K. C. JAYARAM

THE FRESHWATER FISHES OF INDIA.....

A HANDBOOK



ZOOLOGICAL SURVEY OF INDIA
CALCUTTA

The Freshwater fish fauna of the Indian subcontinent is highly varied and rich in the number of known species. Several new additions and changes in the piscine component of this area have been published during the last hundred years subsequent to the classical work of Francis Day. There is at present no concise and comprehensive handbook on the freshwater fish fauna of India, Pakistan, Bangladesh, Burma and Sri Lanka providing information under one cover of all the known species classified according to the latest system, with their known range of geographical distribution and above all with a key for their easy identification. This publication attempts to meet these requirements. It is aimed to serve several Ichthyologists, naturalists, fishery workers, and environment scientists, interested in the fish fauna of India and the adjacent countries.

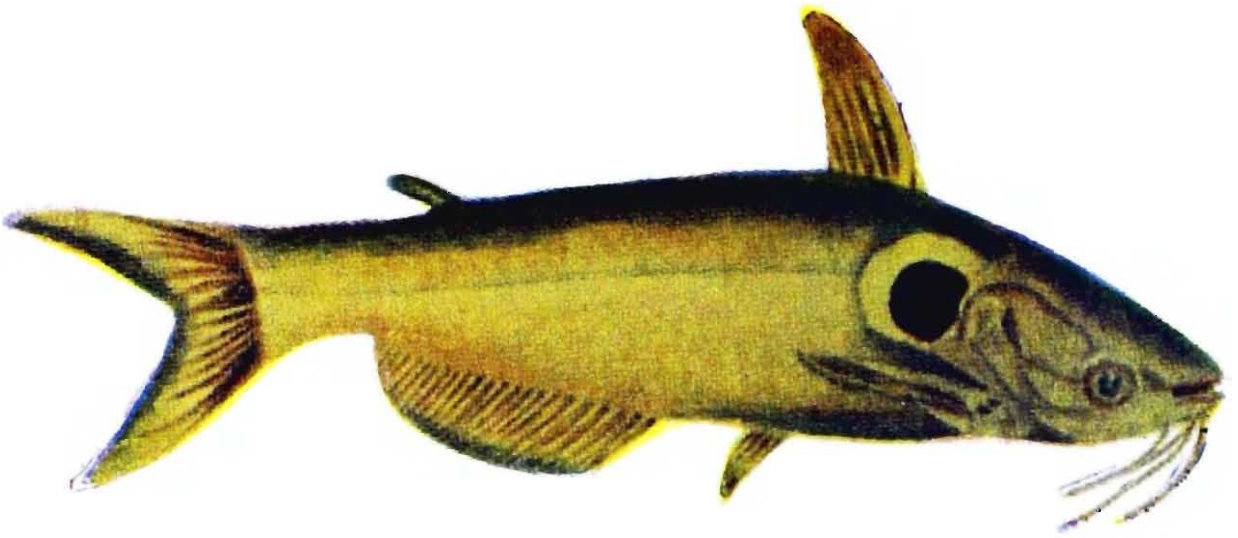
The book has grown out of the author's experience of freshwater fish study for the past 30 years in the Zoological Survey of India and also the expertise gained out of several surveys of freshwater bodies in India. Examination of the century old collections from the now politically independent countries as Burma, Pakistan, Bangladesh, Sri Lanka preserved in the same institution has also been an added advantage.

THE FRESHWATER FISHES OF INDIA PAKISTAN, BANGLADESH, BURMA AND SRI LANKA

—A HANDBOOK

By

K. C. JAYARAM



Horabagrus brachysoma (Giinther) (After Day, F. 1865 *Fish Malabar*, Plate XIII, Fig. 2).

THE FRESHWATER FISHES OF INDIA, PAKISTAN, BANGLADESH, BURMA AND SRI LANKA

—A HANDBOOK

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K. C. JAYARAM

Zoological Survey of India

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FOREWORD

The Handbook of Freshwater Fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka fulfils a long-felt need for a consolidated account of the fish fauna of this region. Apart from some interim reports on a few families of fishes, there has been no such publication after the classical work of Fishes of India by Day (1876-78). The freshwater fish fauna of India is highly diverse in nature. The credit for developing a sustained interest for highlighting the rich piscine fauna largely goes to the late Dr. Sunder Lal Hora, the former Director of the Zoological Survey of India. Dr. Hora published a series of papers, revising the many genera and proposing several new taxa and families. However, the need for an up-to-date guide for an easy identification of all the known freshwater fishes of our rivers, lakes, reservoirs, ponds, etc., was increasingly felt by many ichthyologists, fishery biologists, students and teaching staff in colleges and universities. The innumerable nomenclatural and zoological changes introduced in the taxonomic components of the fauna, from time to time, made the problem rather intriguing. The present Handbook prepared by Dr. K. C. Jayaram, Deputy Director of the Zoological Survey of India claims to meet several types of needs. The book has an added advantage because the coverage of the geographical region has been wide. It includes the entire Indian subcontinent. The piscine fauna of the different countries forming this region, are known to be zoogeographically inter-related. The information on the fish fauna of the entire region would be of particular interest to readers.

In all, 742 species under 233 genera and 64 families have been covered in this publication. It is greatly hoped that the book will be widely used by all interested in the fish fauna of this region.

Dr. K. C. Jayaram, Deputy Director, Zoological Survey of India has been for more than 30 years with the Zoological Survey of India. He has a rich experience in freshwater fish taxonomy and zoogeography. He was trained by the late Dr. S. L. Hora in the specialisation of Siluroid fishes. He is now considered an authority on the Indian catfishes. He was invited as a consultant by the F A O for the preparation of identification sheets for the Siluroid families Ariidae and Plotosidae of the Western Indian Ocean (Area 51). He has a good field experience and has worked out the fish fauna of major riverine systems of our country such as the Brahmaputra, Mahanadi, Cauvery, etc. He also worked in the Central Inland Fisheries Research

Institute, for a brief period and has gained considerable experience in the work related to fisheries and riverine survey. He has to his credit about 100 publications.

New Delhi
October 5, 1981

S. Z. QASIM
Secretary to the Govt. of India
Department of Environment

EDITOR'S PREFACE

One of the major functions of the Zoological Survey of India has been to maintain and provide up to date inventories of the fauna of the country. With this objective this department has been undertaking extensive field survey programmes and publishing several faunistic reports on different groups of animals. Thus a large number of papers have been published on the fish fauna of the Indian region by ichthyologists like the late Dev Dev Mukerji, Sunder Lal Hora, K. S. Misra and others. Consequently several new taxa have been established and the taxonomic concepts of many genera and families have been reorientated as compared to the century old Day's monumental classic on the Fishes of India (1878). In a similar manner, several papers have also been published from our neighbouring countries Pakistan, Nepal, Bangladesh and Sri Lanka whose fauna is closely interrelated with that of ours both taxonomically and also zoogeographically. In the light of the aforesaid facts it became increasingly clear that a comprehensive guide for the identification of all the freshwater fishes so far known from the Indian subcontinent was badly needed.

A publication entitled "An aid to the identification of the common commercial fishes of India and Pakistan" by the late Dr. K. S. Misra was published by this department in 1962, which soon went out of print within a couple of years of its release. Moreover this publication was much limited in scope and contents. It dealt with only 100 families of selected fish groups. With a view to up date this publication and at the same time to make it more comprehensive Dr. K. C. Jayaram, undertook to prepare this Handbook which deals with all the known freshwater fishes of the entire Indian subcontinent.

I wish to congratulate Dr. Jayaram for having undertaken this onerous task which I am sure will be useful to several students of ichthyology and research workers.

B. K. TIKADER
Director
Zoological Survey of India

Calcutta
October 5, 1981

AUTHOR'S PREFACE

This Handbook was initially meant to up date the late Dr. K. S. Misra's "An aid to the identification of the common commercial fishes of India and Pakistan" (1962) which went out of print within a short time of its publication. Several colleagues, young research workers and correspondents have from time to time urged me the necessity of bringing out an up todate and more comprehensive publication on the freshwater fish fauna of our country. Ichthyologists from Pakistan and Bangladesh also evinced interest in this project and very willingly spared reprints of recent work on the fish fauna of their countries, and volunteered useful information. Positive encouragement from my colleagues in the Zoological Survey of India and elsewhere encouraged me to undertake this task which is now completed.

Prof. M. R. Mirza, Govt. College, Lahore (Pakistan), Dr. Ataur K. Rahman (Bangladesh) were extremely generous to provide much needed information on the fish fauna of their countries and gladly spared many valuable papers on the subject. Prof. Petru Banarescu, and Dr. Theodore Nalbant, Bucharest, Romania in a similar manner clarified several taxonomic points and also reviewed the manuscript in part, offering very useful suggestions and modifications. Dr. Gordon Howes, of the British Museum (Natural History), London readily spared his recent contributions on the Rasborine fishes and clarified many of my doubts regarding their taxonomy. The cooperation of these noted ichthyologists have helped to a large extent the wide coverage of this publication. I offer my very warm and sincere thanks to each one of them. Dr. T. N. Ananthakrishnan, former Director of the Zoological Survey of India was the first to moot such an idea of publishing Handbooks for the identification of Indian animal groups. Dr. B. K. Tikader, the present Director supported this idea very encouragingly and gave excellent suggestions for the final get up and inclusion of colour photographs and plates. Dr. S. Z. Qasim, Secretary, Department of Environment, Govt. of India very kindly agreed to our request for writing a Foreword. I am grateful to all these gentlemen for their encouragement, courtesies and cooperation.

A special word of thanks is due to Shri Sivagurunathan, the able and energetic Publication Production Officer and the staff of the Publication Division of the Zoological Survey of India for their untiring efforts to bring out this publication fast and in a very efficient manner

from the press. M/s Sri Aurobindo Press, the printers of this Handbook deserve my sincere appreciation for their ungrudging assistance in timely supply and faithful incorporation of the corrections in several proofs.

I fervently hope that this publication will generate further interest in the fish fauna of our country and will stimulate more research investigations on Indian Ichthyology.

Calcutta K. C. JAYARAM

October 12, 1981

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+See Banister, 1970.

*_Lates_ and _Chanda_ are placed under Centropomidae by Regan (1913) and Weber & Beaufort (1929). Jordan (1923) placed _Lates_ under Latidae, a separate family. The classification here is after Greenwood, 1976.

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* Mastacembeliformes is kept separate following Berg (1940)

Introduction

Over one hundred years ago, Francis Day, an Assistant Surgeon of the East India Company, on being posted as a medical officer of its Madras establishment in India took interest in fishes and other animals found in this country. What began as a hobby became an obsession with Day and during the twenty-two years he was in India (1852-1874) he travelled far and wide, collected extensively, observed keenly and finally published the inimitable masterpiece of a treatise the famous "Fishes of India" (1875-1878). Day included in this work (including the supplement) 1418 species of fishes found in the territories of the present day Republics of India Pakistan, Bangladesh, Burma and Sri Lanka. A separate volume of illustrations with 195 plates was also issued. Day's monograph is the first publication to contain a comprehensive account of all the fishes, both freshwater and marine, found in the entire Indian subcontinent up to 1878. Even today the "Fishes of India" remains as an important reference manual for the ichthyology of the region, and will continue to be so for many more years to come.

However, subsequent to Day considerable advances have been made in the study of fishes of the Indian subcontinent. Many more new taxa from areas not covered by Day and extensions of the range of distribution of a large number of species have been published. The concept of species itself having changed, many alterations in family and generic composition, descriptions have been eflected. Modern taxonomic practice adopting the International Code of Zoological Nomenclature has necessitated many changes in type designations, family and generic nomenclature, etc. A large number of families of Day have been split up on the basis of further revisionary studies. The total number of known genera and species has also greatly increased, thanks to the pioneer researches of ichthyologists like Alcock, Annandale, B. L. Chaudhury, D. D. Mukerji, S. L. Hora, K. S. Misra and others.

This vast additional information is scattered in innumerable publications well known or obscure, Indian and foreign. Access to these is limited to very few scientists and organisations. A large majority of workers in distant colleges, universities, research institutions and laboratories still rely on the "Fauna of India" volumes on Fishes (first edition) by Day (1889) and some on "Fishes of India" (1875-1878) which have become outdated. These scientists are unable to arrive at

correct identifications and follow the recent classification because of the aforesaid handicaps.

