mean=762); anal fin concave, third simple ray rather weak; anal fin origin opposite 22nd-23rd scale of lateral ine. Caudal fin deeply forked; its lobes more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 126-177 (mean=144); least depth of caudal peduncle 118-143 (mean=129); usually more than half of head length, and surrouded by 16 scale rows. Scales with nearly parallel radii, predorsal scales usually 11 (rarely 10); circumferential scales 11/2/13; transverse scales to the base of pelvic fin is 5.5/1/4.4 Lateral line scale usually 32 (rarely 31 or 33), with two additional pored scales on caudal base. Lateral line somewhat straight but slightly cureved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 26-34 (mean=31.8).

Preserved specimens are dark brown on the upper two-fifths of the side, the dorsal part of head and back are darker. About eight (5-6 distinct) longitudinal dark stripes or rows of spots formed in each scale pocket, the stripes more intense on posterior two-thirds of the body, and the stripe on the lateral line more distinct than the others. A large black blotch occurs on the caudal peduncle, the dorsal fin membrane is dusky, other fins are hyaline. Coloration of fresh or live specimens unknown.

Distribution

O. sarawakensis is restricted to mountainous areas of Sarawak and of the western part of the state of North Borneo (Malaysia),

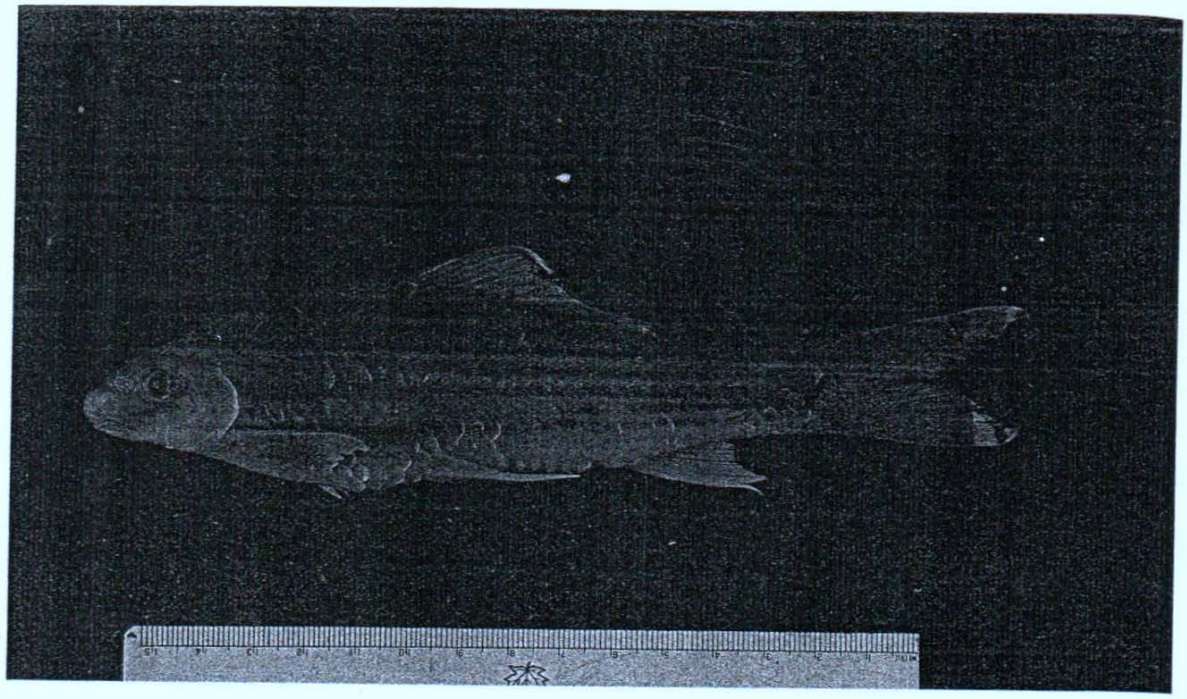


Fig. 23 *Osteochilus sarwakensis* new species Holotype

Habitat

Forest streams with clear water and swift current (persv. comm. Dr. R. F. Inger).

Discussion

Most of the specimens of this species used in this study are from The Field Museum of Natural History in Chicago and were collected from Sarawak and North Borneo. The specimens were identified as *Osteochilus vittatus* and were used for the account of that species in Inger & Chin (1962) "The Fresh-Water Fishes of North Borneo" Some specimens that I examined in the British Museum are identified as *O. vittatus or* as *O. hasselti* (see description of *O. vittatus* and *O. haselti*). This species is also similar to the sympatric *O. harrisoni* Fowler. There are slight differences in the color pattern on the body but these characters are not very useful since there is a variation with the age of the fish. The major character that I used to separate *O. sarawakensis* from *O. harrisoni* is the number of branched dorsal rays. I have examined more than 150 specimens of *O. sarawakensis* and found a variation of only 11 to 13 branched dorsal rays. Unfortunately there were only two specimens of *O. harrisoni* available for the study and they have 16 and 15 branched dorsal rays which in my opinion is different enough to separate them into two species because (from my study) no single species had as much varitaion in the number of branched dorsal rays (except the allopatric form of *O. kahajanensis* and *O. hasselti).*

Etymology name after the only known area of occurrence.

Material Examined (160 specimens, 20.1 mm-138.5 mm standard length)
Holotype, FMNH ... (1) 138.5 mm in standard length, and paratopotypes FMNH .....(49 spec.) 23.5 mm-126.5 mm.; type locality; Sungai Putai, branch of Baleh River, Sarawak 3rd Division (Borneo Malaysia); Collected by Dr. R. F. Inger, August 8, 1956.

Additional paratype:

FMNH 68530 (20 spec.) 20.1 mm-116.0 mm; Baleh River tributary between Sungai Entunau and Sungai Putai, Sarawak 3rd Division.

FMNH 68908 (7 spec.) 42.0 mm-80.7 mm; Mengiong River, Rapit District, Sarawak 3rd Division.

FMNH 68906 (5 spec.) 67.5 mm-73.5 mm; tributary of Baleh River, Sarawak 3rd Division, about 1000 feet above sea level.

FMNH 68892 (7 spec.) 40.4 mm-70.4 mm; Kapit District, Sarawak 3rd Division.

FMNH 44737 (2); 88.0 mm-124.6 mm; Kota Belud District; State of North Borneo

FMNH 68531 (1 spec.); 135.5 mm; Baleh River, Sungai Dapu, Sarawak 3rd Division.

FMNH 68537 (1 spec.); 76.8 mm; Baleh River near Sungai Arau; Sarawak 3rd Division, about 600 feet above sea level.

FMNH 68912 (1 spec.); 93.2 mm; Mengiong River, Nanga Takalit camp, Kapit District, Sarawak 3rd Division.

FMNH 6882 (1 spec.); 103.2 mm; Mengiong River, Sarawak 3rd Division.

FMNH 68534 (1 spec.); 75.2 mm; Baleh River, Sungai Putai, Sarawak 3rd Division.

FMNH 68539 (1 spec.); 51.5 mm; Meligon Akah at 1000 ft above sea level; Sarawk 4th Division.

FMNH 68536 (1 spec.); 47.5 mm, 81.0 mm; Sungai Bunoh near Sungai Balang at 1,000ft. above sea level, Sarawk 3rd Division.

FMNH 68535 (2 spec.) ; 93.0 mm., 70.8 mm.; Upper Balch and pool near Sungai Menuang, Sarawak 3rd Division.

FMNH 68534 (2 spec.); 76.0 mm., 77.0 mm; Baleh River, Sungai Putai Camp. Sarawak 3rd Division.

BMNH 1915.3.25.4 (1 sapec.); 129.8 mm; Baram River, Sarawak 4th Division.

BMNH 1893.3.6.223-6 (4 spec.); 105.8 mm-119.6 mm.; Merabah, State of North Borneo.

BMNH 1892.9.2.31 (1 spec.); 55.6 mm; Baram River, Sarawak 4th Division.

BMNH 1895.7.2.78 (1 spec.); 99.7 mm.; Pata River.

Osteochilus harrisoni Fowler

Osteochilus harrisoni Fowler, 1905: p.481; original descripton; type locality: Baram River, Boneo; Holotype ANSP 114892: 116.7 mm.; standard length; paratype, same catalogue number: 152.6 mm. standard length.

Osteochilus harrisoni Weber & de Beaufort, 1916: vo.3, p.139; description (after Fowler, 1905)

Nomenclature

Fowler described *Osteochilus harrisoni* in 1905 from two specimens collected by Mr. Alfred C. Harrison Jr. in Baram River, Borneo (Sarawak). Fowler noted that this species was close to *O. kahajanensis* without actually having seen specimens of the latter species. Weber & de Beaufort (1916) did not see Fowler's type specimens. They stated that they were not sure about the validity of this species as Fowler did not say anything about the presence of absence of pores on the snout No additional specimens have been collected since 1905. My examination of the two known specimens shows that these two species are not closely related. From studying of the original description of *O. vittatus* (Cuv. & Val.), it seems probable that it is closely related to *O. harrisoni* Unfortunately the type specimen of *O. vittatus* is in very bad shape and the coloration is gone (see also nomenclature discussion of *O. microcephalus* and *O. vittatus,* page 28 and 185).

Diagnosis

D. IV, 15-17; l.l. 31-33; c.f. 11/2/13; c.p. 16

Osteochilus harrisoni has a long dorsal fin (15-17 branched rays). About ten longitudinal stripes along the body. Snout without tubercle or pores. Mouth subinferior; ventral surface of upper lip with long undivided costae. Gill rakers on the first gill arch 36 (counted on paratype)

Osteochilus harrisoni is closely related to *O. sarawakensis* but *O. sarawakensis* has a shorter dorsal fin and fewer rays (IV, 11-13) and about five to eight rows consisting of spots instead of continuous stripes as in *O. harrisoni. O. harrisoni* is also related to *O. pentalineatus,* but the latter species has a shallower body, a shorter dorsal fin (IV, 10), and only five strpes on the body.

Description

Body oblong and compressed, depth 358-374 (in thousanths of standard length). Head 231-242; eye 53-56. Snout 81-83; entire without tubercles or pores; snout longer than eye diamter, shorter than interorbital space, and about equal to postorbital length in adult fish. Interorbital space slightly convex, 131-132. Mouth subinferior, two pairs of well developed barbels; maxillary barbels longer than eye diameter, rostral barbels shorter than the maxillary ones. Ventral surface of upper lip consists of well developed long undivided costae. Predorsal length 423, origin of dorsal fin opposite 9th-10th scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin of a normal height, its fourth simple ray much shorter than the base of dorsal fin 327-329; branched dorsal rays 15-17. Insertion of dorsal fin opposite 21st-23rd scale of lateral line, number of scales from insertion of the dorsal fin to vertical from anal fin origin varies from -1 to 2. Tip of pectoral fin not reaching the pelvic fin insertion, usually opposite 9th scale of lateral line. Prepelvic length 461, pelvic fin insertion opposite 11th scale of lateral line. Preanal length 773; anal fin concave, thid simple ray rather weak; anal fin origin opposite 22rd-23rd scale of lateral line. Caudal fin deeply forked its lobes more of less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 126-147; least depth of caudal peduncle 146-147, greater than half of the head length, and surrounded by 16 scale rows. Scales with nearly parallel radii, predorsal scales 10; circumferential scale 11/2/13 (5.5/1/4.5 in transverse series to the base of pelvic fin). Lateral line scale 31-33, with two additional pored scales on caudal base, lateral line somewhat straight but slightly curved upward anteriorly, lateral line scales with simple tubes. Gill rakers on the first gill arch 36 (measured from paratype).

Preserved specimens are dark brownish green on upper two fifth of the body, the dorsal part of head and back darker. Body marked with a longitudinal strip on each scale row, (about 10 stripes along side) of the body; the stripes are equally distinct. Dorsal and caudal fin darker with melanophores other fins hyaline. Coloration of fresh specimens unknown.

Distribution

Only two specimens known from Baram River, Sarawak, 4th Division, northwestern Borneo.

Habitat

Unknown

Material Examined (2 specimens 166.7 mm, 152.6 mm, standard length)

ANSP 114892: (Holotype and Paratype) Baram River, Borneo.

Osteochilus pentalineatus Kottelat

The following information is modified from that kindly provided by Mr. Maurice Kottelat. The description of this species is currently in press (Fishes from the Mentaya Drainage, Revue Suisse de Zoology, 1981).

Holotype: the only known specimen; Museum d'Histoire Naturelle, Geneva, Switzerland (cat no. unknown) 56.4 mm. standard length, type locality; Mentaya Drainage, Southern Borneo.

Diagnosis

D. IV, 10; l.l. 30, c.f. 9/2/13, c.p. 12

Osteochilus pentalineatus has five longitudinal stripes on the body, one no the lateral line, two above

and two below. The scales are rather large, there being only 7/2/9 circumferential scales, and only 12 circumpeduncular scales.

O. pentalineatus shares some characters with *O. harrisoni* and *O. sarawakensis* but differs in having a shorter dorsal fin, fewer circumferential scales, and a lower number of stripes.

Description

Body oblong, slender, and compressed; depth 255 (in thousanths of standard length). Head 235; eye 75. Snout 82; without tubercles but numerous pores in the front. Snout longer than eye diameter interorbital space, about equal to the postorbital length in adult fish. Interorbital space sligthly convex, 122. Mouth subinferior. two pairs of well developed barbels. Predorsal length 438; origin of dorsal fin opposite 9th scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin of normal height, the length of the fourth simple ray 205, and the base of dorsal fin 250; branched dorsal fin rays 10. The insertion of dorsal fin opposite 18th scale of lateral line, number of scales from posterior base of dorsal fin to vertical from anal fin origin three. Tip of pectoral fin not reaching the pelvic fin insertion, oppostie 8th scale of lateral line. Prepelvic length 505; pelvic fin insertion opposite 11th scale of lateral line. Preanal length 800; anal fin concave, third simple ray rather weak; anal fin opposite 21st scale of lateral line Caudal fin deeply forked, its lobes more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peducle 130; caudal peduncle surrounded by 12 scale rows. Circumferential scales 9/2/13 (4.5/1/4.5 in transverse series to the base of the pelvic fin), lateral line scales 31, with two additional pored scales on caudal base. Lateral line somewhat straigth, its scales with simple tube.

Preserved specimens are dusky on the upper two fifths of the body, the dorsal part of head and back darker Ground color reddish brwn, five blackish brwn longitudinal stripes, one running along lateral line, two above and two below. Fins hyaline; extremity of median caudal rays dark. A row of dark spots on the membrane between the dorsal rays in about 1/3 of its height. These spots are more distinct posteriorly.

Disribution

Mentaya River, Southern Bormeo.

Habitat

Unknown.

Material

Not seen, description based on Mr. M. Kottelat's original description and photograph of the Holotype.

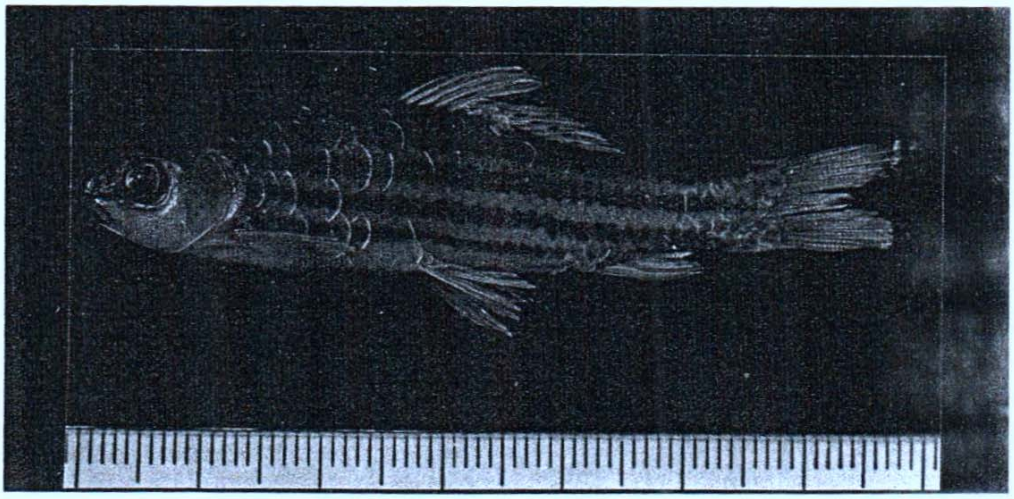


Fig. 24 *Osteochilus pentalineatus* Kottelat Holotype

Osteochilus hasselti (Valenciennes)

Rohita hasselti Valenciennes in Cuvier and Valenciennes, 1842: Vol. 16, p.20; original description; type locality: Java; syntypes: 5 specimens (3 dry, 2alc.) RMNH 2188, dry (216.8 mm, S.L.); RMNH 217, dry (141.1 mm S.L.); RMNH 2120, dry (104.4 mm S.L.) RMNH 2588, in alc. (2 spec., 136.1, 109.7 mm, S.L.)

Rohita rostellatus Cuv. and Val., 1842: vol.16, p250; original description; type locality: Rangoon, Buram; holotype MHNP 85-177-31-1, 75.1 mm in standard length.

Rohita (Rohita) kuhli Bleeker, 1860: vol.2, p.177; original description; type locality: Palembang, Sumatra; holotype BMNH 1866.5.2.171, 160 mm total length (given by Bleeker) 116.7 mm standard length (my measurement).

Rohita (Rohita) hasselti Bleeker, 1863: vol.3, p.65; description; locality: Java, Sumatra, Borneo (78 specimens); with color plate.

Osteochilus hasselti Gunter, 1868: vol.7, p.41; description; locality: Java, Sumatra, Borneo.

Osteochilus kuhlii Gunter, 1868: vol.7, p.43: descrition; Bleeker's specimen.

Osteochilus neilli Day, 1870: p.99; original description; type locality: Sittang River, Burma; syntype (2 specimens) ZSI 669, 60.9 mm and 52.9 mm standard length (my measurement)

Osteochilus neilli Day, 1876: p.545, plt 80, fig.2; description; locality Sittang and Billing in Burma.

Osteochilus neilli Day, 1889: vol.1, fig. 94; description; locality: Rangoon, Burma.

Osteochilus hasselti Weber & de Beaufort, 1916: vol.3, p.135; description; locality Sumatra, Java, Borneo, Malacca, and Siam.

Osteochilus hasselti Tirant, 1929: p.151; description; locality: Cochinechine and Cambodia.

Osteochilus duostigma Fowler, 1937: p 182, fig. 120, 121; original description; type locality Kemarat, northeastern Thailand; holotype ANSP 68069, 115 mm total length (given by Fowler), 85.7 mm standard length (my measurement)

Osteochilus hasselti Smith, 1945: p.214; description; locality: various parts of Thailand, Mekong basin (Laos & Cambodia).

Osteochilus hasselti tweediei Menon, 1954: p.12, fig 3; original description; type locality Kuala Tahan, Pahang, Malaysia; holotype ZSI F324/2, 118.9 mm standadrd length (my measurement).

Nomenclature

Osteochilus hasselti is one of the commonest species of the genus, it has been found almost throughout the range of the genus except in N. Vietnam, China, and eastern Borneo. This species demonstrates considerable geographical variation in body proportion, color pattern, and length of dorsal fin, and for this reason, many nominal forms of it have been described. The majority of *O. hasselti* specimens have a rather deep body, long dorsal fin (15-17 branched dorsal rays), with about 6-9 rows of spots or stripes on the posterior two-thirds of the body. Some specimens have a black blotch on the scales above the middle part of the pectoral fin; this form represents the nominal form of *O. neilli* Day (Burma) and *O. duostigma* Fowler (Thailand). This character is only seen in young specimns. Some specimens have a rather slender body and short dorsal fin (12-13 branched dorsal rays) which are usually found in eastern Malaysia, the islands between Sumatra and Borneo, Sumatra, and Java in possible response to the running water habitat; this form is a norminal form of *O. hasselti tweediei.* This subspecies, described by Menon (1954) was based on specimens from Pahang, eastern Malaysia.The type specimen of *O. hasselti* also represents this form (with 13 branched dorsal rays), therefor, I do not recognize Menon's subspecies. The syntypes of *O. hasselti* (Cuv. & Val.) are dry mounted varnished specimens that have been ignored for a long time because Bleeker's (1963) Atlas and figure have been so useful. *O. hasselti* of Bleeker represents the common form which many ichthyologists accept as typical. This form has faint rows of spots which sometimes disappear after death or preservation in alcohol. It represents the nominal form of *Osteochilus kuhli* Bleeker.