The need for an up to date identification manual for the fishes of the Indian region incorporating data so far published, with correct nomenclature, arrangement of taxa to be adopted and reference to further literature to be followed has been increasingly felt for some years, especially since the middle of this century. A revised set of volumes on Fishes in the "Fauna of India" series was assigned to the late Dr. Sunder Lal Hora in the early thirties. For this purpose he published a number of valuable revisionary studies under various serial headings such as "Siluroid Fishes of India, Burma and Ceylon", "Notes on Fishes in the Indian Museum", "Game Fishes of India", etc. Unfortunately Hora could not even begin his volumes in the "Fauna of India" series due to his various preoccupations and his death in 1955. K. S. Misra (1949, 1952, 1953) published a series of Checklists and Aids for the identification of fishes of India, Burma and Sri Lanka. Later he (1952) published "An aid to the identification of the common commercial fishes of India and Pakistan" dealing with 402 marine, brackish and freshwater species belonging to 205 genera and 100 selected families, which constituted the most common commercial fishes of this region. Though limited in scope, this publication was very well received indicating the demand for such an up to date manual, and it soon went out of print. Further, Misra wrote under the "Fauna of India" series a second edition on Pisces in three volumes : Elasmobranchii and Holocephali (1969) vol. I ; Clupeiformes, Bathyclupeiformes, Galaxiformes, Scopeliformes and Atelopiformes (1976) vol. II ; and Cypriniformes : Siluri (1976a) vol. III. The last two volumes were published after his death in 1969. The remaining groups are yet to be completed.

Unfortunately, the above volumes in the "Fauna of India" series suffer from the same deficiencies and inadequacies found in Day's "Fishes of India." Recent literature have not been referred to and the groups have been treated in a very cursory manner. Generic and family allocations, geographic limitations are in many cases erroneous. For instance the genus *Batasio* Blyth has been grouped under Sisoridae whereas it belongs to Bagridae (1976a, p. xviii., 215). The genus *Pseudobagrus* Bleeker is reported as occuring in India (1976a, p. 108) whereas it is a genus found only in Japanese and Chinese waters.

It is now evident that such a large and diverse group as the Indian fishes cannot be dealt with by any single individual however competent he may be, especially when more and more specialisations in selected

orders and families are being undertaken by many ichthyologists. A basic up to date compendium of all information on the piscine fauna of this subcontinent is a prerequisite and of utmost need, which alone in turn will enable specialists to tackle further selected areas for useful revisionary and monographic studies.

It is hoped that this work will serve not only as an identification manual for interested workers but also stimulate further detailed investigations in future.

ARRANGEMENT

This Handbook deals with 233 genera with 742 species falling under 64 families and 16 orders. It includes all the known fresh and brackishwater fishes both indigenous and exotic found within the political boundaries of India, Pakistan, Bangladesh, Burma and Sri Lanka. Though not indicated in the title, Nepal and Bhutan are also covered. Only the bony fishes or Teleostomi are treated : the Elasmobranchii and Holocephali are left out.

An uniform pattern of citation and arrangement is adopted. Brief salient features of all taxa up to orders are given. Details in respect of families and genera are provided more elaborately. Important diagnostic features in these descriptions are printed in italics. Dichotomous keys are given for all orders, families, genera and species. All the keys are artificial in the sense that they do not reflect any phylogeny. In the case of *Noemacheilus* an additional key on the basis of geographical grouping is given since most of the species one often encounters may be only within the respective zoogeographic zones delineated. All species that are known till 1979, are listed under each genus with their geographical distribution.

Most of the species belonging to the following families Elopidae, Megalopidae, Moringuidae, Muraenidae, Muraenosocidae, Ophichthidae, Clupeidae (Subfamilies : Dorosomatinae, Pristigasterinae), Engraulidae (Subfamilies : Engraulinae, Coilinae), Ariidae, Plotosidae, Syngnathidae, Leiognathidae, Pomadasyidae, Sciaenidae, Mugilidae, Polynemidae, Gobiidae, Stromateidae and Tetraodontidae are either visitors or inhabitants of estuaries. They do occur in freshwater zone of the rivers and may even extend beyond that zone. These are listed under the subheading "Species visiting freshwater". Such of those which are purely marine in the same genus are excluded since they are beyond the scope of this handbook.

Synonymic changes, previous generic positions and such relevant

details of species are indicated as foot-notes wherever necessary. An illustration of one or two common species of some genera is also provided. Key characters requiring further explanation are also illustrated. Useful notes on commercial importance, food, feeding habits, bionomics and their status in nature whether they are rare, common or endangered are mentioned under "Remarks" column.

The classification adopted is after Greenwood *et al.* (1966), Rosen and Patterson (1969) with slight modifications. Genera are arranged according to their phylogenetic and/or intergeneric affinities. Species are listed alphabetically.

A glossary at the end explains the meaning and usage of technical terms in detail.

The bibliography contains all pertinent literature of the fishes dealt in this work. An index to the scientific names found in this Handbook is appended last.

Acknowledgements

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Methods of Collection

Collecting fishes varies from place to place and species to species. A majority of the freshwater fishes are caught by seine nets which are operated across a river and either dragged or closed like a purse. Hill-stream fishes are often collected by damming a stretch of the river or

diverting the water for the stream to dry up. Fishes are then picked up by hand from below stones, rocks and boulders. Often poisonous or narcotising roots and drugs are used to collect such fishes. Use of bait or fly-fish for some riverine fishes are also common. Spearing of fishes as done in Kashmir lakes often results in damaged specimens. Large reservoirs, tanks and pools are often fished with gill nets, set in different positions.

The collector may use any means to capture fish with the sanction of local authorities, but the aim should be to obtain them intact with all their body parts undamaged for taxonomic studies.

METHODS OF PRESERVATION

Whole fish are preserved in a solution of formalin. Live fish are generally killed in such a solution to obtain best results, as they die in this solution with all the fins expanded. This solution is made by diluting one part of the concentrated formalin or commercial formaldehyde (which varies in strength from 37%—40%) with nine parts of water. It is advisable to neutralise this solution with five to ten grams of Borax per litre. The volume of material to be preserved should never exceed that of the preserving liquid. The fish should be left in this solution atleast for four or five hours for proper fixation.

Fish less than 10 cm (four inches) long should be immersed completely in the formalin solution. Fish 10 to 30 cm (up to one foot) should have a narrow cut made on the abdominal wall a little to one side of the midventral line. Care should be taken to avoid a deep cut to injure or expose the intestines or alimentary canal. Fish longer than 30 cm (more than one foot) should be injected with *undiluted concentrated* formalin in several places and the belly should be slit in 2 or 3 places. Delicate fishes such as clupeoids, *Chela* etc. are preferably injected even when they are 20 to 30 cm long. Where the abdomen is not rounded but with a keel, the incision is preferably made on the left side of the fish.

All colours, colour patterns, spots, blotches, number and design should be carefully noted in field note-book as soon as the fishes are caught and when they are fresh.

Labels indicating station number, serial number, exact locality, its provenance, the altitude where necessary, longitude and latitude if possible, date and time of collection, name of collector, gear employed should be clearly written out in pencil and packed with each lot. If any field identification is made it should also be noted on the label, with local names current in that area. Information on the nature of water,

substratum, extent of vegetation and animal associations should be recorded in the field note book.

Preserved fish are packed in thin muslin or mulmul cloth for transportation. They may also be kept in plastic bags soaked with formalin-wet cloth or cotton.

Containers for transportation may be empty clean tin cans, paint-buckets and large or small oil cans which have been cleansed of their contents completely and thoroughly. These are generally soldered on the top before despatch. In recent years extra-wide mouthed (eight inch or 20 cm opening) plastic drums of 40 litre capacity are available which are very useful.

Measurements

Sharp pointed needle-like dividers or a dial-reading calipers are used for taking body measurements. Dividers should have one point flat at right angle to the place of operation and the other kept at a needle point. For accurate readings, a stainless steel ruler with measurements to millimeter is recommended. Measuring boards or meter scales often used in fishery biological investigations are unsuitable for systematic studies.

The various body measurements of a fish are :

Total Length (AL, Fig. 1B, AJ Fig. 2A)—the greatest distance between the most anterior projecting part of the head (even if it is a prolonged beak as in *Xenentodon*) to the posterior most tip or the caudal fin, including filamentous prolongations, if any. The measurement is a straight line and is not taken over the curves of the body. Where the caudal fin has either of the lobes longer than the other, the maximum length is taken. Where the jaws are unequal, the mouth is closed and measured from the tip of the jaw which is longer.

Standard Length (AK, Fig. 1B, AH, Fig 2A)—the straight distance from the anteriormost part of the head to the end of the vertebral column. In actual practice the flexure line of the body over the caudal peduncle is taken as the posteriormost point. Some authors however take this as mid of the caudal fin base. This flexure line need not necessarily coincide with the most posterior scales.

Body Depth (OP, Figs. 1B, 2A)—the vertical measurement from a point in the body of the fish on its back where its height is greatest to a straight line to the ventral surface or profile. The fleshy or scaly structures pertaining to fin bases are excluded. It need not necessarily be in the middle of the fish.

HEAD LENGTH (AD, Figs. 1B, 2A)—a straight measurement of the distance from the tip of the snout to the most distant point on the opercular membrane. Any fleshy membrane of the gill cover is also included (as in *Amblyceps*).

HEAD DEPTH OR HEIGHT OF HEAD AT OCCIPUT—the perpendicular distance measured from the midline at the occiput vertically downwards to

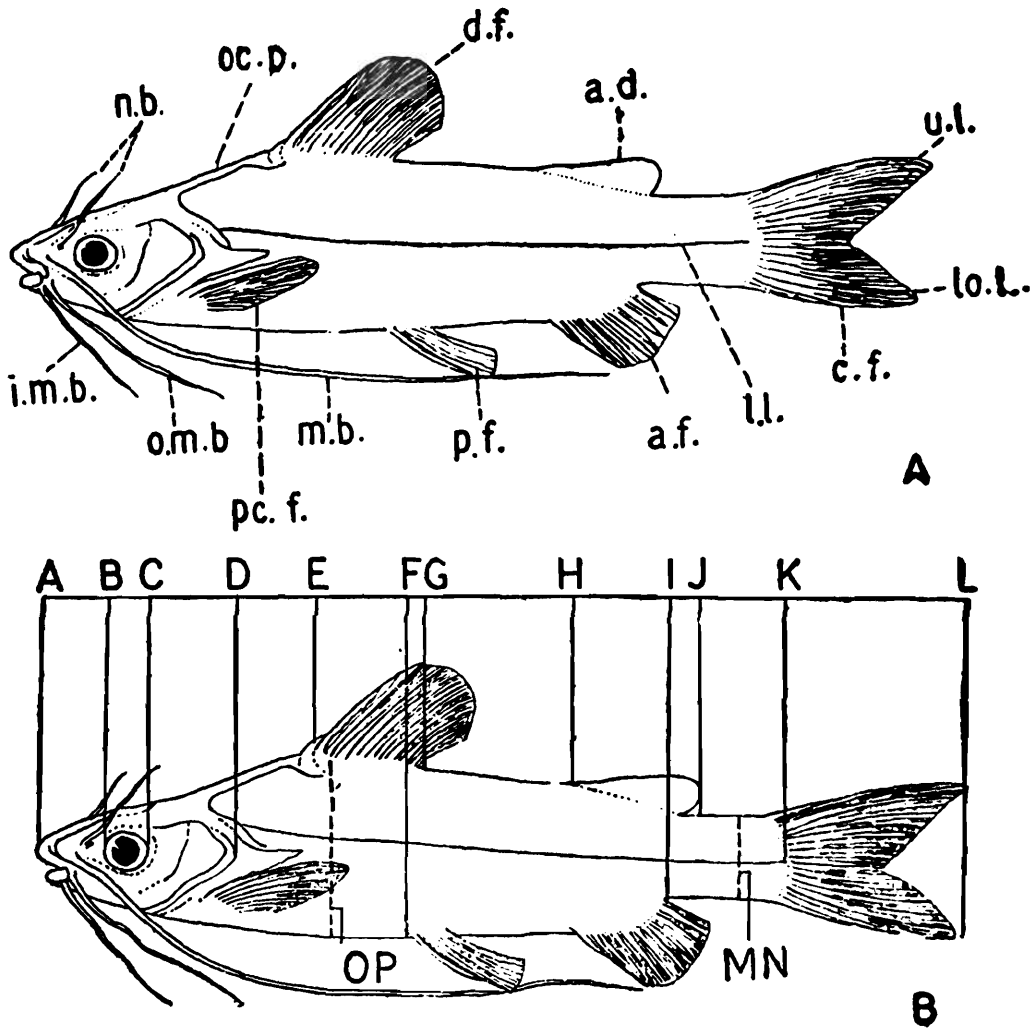


Fig. 1 (A & B) Lateral view diagrams of *Mystus vittatus* (Bloch). A, to show various body parts. B, to show different body measurements. (After Hora and Mukerji, 1938 ; Jayaram, 1977).

a.d.=adipose dorsal fin ; a.f.=anal fin ; c.f.=caudal fin ; d.f.=dorsal fin ; i.m.b=inner mandibular barbel ; l.l.=Lateral line ; lo.l=lower lobe of caudal fin ; m.b.=maxillary barbel ; n.b.=nasal barbel ; oc.p=occipital process ; o.m.b.=outer mandibular barbel ; p.f.=pelvic fin ; pc.f=pectoral fin ; u.l.=upper lobe of caudal fin.

AB=Snout length ; AC=Postorbital length ; AD=Head length ; AE=Predorsal length ; AF=Prepelvic distance ; AK=Standard length ; AL=Total length ; BC=Eye diameter ; EG=Width of dorsal fin, or length of base of dorsal fin ; GH=distance between rayed dorsal fin and adipose dorsal fin ; HJ=Length of base of adipose dorsal fin ; IK=Length of caudal peduncle ; MN=Depth or least height of caudal peduncle ; OP=Body depth.

the vertical contour of the head or the breast. In actual practice, one arm of the divider is placed at the occipital crest and the other arm

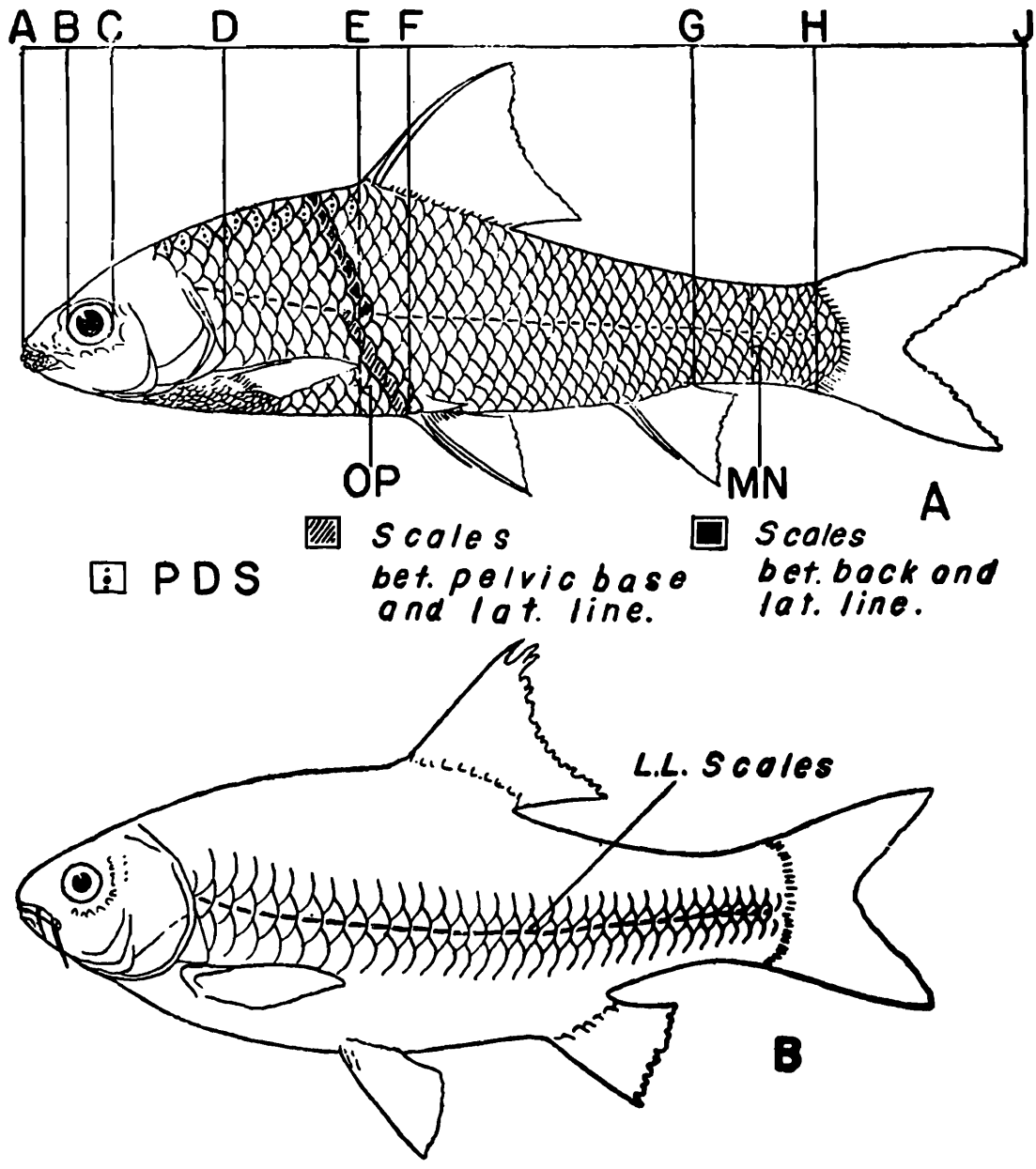


Fig. 2 A. Outline drawing of *Labeo* sp. to show different body measurements. Indicator lines and alphabets are same as in Fig. 1B, except the following GH = length of caudal peduncle, AJ = total length.
B. Outline drawing of *Puntius sarana* to show lateral line scales.

below the head vertically opposite to the upper arm, to form a vertical line. Unlike body depth this measurement *is not taken* upto ventral profile line.

Head Width—distance straight across the head in a ventral position ; if the opercles are dilated they are forced into a reasonably normal position.

Eye Diameter (Bc, Figs. 1B, 2A)—the distance between margins of the cartilaginous eyeball across the cornea.

SNOUT LENGTH (AB, Figs. 1B, 2A)—the distance from the most anterior midpoint on the snout or upper lip to the front hard margin of the orbit.

INTERORBITAL WIDTH—the least distance between the bony rims between inner margin of the eyes.

PREDORSAL LENGTH (AE, Figs. 1B, 2A)—a straight measurement from the midpoint or tip of the snout or upper lip or the anteriormost part of the head to the structural base of the first dorsal fin ray. In fishes with a dorsal spine the basal bone of the dorsal fin is taken as the structural base.

POSTDORSAL LENGTH (EK, Fig. 1B, EH, Fig. 2A)—a straight line measurement from the structural base of the dorsal fin to the flexure line of the body or the end of the vertebral column.

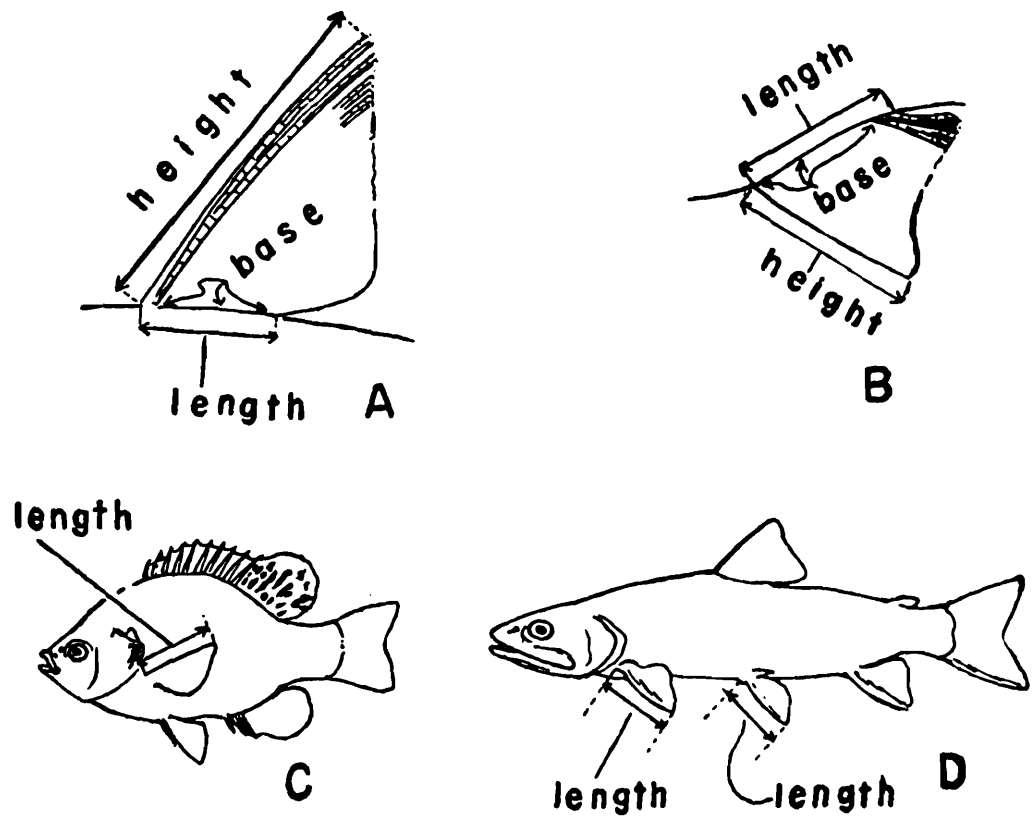


Fig. 3. A. Outline sketches to show height and width of dorsal and B. anal fins. C, D. Outline sketches to show length of pectoral and pelvic fins.

PREPELVIC DISTANCE (AF, Figs. 1B, 2A)—a straight distance from the mid-point of the base of the pelvic fin to the anteriormost point of head.

HEIGHT OF DORSAL (Fig. 3A)—ANAL FIN (Fig. 3B) OR LENGTH OF DORSAL FIN SPINE—measured from the anterior point of junction with the body to anterior tip of the fin even if the other rays do not reach this point.

LENGTH OF BASE OF SPINOUS OR SOFT DORSAL (Figs. 3A, 5B), ADIPOSE DORSAL (Fig. 5A), ANAL FIN—the greatest distance measured in a straight line between the anteriormost and posteriormost points of junction with the body.

LENGTH OF PECTORAL (Figs. 3C, D) and PELVIC FINS (Figs. 3D) OR SPINES —measured between its origin or place of insertion into the body to the extreme tip.

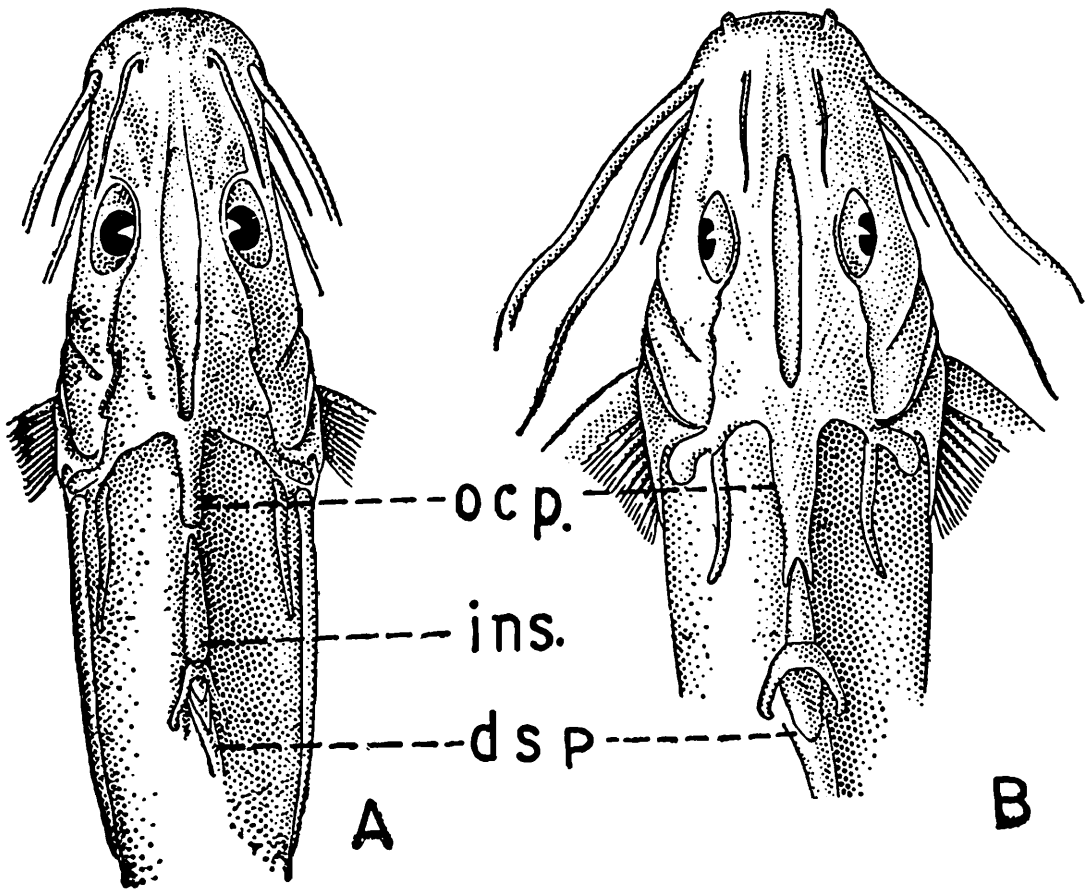


Fig. 4. Dorsal view of head and anterior part of body of A. *Aorichtys aor* and B. *Mystus leucophasis* to show the length of occipital process.