Diagnosis

D. IV, 12-17; l.l. 30-33; c.f. 11/2/13; c.p. 16

The number of branched dorsal rays varies widely in *Osteochilus hasselti*. There are 15-17 rays in specimens of most populations (and only this) on the mainalnd, but there are 12-14 rays in some populations in the archipelago area. There are 6-9 rows of spots or stripes on the posterior two-thirds of the body; some young specimens have a black blotch on the scales above the pectoral fin.

O. hasselti shares some characters with *O. sarawakensis* such as the rows of spots or stripes on the body; However, *O. sarawakensis* has an inferior mouth with long undivied costae on the ventral part of the upper lip, while *O. hasselti* has short divided costae on the lip. *O. sarawakensis* also has a short dorsal fin of 11-13rnched rays.

O. hasselti is closely related to *O. kappeni*. The differences that separate them are: circumferential scales 13/2/15; body deeper and more compressed; rows of spots on the body are not distinct in *O. kappeni*

Description

Body oblong and slightly compressed; depth 327-410 (mean=368) (in thousandths of standard length), head 219-258 (mean=254); eye 42-70 (mean=57), large fish with relatively small eye. Snout 67-91 (mean=79), entire, without tubercles or pores; snout longer than eye diameter in adult fish, shorter than interorbital space, shorter than postorbital part of the head. Interorbital space slightly convex, 114-143 (mean=122). Mouth ascending, two pairs of well developed barbels; maxillary barbels longer than or about equal to eye diameter, rostral barbels shorter than the maxillary ones. Ventral surface of upper lip consists of well developed short, divided, costae. Predorsal length 420-440 (mean=433), origin of dorsal fin opposite 8th to 10th scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin usually with normal height, length of fourth simple ray 227-294 (mean=268), base of dorsal fin 324-403 (mean=372) and branched dorsal rays 15-18 (specimens from Java, and Biliton Island may have 12-14 rays). The insertion of the dorsal fin opposite 22nd-24th scale of lateral line, number of scales from insertion of the dorsal fin to vertical from anal fin origin varies from -2 to 0. Tip of pectoral fin not reaching the pelvic fin insertion, usually opposite 8th-10th scale of lateral line. Prepelvic length 421-580 (mean=516); pelvic fin insertion opposite 11th-12th scale of lateral line. Preanal length 761-903 (mean=792); anal fin concave, third simple ray rather weak; anal fin origin opposite 22nd-24th scale of lateral line. Caudal fin deeply forked, its lobes more or less acute, upper lobe slightly longer than the lower lobe. Least depth of caudal peduncle 133-156 (mean=142), usually greater than its length, and more than half of head length; length of caudal peduncle 101-143 (man=113). Caudal peduncle surrounded by 16 scale rows. Scales with nearly parallel longitudinal radii, predorsal scales usually 9-11; circumferential scales 11/2/13 (5.5/1/4.5 intransverse series to the base of pelvic fin); lateral line scales 30-33with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 27-35.

Preserved specimens are dusky on the upper two-fifths of the side; the dorsal part of head and back are darker; six to nine longitudinal rows of spots or stripes on posterior two-thirds of the body. A large round black spot is present on the caudal peduncle. Some young specimens also have a dark blotch formed by dark bars on the fifth scale of the lateral line, and on the lateral line, and on the one above and the one below (above the middle part of the pectoral fin). Dorsal and caudal fins with melanin pigment in the membranes, other fins plain. Coloration of fresh specimens olive-brown with orange spots between the rows of black spots; all fins are pinkish.

Distribution

O. hasselti has a wide distribution from Burma eastward to as far as the Mekong Basin and its tributaries, southward to Malay Peninsula and the Islands of the archipelago west of Wallace's line.

Habitat

Lakes and large rivers with still or slow moving water at the low elevations with turbid water, It can occur in running water but never in swift water.

Material examined (530 specimens 54.8-224.0 mm standard length)

Syntypes: RMNH 2117, 2118, 2120 (3 spec., dry, mounted), Java

RMNH 2588 (2 spec., alc.) (said to be syntypes) Java

Other specimens:

ZSI 669 (2 spec., syntypes of *O. neilli*) Sittang, Burma

MHNP 85-177-31-1 (1 spec., type of *O. rostellatus*) Rangoon, Burma.

ANSP 68096 (1 spec., type of *O. duostigma*) Kemarat, Thailand

ZSI 324/2 (1 spec., type of *O. hasselti tweediei*) Kuala Tahan, Pahang

Borneo: BMNH 190.4.1.20.2 (1 spec.) no spacific locality

BMNH 1898.11.14.5 (1 spec.) Sarawak, Baram River

FMNH 68543 (2 spec.) Sungai Subis, Sarawak 4th Div.

FMNH 62991 (21 spec.) R. Niah, Sarawak 4th Div.

FMNH 68854 (1 spec.) Sungai Tangap, Sarawak 4th Div.

FMNH 68853 (1 spec.) Sungai Tangap, Sarawak 4th Div.

FMNH 62985 (1 spec.) R. Niah, Sarawak 4th Div.

FMNH 62986 (1 spec.) R. Niah, Sarawak 4th Div.

FMNH 68707 (1 spec.) Sungai Subis, Sarawak 4th Div.

FMNH 68544 (2 spec.) Lower Niah, Sarawak 4th Div.

FMNH 68850 (1 spec.) Kampon Tangap, Sarawak 4th Div.

FMNH 68852 (2 spec.) Niah, Sarawak 4th div.

KCTR 76-8 (9 spec.) Sungai Keniyatan, about 65 km N.E. of Pontianak (tributary of Kapuas)

Burma: RMNH 8622 (1 spec.) no spacific locality

ZSI 667 (1 spec.) Sittang River

Bali: BMNH 1974.10.10.886 (1 spec.) Darau Tamblingan

BMNH 1974.10.10.888 (1 spec.) Darau Tamblingan

BMNH 1974.10.10.884-885 (2 spec.) Darau Buyam

BMNH 1974.10.10.880-883 (3 spec.) Darau Batan

Indochina: MHNP 85-177-13-8 (3 spec.) Cochinchina

UMMZ 181131 (4 spec.) Prek Tock, Prey Veng Prov., Cambodia

UMMZ 181187 (1 spec.) Fish pond at Bamnak, Pursat Prov., Cambodia

UMMZ 181153 (1 spec.) Prek Angkor 15 km west of Phnom Penh, Cambodia

UMMZ 182250 (1 spec.) Great Lake at Kampong Laung, Cambodia

Java: BMNH 1974.10.10.875-879 (5 spec.) Telaga Patengan, near Bandung

MHNP 85-177-13-10 (2 spec.) Batavia

UMMZ 155735 (3 spec.) Fish pond near Trogong

UMMZ 155577 (3 spec.) no specific locality

UMMZ 155577 (3 spec.) no specific locality

UMMZ 155732 (2 spec.) fish pond near Singaparna

UMMZ 155737 (1 spec.) Vic Bandveng (market)

UMMZ 155731 (1 spec.) Lake Tjiboeroej

UMMZ 155733 (1 spec.) Tjitandej Godebak

Malaysia (continental), and Singapore:

BMNH 1882.5.19.22-24 (3 spec.) Telom River, Pahang

BMNH 1931.7.20.34 (1 spec.) Tasek Bera, Pahang

AMNH 13831 (1 spec.) Sungai Lampan, Perak

FMNH 42429 (2 spec.) Lake Chin Chin, Malacca

NMNH 101258 (3 spec.) Lake Chin Chin, Malacca

NMS 629 (2 spec.) Lake Chin Chin, Malacca
NMS 627 (2 spec.) Kakai Bukit, Peris
NMS 630 (2 spec.) Kuala Tahan, Pahang
NMS 634 (3 spec.) Lake Chini, Pahang
NMS (uncatalogued, 3 spec.) Singapore
NHNP 85-177-13-11 (3 spec.) Malacca

Sumatra: AMNH 9502 (1 spec.) Padangsche, Bovenlanden
AMNH 9501 (1 spec.) Kalung (Tilatang), Padangsche, Bovenlanden
AMNH 9297 (1 spec.) Djambi, Batang Hari River
ANSP 170307 (68 spec.) Buta Songkar, Padangsche, Bovenlanden
ANSP 32377 (1 spec.) Padang
ANSP 27305-6 (2 spec.) Batu Songkar, Padangsche, Bovenlanden
RMNH 13729 (1 spec.) lat. 4 degree N., long. 98-49 degree E.
RMNH 26911 (1 spec.) Sockadana
RMNH 17611 (7 spec.) River Poeloeweh
UMMZ 15582 (1 spec.) Moesi River, Maeara Klingi
ZMA 116.087 (6 spec.) Padang Benedenloop
ZMA 116.084 (1 spec.) Patang Hari River, Djambi
ZMA 116.102 (2 spec.) River near Solok
ZMA (uncatalogued, 3 spec.) Fort de Kock
ZMA (uncatalogued, 1 spec.) Talack

Biliton Island: ZMA 116.092 (4 spec.)
Thailand: AMNH 14583 (1 spec.) Chanthaburi River
ANSP 58060 (1 spec.) Chanthaboon
ANSP 57506 (2 spec.) Chanthaboon (with 11 pec. of O. lini)
ANSP 87862 (10 spec.) Huey Yang
ANSP 57508 (1 spec.) Chiengmai
ANSP 57507 (1 spec.) Chiengmai
ANSP 89404 (18 spec.) Huey Yang
ANSP 76817 (4 spec.) Krabi
ANSP 60329 (1 spec.) Trad
ANSP 60843-44, 60941-42 (4 spec.) Bangkaok
ANSP 60325-6 (2 spec.) Ban Thung Luang (near Hua Hin)
BMNH 1934.12.18.14 (1 spec.) Hang Kra Ben, Chao Phya River
NMNH 108039 (2 spec.) Pattani River
NMNH 108052 (2 spec.) Talesap, Songkhla
NMNH 108051 (1 spec.) Chanthaboon River
NMNH 103260 (1 spec.) Bukit, Pattani
NMNH 108053 (1 spec.) Tale Noi, Songkhal
NMNH 108040 (1 spec.) Talesap, Songkhla
NMNH 108030 (1 spec.) Meklong at Ban Pong
RMNH 16462 (1 spec.) Pattalung
UMMZ 201055 (4 spec.) Chao Phya River
UMMZ 201066 (3 spec.) Huay Kwang, Ubol
UMMZ 201056 (1 spec.) Creek at Ban Tha Mai, Ubol
UMMZ 201058 (1 spec.) Lam Pao Reservoir, Kalasin
UMMZ 201059 (4 spec.) Lam Pao Reservoir, Kalasi
UMMZ 201059 (4 spec.) Lam Pao Reservoir, Kalasin
UMMZ 201065 (1 spec.) Lam Pao Reservoir, Kalasin
UMMZ 201060 (1 spec.) Lam Pao Reservoir (S.W.end)
UMMZ 201061 (1 spec.) Huay Thom-Loe at Ban Bung
UMMZ 201063 (2 spec.) Lam Pao Reservoir, Kalasin
UMMZ 201064 (2 spec.) Mekong River, at Ban Tha Sadet, Nong Khai
UMMZ 201057 (1 spec.) Mun River at Ban Dan, Ubol
UMMZ 195372 (4 spec.) Chao Phya River at Maharaj District
UMMZ 195791 (1 spec.) Huay Yang Reservoir, North of Korat
UMMZ 195757 (10 spec.) Reservoir of Mahasarakam
UMMZ 195679 (12 spec.) Market at Ubol
NIFI (uncatalogued, 10 spec.) Chao Phya River at Ayuthya
NIFI (uncatalogued, 56 spec.) Ubolratana

Reservoir

NIFI (uncatalogued, 15 spec.) Huay Luang, Udorn

NIFI (uncatalogued, 21 spec.) Mekong River at Nong Khai

NIFI (uncatalogued, 16 spec.) Lamdome Noi, Ubol

NIFI (uncatalogued, 38 spec.) Nongharn, Sakol Nakorn

NIFI (uncatalogued, 24 spec.) Bung Borapet, Nakorn Sawan

NIFI (uncatalogued, 4 spec.) Meping at Cheingmai

NIFI (uncatalogued, 14 spec.) Meklong River at Karnchanaburi

NIFI (uncatalogued, 4 spec.) Surathani

NIFI (uncatalogued, 20 spec.) Chanthaburi River

NIFI (uncatalogued, 9 spec.) Petchaburi

NIFI (uncatalogued, 3 spec.) Chumporn

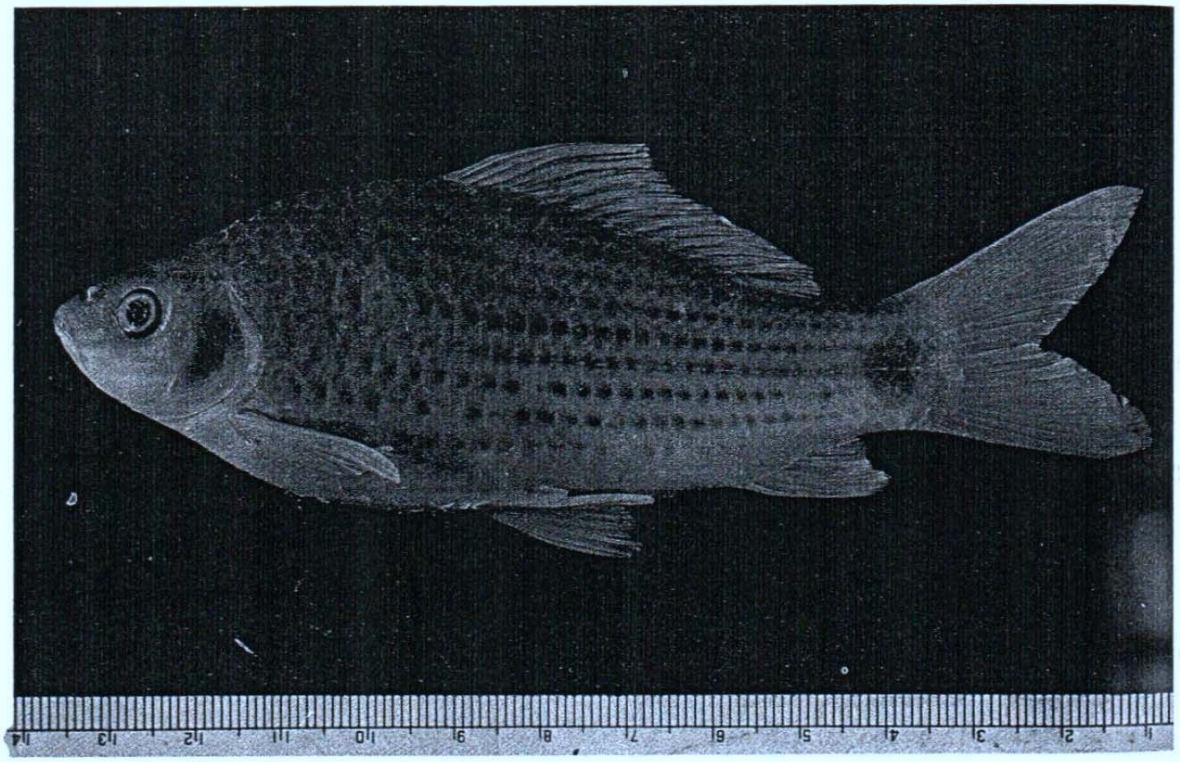


Fig. 25 *Osteochilus hasselti* (Cuv. & Val.) NIFI (uncatalogued) Mekong River

Osteochilus kappeni (Bleeker)

Rohita kappenii Bleeker, 1857: p.19; Original description; type locality, River Kapuas at Pontianak; Holotype BMNH 1866.5.2.174; 120 mm total length (given by Bleeker), 86.0 mm standard length (my measurement).

Rohita (Rohita) kappenii Bleeker, 1860: vol.2, p.167; redescription (same specimen), with color plate.

Osteochilus kappenii Gunther, 1868: vol.7, p.42; redescription (from Bleeker's specimen).

Osteochilus kappenii Weber & de Beaufort, 1916: vol.3, p.137; description; locality Sumatra (Djambi). I have not seen the specimen.

Osteochilus brevicauda Weber & de Beaufort, 1916: vol.3: p.138; original description; type locality: Kapuas River at Sibua, Putus Genting; Borneo; syntype ZMA 100.167 (1 spec. 175.0 mm S.L.) ZMA 112.675 (6 spec. 46.8-67.2 mm S.L.).

Nomenclature

Osteochilus kappeni was described by Bleeker in 1857, and redescribed from the same specimen in 1860 and 1863. There was a slight difference in the description of 1857 from that given in 1863 as follows: 32-34 vs 33-34 ateral line scales 12 vs 14.5 (15) scales in transverse series, and 6 vs 6.5(7) scales above lateral line to origin of dorsal fin. Gunther (1868) claimed that the type specimen of this species was BMNH 1866.5.2.174. In my examination of this specimen I counted 5.5 scales from above the lateral line to the origin of the dorfin, and 30+2 scales along the lateral line (same on both sides of the body). I am not sure that this specimen is really the type that Bleeker used or not; in addition, the difference within Bleeker's papers is unexplainable.

In 1916, Weber and de Beaufort described *O. brevicauda* on the basis of minor differences. He used two characters to separate these two species as follows the number of scales below the lateral line to the mid-line of the abdomen (6.5 in *O. kappeni* and 7.5 in *O. brevicauda*) and the shape of the black blzotch on the caudal peduncle. From my study of other additional specimens, I found that these two characters vary within the species. Since I am not certain about the type specimen, I have based my description of this species on Bleeker's (1863) illustration which has 32+2 lateral line scales, 6.5/1/5.5 transverse scales to the base of pelvic fin, an 16 branched dorsal rays. These characters agree with the *O. brevicauda* of Weber and de Beaufort.

Diagnosis

D. IV, 15-17; l.l 31-33; c.f. 13/2/15; c.p. 16

O. kappeni has a deep body with 13/2/15 circumferential scales, 6.5/1/5.5 transverse scales to the base of pelvic fin; and a large round black blotch on the caudal peduncle. In young specimens there is an indication of an incomplete brown vertical band above and below the lateral line, and above the mid-portion of the pectoral fin.

O. kappeni is related to *O. hasselti* and it is quite difficult to distinguish between these two species. *O. hasselti* has larger scales, a more slender body, and 11/2/13 circumferential scales. There are rows of spots on the body in both species but they are very distinct in *O. hasselti*, while in *O. kappeni* the rows of spots are small and faint and usually disappear in adult specimens.

Description

Body oblong, deep and compressed, depth 351-446 (mean=385) (in thousanths of standard length). Head 242-300 (mean=268), eye 51-94 (mean=78), large fish with a relatively small eye. Snout 72-103 (mean=87) entire, without tubercles or pore; about equal or a little longer than eye diameter, shorter than interorbital space, usually shorter than the postorbital part of the head. Interorbital space slightly convex, 115-144 (mean=127). Mouth subinferior, two pairs of well developed barbels; maxillary barbels longer than eye diameter, rostral barbels usually shorter than the maxillary ones. Ventral surface of upper lip consists of well developed short costae, most of which are divided into more than two portions. Predorsal length 424-459 (mean=439); origin

of dorsal fin opposite 7th or 9th scale of lateral line, before mid-ont between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin long and normal in heigth, its fourth simple ray shorter than the base of the dorsal fin, the length of fourth simple ray 247-311 (mean=289), and the base of dorsal fin 334-406 (mean=377); branched dorsal rays 15-17. Insertion of the dorsal fin opposite 22nd-24th scale of lateral line, number of scales from posterior base of dorsal fin to vertical from anal fin origin varies from -2 to 0. Tip of pectoral fin not reaching the pelvic fin insertion, usually opposite 9th-12th scale of lateral line. Prepelvic length 523-559 (mean=539); pelvic fin insertion opposite 11th-12th scale of lateral line. Preanal length 768-831 (mean=796); anal fin concave, third simple ray rather weak; anal fin origin opposite 21st-24th scale of lateral line. Caudal fin deeply forked, its lobes more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 94-153 (mean=143); least depth of caudal peduncle 130-151 (mean=143), and surrounded by 16 scale rows. Scales with few radii, parallel centrally and radiating laterally; predorsal scales 9-11; circumferential scales 13/2/15 (rarely 11-12/2/15), scales in transverse series the base of pelvic fin 6.5/1/5.5 (rarely 5.5/1/5.5). Lateral line scales 31-33, with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 26-34.