DEPTH OR LEAST HEIGHT OF CAUDAL PEDUNCLE (MN. Figs. 1B, 2A)—the least vertical distance from the dorsal to ventral profile at the narrowest part of the caudal peduncle. It is a straight measurement.

LENGTH OF CAUDAL PEDUNCLE (IK, Fig. 1B, GH, Fig. 2A)—an oblique measurement from the last point of contact of anal fin posteriorly to the end of the vertebral column or the flexure line of the body.

LENGTH OF LONGEST FIN RAY (Fig. 5 C, D.)—measured from the structural base of the longest fin ray to its tip.

POSTORBITAL LENGTH (CD, Figs. 1B, 2A)—the greatest distance from the posterior edge of orbit to the posterior tip of the fleshy operculum.

SUBORBITAL WIDTH—the least distance from the lowermost margin of the orbit to suborbital or preorbital margin.

WIDTH OF GAPE OF MOUTH—the greatest transverse distance across the opening of the mouth, without stretching the mouth opening.

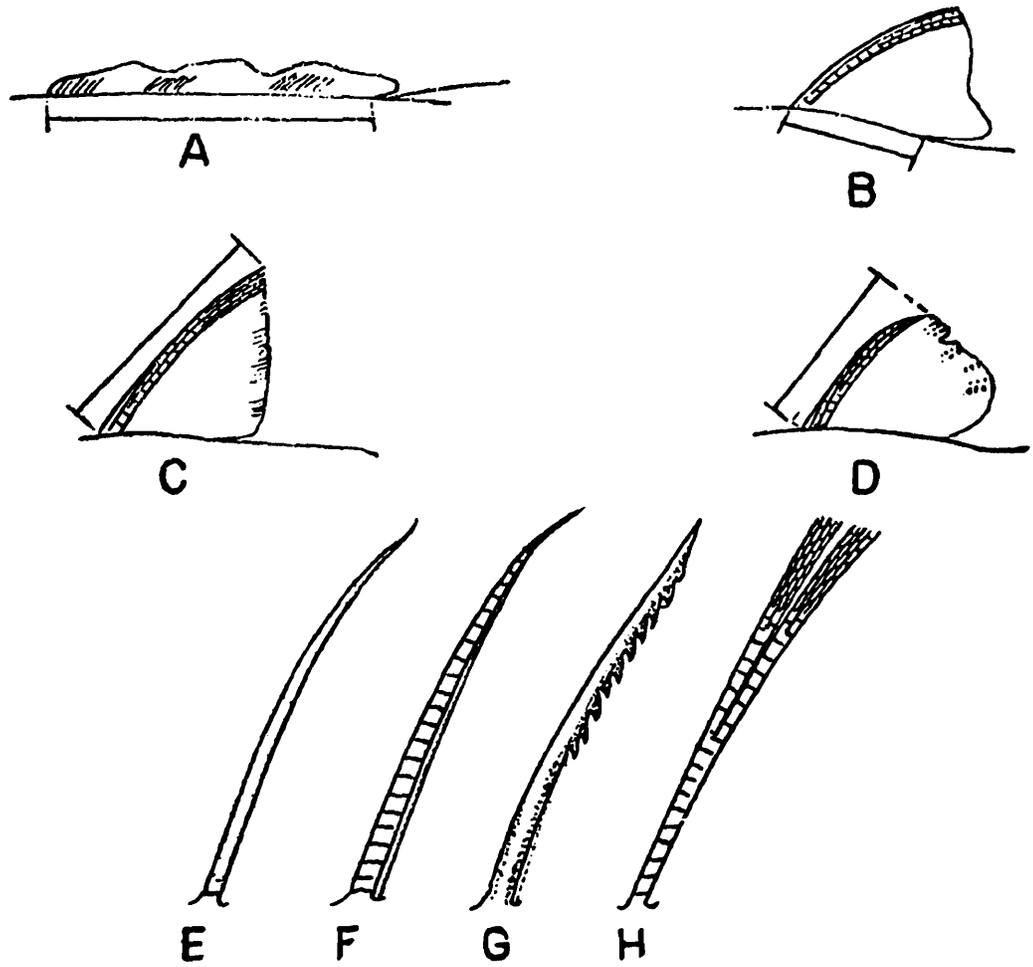


Fig. 5. Outline sketches to show different types of fins and "rays"
A = Long dorsal fin.
B = Short dorsal fin. C = High dorsal fin. D = Low dorsal fin.
E = Simple unbranched ray. F = Thickened or principal ray.
G = Serrated spinous ray. H = Branched ray.

WIDTH OF PREMAXILLARY TEETH BAND—the maximum width of the band.

LENGTH OF OCCIPITAL PROCESS (Fig. 4B)—the distance from the point of origin or base of the occipital process on the supraoccipital bone to its posteriormost tip where it meets the basal bone of the dorsal fin, the latter is excluded. Where it meets the interneural shield, (Fig. 4A) the shield is excluded.

WIDTH OF BASE OF OCCIPITAL PROCESS—the maximum width at base of occipital process where it originates from the supraoccipital bone.

Counts

The accurate enumeration of meristic data or counts of fin rays is of diagnostic importance. Great care should be taken to count accurately the simple and branched rays and present the data in charts of frequency distribution wherever possible.

The important counts are :

Fin Rays—All paired and median fins in teleosts have long, mobile filament like prolongations called rays. The movements of the fins are due to the action of the muscles, these movements being possible because of the articulations and often flexibility of these rays. The term "ray" also applies to spines whether they are included within the membrane of a fin or not.

Three chief types of fin rays are encountered :

Soft Ray (H, Fig. 5)—are often very thin, flexible and most often branched.

Hard Rays (F, Fig. 5)—are a number of soft rays united solidly to compose hard rays which are rigid and sometimes sharply pointed. These are formed of cartilage, and when freed from the membranous sheath holding them, clearly show the juxtaposed soft rays. Some of perches and sisorids have such hard rays. The outermost caudal fin ray called the principal ray is also a hard ray (see Fig. 6).

Spinous Rays (G, Fig. 5)—are made of bone tissues, and are harder and stronger than rays. These are usually not covered by the membrane of the fin and often are with serrations or teeth. They are common in catfishes.

Simple Ray (E, Fig. 5)—is either soft or hard but without any branching at its tip or elsewhere ; in the anal fins often these rays remain within the membranous covering and should be teased out.

Branched Ray (H, Fig. 5)—is as the term indicates with branches either from the base or middle or tip of the ray.

Rudimentary Ray—is an undeveloped ray grading into different stages of a developed one. If included in the count, it should be specifically mentioned.

Caudal Fin Rays (Fig. 6)—are counted separately for the principal rays and the branched rays in each lobe.

Pectoral and Pelvic Fin Rays—are counted including the smallest one at the inner end of the fin base. A good magnification is often needed for this count.

LATERAL LINE SCALE COUNT (Fig. 2B)—the number of scales or pores along the lateral line up to the structural caudal base or end of hypural plate or at the flexure line of the body. The scales wholly on the caudal fin base or beyond this point are excluded. Where the flexure line cuts a scale, depending upon the front or behind of the midline of the scale, the count is made. If the cut is behind the midline of the scale it is included. Indicated as L. L. or L. 1. in fin formulae.

If the line is incomplete or absent, or if all the scales do not have pores or perforations the scales themselves may be counted along the normal course of line. Near the head the first scale to be

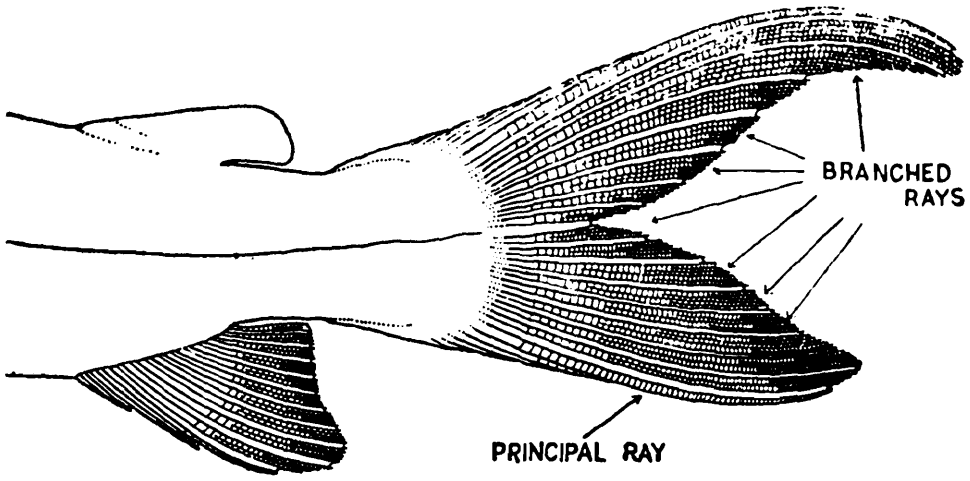


Fig. 6. Outline drawing of the caudal fin of a Bagrid fish to show the principal and branched rays.

counted is the one which touches the pectoral girdle and which is followed by a scale which does not touch it.

SCALES FROM THE BACK TO LATERAL LINE (Fig.2A)—generally the count is taken from the insertion of the first dorsal fin including the small scales, counting *downward and backward following the natural scale row* to but not including the lateral line scale.

SCALES BELOW LATERAL LINE OR FROM LATERAL LINE TO PELVIC BASE (Fig. 2A)-are counted as above but from below upwards and forward from base of pelvic to lateral line. Small scales are included. The scale nearest the pelvic fin is counted as half when it is so. When counting upward and forward, if the scale rows are found wavy backward and forwards, the backward rows are taken.

PREDORSAL SCALES (Fig. 2A)—the number of scales from the origin of the dorsal fin to the occiput. All scales which wholly or partly intercept the straight midline running from the origin of the dorsal fin to occiput is taken, Indicated as P. D. S. in fin formulae.

SCALES IN TRANSVERSE SERIES—where the lateral line is absent, the number of transverse rows of scales between the ccciput and the structural base of the caudal fin is counted. Indicated as L. r. in fin formulae.

CIRCUMPEDUNCULAR SCALES—scales around the least depth of caudal peduncle. It is always better and useful to indicate the number of circumpeduncular scales above and below the lateral line.

BRANCHIOSTEGAL RAYS—numerous tiny thin bones arranged fanwise from the lower edge of the opercle to the ventral surface of the head and covered by the branchiostegal membrane. Care should be taken to include the most anterior branchiostegals which are likely to be very short, slender and hidden.

GILL RAKERS (C, D, E, Fig. 7)—thin needle like filamentous prolongations on the gill arches. For count purposes, the rakers on the first arch

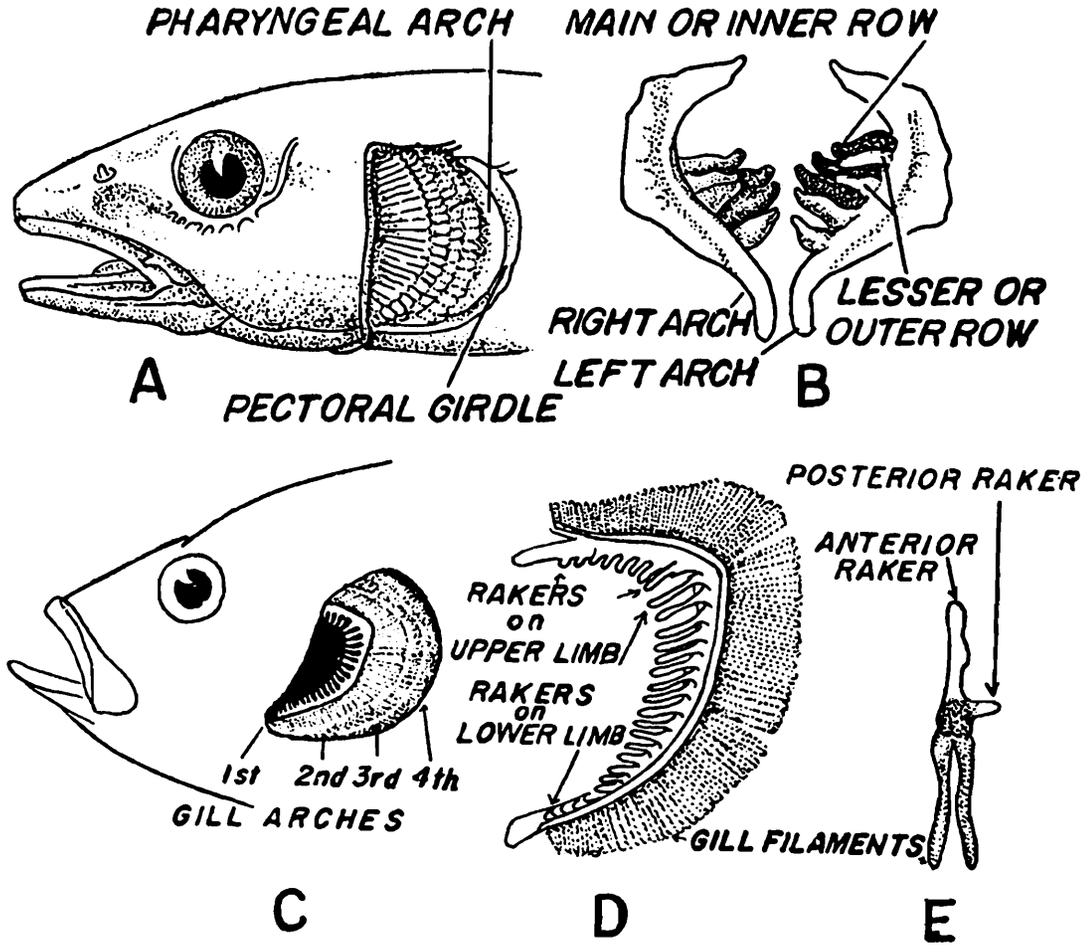


Fig. 7. Outline drawing to show A, position of pharyngeal arch ; B, pharyngeal teeth ; C, position of gill arches ; D, side view of the first gill arch ; E, top view of cross section of 1st gill arch. (After Miller, D. J. and Lea, R. N. 1972. *Fish. Bull.* 157, California Dept. of Fish and Game).

is taken. If the counts of both the upper and lower limbs of the gill arch are taken they are separated by a plus (+) sign ; generally

the lower limb alone is considered. If rudiments are included this fact should also be mentioned.

PHARYNGEAL TEETH (A, B, Fig. 7)—"throat teeth" borne on two bones which are modified fifth gill arches, each with one to three rows of teeth. The teeth in each row are counted and are indicated in formula in order from left to right. For example 2, 5—4, 2 would indicate that the pharyngeal bone of the left side has two teeth in the outer row, five in the inner whereas the right bone has only four teeth in the inner row and two in the outer. The formula 3—3 would show that no teeth are developed in the outer row. The number and series of pharyngeal teeth are of classificatory value.

Class PISCES

Subclass TELEOSTOMI

Endoskeleton bony, sometimes cartilaginous. Membrane bones of head well developed. Skull hyostylic, sometimes amphistylic. Skull with sutures. Endocranium ossified. Optic nerves forming solid chiasma or not forming solid chiasma. Palato-quadrate not fused with endocranium. Fin rays with pterygials. Four pairs of gill arches ; 5th pair modified into tooth-bearing lower pharyngeal. Gills with outer edges free ; their bases attached to bony arches. A single lateral gill opening on either side of pharynx covered by operculum or a single ventral gill opening in pharynx. Heart divided into auricle, ventricle and arterial bulb. Arterial bulb either muscular with numerous valves or thin with a pair of opposite valves. Branchial septa reduced.

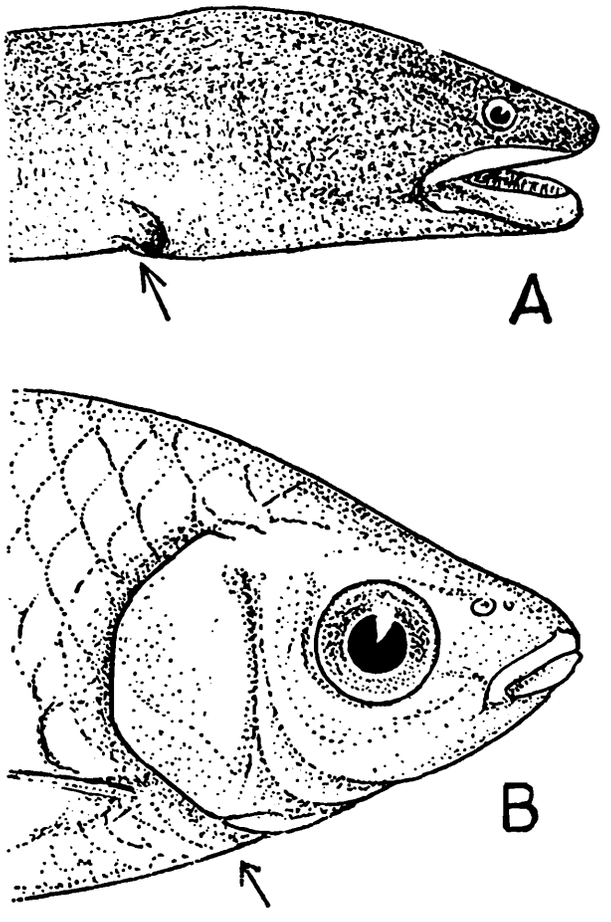


Fig. 8. A. Anterior part of head of *Anguilla bengalensis* to show slit like small gill openings.
B. Anterior part of head of *Puntius sophore* to show gill membranes and wide slits.

Branchial lamellae with double row of branchial rays. No intestinal valve. No nictitating membrane. Air-bladder or lung. No cloaca

except in *Nerophis aequoreus* (L.) (Syngnathidae). No pterygopodia but some with gonopodium. Ova small. Mostly oviparous ; a few viviparous.

Lower Devonian to recent.

Three cohorts, seven superorders and 16 orders are dealt with here.

KEY TO ORDERS

1. Body elongated, more or less cylindrical, eel-like, long drawn out. (Fig. 9A) 2

   —Body not elongated, fusiform, compressed not eel-like. (Fig. 9B) 6

2. Gill openings small, confluent into transverse or round slits or moderately wide. 3

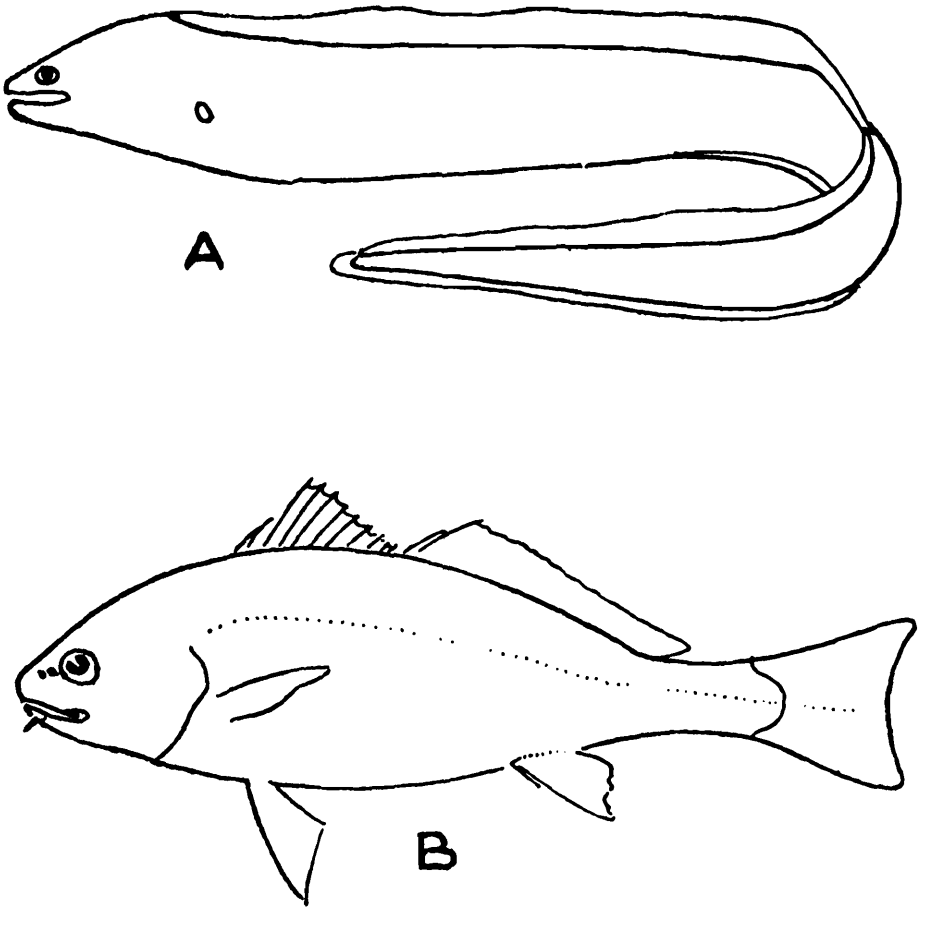


Fig. 9. A. Body eel-like *Anguilla*

B. Body fusiform.

   —Gill openings as wide, lateroventral slits with membranes. 5

3. Body smooth with minute scales. Snout not produced. Teeth present. ... SYNBRANCHIFORMES

—Body with a dermal segmental skeleton of bony scutes and forming rings round the body. Snout produced. Teeth absent. 4

4. Branchiostegal rays six. Lower jaw elongated. INDOSTOMIFORMES

—Branchiostegal rays not more than three. Lower jaw not elongated. ... GASTEROSTEIFORMES

5. Pelvic girdle and fins absent. ... MASTACEMBELIFORMES

—Pelvic girdle and fins present. 6

6. Dorsal and anal fins far from caudal. Gill openings wide, membranes of two sides connected beneath the isthmus. Scales moderately large. (Fig. 10) ... CHANNIFORMES (=OPHIOCEPHLIFORMES

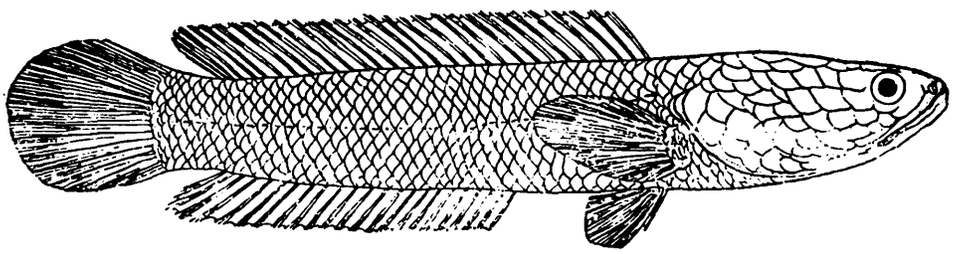


Fig. 10. Lateral view of *Channa punctatus*. (After Hora, S. L. 1951, *J. Asiat. Soc. Beng.* **17**, pl. 19, fig. 7).

—Dorsal and anal fins confluent with caudal when latter is present. (Absent in Ophichthidae). Gill openings of moderate extent situated nearer base of pectoral fins. Scales present or absent, when present small imbeded in skin. ... ANGUILLIFORMES

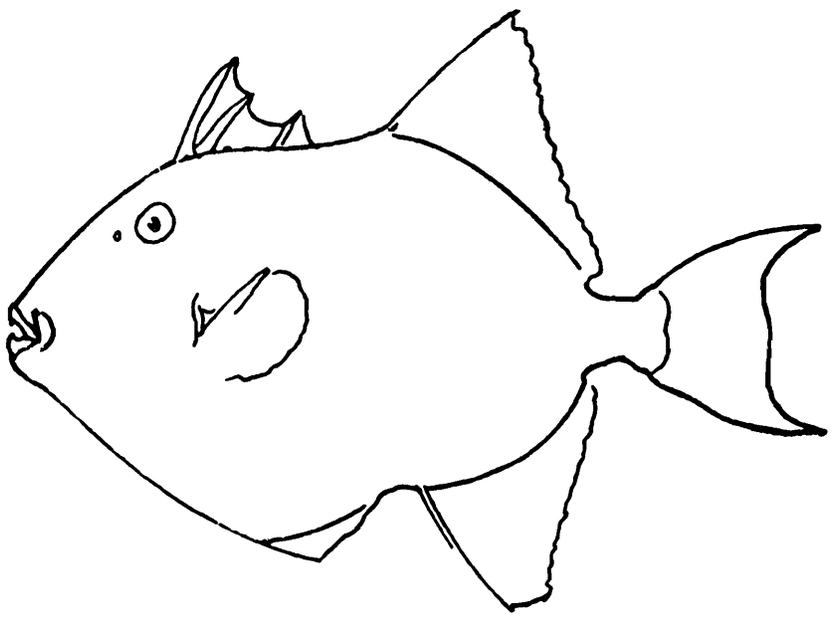


Fig. 11. Outline drawing of *Tetraodon* to show deep body, and narrow mouth.