Preserved specimens are dusky on the upper two-fifths of the side, the dorsal part of head and back are darker. There is a large round black blotch on the caudal peduncle and spots in rows are irregular, usually faint, an disappear in adult fish. Young specimens also have dark incomplete bar at the two or three scales above and below the lateral line and opposite the mid-portion of the pectoral fin. Dorsal and caudal fin with melanin pigment in its membrane other fins clear. Coloration of fresh specimen unknown.

Distribution

All specimens studied are from the Kapuas River, Borneo. Weber and de Beaufort reported this species from Djambi Sumatra (not seen; it is possible that this species occurs there). Fowler (1905) reported *O. kappeni* from the Baram River in Sarawak (not seen); from his description it is more probably *O. kahajanensis.*

Habitat

Small or large rivers with weak current and turbid waters seem to be prefered.

Material Examined (17 specimens 46.8 mm-175.0 mm standard length)

Holotype BMNH 1866.5.2.174 (?) Kapuas River, Pontianak, Borneo

Syntypes of *O. brevicauda* (7 specimens)

ZMA 100.167 (1 spec.): Kapuas River at Putus Sibau, Borneo.

ZMA 112.675 (6 spec.): Kapuas River at Putus Genting, Borneo.

Other specimens:

MHNP 85-177-17-1 (2):Borneo

AMNH 9273 (1):Borneo, Poetus Genting (presumably from ZMA 112.675).

KCTR 76-37 (2):small forested stream where it flows into Sungai Mandai 2-3 km upstream from its Kapuas mainstream, 17 km WSW of Putussibau, (curretn weak, water turbid).

KCTR 76-28 (3):small forested streams flowing into Sungai Pinoh near village of Ribang-Rabing; about 55 km SSE of Nangapinoh and 2 km NE of Katabahru.

KCTR 76-43 (1):small oxbow lake completely cut off from Kapuas mainstream opposite Empangau, 124 km NE of Sintang.

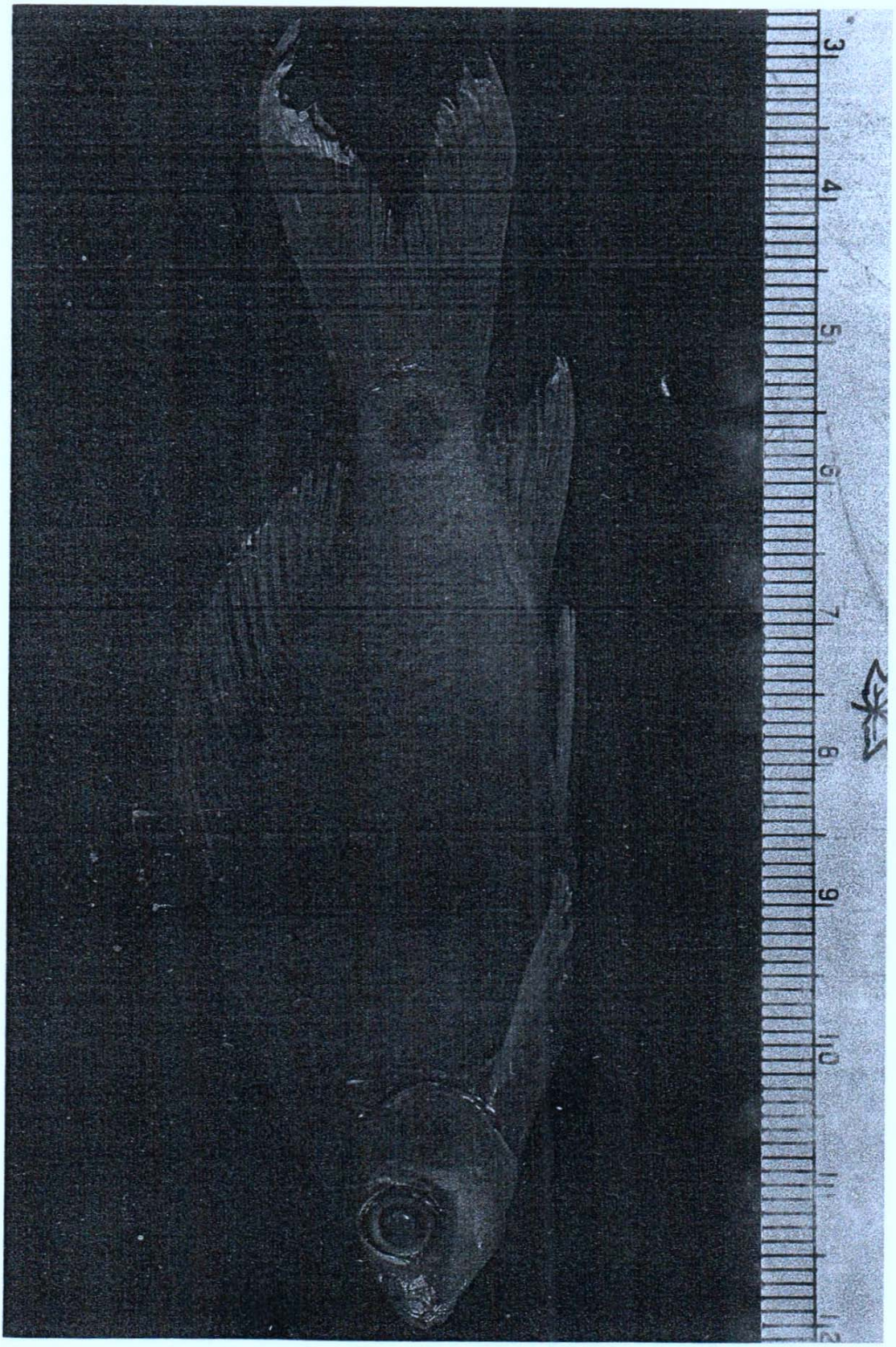


Fig. 26 *Osteochilus kappeni* (Bleeker) KCTR 76-28

Osteochilus lini Fowler

Osteochilus lini Fowler, 1935: p118, figs. 54,55; original description; type locality: Khao Nam Poo, northern part of central Thailand; holotype ANSP 60812, 84mm total length (given by Fowler), 63.2 mm standard length (my measurement); paratype (29 spec.) 65-83 mm total length (given by Fowler), 51.2-57.1 mm standard length (my measuremnt).

Osteochilus lini Smith, 1945: p216; referring to Fowler's description.

Osteochilus duostigma Smith, 1945: p215 (in part); locality: Khao Sabab, south estern Thailand.

Nomenclature

Osteochilus lini was described from 30 specimens from Khao Nam Poo, Thailand in 1935. Smith (1945) did not see Fowler's materials and misidentified *O. lini* as *O. duostigma* (=*O. hasselti*) as the two forms are similar. In the original description, Fowler did not indicate whether or not there are pores or tubercles on the snout, but in his illustration of *O. lini* there are several spots drown on the snout. On the basis of Fowler's picture Smith believed that *O. lini* has pores on the snout and he identified his specimens of *O. lini* as *O. duostigma*. I have examined the type specimens of *O. lini* and all of them have entire snouts without pores or tubercles.

Diagnosis

D. IV, 12-13 (rarely 14-15); l.l. 32-34; c.f. 11/2/13: c.p. 16

O. lini has a black blotch on the side above the pectoral fin, formed by two or three black bars on the fifth scale of the lateral line and the scale immediately above and below it. The under surface of the upper lip consists of short divided costae.

O. lini shares some characters with *O. hasselti* such as the structure of the mouth and general body shape, but *O. hasselti* has rows of spots on the body while *O. lini* has only one black blotch on the side. *O. hasselti* also has a longer dorsal fin (15-17 branched dorsal rays on the mainland)

Description

Body oblong, deep, and compressed; depth 330-370 (mean=352) (in thousandths of standard length). Head 198-254 (mean=225), eye 43-62 (mean=54), large fish with relatively small eye. Snout 69-94 (mean=81); entire, without tubercles or pores; about equal to or a little longer than eye diamter, shorter than interobital space, usually shorter than the postorbital part of the head. Interorbital space slightly convex, 107-123 (mean=113), Mouth subinferior, two pairs of well developed barbels; maxillary barbels about equal to or longer than eye diameter, rostral barbels usually shorter than the maxillary ones. Ventral surface of upper lip consists of well developed short, divided costae, most of which are divided into two or more portions. Predorsal length 380-445 (mean=415); origin of dorsal fin opposite 7th-9th scale of lateral line before mid point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin modrately long with normal heigth, its fourth simple ray 213-246 (mean=232) shorter than the base of dorsal fin 274-329 (mean=305); branched dorsal rays 12-14 (rarely 15). Posterior base of dorsal fin opposite 20th-21st scale of lateral line, number of scales from the posterior base of dorsal fin to vertical from anal fin origin varies from one to three. Tip of pectoral not reaching the pelvic fin insertion, usually opposite 7th-9th scale of lateral line. Prepelvic length 479-529 (mean=497); pelvic fin insertion opposite 10th-12th

(usually 11th) scale of lateral line. Preanal length 728-772 (mean=753); anal fin concave. third simple ray rather weak; anal fin origin opposite 21st-23rd scale of lateral line. Caudal fin deeply forked, its lobes more or less acute, upper lobe slighy longer than the lower lobe. Length of caudal peduncle 112-139 (mean=124); least depth of caudal peduncle 131-147 (mean=140); surrounded by 16 scale rows. Scales with few radii parallel medially and radiating laterally; predorsal scales 9-11; circumferential scales 11/2/13 (transverse scales to the base of pelvic fin 5.5/1/4.5). Lateral line scales 31-34 with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 27-36.

Preserved specimens are grayish brown, the back and the dorsal part of the head darker. Black blotch on the side formed by two or three black bars on the fifth scale of lateral line and one above and one below. This blotch is right above the middle part of the dorsal fin; other parts of the body uniformly gray. All fins are pale pink or whitish and hyaline.

Distribution

The distribution of *O. lini* is restricted to northern and eastern parts of central Thailand (Phetchbun, Nakorn Nayok, Chanthaburi) and the lower Mekong Basin and its tributaries of northeastern Thailand.

Habitat

Found in both rivers, lakes, and mountain streams (at low elevation). The rapid or rocky parts of rivers are preferable, but it also does well in the ponds.

Materials examined (354 specimens 50.1-135.6 mm standard length).

holotype : ANSP 60812; Khao Nam Poo; Thailand
paratypes : ANSP 60813-41 (29 spec.); same data as holotype

Other specimens:

Thailand: ANSP 57606 (11 spec) (3 specimens of this no. belong to *O. hasselti*, all specimens of this no. were identified as *O. hasselti*) Chanthaboon, southeastern Thailand.

ANSP 58060 (1 spec.) Chanthaboon, S.E. Thailand (this specimens of this number was identified as *O. hasselti*)

USNM 10857 (1 spec.) Pleiw water fall, Chanthaboon

USNM 108056 (2 spec.) Chanthaburi River, S.E. Thailand

USNM 108041 (1 spec.) Kao Bantad, Trad, S.E. Thailand

USNM 108042 (1 spec.) Trad River at Trad, S.E. Thailand. (all the USNM specimens were identified as *O. duostigma*)

UMMZ 201079 (2 spec.) Mekong River, back water at Tha Sadet, Nong Khai

UMMZ 201080 (7 spec.) wadeside ditch, near Ban Thang, Nakorn Phanom.

UMMZ 201078 (8 spec.) Mekong River, back water at Tha Sadet, Nong Khai.

UMMZ 201077 (3 spec.) Huay Thom-Loe, Ubol

NIFI uncatalogued (120 spec.) Ubolratana Reservoir, N.E. Thaiand

NIFI uncatalogued (50 spec.) Ubolratana Reseroir N.E. Thailand

NIFI uncatalogued (3 spec.) Nakorn Nayok, central Thailand

NIFI uncatalogued (40 spec.) Nong Harn, Sakol Nakorn

NIFI uncatalogued (20 spec.) Huay Luang, Udorn

NIFI uncatalogued (15 spec.) Krating Water fall, Chanthaburi

NIFI uncatalogued (30 spec.) Ubolratana Reseroir

NIFI uncatalogued (8 spec.) Khon Kaen, N.E. Thailand

Cambodia:

UMMZ 181188 (4 spec.) fish pond at Bannak, Pursat Prov.

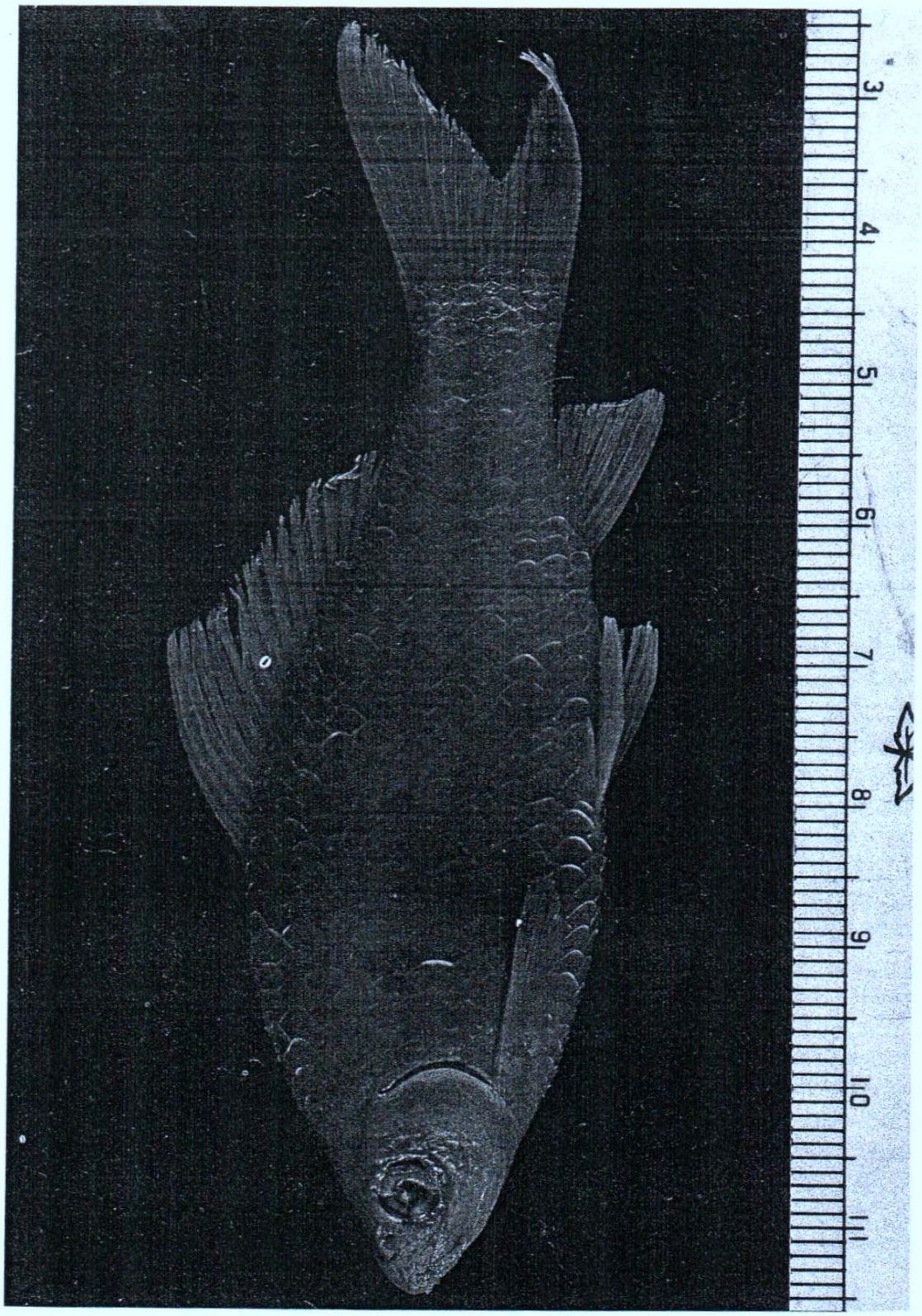


Fig. 27 *Osteochilus lini* Fowler NIFI (uncatalogued) Mun River

Osteochilus repang Popta

Osteochilus repang Popta, 1904: p.196; original description; type locality: River Bo, tributary of Mahakam River, Borneo; holotype RMNH 7579, 268 mm total length (given by Popta) 192.1 mm standard length (my measurement). 1906: p.101; description.

Osteochilus repang Weber and de Beaufort, 1916: vol.3, p.131; description (after Popta)

Nomenclature

Osteochilus repang was described by Popta (1904) from a single specimen. The holotype is the only known specimen, but the species has unique characters which distinguish it from other species.

Diagnosis

D. IV, 16; 32; c.f. 12/2/14; c.p. 16; g.r. 24 (approx.)

O. repang has a uniform brown color on the body, three tubercles on the front of the snout, and a long dorsal fin (16 branched rays)

O. repang shares some characters with *O. borneensis* such as many of the body proportions, the long dorsal fin, and the tubercles on the snout. *O. repang* has larger scales (32 scales in lateral line), but *O. borneensis* has small scales (47-49 scales in lateral line).

Description

Body oblong, deep, and compressed; depth 442 (in thousandths of standard length). Head 231; eye 49; snout 96, with three pointed tubercles in the front, the middle one largest and lateral ones smaller; snout longer than postorbital part of head. Interorbital space 146, slightly convex. Mouth subinferior, two pairs of well developed barbels; maxillary barbels about equal to eye diameter, rostral barbels much shorter than the maxillary ones. Ventral surface of upper lip consists of well developed short costae. Predorsal length 420 rigin of dorsal fin opposite 9th scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin with normal heigth, the length of the fourth simple ray 279, and the base of dorsal fin 420, branched dorsal rays 16. The insertion of the dorsal fin opposite 23rd scale of lateral line, number of scales from posterior base of dorsal fin to vertical from anal fin origin is -1 Tip of pectoral fin not reaching the pelvic fin insertion, and opposite the eighth scale of lateral line. Prepelvic length 522; pelvic fin insertion opposite 12th scale of lateral line. Preanal length 763; anal fin origin opposite 22nd scale of lateral line. Caudal fin deeply forked, its lobe more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 18; least depth of caudal peduncle 154, greater than its length and surrounded by 16 scale rows. Scales with nearly parallel longitudinal radii, predorsal scales 11; circumferential scales 12/2/14, transverse scales (to the base of pelvic fin) 6/2/5. Lateral line scales 32 with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch approximately 24.

The holotype is dark brown; the dorsal part of the head is darker than the rest of the body. Coloration of the body is uniform.

Distribution

Only one specimen known from River Bo, left branch of the superior Mahakam, Central Borneo.

Habitat

Unknown

Material examined (1 specimen 192.1 mm standard length)
holotype: RMNH 7579 ; River Bo, tributary of Mahakam River, Borneo.

Osteochilus borneensis (Bleeker)

Rohita borneensis Bleeker, 1857: p.17; original description; type locality: Borneo (Kapuas River at Pontianak); type specimen BMNH 1866.5.2.173; total length 80mm. (given by Bleeker), 62.8 mm. standard length (my measuremnt).

Rohita (Rohita) borneensis Bleeker, 1863: vol. 3, p.63; description; locality (same as above); with color plate.

Osteochilus borneensis Gunther, 1868: vol.6, p.41; description, locality (from Bleeker's specimen).

Osteochilus borneensis Weber & de Beaufort, 1916: vol.3, p.133; description, locality: Sumatra)Si-Djandjung, Djambi), Borneo (Kapuas River, Pontianak, Smitau and Mandai River).

Nomenclature

Osteochilus borneensis was described from a single specimen by Bleeker in 1857 and was redescribed again in 1863 in his Atals, refering to the same specimen. Bleeker's type specimen was purchased by the British Museum and was redescribed by Gunther in 1868. After 1900, a number of specimens had been collected which confirmed the validity of this species.

Diagnosis

D. IV, 16-19; l.l. 41-49; c.f. 17-19/2/17-20; c.p. 22-24

O. borneensis has several unique characters and is easily recognized. It has small scales (l..l. 41-49) as does *O. melanopleurus* (l.l. 45-53), but there is a difference in the mouth strcuture and circumferential scales. *O. borneensis* has a normal subinferior mouth with short divided mound-shaped costae arranged in regular rows (fig. 46), while *O. melanopleurus* has an ascending mouth, with mound-shaped costae which are irregularly arranged (fig 47). The circumferential scale formula of *O. borneensis* is 17-19/2/17-20, while it is 22-23/2/23-24 in *O. melanopleurus.*

Description

Body oblong, deep, and compressed; depth 334-380 (mean=360) (in thousandths ot standard length). Head 200-276 (mean=234); eye 42-78 (mean=62), large fish with relatively small eye. Snout 66-96 (mean=82); usually with three pointed tubercles in the front, the middle one the largest and lateral one small or rudimentary; snout longer than eye diameter in adult fish, shorter than interorbital space, about equal to the postorbital part of head. Interorbital space slightly convex, 101-138 (mean=125). Mouth subinferior, two pairs of well developed barbels; maxillary barbels about equal to eye diameter, rostral barbels much shorter than the maxillary ones. Ventral surface of upper lip consists of well developed, short, mound-shaped costae (fig. 46). Predorsal length 428-447 (mean=442); origin of dorsal fin opposite 9th to 13th scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin usually of normal heigth, length of the fourth simple ray 228-276 (mean=255)' and the length of dorsl fin base 351-420 (mean=370), branched dorsal rays 16-19. The insertion of the dorsal fin opposite 31st-35th scale of lral line, number of scales from insertion of the dorsal fin to vertical from anal fin origin varies from-2 to 0. Tip of pectoral fin not reaching the pelvic fin inserion, usually opposite 10th-13th scale of lateral line. Prepelvic length 515-540; pelvic fin insertion opposite 15th-17th scale of lateral line. Preanal length 738-792 (mean=776); anal fin concave, third simple ray rather weak; anal fin origin opposite 30th -34th scale of lateral line. Caudal fin deeply forked, its lobes more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 102-140 (mean=122); least depth of caudal peduncle 127-138 (mean=134) usually greater than its length, and more than half of head length; length of caudal peduncle 102-140 (mean=112). Caudal peduncle is surrounded by 22-24 scale rows Scales with nearly parallel longitudinal radii, predorsal scales usually 13-16; circumferential scales 17-19/2/17-20 (8.5-9.5/1/5-6.5 in transverse series to the base

of pelvic fin). Lateral line scale 41-49 with three additional pored scales on the caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 28-31.

Preserved specimens are dusky on the anterior part of the body; the dorsal part of head and back are darker. Several narrow faint bands (15-17) along side of the body, more distinct on bottom half of the body. A large round black spot on caudal peduncle. Dorsal, pectoral and caudal fin densely pigmented with dark melanophores on the fin membranes, other fins plain.

Distribution

O. borneensis is definitely known only from Borneo and Sumatra (most specimens were collected from the Kapuas River). Bleeker (1865) reported this species from Thailand on the basis of a drawing by Catelnau contained in an album of Thai fishes. None of the existing specimens is from Thailand. Therefore, Catelnau's drawing might be inaccurate, might not be based on a Thai specimen, or might have been misidentified by Bleeker. Smith (1945) gave examples of many which were contained in Catelnau's drawings which were certainly not Thai. The locality stated as "Siam" in Weber and de Beaufort (1916) was after Bleeker (1865).

Habitat

Large or small streams, probably prefering turbid waters.

Material Examined (14 specimens, 62.8-282.0 mm. in standard length)

Holotype: BMNH 1866.5.2.173, Pontianak, Kapuas River, Borneo.

Other specimens:

Borneo: PMNH 85-177-3-1 (2 spec.)
PMNH 85-177-3-2 (1 spec.)
RMNH 7676 (1 spec.) Nangah Rahoen
RMNH 7675 (2 spec.) Kapuas River at Semitau
KCTR 76-16 (2 spec.) Sungai Tekam (tributary of Kapuas).

KCTR 76-17 (1 spec.) Small forest stream, tributary of Kapuas.

KCTR 76-33 (1 spec.) Kapuas main stream at Selimbau

Sumatra: ZMA 116.062 (1 spec.) no specific locality
ZMA 116.063 (1 spec.) no specific locality
AMNH 9492 (1 spec.) Djambi

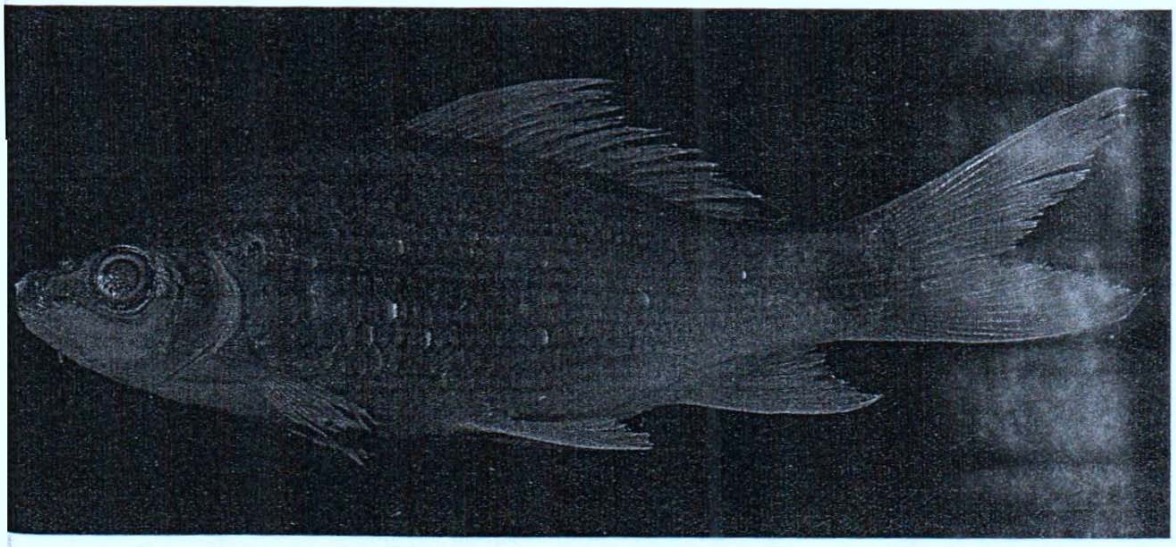


Fig. 28 *Osteoehilus. borneensis.* kapuas 1976-16, 84.9 mm. (CAS 49226)

Osteochilus schlegeli (Bleeker)

Rohita schlegeli Bleeker, 1851: p.432; original description; type locality; Bandjermassing (Southern Borneo); single type specimen 120 mm. total length (given by Bleeker) is not available.

Rohita (Rohita) schlegeli Bleeker, 1860: p.169; redescription.

Rohita (Rohita) schlegeli Bleeker, 1863: vol. 3, p.65; rdescription, 11 additional specimens; locality: Sumatra (Meninju, Palembang, Lahat); Borneo (Bandjermasin, Prabukarta, Pontianak); with color plate.

Osteochilus schlegeli Gunther, 1868: vol.7, p.42; description; 1 spec. from Bleeker's collection, 1 specimen from Leyden Museum; both with no locality; 1 specimen from Siam.

Osteochilus schlegeli Sauvage, 1881: p.163; 1883: p.152; locality: Siam, Menam Chaophya.

Osteochilus schlegeli Weber and de Beaufort, 1916: vo.3, 129; description; locality:Sumatra (Palembang, Djambi); Borneo (Djonkong).

Osteochilus schlegeli Smith, 1945: p.216; locality:Thailand, Chaophya River at Angtong; Maeklong River at Ban Pong.

Nomenclature

Osteochilus schlegeli was described by Bleeker in 1851 from a single specimen of 120 mm. total length. In his 1863 Atlas 11 additional specimens were listed as 71 mm to 258 mm. total length. In 1868 Gunther claimed that specimen no. BMNH 1866.5.2.166 from Dr. Bleeker's collection is the type of the species but I have examined this specimen and it is 173.8 mm. in standard length (216 mm T.L.). It is, therefore, not possible for it to be the holotype. There are no specimens in RMNH indicated as a type and none of the specimens from Bleeker's collection of this species have a label of specific locality. I cannot locate the real type specimen and it is probably lost. The species has unique characters and there are no foreseen taxonomic problems with it; therefore, I do not intend to designate a neotype.

Diagnosis

D. IV, 13-14 (rarely 12); l.l. 32-33; c.f. 13/2/15; c.p. 20.

Osteochilus schlegeli is a large fish which grows to more than 300 mm (S.L.), It has a unique number of circumpeduncular scales (20) except for *O. kalabau* which sometimes has 20 circumpeduncular scales. The body is plain except that young specimens usually have a black vertical blotch on the side above pectoral fin which lies across the fifth scale of the lateral line and the one scale above and the one below. Some specimens of *O. schlegeli* have a large black spot on the anterior base of the dorsal fin. This character is shared with *O. triporus* and *O. intermedius*, but the latter two species have a more slender body and 16 circumpendunclar scales. *O. schlegeli* shares some characters with *O. melonoplurus* and *O. kalabau* such as the structure of the lip (with irregular round-shaped costae) and a deep body but *O. schlegeli* has a much shorter dorsal fin and fewer circumferential scales.

Description

Body oblong, deep, and compressed; depth 340-433 (mean=375) (in thousandths of standard length). Head 213-280 (mean=247); eye 58-88 (mean=68), large fish with relatively small eye, center of the eye on the lower half of head. Snout 60-93 (mean=78), entire, no tubercles or pores on the tip; snout longer than eye diameter in adult fish, shorter than interorbital space, and shorter than the postorbital part of head. Interorbital space slightly convex 134-159 (man=145). Mouth subinferior, two pairs of well developed barbels; maxillary barbels usually shorter than eye diameter, rostral barbels much shorter than the maxillary ones (slightly more than 1/2 length of maxillary barbels). Ventral surface of upper lip consists of well developed irregular round mound shaped costae. Predorsal length 420-510 (mean=450); origin of dorsal fin opposite 8th-10th scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin

usually high, the length of the fourth simple ray 252-344(mean=292), and the base of dorsal fin 274-346 (mean=315); branched dorsal rays 13-14 (rarely 12). The insertion of the dorsal fin usually opposite 21st-22nd (rarely 19th or 20th) scale of lateral line, number of scales from insertion of dorsal fin to vertical from anal fin origin varies from 0 to 2. Tip of pectoral fin usually not reaching the pelvic fin insertion, usually opposite 9th to 10th (rarely 8 or 11th) scale of lateral line. Prepelvic length 457-504 (mean=487); pelvic fin insertion opposite 9th-11th scale of lateral line. Preanal length 744-780 (mean=764); anal fin concave, third simple ray rather weak; anal fin origin opposite 21st-23rd scale of lateral line. Caudal fin deeply forked; its lobes more of less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 119-164 (mean=141); least depth of caudal peduncle 121-158 (mean=142), longer than half of head length and surrounded by 20 scale rows. Scales with nearly parallel longitudinal radii, predorsal scales usually 11 (may be 10 or 12); circumferential scales 13/2/15, transverse scales to the base of base of pelvic fin 6.5/1/5.5 Lateral line scales 32-33 with two additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly, its scales with simple tubes. Gill rakers on the first gill arch 24-30 (mean=28.5)

Preserved specimens are dusky on the upper fifths of the side; the dorsal part of the head and the back are a little darker. The main part of the body is uniformly plain pale brownish-yellow. Most young specimens have a vertical blotch on the 5th scale of the lateral line and one scale above and one scale beloww the lateral line, above the middle portion of the specimens have a large black spot on the anterior base of the dorsal fin. All other fins lack pigmentation.

Distribution

The distribution of *O. schlegeli* is separated into two disjunct areas: the northern range is central Thailand (lower Chao Phay river and Me Klong River), and the southern range is Malaysia, Sumatra, and Borneo.We have never found *O. schlegeli* in Thailand since 1970, may be extint at present.

Habitat

Large rivers with slow current and turbid water.

Material Examined (46 speciemens, 66.4 mm.-313.7 mm standard length)

Bleeker's Collection: BMNH 1866.5.2.166 (1 spec.) no locality

: RMNH 6992 (5 spec.) no locality.

: BMNH (without no.) (1 spec.) indicated from Layden Museum; no locality (107.3 mm S.L.)

Borneo : RMNH 1767 (2 spec.) no specific locality

: RMNH 2594 (3 spec.) no specific locality

: RMNH 2595 (1 spec.) no specific locality

: RMNH 282 (2 spec.) no specific locality

: ZMA 116.061 (1 spec.) Djongkong (Eastern Borneo)

Thailand : BMNH 1898.4.2.180-187 (7 spec.) Chao River

: MHNP 85-177-32-2 (8 spec.) Bangkok

: MHNP 85-177-35 (2 spec.) no specific locality

: ZMA 116.057 (1 spec.) Chao Phay River near Angtong

: NIFI (uncatalogue) (2 spec.) Ayuthaya

: KCTR 78-19 (1 spec.) Sintang Market

: KCTR 76-44 (1 spec.) Sungai Tawang near Danau Pengembung, tributary of Kapuas.

Sumatra : ZMA 116.060 (3 spec.) Palembang

: ZMA 116.059 (1 spec.) Batang Hari River, Djambi

: AMNH 9297 (1 spec.) Batang Hari River, Djambi

: UMMZ 155573 (1 spec.) Palembang Market.

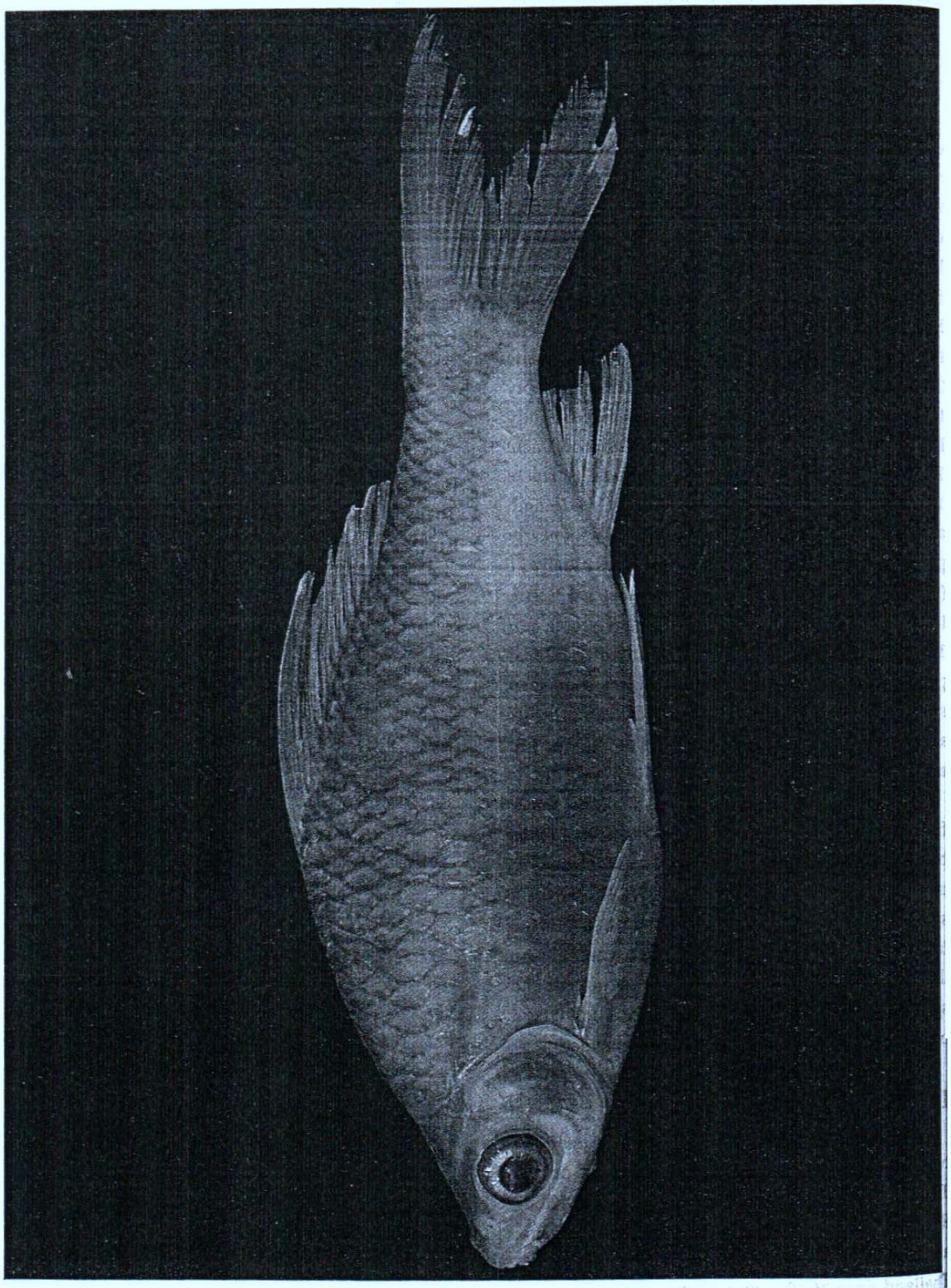


Fig. 29 *Osteochilus schlegeli* (Bleeker) KCTR 78-19

Osteochilus kalabau Popta

Osteochilus kalabau Popta, 1904: p.196; original description; type locality: River Bo, Borneo; Holotype, RMNH 7578, 218 mm., total length (given by Popta), 200.6 mm. standard length (my measurement).

Osteochilus kalabau Popta, 1906: p.99; description (referring to the same specimen).

Osteochilus kalabau Weber and de Beaufort, 1916: vol.3, p.128; description; locality: Batu Panga, Mahakam River; Borneo.

Nomenclature

O. kalabau was described by Popta in 1904 form a single specimen. Besides the holotype (RMNH 7578), only two additional specimens had been collected during Weber and de Beaufort's studies. Although there are only three specimens available for this study, this species is unique and easily recognized. *O. kukenthali* Ahl,(1922)is probably a junior synonym of this species (see page....).

Diagnosis

D. IV, 16; l.l. 35; c.f. 16-17/2/16-17; c.p. 17-18

O. kalabau has a large blackish vertical blotch on the side of the body above the pectoral fin, large scales (35 in lateral line) and a long dorsal fin (D. IV, 16). Mouth ascending, ventral part of upper lip with round mound-shaped costae.

O. kalabau shares many features with *O. melanopleurus* such as a a large blackish blotch, an ascending mouth, similar lip strucutures, and the long dorsal fin, but *O. melanopleurus* has much smaller scales (45-53 in lateral line).

Description

Body oblong, deep, and compressed; depth 330-398 (in thousandths of standard length). Head 236-252; eye 54-68; large fish with relatively small eye. Snout longer than eye diameter in adult fish but shorter than interorbital space, and shorter than postorbital part of the head. Interorbital space slightly convex, 140-157. Mouth ascending, two pairs of well developed barbels; maxillary barbels longer than eye diamter, rostral barbels shorter than the maxillary ones. Ventral surface of upper lip consists of well developed irregular round mound-shaped costae. Predorsal length about 438; origin of dorsal fin opposite 9th or 10th scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin usually falcate, its fourth simple ray greatly porduced but shorter than base of dorsal fin; the length of the fourth simple ray 309-356, and the base of dorsal fin 349-364; branched dorsal rays 16. The insertion of the dorsal fin opposite 25th scale of lateral line, number of scales from insertion of the dorsal fin to vertical from anal fin origin varies from -1 to 0. Tip of pectoral fin reaching the pelvic fin insertion, usually opposite 11th to 12th scale of lateral line. Prepelvic length about 486; pelvic fin insertion opposite 11th-12th scale of lateral line. Preanal length about 791; anal fin concave, third simple ray rather weak; anal fin origin opposite 24th-25th scale of lateral line. Caudal fin deeply forked, its lobes more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 133-140; least depth of caudal peduncle 133-140; least depth of caudal peduncle 140-157, greater than half of head length, and also greater than its length, surrounded by 22 scale rows. Scales with parallel longitudinal radii, predorsal scales 13-14; circumferential scales 16-17/2/16-17 (8-8.5/1/5.5-6 in transverse series); lateral line scales 34-35 with three additional pored scales on caudal base. Lateral line somewhat straight but slightly curved upward anteriorly. Its scales with simple tubes gill rakers on the first gill arch 29-34

Preserved specimens are dark brown, the dorsal part of the head and the back are darker than the rest of the body. There is a large blackish vertical blotch avove the pectoral fin at 5th and 6th scale of lateral line, extending two rows above and four rows below the lateral line. According to Popta's description, the body and fins are violet-red, darker above and yellowish-violet below.