7. Body short, rounded. Bones of upper and lower jaw in the form of a beak having a cutting edge, and covered with a layer of ivory-like substance. (Fig. 11) ... TETRAODONTIFORMES

— Body fusiform. Bones of upper and lower jaw normal without any modifications as above. 8

8. Skin without scales, either smooth or covered with osseous plates or with scattered tubercles. Pectoral fins with outermost ray modified into osseous spine or thick ray. ... SILURIFORMES

— Skin scaled or rarely without scales, but never with osseous plates. Pectoral fins without any such modifications. 9

9. Abdominal edge keeled with double or single serrations. 10

— Abdominal edge smooth, rounded. 11

10. Lateral line present. Abdomen with double serrations. ... OSTEOGLOSSIFORMES

— Lateral line absent. Abdomen with single serration. (Fig. 12) ... CLUPEIFORMES

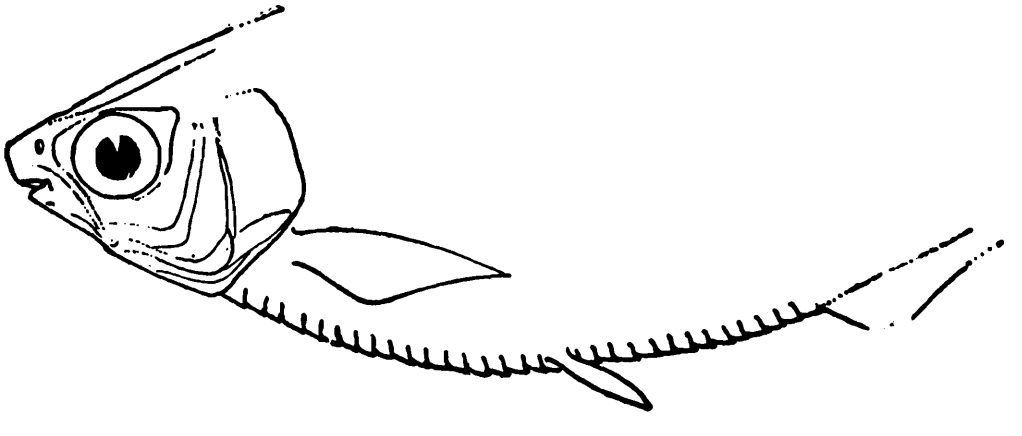


Fig. 12. Outline drawing of the ventral edge of *Goniolosa manmina* to show the nature of abdominal scutes. (After Hora, S. L. & Mukerji, D. D. 1938).

11. An osseous gular plate at symphysis of lower jaw covering the intermediate area present. (Fig. 13) ELOPIFORMES

— Gular plate absent. 12

12. An adipose dorsal fin present. (Fig. 14) ... SALMONIFORMES

— An adipose dorsal fin absent. 13

13. Gill membranes entirely united below and not attached to isthmus. An accessory branchial organ in a recess behind the true gill cavity present. Jaws without teeth. ... GONORHYNCHIFORMES

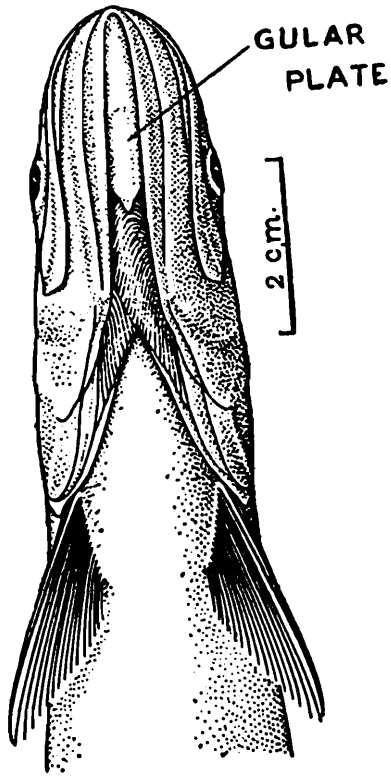


Fig. 13. Ventral view of head and anterior part of *Elops machnata* (Forskal) to show the gular plate.

— Gill membranes free. No accessory branchial organ present. Jaws with teeth. 14

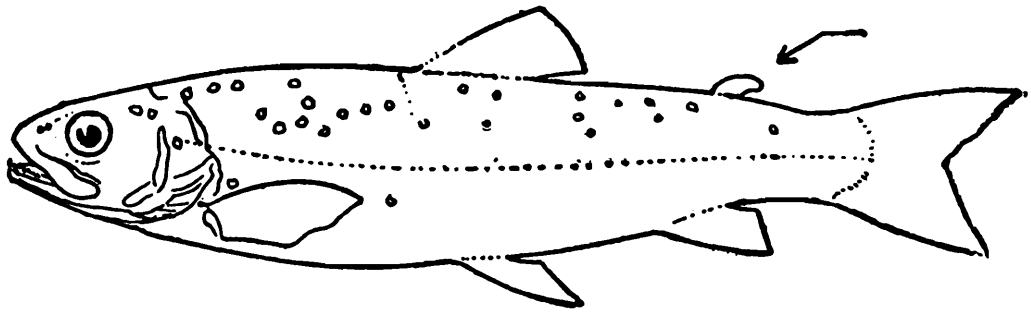


Fig. 14. Outline sketch of *Salmo gairdneri gairdneri* to show presence of adipose dorsal fin.

14. Pelvic fins inserted in the abdominal region and without spines. Dorsal and anal fins without spines. Mostly a single dorsal fin. 15

— Pelvic fins inserted in the thoracic region and with spines. Dorsal and anal fins with spines. Mostly dorsal fin in two parts, continuous or separate, one spiny another with rays. (Fig. 15) PERCIFORMES

15. Scales on head and body. Teeth present on jaws. ... ATHERINIFORMES

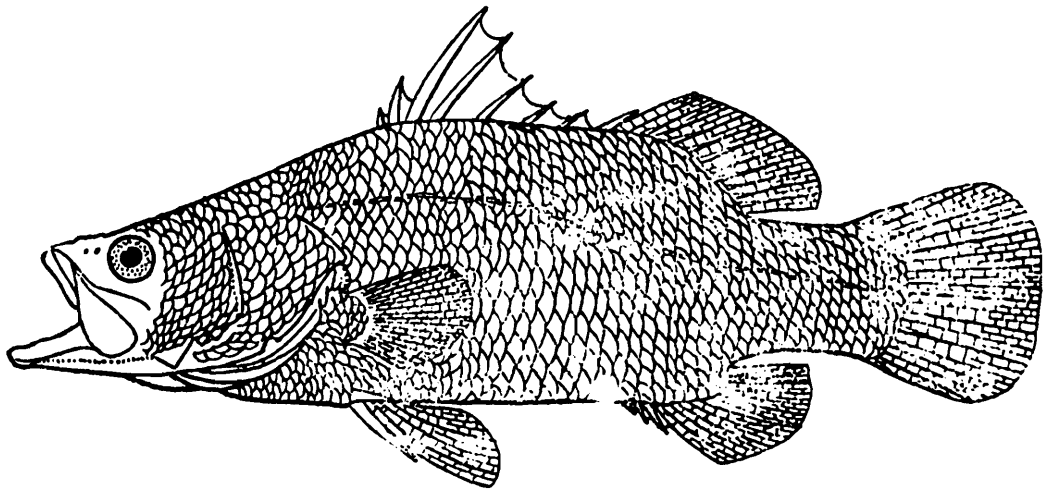


Fig. 15. Lateral view of *Lates calcarifer* (Hamilton). (After Misra, K. S. 1962, text-fig. 136).

— No scales on head. No teeth on the jaws. ... CYPRINIFORMES



Fig. 16. Lateral view of *Strongylura strongylura* (van Hasselt) (After Misra, K. S. 1962, text-fig 115).

Cohart TAENIOPAEDIA Greenwood *et al.* 1967

(Type-genus *Elops* Linnaeus)

A short, broad and arcuate maxilla equipped with large movable supramaxilla in association with a high coronoid process on the dentary and articular present. Maxillary teeth that are seldom excluded from the gape of the mouth even partially present. Parasphenoid and pterygoid teeth developed. Basicranium with numerous separate introsseous passages for the parts of the fifth and seventh cranial nerves and certain major blood vessels. A full complement of intermuscular bones developed. Caudal fin when present with hypural supports on one to four centra. A functional ductus pneumaticus present. Air-bladder connected with otic region through bilateral prolongations of the bladder. An ethmoidal commissure of the cephalic lateral line system developed. A recessus lateralis formed by the confluenze between preopercular and infraorbital cephalic lateral line canals present. Larva leptocephalus. (After Greenwood *et al.* 1966).

Superorder ELOPOMORPHA

Gular plate present in non eel-like representatives. Branchiostegals usually very numerous. Mesocoracoid arch present only in the non eel-like forms. Hypurals when present, on three or more centra. Ethmoidal commissure present or in modified state in many groups. Opercular series often reduced or even absent. Larva when known, a leptocephalus. (After Greenwood *et al.* 1966).

Two orders are dealt with here.

Order ELOPIFORMES

Body with thin, small scales. Head without scales. Mouth not protractile. *A gular plate present in non eel-like representatives* (as the genera dealt wtth in this work). Two supramaxillaries. Villiform teeth on jaws and palate. Mesocoracoid present in genera dealt with here. Opercular series often reduced or even absent. Branchiostegals usually very numerous. A single dorsal fin without any spine. No adipose dorsal fin. Pseudobranchiae present. Hypurals when present on three or more centra. Young pass through a metamorphosis ; larva when known is a leptocephalus. Lateral line complete. Scales cycloid. Ear-air-bladder linkage present only in *Megalops*. The cranial air-bladder diverticula are lodged within bullae formed principally from to intercalare of each side.

Mostly marine fishes, of extremely diverse types, many of the modern species being eel-like. Known from lower cretaceous to recent era as fossils. These are sometimes classified with the primitive holostean fishes.

Two families and two genera are dealt with here.

KEY TO FAMILIES

1. Body elongate and compressed. Scales small, 95-100 along lateral line. Anal fin short, with 15-17 rays. Dorsal fin ray simple. ... ELOPIDAE
   (Genus *Elops* Linnaeus)

   Body oblong and compressed. Scales large, 37-42 along with 24-27 rays. Dorsal fin ray elongated. ... MEGALOPIDAE
   (Genus *Megalops* Commerson)

Family ELOPIDAE

Lady fishes

A very primitive group of fishes of diverse types, sometimes classified with the holostean fishes.

Head scaleless. Two supramaxillaries. *An osseous gular plate attached to the junction of the mandible covering the intermediate area* (Fig. 13). Gill membranes free, separated, *opercular bones often reduced or even absent*. No barbels. Pectoral radials in one row. A single dorsal fin. Anal fin placed behind ends of inner margin of dorsal fin. Lateral line distinct. Pyloric appendages many. Larva when known is a leptocephalus.

Other characters as in genus.

Tropical and subtropical seas.

A single genus is dealt with here.

Genus **Elops** Linnaeus

Elops Linnaeus 1766, *Syst. Nat.* **1**, p. 518 (type-species, *Elops saurus* Linnaeus, by monotypy).—Misra, 1976, *Fauna of India*, Ed. 2, **2**, p. 8.