Distribution

River Bo, River Mahakam and its tributaries, Central and Eastern Boreo.

Habitat

Unknown

Material Examined (3 specimens 94.3-200.6 mm. standard length)

Holotype : RMNH 7578, River Bo, Borneo

Other specimens:

ZMA 116.056 (2 spec.) Batu Pangal, Mahakam River, Borneo.

Osteochilus melanopleurus (Bleeker)

Rohita melanopleura Bleeker, 1852: p.430; original description; type locality: Bandjermassing, Borneo, and Palembang Sumatra; Syntypes (3 specimens) 126 mm-320 mm total length (given by Bleeker), BMNH 1866.5.2.212 (1 spec.) 101.6 mm standard length, RMNH 6990 (2 spec.) 103.1, 238.9 standard length (my measurement).

Rohita (Rohita) melanopleura Bleeker, 1860: vol.2, p.40; description; locality: Kahajan, Pontianak, Borneo. --- 1863: vol 3, p 62; description; same locality.

Osteochilus melanopleura Gunther, 1868: vol.7, 40; description; one type specimen from Bleeker's collection, and one specimen from Thailand.

Osteochilus melanopleurus Fowler, 1905: 479; description; locality: Kapuas River, Borneo, Baram River in Sarawak.

Osteochilus melanopleura Weber & de Beaufort, 1916: vol 3, p. 127: description; locality: Palembang, Djambi in Sumatra.

Osteochilus melanopleura Smith, 1945: 212; locality: Peninsula Thailand, central Thailand at Mekong River and Chao Phya River, Mawang at Lampang, and Manam Mun northeastern Thailand.

Nomenclature

Osteochilus melanopleurus was described from three specimens from Sumatra and Borneo in 1852. The original locality label of the syntypes may have been lost and it is impossible to tell which specimens came from where. This species was designated as the type species of the genus by Jordan (1919), which he selected as the first name in the species list in Gunther (1868). This species has unique characters and is easy to recognize. There are no anticipated systematic problems for this species, and therefore, I choose not to designate a lectotype.

Diagnosis

D.IV, 16-18; l.l.41-53; c.f.22/2/23-24; cp. 22-24

O. melanopleurus can be distinguished by the small scales (41-53 in lateral line), an ascending mouth, and a large blackisk vertical blotch on the side of body above the pectoral fin. Snout entire; ventral part of upper lip with round shaped costae arranged in irregular rows, gill rakers on the first gill arch 27-35

O. melanopleurus shares many characters with *O. kalabau* such the blotch above the pectoral fin, the asceding moth, and a long dorsal fin; *O. kalabau* has larger scales (32-33 lateral line scales, c.f. 16-17/2/-17).

O. borneensis is the only other species that has small scales (1.1.47-49), but it has a subinferior mouth and it does not have a blotch above the pectoral fin.

Description

Body oblong, deep, and compressed; depth 310-405 (mean=376) (in thousandths of standard length). Head 224-297 (mean=262); eye 44-93 (mean=63); large fish with relatively small eye. Snout 83-110 (mean=94), entire, without tubercles; snout longer than eye diameter in adult fish, shorter than interorbital space, shorter than postorbital part of the head. Interorbital space slightly convex, 127-157 (mean=145); mouth ascending. Two pairs of well developed barbels; maxillary barbels longer than eye diameter, rostral barbels shorter than the maxillary ones. Ventral surface of upper lip consists of well developed, irregular, round mound-shaped, costae.

Predorsal length 421-458 (mean=443); origin of dorsal fin opposite 11th or 14th scale of lateral line, before mid-point between tip of snout and caudal base and also before the pelvic fin insertion. Dorsal fin usualy falcate, its fourth simple ray greatly produced, but shorter than base of dorsal fn, the length of the fourth simple ray 221-329 (mean=228), and the base of dorsal fin 285-402 (mean=372); branched dorsal rays 16-18. The insertion of the dorsal fin opposite 30th to 37th scale of lateral line, number of scales from insertion of the dorsal fin to vertical from anal fin origin varies from -3 to -1. Tip of pectoral fin reaching the pelvic fin insertion, usually opposite 12th to 15th scale of lateral line. Prepelvic length 478-452 (mean=506) pelvic fin insertion opposite 13th-17th scale of lateral line. Preanal length 743-780 (mean=764); anal fin concave, third simple ray rather weak, anal fin origin opposite 28th-34th scale of lateral line. Caudal fin deeply forked, its lobes more or less acute, upper lobe slightly longer than the lower lobe. Length of caudal peduncle 102-153 (mean=132); least depth of caudal peduncle 129-154 (mean=138), greater than half of head length, and also greater than its length, surrounded by 22 to 26 scale rows. Scales with parallel longitudinal radii, predorsal scales 15-22; circumferentail scales 22-23/2/23-24 (11-11.5/1/11.5-22 in transverse series to the base of the pelvic fin); Lateral line scales 41-53, with three additional pored scales on the caudal base. Lateral line somewhat straight but slightly curved upward anteriorly; its scales with simple tubes. Gill rakers on the first gill arch 25-35 (may exceed 40 in the specimens larger than 200 mm SL)

Preserved specimens are greyish brown, the dorsal part of the head and back are darker. A large blackish vertical blotch is on the side above the middle part of the pectoral fin. Fresh specimens are dark gray above and light gray below, dorsal and caudal fins with melanin pigment, other fins plain.

Distribution

O. melanopleurus has a wide distribution but restricted to the low elevations. Smith (1945) states that there are no records of this species from the mountain regions of northern and western Thailand. The range of *O. melanopleurus* extends from Borneo, Sumatra, Java, and Malay Peninsula northwest to central and northeastern Thailand as far as the Mekong Basin and its tributaries (Laos, Cambodia, and South Vietnam).

Habitat

On the mainland of Southeast Asia, *O. melanopleurus* is always found in large rivers or lakes which have slow moving waters. Turbid waters are preferred but the specimens collected by Dr. Tyson Roberts from Borneo (KCTR 76-20, KCTR 76-49) are both from swift current and clear waer.

Material Examined (164 specimens, 70.9-365-7 mm standard length)

Syntype : BMNH 1866.5.2.212 (1 spec.) no locality
RMNH 6990 (2 spec.) Banjermassin or Palembang

Other specimens:

No locality: RMNH 9247 (6 spec.) from Bleeker's collection

Borneo: RMNH 2593 (1 spec.) no spectific locality
MHNP 85-177-24-8 (1 spec.) no specific locality
MHNP 85-177-24-9 (1 spec.) no specific locality
KCTR 76-20 (3 spec.) lower part of Sungai Kebian, tributary of Kapaus
KCTR 76-49 (1 spec.) Sungai Djentawang, 37-38 km N.E. of Sintang.
ANSP 72241 (1 spec.) Kapuas River
ANSP 72240 (1 spec.) Baram River

Sumatra: MHNP: 85-177-24-10 (1 spec.) no specific locality
ZMA uncatalogued (3 spec.) Djambi
ZMA uncatalogued (1 spec.) Palembang
USNM 93286 (1 spec.) Mandan River at Siak

Malysia: NMS 1954 (2 spec.) Poloh Nering, Kalantan
NMS 1883 (1 spec.) Chanderoh Dam, Perak

Thailand: AMNH 14597 (1 spec.) Tapi River at Bandon
ZSI 10514/1 (3 spec.) Nontaburi & Bangkok
AMNH 14574 (1 spec.) Meklong River at

Banpong

USNM 71012 (1 spec.) Mekong River

USNM 103257 (1 spec.) Meyom at Lampang

USNM 103258 (1 spec.) Menam Mun at Ta Charng

UMMZ 201072 (1 spec.) Nam Pong Reservior

UMMZ 201068 (3 spec.) Huay Hin Tack, Bandon, Ubol

UMMZ 201069 (2 spec.) Lam Pao Reservior, Kalasin

UMMZ 201071 (1 spec.) Lam Pao Reservior, across Ban Kok Kang

UMMZ 102067 (1 spec.) Mun River at Bandan, Ubol

UMMZ 201074 (1 spec.)

Mun River at 3 km downstream from Ubol.

UMMZ 201070 (4 spec.) Huay Kwang, S. of Khong Chiam, Ubol.

UMMZ 201073 (1 spec.) Mun River, 1.3 km upstream from

Ubol UMMZ 201075 (1 spec.) Mun River, 3 km downstream from Ubol

UMMZ 195729 (3 spec.) Mun River, 20 km downstream from Ubol

UMMZ 195680 (3 spec.) Market at Ubol

UMMZ 195273 (10 spec.) Meklong River at Rajburi ANSP 89367 (7 spec.) Bangkok

ANSP 60327-28 (2 spec.) Bangkok

ANSP 60804-7 (4 spec.) Bangkok

ANSP 57560 (1 spec.) Bangkok

NIFI uncatalogued (20 spec.) Ubolratana Reservior, N.E. Thailand

NIFI uncatalogued (15 spec.) Ubolratana Reservior, N.E. Thailand

NIFI uncatalogued (8 spec.) Hauy Luang, Udorn

NIFI uncatalogued (12 spec.) Mekong River at Nong Kai

NIFI uncatalogued (9 spec.) Mekong River 100 km East of Nong Kai

NIFI uncatalogued (7 spec.) Chao Phya River at Ayuthya

NIFI uncatalogued (10 spec.) Ubol Market.

Cambodia : UMMZ 181249 (2 spec.) Great Lake at Kampong

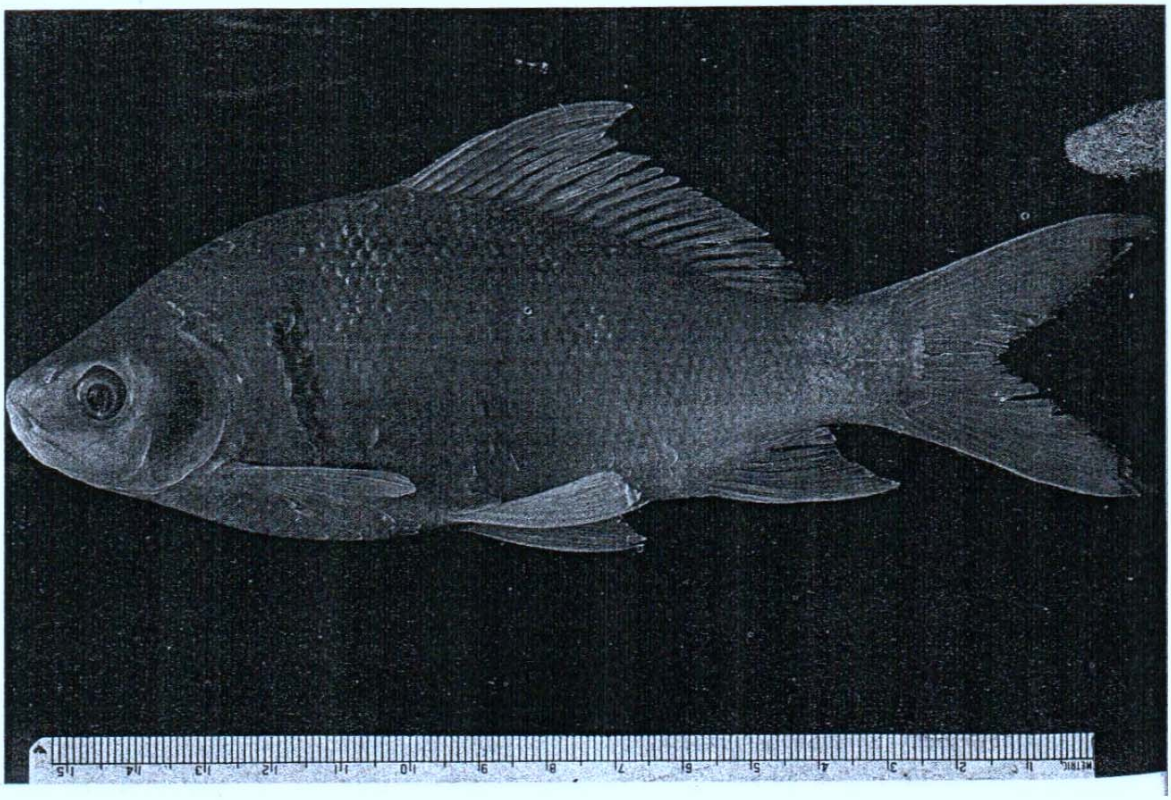


Fig.30 *Osteochilus melanopleurus.* (Bleeker) KCTR 78-19

SPECIES OF *OSTEOCHILUS* WITH UNCERTAIN STATUS

Osteochilus vittatus (Valenciennes)

Rohita vittatus Valenciennes in Cuvier and Valenciennes, 1842: vol. 16 p.203; original description: type locality Java; holotype: MHNP 85-177-44-1; five inches total length (given by Valenciennes), 94.2 mm standard length (my measurement).

Diagnosis (counts and measurements taken from holotype)

D.IV, 14; p.13; A.III, 5; l.l.32-33; c.f. 11/2/13; c.p. 16; p.d. 10; g.r.25.

Depth 350; head 219; eye 66; snout 69; interorbital space 118; length of caudal peduncle 149; base of dorsal fin 294; last simple dorsal ray 240.

Discussion

The *Osteochilus vittatus* that was described in 1842 by Valenciennes (in Cuvier and Valenciennes, 1842) is not the same species as the *O. vittatus* that is popularly recognized. The original description is very superficial and does not diagnose the species. The holotype (MHNP 85-177-44-1) from Java has 14 branched dorsal rays. It is in bad condition, scales are left only on the posterior half of the body, and the specimen is soft and spoiled. I could not see a stripe or any other pattern on the body, and the specimen does not have tubercles or pores on the snout. In cuvier and Valenciennes's (1842) original description, it was called Le Rohite a Bandes" (= striped Rohita), and their description does not mention a single stripe but nine brown lines or bands are said to be present

The *O. vittatus* that we recognize now is based on Bleeker's publication (mainly the 1863 Atlas with a color plate), and it is not the same species as Valenciennes's *O. vittatus.* Weber & de Beaufort (1916) stated: "The above description is in accordance with that of Bleeker given for *Rohita vittatus;* the description of Cuvier & Valenciennes is too superficial to be sure that it is the same as Bleeker's species." Bleeker's *O. vittatus* has 11-12 branched dorsal rays and a single median lateral stripe.

Bleeker's *O. vittatus* is the same as *O. microcephalus* (Cuv. & Val., 1842), of which two syntypes exist (RMNH 2115, 2116). Although these syntypes are dry mounted specimens, they are in good condition and readily identifiable. Therefore, the valid name for the *O. vittatus* of Bleeker and of current usage is *O. microcephalus* (Cuv. & Val.). The status of *O. vittatus (Val.)* is still doubtful, it is possibly close to *O. hasselti, O. sarawakensis* or *O. harrisoni*, but the two latter species are restricted to the northern part of Borneo (Sarawak) and have never been recorded from Java; more collections are needed to confirm the status of this species.

Osteochilus kukenthali Ah

Osteochilus kukenthali Ahl, 1922: p.33; orginal description; type locality Mahakam Kutei, southeast Borneo; syntypes: Mus. Berol. Pisc. (Germany) cat.no. 20537 (not seen) (2 specimens) 8.3 and 10.1 cm total length (given by Ahl).

Diagnosis (counts and measurements based on the original description)

D. IV, 15-16; P. 16-18; A. III,5;l.l. 36; c.f. 17/2/17; transverse scales 8.5/1/5.5 to the base of pelvic fin; c.p. 18

Depth 2 2/3 in standard length, 3 3/4-3 4/5 in total length; head 3 1/3-3 1/2 in standard length, 4 1/2-4 3/4 in total length; eye 3-3 1/3 in head, 1 5/6-2 in interorbital width, depth of caudal peduncle two in head.

Lower jaw is slightly ascending. Origin of dorsal fin opposite 10th scale of lateral line; predorsal scales arranged irregularly, about 24-27; the first ray of dorsal fin elongated, its height a little shorter than head. Origin of anal fin opposite the 24th scale of lateral line, still under the dorsal fin. Pelvic fin origin is opposite the 12th scale of lateral line. Caudal fin deeply forked, much longer than head but less than the body height.

Body color is brownish-silver, the back is a darker brown. A large black spot on the caudal pedun-

cle : black blotch on some scales above the middle part of pectoral fin, above and below the lateral line.

Discussion

Ahl (1922) comments at the end of his description that this species is intermediate between *Osteochilus kalabau* Popta and *O. schlegeli* (Bleeker), but closer to the former species. The only difference between *O. kalabau* and *O. kukenthali* stated by Ahl is the arrangement of the predorsal scales. I feel that this character is a poor one to use to separate the species, since I found many individuals of other species with an irregularly arrangement of predorsal scales, especially in species from Borneo. From the distribution of other characters, I believe that this species is probably *O. kalabau*, but the type specimen of this species should be examined.

Osteochilus melanopterus Tirant

Osteochilus melanopterus Tirant, 1929:p.27 (see also p.153); original description; type locality: rivers in Hue, Vietnam; type specimen: Lyon, France? (not seen).

Diagnosis (counts and measuements from original description)

D. IV, 14; A. III,5;l.l.29 (to the last scale); c.f. 13/2/13

Body silvery white with 9 to 11 black longitudinal stripes; with four barbels; all fins with black border.

Discussion

Tirant (1929: p.27) gave a very short description. He did not describe the mouth so it is uncertain whether this species belongs to *Osteochilus*. Tirant (1929: p.153) gives a slightly different description of this species in stating "all fins blackish; tip of ventral fin dark black." I presume that this species is variable in coloration of the fins. If this species belongs to *Osteochilus* and if the counts (cited above) are correct it presumably is a valid species.

SPECIES IMPROPERLY ASSIGNED TO *OSTEOCHILUS*

Dangila lipocheila Valenciennes

Dangila lipocheila Valenciennes in Cuvier and Valenciennes, 1842: vol. 16, p. 176-177; original description; type locality Java; type specimen not available, no illustration.

Dangila lipocheila Bleeker, 1863: vol. 3, p.48, plt. 7, fig. 1; description and comment (probably not *D. lipocheila*)

Dangila lipocheila Gunther 1868: vol. 7, p.40; comment

Osteochilus lipocheilus Fowler, 1976: p.47; list of species of *Osteochilus*

Discussion

The type specimen of *Dangila lipocheila* was lost and the original description does not diagnose the species. The original description states that the specimen has eight branched dorsal rays and 36 lateral line scales; it does not, therefore, belong in our concept of *Osteochilus* or *Dangila*. Bleeker says that this name was first given by Kuhl and Van Hasselt to a fish which they had drawn and which he (Bleeker) had copied; it would appear to have 18 branched dorsal rays and 32 lateral line scales. Bleeker thinks that it has been confused by Valenciennes with *Barbichthys leavis*, with which his description agrees better, than with the *D. lipocheilus* of Kuhl and Van Hasselt. Gunther (1868) considers that it possibily belongs to *Osteochilus* (species of *Dangila (=Labeobarbus)* have more than 20 branched dorsal rays). The status of this species is not certain and it is impossible to establish to what species it should be applied. Therefore, I consider this species to be a *nomen nudum*.

Cyrene cyanopareja Heckel

Cyrene cyanopareja Heckel, 1843: p. 1025; description; type locality : Philippine Islands; type specimen not seen (probably lost), no illustration.

Cyrene cyanopareja Gunther, 1868: vol. 7, p.40; footnote

Osteochilus cyanopareja Fowler, 1976: p.46; list of species of *Osteochilus*

Discussion

The species was poorly described in 1843 by Heckel According to the original description this species has 17 branched dorsal rays and 35 scales along the lateral line. It is probably an *Osteochilus*, but *Osteochilus* has never been recorded from the Philippines. At this stage it is not possible to determine the status of this species. If the type specimen of this species is lost, this name should be considered a *nomen nudum*..

Osteochilus malabaricus Day

Osteochilus malabaricus Day, 1873: p.527; original description; type locality; Vithry, in the Wynaad, India; no type specimen, no illustration.

Discussion

Osteochilus malabaricus as described by Day (1873) has 11 branched dorsal rays; 44 scales on the lateral line, and 8/ 1/8 scales in transverse series (to the mid abdominal point). Day also stated "neither lip fringed; no horny substance over lips or inside the lower jaw". From this statement in the original description, it is clear that this fish does not belong to *Osteochilus*. Day (1876) considered the close similarity of *O. malabaricus* to *Scaphiodon nashi* but did not think that they were the same species. Mukerji (1932) states for the name *O. malabaricus* ".....in all probability this is a misnomer. Day does not seem to have called anything by this name". As the species was allied to *Scaphiodon* by Day (1876), and Hora (1942) used this alignment to place some species of *Scaphiodon* into *Osteochilus* (see page). *O. malabaricus* was poorly described and no type specimen is available, therefore, I consider this name to be a *nomen nudum*.

Rohita simus Sauvage

Rohita sima Sauvage 1878: p.238; original description; type locality: Phnom-Penh, Cambodia; no type specimen, no illustration.

Rohita sima Sauvage 1881: p.177; description; locality: Mekong and Phnom-Penh.

Osteochilus sima Fowler 1935: p.117; description; locality Srisawat, Thailand. (not *Rohita sima*)

Osteochilus simus Smith 1945: p.219; comment

Osteochilus simus Fowler, 1976: p.49; list of species of *Osteochilus*

Discussion

The type specimen of *Rohita simus* is lost. The original description very poorly diagnoses the species (D.IV, 16; A.III, 5; l.l.48, only rostral barbels, fringed upper lip and lower lip). The type specimen is lost and it is impossible to assign the name to any species. Therefore, I consider this species to be a *nomen nudum*. My examination of the specimens that Fowler (1935) identified as *Osteochilus sima* shows that it is *Cirrhinus macrosemion* (Fowler).

Labeo chrysophekadian (Bleeker) (as a senior synonym of *Rohita barbatula* Sauvage)

Rohita barbatula Sauvage, 1878: p.239; original description; type locality: Mekong River at Phnom-Penh, Cambodia; holotype MHNP 85-124 (dry mounted specimen), 374.9 mm standard length (my measurement); paratype 85-124-31-1 (alc. specimen), 110.3 mm standard length (same data).

Rohita barbatula Sauvage, 1881: p.176, plt.5, fig 3; description; locality Mekong, Phu-Quoc (Gulf of Siam), Phnom-Penh, Tong-Heu (province of Bien-Hoa, Vietnam)

Osteochilus barbatulus Fowler, 1976: p.45; list of species of *Osteochilus*

Diagnosis (counts and measurements taken from the types of *Rohita barbatula*).

D. IV, 17; p.17; A. III,5;l.l. 37-39; c.f. 17-18/2/17; c.p. 22; p.d. 15-16; g.r. 55.

Depth 294; head 270; eye 71; snout 93; interorbital space 139; length of caudal peduncle 155; depth of caudal peduncle 127; base of dorsal fin 313; last simple dorsal ray 303.

Discussion

The examination of the type specimens of *Rohita barbatula* revealed that this species does not belong to *Osteochilus* as was indicated by Fowler (1978). The mouth Structure of *Rohita barbatulus* is not the same as that of *Osteochilus*. This species was compared to the type specimen of *Labeo chrysophekadian*, and found to agree with this species. Therefore, *Rohita barbatulus* is a junior synnonym of *Labeo chrysophekadian*.

Labeo chrysophekadian (Bleeker) (as a senior synonym of *Rohita pectoralis* Sauvage)

Rohita pectoralis Sauvage, 1878: p.238; original description; type locality: Phnom-Penh; Holotype MHNP 85-124-31-3, 119.4 mm standard length (my measurement)

Rohita pectoralis Sauvage, 1881: p.178, plt.8, fig. 1; description; locality Phnom-Penh, Cambodia.

Osteochilus pectoralis Fowler, 1976: p.48; list of species of *Osteochilus*

Diagnosis

D. IV,16; p.17; A.III5;l.l. 38;c.f. 18/2/17;c.p. 22; p.d.16; g.r. approx. 57.

Depth 418 head 258; eye 68; snout 91; interorbital spacc 149; length of caudal peduncle 152; depth of caudal peduncle 134; base of dorgal fin 298; last simple dorsal ray 256.

Discussion

Sauvage described *Rohita pectoralis* and *Rohita barbatulas* at the same time on the basis of differences in the number of lateral line scales with 38 in *R. barbatula* and 46-48 in *Rohita pectoralis*. I examined type specimens of both species and did not

find such a difference (38 in *R. pectoralis* and 37-39 in *R. barbatula*). This species is so similar to the type specimen of *Labeo chrysophekadian* (RMNH 12364), that I consider it to be a junior synonym of *L. chrysophekadian*.

Labeo cephalus Valenciennes

Labeo cephalus Valenciennes in Cuvier and Valenciennes 1842: vol. 16, p.374; fig. 487; original description; type locality: Irrawaddi River at Rangoon, Burma; syntypes (2 specimens) MHNP 85-124-34-1, 253.0, 250.6 mm standard length (my measurement).

Labeo cephalus Gunther 1868: vol. 7, p.40; comment on the species.

Osteochilus cephalus Day 1876: p.546; description; locality Pegu, Burma.

Osteochilus cephalus Day 1889: vol. 1, p.275; description; locality Pegu.

Osteochilus cephalus Fowler, 1976: p.46; list of the species of *Osteochilus*

Diagnosis (counts and measurements taken from syntypes)

D. IV, 13; p.17; A. III, 5; l.l. 37-39; c.f. 13/1/13; c.p. 18; p.d. 13; g.r. 86.

Depth 323-326; head 249-264; eye 54-55; snout 72-76; interorbital space 175-181; length of caudal peduncle 134-154; depth of caudal peduncle 140-142; base of dorsal fin 235-250; list simple dorsal ray 235-250.

Discussion

Labeo cephalus was described by Valenciennes in 1842 in the genus *Labeo*. Gunther (1868), in a footnote, evidently considered this species to be in *Osteochilus*. He did not see the specimen and he came to this decision on the basis of Valenciennes's original description. Day (1876, 1889) placed the species under the genus *Osteochilus*, probably on the basis of Gunther's comment. The examination of the type specimens of *Labeo cephalus* confirmed the placement of this species in the genus *Labeo*.

Labeo curchius (Hamilton)
(as a senior synonym of *Rohita chalybaetus* Valenciennes)

Rohita chalybaeta Valenciennes in Cuvier and Valenciennes 1842: vol. 16, p.206; original description; type localty: Rangoon, Burma; holotype: MHNP 85-124-35-3, 91.7 mm standard length (my measurement)

Labeo chalybaetus Gunther 1868: vol 7, p.60; description, locality Rangoon.

Osteochilus chalybaetus Day 1876: p.545, plt. 79, fig. 1; description; locality: Moulmein, Burma

Osteochilus chalybaetus Day 1889: vol. 1, p.273; description; locality: Irrawaddy and Salween river in Burma.

Osteochilus chalybaetus Fowler, 1976: p.46; list of species of *Osteochilus*

Diagnosis (counts and measurements taken from the holotype of *Rohita chalybaetus*).

D. IV, 14; P.16; A. III,5;l.l. 60; c.f. 23/2/23; c.p. 26; p.d. 23; g.r. 53.

Depth 281; head 254; eye 78; snout 74; interorbital space 135; length of caudal peduncle 129; depth of caudal peduncle 128; base of dorsal fin 266; last simple dorsal ray 263.

Discussion

Rohita chalybaetas was described by Valenciennes in 1842 and was placed in *Labeo* by Gunther (1868); he considered the genus *Rohita* to be a junior synonym of *Labeo*. Day (1876, 1889) considered the genus *Rohita* to be a junior synonym of *Osteochilus*. Day placed this species in *Osteochilus* because his specimen had 18 branched dorsal rays, 54 scales in the lateral line (total number), and 8/1/10 in transverse series (to the mid-abdominal point); these counts show that Day's specimen is not the same species as *Rohita chalybaetus* Cuv. & Val. An examination of the type specimen shows that *Rohita chalybaetus* is a junior synonym of *Labeo curchius* (Hamilton, 1822).

Cirrhinus chinensis Gunther (as a senior synonym of *Osteochilus prosemion* Fowler)

Osteochilus prosemion Fowler, 1934: p.116, fig. 66,67; original description; type locality: Meping River at Chiengmai, Northern Thailand; holotype ANSP 59095, 91.3 mm standard length (my measurement); and paratypes ANSP 59096-7 (two specimens), same data, 85.4-89.4 mm standard length (my measurement)

Osteochils prosemion Fowler, 1937: p.183; locality: Mekong River at Kamarat, N.E. Thailand.

Osteochilus prosemion Smith, 1945: p.218; description

Diagnosis (counts and measurements taken from the type specimens of *O. prosemion*)

D. IV, 11-12; P.17-18; A. III, 5; l.l. 37-38; c.f. 15/2/17; c.p. 18-20; p.c. 12-14.

Depth 266-285; head 211-213; eye 53-58; snout 66-75; interorbital space 87-93; length of caudal peduncle 14.3-16.6; depth of caudal peduncle; 11.2-12.2; base of dorsal fin 21.4-24.5; last simple dorsal ray 24.2-27.2; only rostrol barbels present

Body plain silvery, with large vertical blotch on the side above pectoral fin, all fin plain and hyaline.

Discussion

Fowler described a few species of *Osteochilus* from fishes belonging to the genus *Cirrhinus* on the basis of their having fringed lips. *Osteochilus prosemion* is one of three species; it was described in 1934 and belongs to *Cirrhinus chinensis*. This species has a wide distribution (from China to Southeast Asia) and has been introduced to many places in Asia for food culture. The species is also known by the name *Cirrhinus molitorella* (or *Labeo molitorella* Weber & de Beaufort 191.6: p.213, Smith 1945: p.33), but Banarescu 1916 considered the name *C. molitorella* (Valenciennes) a *nomen nudum* and recognized *C. chinenses* as the valid name for the species.

Cirrhinus macrosemion (Fowler)

Osteochilus macrosemion Fowler, 1935: p.116; original description; type locality: Kwae Yai River at Srisawat, western Thailand; Holotype ANSP 60809, 185 mm total length (Fowler's measurement), 139.6 mm standard length (my measurement).

Osteochilus macrosemion Smith 1945: p.218; diagnosis and comment on the species.

Diagnosis (counts and measurements taken from the holotype)

D. IV, 15; P.17; A. III,5;l.l. 35; c.f. 15/2/17; c.p. 20; p.d. 11

Depth 330; head 197; eye 62; snout 57; interorbital space 102; length of caudal peduncle 138; depth of caudal peduncle 123; base of dorsal fin 292; last simple dorsal ray 360; gill rakers on the first gill arch 72; only one pair of barbles (rostral) present.

Body coloration plain; a black vertical blotch on the side above the middle part of the pectoral fin. Dorsal fin with darkish margin, other fins plain.

Discussion

O. macrosemion was described by Fowler in 1935. This species is closely related to the previous species *(Cirrhinus chinensis)* but has a longer dorsal fin and fewer lateral line scales. *O. macrosemion* has one pair of barbles (rostral) and the structure of the lips shows that it belongs to *Cirrhinus*. *O. macrosemion* and *O. spilopleura* were described at the same time and the specimens were collected from the same locality. The species was regarded by Fowler as "apparently distinct" from *O. spilopleura*, by having no pores on the snout and a prolonged last simple ray of the dorsal fin. From my examination of the type specimens I found that both species bear pores (tubercles) on the snout; other characters are identical except for the elongation of the last simple dorsal ray of *O. macrosemion* which has little taxonomic importance. Apparently they are the same species and belong to the genus *Cirrhinus*. The species should be recognized as *Cirrhinus macrosemion.*

Cirrhinus macrosemion (Fowler)
(as a senior synonym of *Osteochilus spilopleura* Fowler)

Osteochilus spilopleura Fowler, 1935: p.115, ig. 52, 53; original description; type locality: Kwai Yai River at Srisawat; Western Thailand; Holotype: ANSP 101604, 213 mm total length (Fowler's measrement), 154.7 mm standard length (my measurement).

Osteochilus spilopleura Smith 1945: p.218; ocality: Mesoi, a tributary of Mewang, north of ampang.

Diagnosis (counts and measurments taken from olotype of *O. spilopleura*)

D. IV, 15; P.17; A. III,5;l.l. 35; c.f. 15/2/17; .p. 20 p.d. 12.

Depth 348; head 210; eye 59; snout 73; nterorbital space 108; length of caudal peduncle 145; epth of caudal peduncle 124; base of dorsal fin 293; ast simple dorsal ray 279; gill rakers on the first gill rch 70; only one pair of barbels (rostral) present.

Body coloration plain; a large vertical blotch bove on the side above pectoral fin; all fins plain.

)iscussion

This species is a junior synonym of *Cirrhinus acrosemion* (see the discussion of the previous pecies).

Labeo dyocheilus (McClelland)
(as a senior synonym of *Osteochilus ochrus* Fowler)

Osteochilus ochrus Fowler, 1935: p.118, fig. 6,57; original description; type locality: Bangkok, hailand; holotype: ANSP 61781, 130 mm total length given by Fowler), 96.1 mm standard length (my easurement)

Osteochilus ochrus Fowler, 1937: p.180; lo-ality: Kemarat, N.E. Thailand.

Osteochilus ochrus Smith, 1945: p. 217; com-ent on the species.

Diagnosis (counts and measurements taken from the holotype of *Osteochilus ochrus*).

D. IV, 11; P.17; A. III,5;l.l. 40; c.f. 18/2/17; c.p. 22; p.d. 12

Depth 302; head 239; eye 66; snout 88; interorbital space 115; length of caudal peduncle 162; depth of caudal peduncle 132; base of dorsal fin 214; last simple dorsal ray 281; gill rakers on the first gill arch numerous, but partly damaged, unable to count; one pair of barbles (maxillary), small and concealed in the post labial groove; snout with numerous small tubercles.

Upper surface of head and body olive and grayish; dorsal part of head and back are darker than sides. Faint lateral gray band, forming more definite dark gray diffuse spot at caudal base. Dorsal and caudal fins grayish, other fins hyaline.

Discussion

Fowler (1935) did not explain why he placed this species in *Osteochilus*. The type specimen has one pair of short flat barbels (maxillary) hidden in the post larbial groove. The structure of the lips, barbels, small scales, and numerous gill rakers show that it is *Labeo dyocheilus* a species common in Thailand.

Bangana pierrei (Sauvage)
(as a senior synonym of *Osteochilus tatumi* Fowler)

Osteochilus tatumi Fowler, 1937: p.180, fig. 118, 119; original description; type locality: Bangkok, Thailand; holoype; ANSP 68095, 117 mm total length (Fowler's measurement), 82.6 mm standard length (my measurement).

Osteochilus tatumi Smith, 1945: p.217; comment on the species

Diagnosis (counts and measurement taken from the holotype of *Osteochilus tatumi*)

D. IV, 13; P.20; A. III,5;l.l. 35-36; c.f. 19/2/19; c.p. 20; p.d. 14.

Depth 286; head 255; eye 55; snout 73; interorbital space 97; length of caudal peduncle 181; depth of caudal peduncle 136; base of dorsal fin 252; last simple dorsal ray 284; gill rakers on the first gill arch 49; one pair of barbels (maxillary), concealed in the post labial groove

Back brown, the color on the sides and below is faded to whitish. Two small dark brown or dusky spots at the scales immediately above and below the fifth scale of the lateral line. Diffuse grayish blotch or at caudal base. Dorsal fin dusky with dark anterior edge, caudal fin also dusky, other fins hyaline.

Discussion

Fowler (1937) described and placed this species under *Osteochilus* because it is similar to *O. ochrus* (=*Labeo dyocheilus*), a species which he described in 1935. From my examination of the lips (and other characters: scales, gill rakers, barbels, and color pattern) of the type specimen, I conclude that this species belongs to *Labeo behri* Fowler (=*Bangana pierrei)*

Labeo dyocheilus (McClelland)

(as a senior synonym of *Osteochilus sondhi* Hora & Mukerji)

Osteochilus sondhii Hora and Mukerji, 1934: p.359, fig. 2 a, b; original description; type locality: Salween River at Takaw in the Kengtung State, Burma; holotype: ZSI F11600/1, 118.7 mm standard length (my measurement); paratype: same cat. no. (does not belong to the same species, see text), 104.4 mm standard length (my measurement).

Diagnosis

Holotype: D. IV, 12; P.19 A. III; 5;l.l. 39; c.f. 17/2/17; c.p. 22; p.d. 14; g.r. damaged, unable to count (small and numerous). Depth 295; head 222; eye 53; snout 8.5; interorbital space 114; length of caudal peduncle 180; depth of caudal peduncle 132; base of dorsal fin 213; last simple ray 213.

Paratype: D. IV, 11; P.17; A. III,5;l.l.38; c.f. 16/2/17; c.p. 20; p.d. 13; g.r. damaged, unable to count (small and numerous). Depth 278; head 221; eye 54; snout 74; interorbital space 84; length of caudal peduncle 153; depth of caudal peduncle 126; base of dorsal fin 207; last simple dorsal ray 228.

Discussion

Hora and Mukerji (1934) described *Osteochilus sondhi* from two specimens, the figure is drawn from the specimen which I refer to as the holotype (Hora did not designate the holotype). The second specimen is superficially similar to the first but the structure of its mouth is completely different. The second specimen also has a transverse groove across the snout. I identify the first specimen as *Labeo dyocheilus* (McClelland, 1839), and the second as *Bangana almorae* (Chaudhuri, 1912).

Subgenera *Kantaka* and *Osteochilichthys*

Hora (1942) proposed two new subgenera of *Osteochilus*: *Kantaka* which contains one species (*Semiplotus brevidorsalis* Day, 1873), and *Osteochilichthys* which contains two species (*Scaphiodon thomassi* Day, 1877, and *S. nashi* Day, 1877). Thes three species apparently belong to subfamily Barbinae and not related to *Osteochilus*.Therefore I exclude these three species from *Osteochilus*. The systematic position of these three species needed for further study, but it is beyond the scope of this paper. *Kantaka* and *Osteochilichthys* are probably deserved the generic rank (in Barbinae).