Diagnosis.—Body elongate, compressed. Abdomen wide. Head long, compressed. Snout sharp. Mouth wide, anterior, cleft oblique, extending to behind posterior margin of eyes. Eyes large, lateral, in anterior part of head, not visible from below ventral surface. Lips thin. Lower jaw slightly longer. Villiform teeth on jaws, palate, and also on

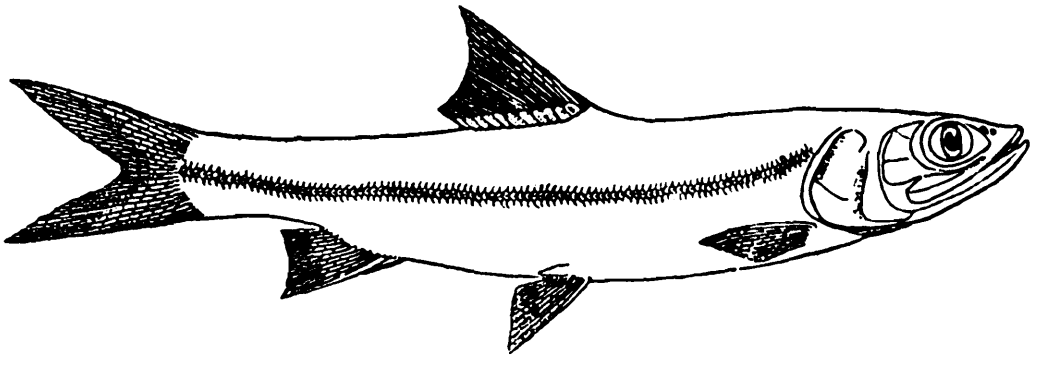


Fig. 17. Lateral view of *Elops machnata* (Forskal). (After Misra, K. S. 1962, text-fig. 32).

tongue and base of skull. Dorsal fin inserted slightly ahead of pelvic fins with 20—25 rays and no spine. Anal fin with 15—17 rays. Caudal fin deeply lobed. *Scales* small, *a few fine rows forming a sort of sheath to dorsal, anal fins and over caudal root*. Lateral line distinct, complete, with 95-100 scales.

Distribution.—India. Pakistan. Sri Lanka. Tropical and subtropical seas. Often recorded from freshwater.

Species visiting freshwater.—*Elops machnata* (Forskäl) is the single species so far known from the Indian region.

Family Megalopidae

Tarpons

Head scaleless. Two supramaxillaries. *Osseous gular plate at junction of mandibles narrow, but covering the intervening area.* Branchiostegals numerous. Pseudobranchiae absent. Gill membranes entirely separated. No barbels. Pectoral radials in two rows. Anal fin with 22-29 rays not behind ends of inner margin of dorsal. Lateral line distinct.

Other characters as in genus.

Indian and Pacific oceans.

A single genus is dealt with here.

Genus **Megalops** Lacépède

Megalops Lacépède, 1803, *Hist. nat. Poiss.*, **5**, p. 289 (type-species, *Megalops filamentosus* Lacépède = *Clupea cyprinoides* Broussonet, by monotypy). —Misra, 1976, *Fauna of India*, Ed. 2, **2**, p. 12.

Diagnosis.—Body oblong and compressed. Abdomen rounded. Head large, compressed. Snout blunt. Mouth anterior, cleft not very wide. Eyes large, lateral, in middle of head, not visible from below ventral surface. Lips thin. Lower jaw prominent, longer than upper. Villiform

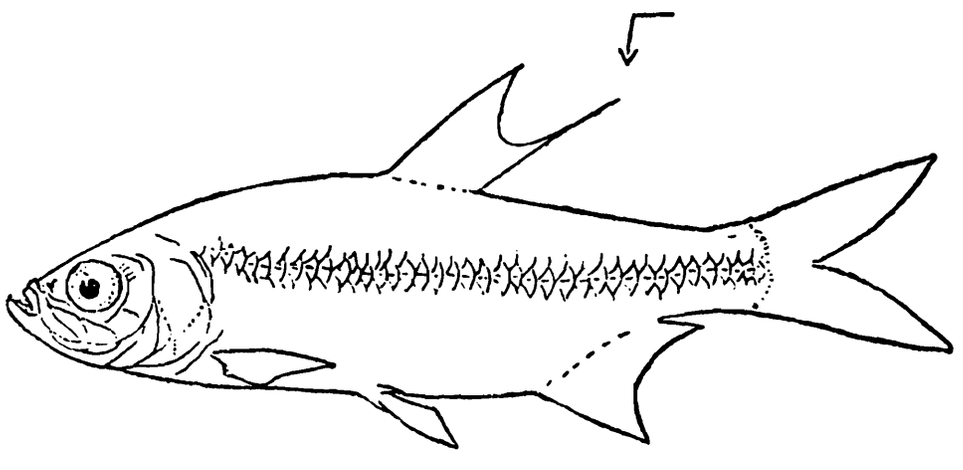


Fig. 18. Outline sketch of *Megalops cyprinoides* (Broussonet) to show the elongated last dorsal fin ray.

teeth on jaws, palate and also on tongue and base of skull. *Dorsal fin* inserted above pelvic base, with 19-21 rays, *last ray prolonged*, and

no spine. Anal fin with 24-27 rays. Caudal fin deeply forked. Scales large, brilliantly silver in color. Lateral line straight, complete, with 37-42 scales and branched tubes.

Distribution.—Indian and Pacific Oceans and estuaries of India, Bangladesh, Burma, Thailand and Sri Lanka. Often captured in the major rivers of India ; common in tanks.

Species visiting freshwater.—Megalops cyprinoides (Broussonet) is the single species so far known.

Order ANGUILLIFORMES

Body eel-like, smooth, with minute or rudimentary scales imbeded in skin or absent. Margin of upper jaw made up anteriorly of premaxillaries. Maxillaries with teeth. *Gill openings in the pharynx as narrow or wide slits.* Premaxilla fused with the ethmoid. Opercular elements reduced. Humeral arch free, not attached to skull. Teeth present on jaws and palate. Vertical fins when present, confluent or separated

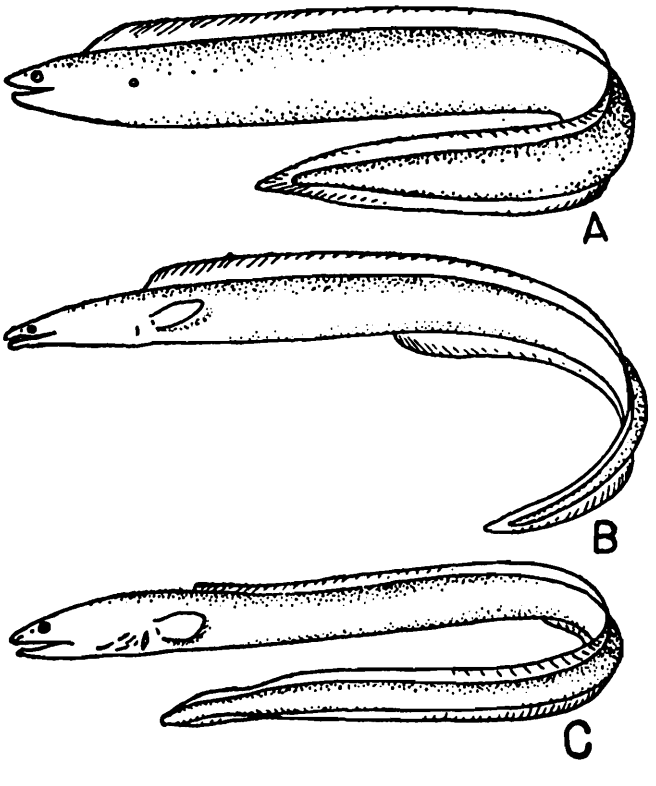


Fig. 19. Outline sketch to illustrate families A. Muraenidae ; B. Muranesocidae ; C. Ophichthidae.

from caudal. Pectoral fins laterally inserted when present. *Pelvic fins absent.* Vent close to root of pectoral fins or a long distance posterior to head. No pyloric appendages. Ovaries without oviducts. Larva a leptocephalus.

Neurocranium well ossified. A supraoccipital is usually developed.

The hyo-palatine arch consists of hyomandibular, quadrate and palatopterygoid only, the last may be reduced as a thin lamina or absent. The hyomandibula and quadrate have an intimate interlocking union. A symplectic is absent.

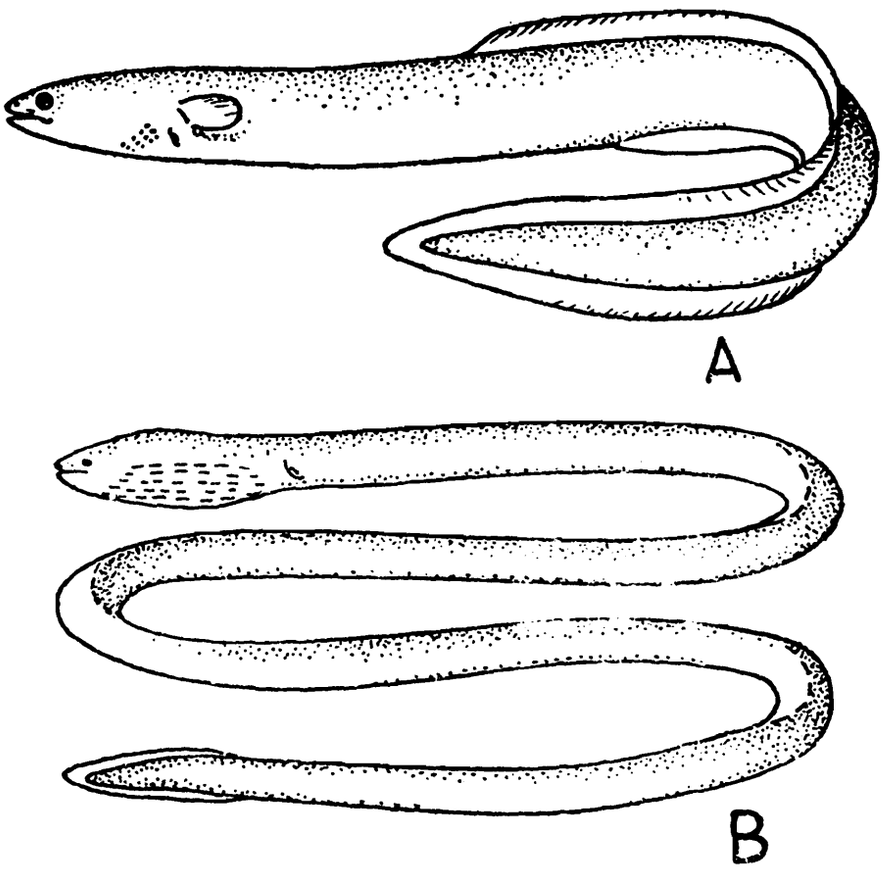


Fig. 20. Outline sketches to illustrate families A. Anguillidae ; B. Moringuidae

Five families and eight genera are dealt with here.

KEY TO FAMILIES*

1.	Branchial openings in pharynx in the form of narrow slits. Pectoral fins absent. ...	MURAENIDAE (Fig. 19A)
	Branchial openings in pharynx in the form of wide slits. Pectoral fins present or much reduced. ...	... 2
2.	Dorsal and anal fins not extending to end of caudal. Caudal fin absent. ...	OPHICHTHIDAE (Fig. 19C)
	Dorsal and anal fins confluent with caudal. ...	... 3
3.	Dorsal fin inserted above or in advance of gill openings. ...	MURAENESOCIDAE (Fig. 19B)

* Applicable only to the freshwater species dealt with here.

	Dorsal fin inserted far behind gill openings. ...	... 4
4.	Body without scales. ...	MORINGUIDAE (Fig. 20B)
	Body with minute, rudimentary scales, embedded in the skin. ...	ANGUILLIDAE (Fig. 20A)

Family ANGUILLIDAE

Freshwater Eels

Diagnosis.—Gill openings situated in the pharynx in the form of moderate slits near base of pectoral fins. Nostrils lateral or superior. Tongue free. Dorsal fin commences at some distance behind nape, far behind gill openings. *Pectoral fins present.* Vertical fins confluent. Lateral line present.

Freshwaters throughout the World but not in areas bordering the Arabic region and S. Atlantic or on W. coast of the American continent.

Other characters as in genus.

A single genus is dealt with here.

Genus **Anguilla** Shaw

Anguilla Shaw, 1803, *General Zoology*, **4**, p. 15 (type-species, *Anguilla vulgaris* Shaw).

Diagnosis.—Body elongate, cylindrical, band-shaped, broader than body. Abdomen rounded. Head long, compressed. Snout pointed. Mouth terminal, cleft of mouth wide, extending to posterior margin of orbit. Eyes very small, superior, in middle of head, not visible from below ventral surface. Lips thick, well developed. Jaws equal. *Villiform teeth on jaws and palate.* Dorsal fin inserted nearer tip of snout than caudal base, with 220-305 rays and no spine. Anal fin equally long, with 200-250 rays. *Caudal fin continued round the end of tail. Scales rudimentary, imbedded in the skin.*

Distribution.—Throughout India. Pakistan. Bangladesh. Burma. Common in the Oceanic Islands of the Indian Ocean.