THE PHYLETIC RELATIONSHIPS

The 23 species of *Osteochilus* fall into two distinct groups on the basis of osteology and external morphology. One group consists of 21 species (the *O. microcephalus* lineage) and the other of three species (the *O. melanopleurus* lineage). If one accepts the contention that ancestral characters can be distinguished from derived characters by the use of ex-groups then we can make decisions on the direction of evolution. In such comparisons, Ross (1974: 153) states, "if one of two or more character states in one group occurs in other closely related groups (i.e., the ex-group) it is probably the ancestral one." Using this procedure, the *O. microcephalus* lineage is considered to be the most primitive because it shows more ancestral character states with the assumed more primitive genus *Labeo* than does the *O. melanopleurus* lineage. The latter has more derived character states not present in *Labeo* than does the *O. microcephalus* lineage. The two lineages were probably derived from a common ancester possessing two pairs of well-developed barbels and an oblong, somewhat compressed body, low gill raker count (28-35), lips with moderately long undivided costae, large scales (l.l. 30-33, c.p. 16 c.f. 11/2/13), and club-shaped lower jaw bones. According to Lowe-McConnell (1969), older faunas are generally found in rivers and not in lakes in the tropics. This is in agreement with my observation that the primitive species of *Osteochilus* (as determined from morphological analysis) occur in large rivers and not in lakes. These rivers are older than the lakes and support older communities of fishes subject to environmental selection for a longer time. This ancestral form of *Osteochilus* was probably well adapted to the rapids of rivers and probably resembled the ancesteral species of the genus *Labeo*. This ancestral group became divided into two major groups (fig. 52), one with a deep body, large size (exceeding 300 cm in standard length), a long dorsal fin, triangular lower jaw bones, an ascending mouth, and an irregular set of small mound-shaped costae on the upper lip; the other group is postulated as remaining similar to the ancestral form and probably possessinhg a median longitudinal stripe and three tubercles on the snout. The difference between these two groups probably represents environmental adaptation. The first group, with an ascending mouth and deeper body, prefers the quiet back-water of rivers and probably dispersed into lakes and other slow moving water systems and gave rise to the *O. melanopleurus* group with three species. The other group has a slender body with a subinferior mouth, similar to its proposed ancestor, and probably gave rise to two subgroups. One, the *O. hasselti* group with five species, possesses divided short costae on the upper lip and a long dorsal fin, and the other possesses long undivided costae on the upper lip and a short dorsal fin. The later subgroups was the ancestor of *O. triporus* and the remaining species. The second subgroup may have evolved further into two additional lines, one with species with multiple longitudinal rows of spots or stripes on the body, and the black spot on the anterior part of the dorsal fin (which became the *O. triporus* group with five species), and the other probably being ancestral to *O. microcephalus* and the remaining species. The latter may have given rise to a small subdivision with fewer lateral-line scales (27-31), fewer circumferential scales (9/2/11), and without a stripe on the body, the *O. spilurus* group (with two species). The ancestor of the remaining species probably had a median lateral stripe and three tubercles on the snout. It probably gave rise to a subdivision which has two tubercles on the snout, a diffused median lateral stripe, and a long dorsal fin; this subdivision consists only of *O. kahajanensis*. The ancestor of the remaining species may have given rise to two final subdivisions, one with a conspicuously inferior mouth, high gill raker count (40-60) (which has become the *O. waandersi* group, of four species), and the other with a subinferior mouth and low gill raker count (28-35) which became the *O. microcephalus* group with three species.

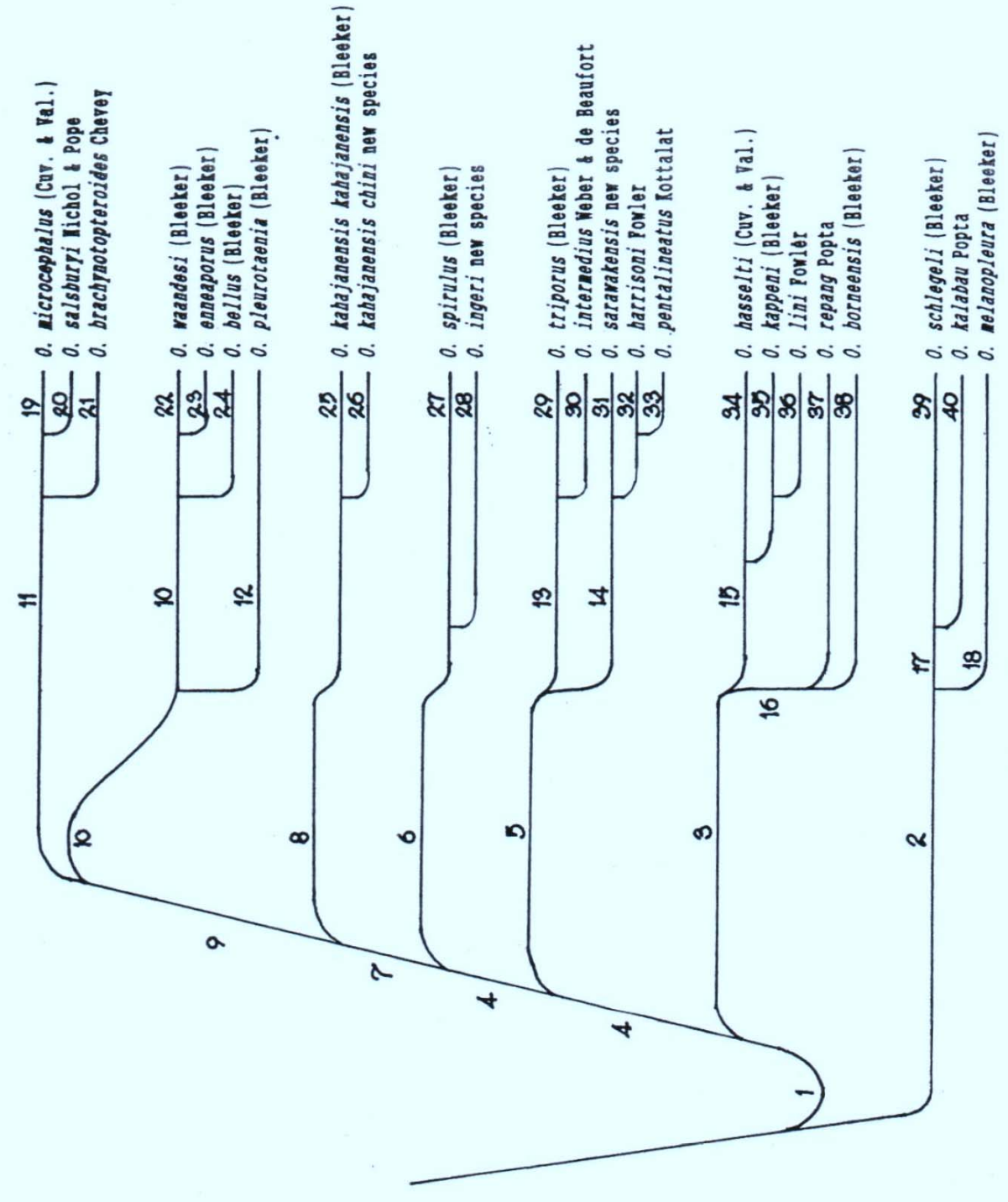


Fig. 31 Hypothetical phylogeny of *Osteochilus* The character states used for this analysis are on the next page

Character states used in the phylogenetic analysis

1. mouth subinferior.
2. mouth ascending.
3. lip costae short and divided into 2-3 portion, long dorsal fin.
4. lip costae long and undivided.
5. rows of spots or multiple stripes on the body.
6. c.f. 9/2/11, without median lateral stripes.
7. c.f. 11/2/13, with median lateral stripes.
8. median lateral stripes diffused, two tubercles on the snout.
9. median lateral stripes distinct, three tubercles on the snout.
10. body long slender, mouth conspicuously inferior, high gill raker count.
11. body oblong, mouth subinferior, low gill raker count.
12. mouth expanded, loss of median lateral stripes (only present in young), large size.
13. black spot on anterior base of dorsal fin, rows of spots-faint.
14. no black spot on the dorsal fin, rows of spots or stripes-intense.
15. rows of spots on the posterior 2/3 of the body.
16. body plain
17. large scales.
18. very small scales.
19. three tubercles on the snout, median lateral stripe, c.f. 11/2/13.
20. loss of stripes (present in young), no tubercle on the snout, c.f. 11/2/13.
21. long, slender body, no stripe, no tubercle, c.f. 9/2/11.
22. median lateral stripe extends to the end of caudal rays, c.f. 11/2/13.
23. median lateral stripe extends to the end of caudal peduncle, c.f. 11/2/13.
24. rows of spots on the body, median lateral stripe only on posterior half of the body, c.f. 9/2/11.
25. long dorsal fin, branched dorsal rays 14-16, long body.
26. short dorsal fin, branched dorsal rays 12-14, short body.
27. small size, I.I. 27-29, g.r. 27-30.
28. medium size, I.I. 30-31, g.r. 31-42.
29. short dorsal fin (IV, 11-12), low gill raker count, lip costae divided.
30. long dorsal fin (IV, 13-14), high gill raker count, lip costae undivided.
31. rows of spots on the body, dorsal fin IV, 11-13, c.p. 16.
32. ten stripes on the body, dorsal fin IV, 15-16, c.p. 16.
33. five stripes on the body, dorsal fin IV, 10, c.p. 12.
34. rows of spots on the body, c.f. 11/2/13, dorsal fin IV, 15-18 (rarely 12-14).
35. rows of spots on the body, c.f. 13/2/15, dorsal fin IV, 16-18.
36. loss of spots on the body, c.f. 11/2/13, dorsal fin IV, 12-15.
37. large scales.
38. small scales.
39. short dorsal fin (IV, 13-14).
40. long dorsal fin (IV, 16-17).

The *O. microcephalus* lineage is the most primitive group. It has three closely related species. *O. microcephalus* has three tubercles on the snout and median lateral stripe extending to the end of the caudal peduncle (primitive states). *O. salsburyi* is very similar to *O. microcephalus* but lacks of tubercles on the snout and lacks of a median lateral stripe on the body (except in some young specimens). *O. brachynotopteroides* has a longer and more slander body and has 9/2/11 (derived state) (11/2/13 in the other two species) circumferential scales.

The *O. waandersi* lineage is derived from the *O. microcephalus* lineage and is adapted to mountain stream habitats. This group consists of four species. *O. waandersi, O. enneaporus,* and *O. bellus* share many characters in common with the primitive *O. microcephalus,* such as a median longitudinal stripe and thee tubercles on the snout. In this lineage the lip costae are more developed and the gill rakers are exceedingly numerous (40-60). The first three species mentioned above are closely related and differ only in the color pattern, except that *O. bellus* has a reduced number of circumferential scales (9/2/11). *O. pleurotaenia* is the most derived form of this lineage. It has an entire snout (there are numerous small tubercles in some large specimens), reaches a large size (up to 300 mm), has a median lateral stripe in some young specimens, and has expanded lips which are more developed than other species of *Osteochilus.*

The *O. kahajanensis* lineage consists of one species with two subspecies. *O. kahajanensis kahajanensis* is distributed in Borneo (except northeastern Borneo), Sumatra, Java, and Malay Peninsula. It has a long dorsal fin (IV, 15-16, rarely 14), with a rather moderately deep body (depth 347). *O. kahajanensis chini* is restricted to northeastern Borneo. It has a short dorsal fin (IV, 12-14) with a rather deep body (depth 362). The derived character that is unique in this lineage is the occurrence of two tubercles on snout.

The *O. spilurus lineage* has only two species. *O. spilurus* is a small species (size rarely exceeding 70 mm in standard length), and with few lateral line scales (27-29) and gill rakers 28-30. *O. ingeri* is a medium size species (up to 120 mm standard length) with more number of lateral line scales (30-31) and gill rakers 40-45. Derived characters that are unique in this group are the reduction of the number of the lateral line and circumferential and loss of tubercles on the snout.

The *O. triporus* lineage consists of five species. The character that unites this group is the rows of spots on the body. *O. triporus* is the only species in this group that primitively has three tubercles on the snout; the others lack tubercles. *O. triporus* and *O. intermedius* have many characters in common such as a black spot on the anterior base of the dorsal fin which is presumably primitive (shared with the out group *O. shlegeli*). *O. intermedius* has more gill rakers (37-50 vs 28-31), a longer dorsal fin (IV, 13-14 vs IV, 11-12), and fewer circumferential scales (9/2/13 vs 11/2/11-13) than the others. The other species lack a black spot on the dorsal fin but have a row of distinct spots on the body which usually form longitudinal stripes in adult specimens (derived state). *O. sarawakensis* has a short dorsal fin (IV, 11-13) and about seven to eight rows of spots or stripes on the body; *O. harrisoni* has a long dorsal fin (IV, 15-16) and about ten stripes on the body; *O. pentalineatus* has a short dorsal fin (IV,10 and five stripes on the body.

The *O. hasselti* lineage consists of five species. A derived character that unites this group is the short divided costae on the lateral part of the upper lip. *O. hasselti* and *O. kappeni* share many characters in common such as rows of spots on the body, a long dosal fin (IV, 15-18, rarely 13-14), and the absence of tubercles on the snout. These two closely related species can be best distinguished by the number of circumferential scales; *O. hasselti* has 11/2/13 (the primitive state) but *O. kappeni* has 13/2/15 (the derived state). *O. lini* has a plain body coloration, except for two or three black spots above the pectoral fin, a relatively short dorsal fin (IV, 12-14 rarely, 15), and no tubercles on the snout. The two onther species, *O. repang* and *O. borneensis,* have three tubercles on the snout and a long dorsal fin (IV, 16-17). *O. repang* has large scales (l.l.32) but *O. borneensis* has small scales (l.l. 47-49).

The *O. melanopleurus* linage consists of three

species. A derived character that unites this group is an ascending mouth which results from a modified triangular lower jaw bone. *O. schlegeli* and *O. kalabau* have large scales (l.l. 32-35), a primitive character; *O. schlegeli* has 20 circumpeduncular scales and short dorsal fin (IV, 13-14) while *O. kalabua* has 22 circumpeduncular scales and a long dorsal fin (IV, 16). *O. melanopleurus* has small scales (derived state) (l.l. 45-53, c.p. 22-24), and a long dorsal fin (IV, 17-18).

O. hasselti is quite variable, especially in the number of the dorsal fin rays; depending on the geographical area it can be 12-13, 14-16, or 15-17, The color pattern of this species is also quite variable. Many young specimens have a black blot above the pectroal fin. This is the nominal form of *O. neilli* Day and *O.duostigma* Fowler. In addition, all specimens have rows of spots along the body which sometimes disappear after preservation in alcohol; *O. kuhli* (Bleeker) represents a form described after preservation and without the spots.

The relationships of *Osteochilus* to other genera of cyprinid fishes had not been discussed until Reid (1987, unpublished Ph.D. thesis) proposed subfamily Labeinae which included *Labeo, Osteochilus,* and a few other genera. Reid's hypothesis is based on the anatomy of soft parts of the oromandibular region. I have reexamined these organs and studied the osteology in many genera of labeine cyprinids in order to evaluate the Reid's subfamily Labeinae. The results of my studies generally seem to agree with the cladorgam constructed by Reid (fig. 34), I disagree with Reid in the subdivision of the subfamily in tribes of Tylognathini and Labeini. In my opinion, *Cirrhinus* and *Labiobarbus* are more closley related to *Tylognathus* than to *Labeo* and they should be included in Tylognathini.

Specializations which unite Labeinae are as follows: (i) the occurrence of a vomoro-palatine organ, (ii) the occurrence of a terete process of basiocipital bone, (iii) having the neural complex of Weberian apparatus in direct contract with the supraoccipital region of the skull, and (iv) the occurrence of the precoronoid arm of the lower jaw bone. Specializations which unite *Osteochilus* are as follows: (i) the unculiferous costate surface of the upper and lower lips, (ii) the reduction of the mesial process of the autopalatine, and (iii) the shape of the maxillary and dentary bone.

The genus *Osteochilus,* as presently conceived, is a monophyletic genus. The genus has been previously recognized with species referable to the genera *Labeo, Cirrhinus,* and *Tylognathus.* The sister group of the redefined *Osteochilus* is *Labeo* (as revised by Reid, 1978) and these genera are included together with *Lobocheilus* in the tribe Labeini. The Labeini is the primitive sister group of the Garrini and both form the derived sister group of the Tylognathini. The Garrini contains several taxa presently considered to be genera as follows: *Garra, Semilabeo* (not seen), *Crossochrilus, Epalzeorhynchos,* and includes *Barbichthys, Cirrhinus,* and *Mekongina.* The primitive tribe, Tylognathini includes those species belonging to the *Labeo diplostomus* group which are referable to *Tylognathus;* it also includes *Barbichthys, Cirrhinus,* and *Labiobarbus.* There are a few more genera that are considered to be included in this subfamily such as *Paracrossochilus, Schismatorhynchus, Henicorhynchus,* etc. I lack specimens of these genera and so do not place them in the classification. This would be and interesting subject for future study.

Ecology

The ecology of *Osteochilus* is very poorly known and has never been critically studied before, I have conducted a small ecological study for three sympatric species in Ubolratana Reservoir, northeastern Thailand. The results of this study show that there are no differences in the food intake and breeding cycle between *O. hasselti* and *O. lini* have a subinferior mouth while *O. melanopleura* has an ascending mouth and feeds on more crustaceans and insect larvae than the former species. *O. lini* and *O. melanopleura* are more restricted in habitat selection than *O. hasselti.*

Zoogeography

This study recognizes 23 species of *Osteochilus* as follows: 1 in Burma; 2 in northern Thailand; 5 in

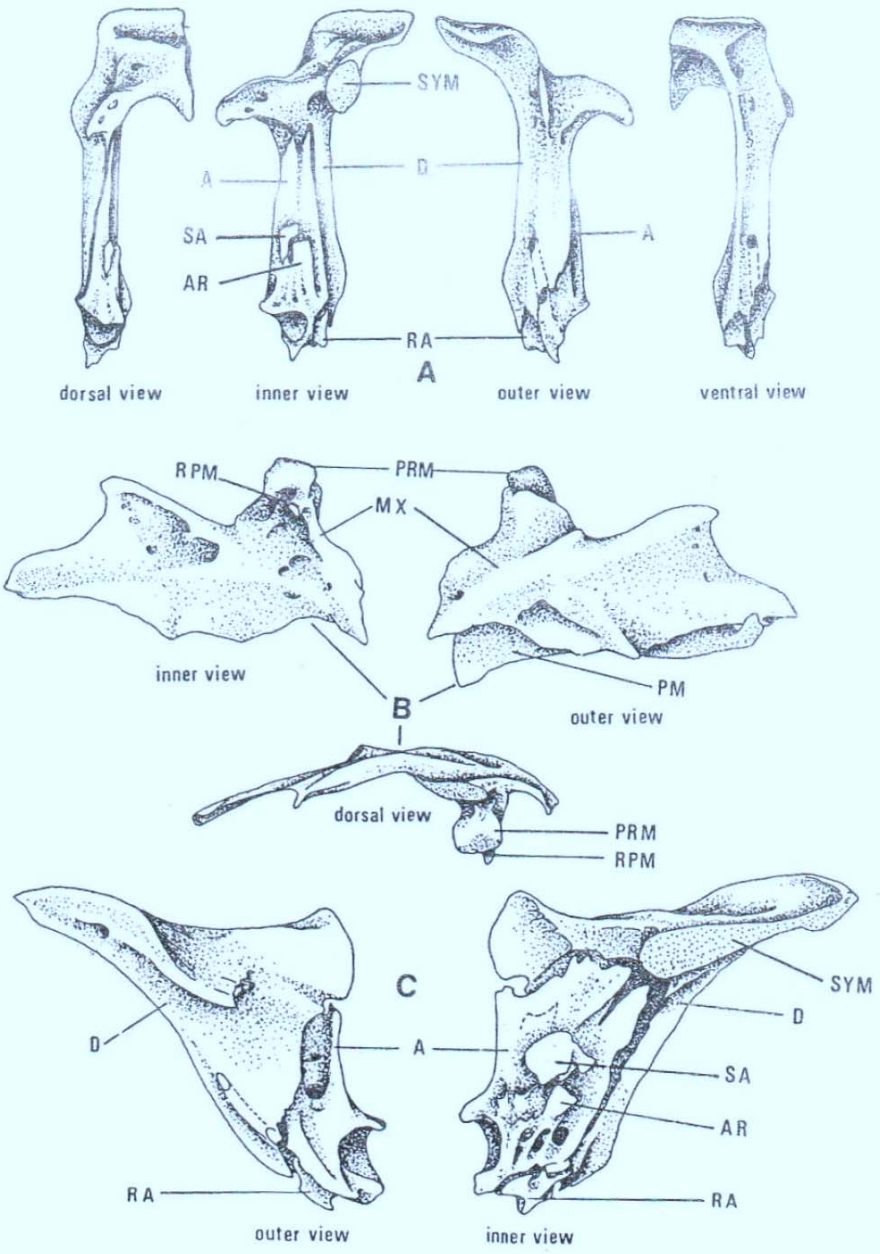


Fig. 32 A. primitive type of left lower jaw bone of *O.triporus*
B. left upper jaw bone of *O.triporus*
C. derived type of left lower jaw bone of *O.melanopleurus*

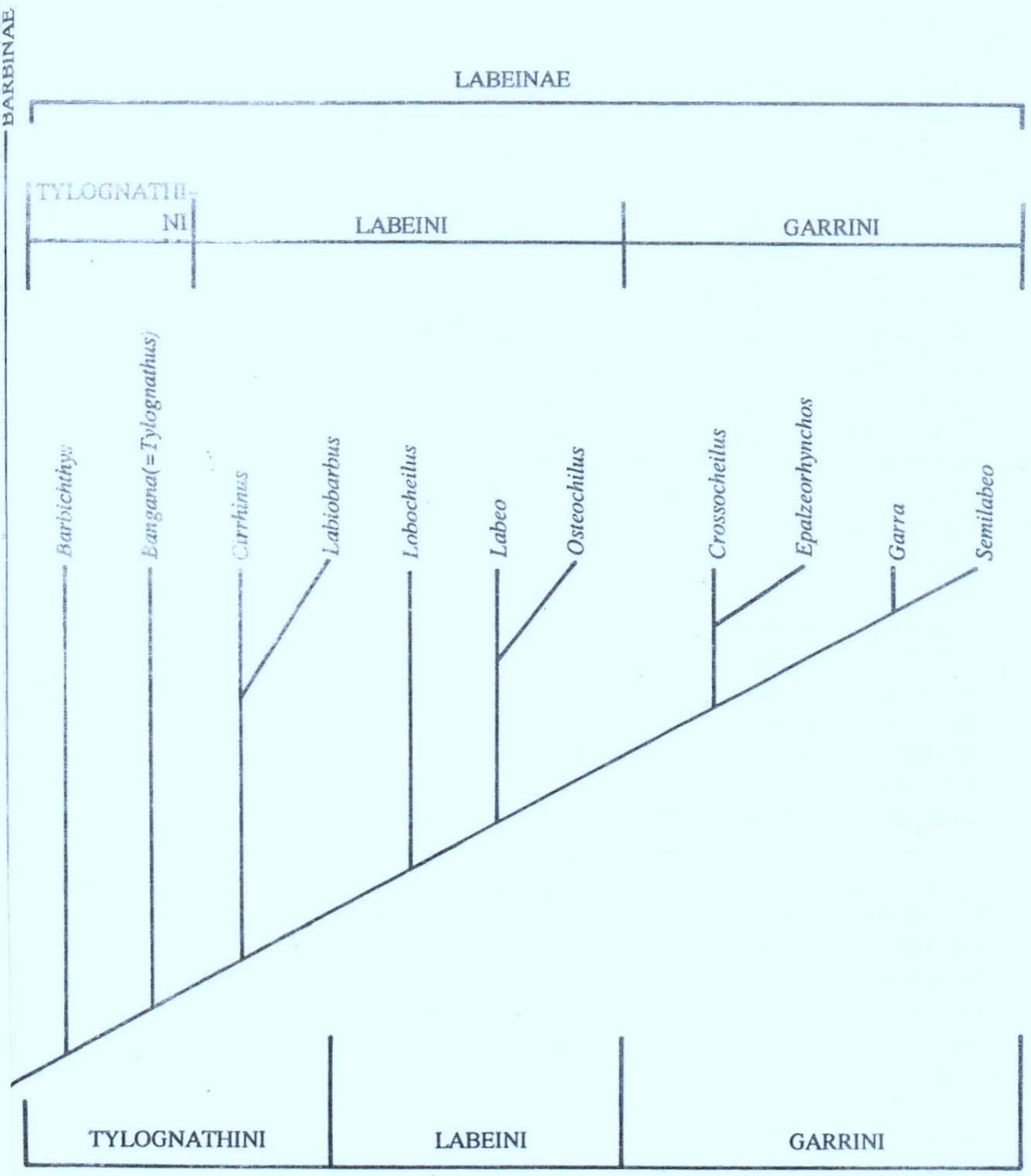


Fig. 33 Reid's cladogram of the subfamily Labeinae The bottom part is my subdivison into tribes

central Thailand; 4 in the Mekong Basin (northeastern Thailand, Loas, Cambodia, and South Vietnam); 1 in middle Vietnam; 1 in southern China and North Vietnam; 7 in the Malay peninsula; 12 in southern Sumatra; 13 in western Borneo (mainly Kapuas Basin); 7 in southern Borneo and Java; 5 in Sarawak (northwestern Borneo); 6 in eastern Borneo (mainly Mahakam Basin); and 2 in northeastern Borneo (State of North Borneo, Malaysia) (see map fig. 1).

Many of the species are shared among these regions. At least nine species occur in three or more of the above metioned regions. The widest ranging species are *O. hasselti* and *O. microcephalus* which are found in a large part of mainland Southeast Asia and also on the islands of the Indoaustralian archipelago west of Wallace's line. Some species have very restricted distributions and on the basis of known collections are found in only a few localities of one river system (*O. repang, O. kappeni,* etc.). No specimens have ever been taken in the adjacent oceans or even in brackish water in the estuaries. Western Borneo and southern Sumatra have the greatest number of species. Thus, the area of greatest taxonomic differentiation is isolated from the remaining areas by ocean and mountain barriers. If maximum differentiation is indicative of the center of origin, then this isolated area would be the center for *Osteochilus.* However, there is considerable controversy over the criteria for postulating centers of origin, and neither maximum diversity nor other criteria provide a satisfactory conclusion (see also Croizat, et al., 1974; Briggs, 1974, 1979). I do not think that any subregion of southeastern Asia can be claimed to be the center of origin of *Osteochilus,* but the southern part of southeastern Asia is thought to have been the center of dispersal of this and many other cyprinine fishes (Banarescu, 1971, 1975; Darlington, 1957).

The question arises as to why certain subregions now separated by salt water have several species of *Osteochilus* in common since all species of the genus are confined to freshwater. The answer is based on the geological history of these land masses. There are connections between the East Indian Islands and also between these islands and the Malay Peninsula in the early Mesozoic period, and after that they started separating from each other and also from the continent because of rising water levels until they became completely separated in the upper Cretaceous (Audley-Charles, 1966). Of more significance in interpreting the biogeography of recent organisms, however, is the fact that these land masses were connected to each other and also to the mainland several times during the Ice age (in the Pleistocene) and perhaps as recently as within early historic time (this area during emergence is called Sundaland). They again separated as they are at the present time (de Beaufort, 1951; Darlington, 1957; and Keast, 1968). The Pleistocene glacial maximum was marked by a fall in the sea level of the Pacific Ocean up to 100 meters (Keast, 1968; P. 374-375), and this brougth the Southeast Asian mainland and the East Indian Islands into broad contact with each other (the deepest part of the sea between Thailand and Borneo is about 73.8 meters, most of the area is about 30-70 meters (National Geographic map, 1967). At this period of time the river systems from these subregions must have flowed into the South China Sea in the area east of the Malay Peninsula at about a mid-point between South Vietnam and Borneo (see fig. 54). The area between Borneo and Sumatra, the center part of Sundaland, was drained mainly by the North Sunda River and its tributaries (Molengraaf, 1921, 1929; Brittan, 1954; Banarescu, 1975). The great North Sunda River is thought to have served as an evolutionary center during the Pleistocene and it probably had a large and varied fauna of *Osteochilus* and species of other genera of freshwater fishes which may be the same as those existing in the region today. *Osteochilus* may have been distributed extensively throughout the region. When the recent subsidence occurred, the main stream was submerged but the upper course of the tributary streams, reaching into Borneo, Malay Peninsula, and Sumatra, remained populated with the species common to the entire river system, as well as later coming to contain those forms subsequently evolved.

Brittan (1954) catagorized various species of *Rasbora* as representing an "old" fauna and a "new" fauna. The older fauna comprises those species that

occupied the river systems of those portions of the Greater Sunda Islands that remained emergent during the Tertairy; they migrated there from mainland southeastern Asia, probably during the Paleocene. This fauna exists today in rivers of the Greater Sunda Islands and many of the species survive in those systems which remained isolated (eastern and North Borneo, e.g. the Mahakam). The newer fauna comprises those species more recently evolved and dispersing after the Pleistocene emergence; they partially replaced the older fauna in the area west of Borneo, Sumatra, and Maley Peninslua which shared the same drainage during the Pleistocene.

It is clear that neither the Mahakam (in eastern Borneo) nor the basins of North Borneo had excess to this Sudaland fauna except through the limited possibilities of stream piracy at the watersheds. Thus the differences in the duration of isolation from the fauna of Sumatra and the Malay Peninsula would lead to a higher percentage of endemism (24% of the endemics in Borneo are in North Borneo, Inger and Chin, 1962) in the faunas of the Mahakam (6 species, 3 endemic) and North Borneo (2 species, 2 endemic) than in those of the Kapuas and Baram (western and northwestern Borneo). The Mahakam, because its sources interdigitate with those of the Kapuas and the Rajang (western Borneo), has probalbly had more opportunities for fauna mixing with the common Sundaland fauna through the agency of stream piracy than have the basins of eastern North Boeneo.

Southern Borneo and Java share several species since they shared the same drainage during the Pleistocene (but they were isolated from the North Sunda River). The number of species here is eight and it declines toward the eastern end of Java and the island of Bali (which is at the southeastern end of the range of *Osteochilus* and close to Wallace's line) and only one species, has been found (*O. hasselti*). Only one endemic species has been found in southern Borneo and none in Java. Southern Borneo is not completely isolated from western Borneo; there are no large mountains between them. This probably explains the lower percentage of endemism in this area, but more collections are needed in order to be sure. Java is a long narrow island which is also poorly collected. It has six or seven species most of which are in the western end and probably only one or two species are at the eastern end. This narrow island is without large river systems and is the area of active volcalnic activities; this has probably limited the number of species.

Violent volcanic eruptions are considered to have caused the disappearance of faunas from large areas (Banarescu, 1975), It is easy to imagine the catastrophic effects of such eruptions on the faunas. They are probably the cause of the great scarcity of some organisms in parts of Southeast Asia where volcanic activities are known to have been common.

Northwestern Borneo (Sarawak and Brunai) is isolated from the rest of Borneo by high mountain ranges. This area has six species; two are endemic and the other species are shared with western Borneo, Sumatra, and the mainland. There are two important tributaries in this subregion, the Baram and the Rajang-Baleh tributaries. The headwaters of the latter interdigitate with the Kapuas and Mahakam; the Baram has it headwaters close to the Kajan of eastern Borneo. Some mountain species might have dispersed by stream piracy such as *O. enneaporus* and the ancestor of the *O. triporus* group that gave rise to two endemic species, *O. harrisoni* and *O. sarawakensis.* The lowland species such as *O. hasselti* and *O. microcephalus* probably probably immigrated through the Sundaland emergance.

Western Borneo and southern Sumatra seem to have been an evolutionary center during the Pleistocene and they share almost the same species; western Borneo has 13 species and Sumatra has 12 species, the greatest number of species in the whole range. There are four endemic species in this area and one species, *O. kappeni,* is endemic to the Kapuas. The similarity and the richness of the fauna in these two subregions strongly suggests that they were still connceted to each other while the mainland had already been separated by the sea level. The two subregions also probably was much allopatric speciation which accounts for it having the richest fauna in the area.

The Malay Peninsula has seven species, all of which are shared with Sumatra and Borneo. This peninsula probably became separated from Sundaland

before Sumatra and Borneo were separated and like Java there are no large river systems in the peninsula; therefore, there are fewer species here than in Sumatra and Borneo. The Malay Peninsula is a long narrow area similar to Java and has only short river systems and has a less heterogenious in habitat which may be why there no endemic species in this subregion.

Central Thailand has five species, all of which occur in the Malay Peninsula, Sumatra, and Borneo. Central Thailand is the farthest from the center of abandance compared to the previous subregions and probably separated first from the Sundaland. Only five species were able to immigrated to this region.

The Mekong Basin (northeastern Thailand, Laos, Cambodia, and South Vietnam) was isolated from the Sundaland and has only four species; one is endemic and the other three species are shard with other regions. *Osteochilus* probabdly dispersed from central Thailand to northestern Thailand and also from southeastern Thailand through Cambodia. Certain species finally gave rise to the endemic species, *O. lini*. There is also a strong posibility that Mekong River might,at one time, drained through Cambodia and to Gulf of Thailand.

The question arises as to why Burma and China each have only one species of *Osteochilus*. There are probably several explanations. First of all, the mountain ranges which extend from the north to the south of Thailand, between Burma and Thailand (except the present passes at the lower part of Tak Province and the upper part of Karnjanaburi Province), may have been a geographical barrier to the immigration of other species. Secondly, there is no river sytem linking Thailand and Burma except for the Salween which drains only the northwestern corner of Thailand, a region of Thailand with only two species (*O. hasselti* and *O. microcephalus*). Thirdly, it is possible that at some times there was a river system which connected the two present political areas, and that river capture occurred but that only *O. hasselti* penetrated to the west. Finally, water temperature and current may be an isolating barrier for other species of *Osteochilus*, with only *O. hasselti* able to disperse into Burma. This species, however, does not occur in the northern part of Burma, but is found in the southern part of Irrawaddi and Sittang Rivers. There are four species in the Mekong River (*O. microcephalus, O. melanopleurus, O. hasselti,* and *O. lini*), but there is only one species that lives in the southern part of China (*O. salsburyi,* which is closely related to *O. microcephalus*). It is most likely that water temperature and swift-flowing stretches of rivers have been a major barrier to the penetration of other species.

There is no well marked association between the extent of a species range and its phylogenetic position. For example, of the three most widely distributed species, one (*O. microcephalus*) is relatively primitive, one (*O. hasselti*) is intermediate, and the other (*O. mealnopleurus*) is advanced.

O. triporus lineage is restricted to Borneo, only two species of this group occur in Sumatra (*O. triporus* and *O. intermedius*). The *O. waandersi* lineage is limited to Malay Peninsula, Sumatra, and Borneo and only one species (*O. waandersi*) occurs up to the southern part of central Thailand. Temperature and climate are probably part of the limiting for these species as the temperature on the mainland fluctuates a great deal more than on the tropical islands.

Many genera of cyprinids, e.g. *Labeo, Barillius*, and *Garra,* have disjunct distributions in Africa and Southeast Asia (Oriental region). Howes (1980), explains the biogeography of barilliine cyprinids by vicariant events occurring after the break-up of Gondwanaland (Indian plate and Southeast Asian block from Africa). The recent views concerning the Gondwanina position of the Southeast Asian block and its likely connection with India were published by Borton (1970) and Ridd (1971). However, Stauffer (1974) did not agree with this proposed juxtaposition of the Malay peninsula with India, but believed the Southeast Asian block once had an African connection. However, there is a controversy over the concept of a Gondwanian origin of cyprinid fishes, and more study of geology and paleoichthyology is needed to prove this concept is true, then *Osteochilus* must have arisen sometime after the break-up of the Southeast Asian block from Africa and spread to the mainland of Southeast Asia when it became connected.

	o.microcephalus	*o.sulaburyi*	*o.brachynotopteroides*	*o.waandersi*	*o.enneaporus*	*o.belius*	*o.pleurotaenia*	*o.kahajanensis kahajanensis*	*o.kahajanensis chini*	*o.spriulus*	*o.ingeri*	*o.triporus*	*o.intermedius*	*o.sarawakensis*	*o.harrisoni*	*o.pentalineatus*	*o.hasselti*	*o.kappeni*	*o.lini*	*o.repang*	*o.borneensis*	*o.schlegeli*	*o.kalabau*	*o.melanopleura*
Burma																	x							
S.China & N.Vietnam		x																						
Middle Vietnam	x		x																					
Mekong Basin (N.E.Thailand, Laos, Cambodia, S.Vietnam)	x																x							x
Central Thailand	x			x													x					x		x
Malay Peninsula	x			x	x			x		x							x					x		x
South Sumatra	x			x	x		x	x		x		x	x				x				x	x		x
West Borneo	x			x	x		x	x		x		x	x				x	x			x	x		x
South Borneo & Java	x			x	x		x	x		x						x	x							x
Sarawak (Northwest Borneo)	x				x			x						x	x		x							
East Borneo	?			?	x	x	x	?									x			?		x	x	
Northest Borneo									x		x													

Fig. 34 Hypothetical phylogeny of *Osteochilus* with their distribution.

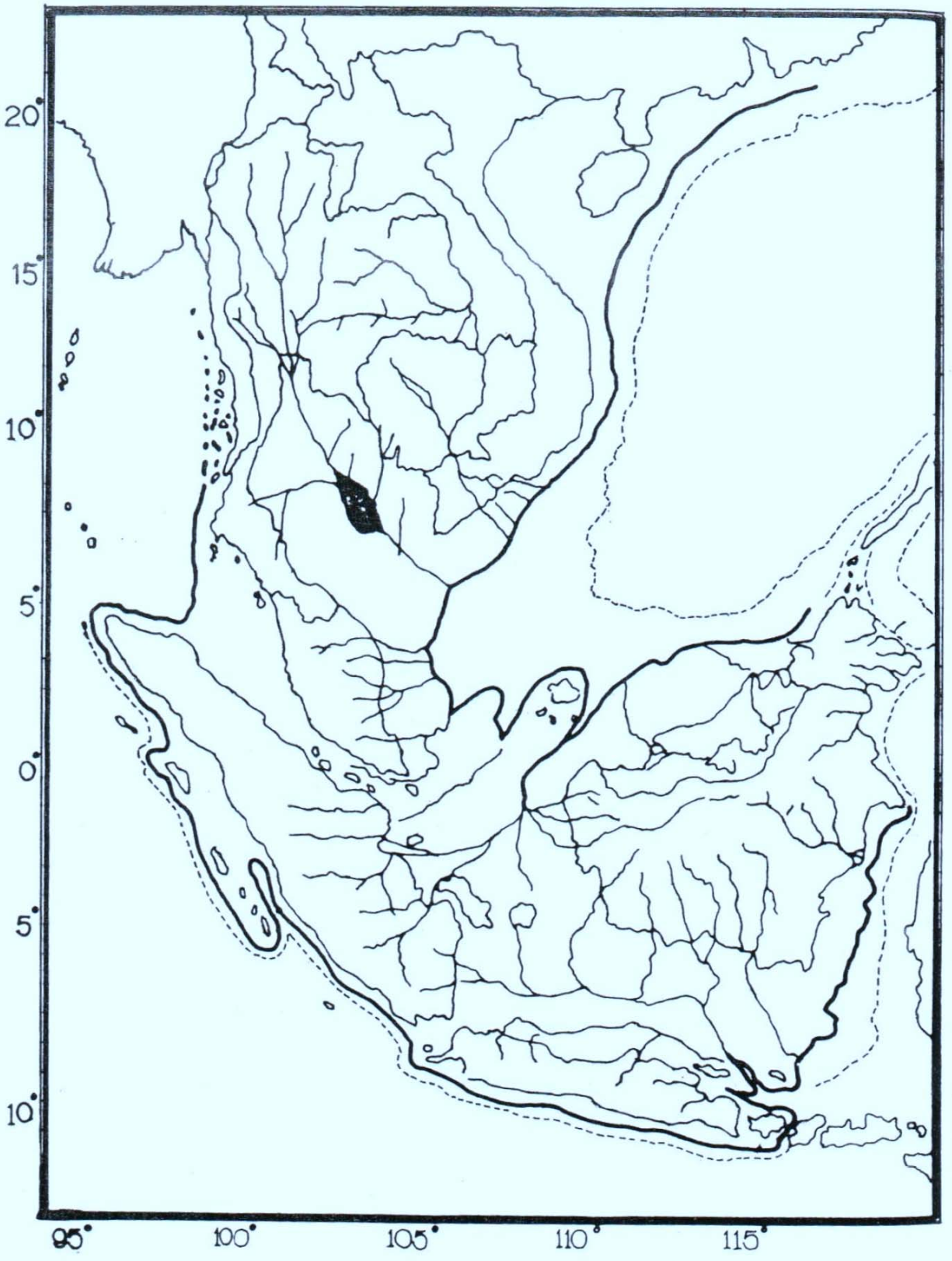


Fig. 35 The pleistocene Sundaland, thick line indicates limits of Sundaland, thin line indicates the present lands and river systems.

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