Species visiting freshwater.—

1. *A. bengalensis bengalensis* (Gray & Hardwicke)—Islands of Indian Ocean. India. Pakistan. Bangladesh. Sri Lanka. Burma. Malay Archipelago. Formosa and the Pacific.
2. *A. bicolor bicolor* Mc Clelland—Coasts of India. Bangladesh to Malay Archipelago.

KEY TO SPECIES

1. Dorsal fin inserted midway between gill-opening and origin of anal fin. Adult coloration variegated. ... *A. bengalensis bengalensis*

   Dorsal fin inserted above or slightly anterior or posterior to vent. Plain coloration. ... *A. bicolor bicolor*

Family MORINGUIDAE

Worm Eels

Gill openings in the pharynx as wide slits, narrow and inferior. Posterior nostril in front of eye. Tongue not free. *Pectoral fins small, when present.* Anal fin limited to caudal region and continuous with it.

Estuaries of Ganga (India), Bangladesh to Malay Archipelago.

A single genus is dealt with here.

Genus **Moringua** Gray

=*Rataboura* Gray

Moringua Gray, 1831, *Zool. Misc.*, p. 9 (type-species, *Moringua lateralis* Gray).

Diagnosis.—Body cylindrical, worm-like. Abdomen rounded. Head short, ovate. Snout pointed, compressed. Mouth terminal, cleft narrow. Eyes small, superior, in middle of head, not visible from below ventral surface. Lips thick. Jaws equal. Teeth villiform, in a single row on jaws and palate, pointed backwards. Dorsal fin slightly developed, inserted far backwards, behind vent, very low. Anal fin also very low *both fins interrupted in the middle. Caudal fin joined by dorsal and anal fins to a blunt paddle-like end. No scales. Lateral line distinct.*

Distribution.—India : Gangetic estuary, W. Bengal. Bangladesh. Malay Archipelago.

Species visiting freshwater.—*Moringua raitaborua* (Hamilton).—distribution as of the genus.

Family MURAENIDAE

Moray Eels

Gill openings situated in the pharynx in the form of narrow slits. A tubular nostril on either side of the upper surface of the snout. *Posterior nostril a round foramen between or opposite eyes, with or without a tube.*

Teeth villiform or molariform on jaws and palate. *Pectoral fins absent.* Scales absent. Vertical fins confluent.

Other characters as in genus.

A single genus is dealt with here.

Seas of temperate and tropical region. A few species ascend tidal rivers.

Genus **Lycodontis** McClelland

Lycodontis McClelland, 1844. *J. nat. Hist. Calcutta,* 5. p. 173 (type-species, *L. literata* McClelland).

Diagnosis.—Body cylindrical, much elongated, compressed. Abdomen rounded. Head large, conical, compressed. Snout sharply conical. *Hind nostril not tubular.* Mouth terminal, wide, cleft extending to behind posterior margin of eyes. Eyes small, situated midway between angle of mouth and end of snout, not visible from below ventral surface. Lips thick, well developed. Jaws equal. *Teeth well developed, acute, or molariform ; maxillary teeth in one or two rows, sharp in the form of depressible canines.* Dorsal fin inserted near tip of snout may or may not be elevated. Anal fin long, similar to dorsal. *Caudal fin continuous with dorsal and anal, in the form of a whip like tail.* Scales small.

Distribution.—Throughout India, Pakistan, Bangladesh, Burma.

Species visiting freshwater.—

1. *L. afer* Bloch—Red Sea. India : Tranquebar (Day, 1878). Indian Ocean, Australia.
2. *L. tile* (Hamilton)—India : West Bengal. Common in Hooghly.

KEY TO SPECIES

1.	Teeth in two rows. Body brownish yellow in colour, with fine white spots, streaks or marks, which may be absent in adult specimens. ...	*L. tile*
	Teeth in a single row. Body brownish black or blotched without any streaks or marks. ...	*L. afer*

Family MURAENOSOCIDAE

Pike Eels

Gill openings situated in the pharynx in the form of wide slits nearing to the abdomen. Nostrils superior. Teeth on jaws and palate. *Anal and*

cuudal fin well developed ; *pectoral fin present or reduced*, dorsal and anal fins confluent with caudal. Pelvic fins absent. No scales.

Other characters as in genus.

Tropical seas, a few species found in estuaries.

Two genera are dealt with here.

KEY TO GENERA*

1. Principal vomerine teeth large, compressed, moderately acute, each with sharp anterior and posterior edges and prominent basal cusps, the teeth in contact or separated ; principal teeth on lower jaw of the same form, erect or turned slightly inwards ...	*Muraenesox* McClelland
Principal vomerine teeth large, round in section, very acute, each with minute cusps distally, the teeth widely separated ; principal teeth on lower jaw of the same form, directed almost horizontally outwards. ...	*Congresox* Gill

Genus **Muraenesox** McClelland

Muraenesox McClelland, 1843, *Calcutta J. nat. Hist.*, **4** p. 409 (type-species, *Muraenesox tricuspidata* McClelland).

Diagnosis.—Body much elongated, compressed. Abdomen rounded. Head long, pointed, compressed. Snout sharply pointed. Mouth wide, cleft extending to much beyond posterior margin of eyes. Eyes moderate, lateral, in anterior part of head, not visible from below ventral surface. Lips thick, well developed. Jaws equal. *Large teeth on jaws with some canines anteriorly* ; palate (*vomer*) with *several rows of teeth, middle ones large and conical.* Dorsal fin inserted above gill openings, with 230—285 rays, much elevated, no spine, confluent with caudal. Pectorals present. Anal fin continued round the end of tail. *No scales.*

Distribution.—Throughout India, Pakistan, Bangladesh, Burma.

Species visiting freshwater.—

1. *M. bagio* (Hamilton)—Throughout the Indo-Pacific from Sydney to Western Oceania and Japan.
2. *M. cinereus* (Forskal)—Red Sea and throughout the northern Indian Ocean to Indonesia and northwards to Japan.

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*After Castle, P. H. J. & Williamson, G. R. 1975. *Spl. Publication* No. 15, *J. L. B. Inst. of Ichthyology.*

KEY TO SPECIES

1. Dorsal fin rays before a vertical through anus 47—59, lateral line pores before anus 33—39, interorbital space width about 10.7 in head length. ...	*M. bagio*
Dorsal fin rays before a vertical through anus 66—78, lateral line pores before anus 40—47, interorbital space width about 8.2 in head length. ...	*M. cinereus*

Genus **Congresox** Gill*

Congresox Gill, 1890, *Proc. U. S. nat. Mus.*, **13**, p. 231 (type-species, *Conger talabon* Cuvier, by original designation).

Diagnosis.—Similar to *Muraenosox,* but chiefly differing in the principal vomerine teeth being very acute, round in section, with only minute distal cusps and basally quite separate ; the teeth on the dentary are essentially in three rows of which the external row consists of prominent, sharp, laterally directed teeth of the some form as those on the medial row of the vomer. Pectorals present.

Distribution.—Red Sea to India, Pakistan, Bangladesh, Indonesia, S. E. Asia and China.

Species visiting freshwater.—

1. *C. talabon* (Cuvier)—India to Indonesia and S. E. Asia. Occasionally obtained in estuaries. Frequently caught in Hooghly estuary.

2. *C. talabonoides* (Bleeker)—Red Sea to India, Indonesia, S. E. Asia and China. Occasionaly caught in Hooghly estuary, but rarer than *talabon.*

KEY TO SPECIES

1. Dorsal fin rays before vertical through anus 57—68, pectoral fin length about 4.1 in head length, lateral line pores before anus 35—40 ...	*C. talabonoides*
Dorsal fin rays before vertical through anus 70—75, pectoral fin length about 3.2 in head length, lateral line pores before anus 41 or 42.	*C. talabon*

*For a number of years this genus was considered as synonymous with *Muraenosox*. The dentition and marked osteological differences has warranted the revival of this genus. (See Castle & Williamson ,1975).

Family OPHICHTHIDAE

Snake eel

Diagnosis.—Gill openings situated in pharynx in the form of wide slits. Posterior *nostrils labial.* Tongue not free. Teeth on jaws and palate. Pectoral fins and anal fin may be reduced. End of tail free, blunt without any fin rays. *Scales absent.*

Other characters as in genera.

Seas and estuaries of India, Bangladesh, Burma to Malaysia.

Three genera are dealt with here.

KEY TO GENERA

1.	Dorsal fin origin far forwards on head. ...	*Bascanichthys* Jordan & Davis
	Dorsal fin origin above gill opening or behind. ...	2
2.	Gill openings lateral, teeth granular, especially on vomer. ...	*Pisodonophis* Kaup
	Gill opening entirely ventral, teeth villiform	*Lamnostoma* McClelland

Genus **Pisodonophis*** Kaup

Boro fish

Pisodonophis Kaup, 1856, *Catalogue of the apodal fish in the collection of the British Museum*, p. 15 (type-species, *Pisodonophis cancrivorus* Richardson, by subsequent designation)—McCosker, 1977. *Proc. California Acad. Sci.* (4) **14**, No. 1, 123 pp. (revision).

Diagnosis.—Body long, snake-like, compressed, cylindrical. Abdomen rounded. Head short, compressed, conical. *Snout obtuse, greatly or*

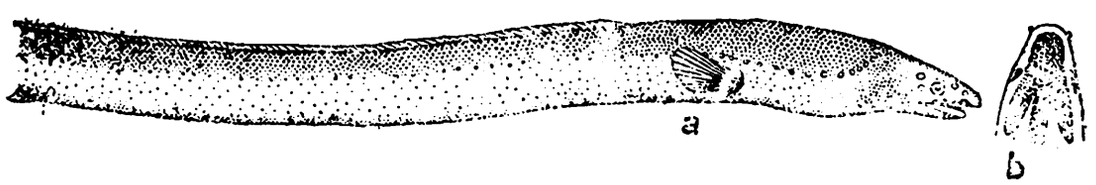


Fig. 21. Lateral view of *Pisodonophis boro* (Hamilton). (After Misra, K. S. 1962, Text-fig. 114).

moderately produced. Mouth terminal, cleft of mouth wide or medium. Eyes small, lateral, in middle of head not visible from below ventral

*The original spelling is *Pisodonophis*, but Kaup added later another "o" spelling it *Pisoodonophis*. The first-published spelling which is not on any account invalid is used here.

surface. Lips may or may not be fringed. Jaws equal. Villform teeth on jaws and vomer, either pointed and granular, or small and conical, in upper jaw in the form of one to four rows or band ; in the lower jaw in one or two rows ; *canines present or absent* ; dentition variable. Dorsal fin low, when present, inserted above gill opening, or behind tip of pectoral fin, with 300—500 rays, no spine. Anal fin low, present or absent, with 250—320 rays. No caudal fin, dorsal and anal fins end before tip of body.

Distribution.—Seas and estuaries throughout India, Pakistan, Bangladesh, Burma to Malaysia.

Species visiting freshwater.—

1. *P. boro* Hamilton.—India : Ganga and its tributaries. Bangladesh.
2. *P. cancrivorus* Richardson—Sri Lanka. Bangladesh (Dakatia river, Chandpur, Comilla dist.)
3. *P. chilkensis* Chaudhuri—India : Rambha bay, Chilka lake, Orissa.

KEY TO SPECIES

1.	Dorsal fin commencing more or less above base of pectoral fin. ...	*P. cancrivorus*
	Dorsal fin commencing well behind pectoral fin. ...	... 2
2.	Head length 5.5 times in length from end of snout to vent. ...	*P. chilkensis*
	Head length 3.5 to 4.0 times in length from end of snout to vent. ...	*P. boro*

Genus **Lamnostoma** Kaup

Lamnostoma Kaup, 1856, *Cat. Apodal fish. Brit. Mus.*, p. 49 (type-species, *Lamnostoma pictum* Kaup).

Diagnosis.—Very much similar to *Pisodonophis*, but differing from it in having the dorsal fin origin at a short distance behind the gill opening and the gill opening themselves being entirely ventral. Teeth pointed, villiform in a single row. Pectoral fin absent.

Distribution.—Seas and estuaries of India, up to Orissa, Sri Lanka. Reported to be very common at Madras.

Species visiting freshwater.—*L. orientalis* (McClelland)—distribution as of the genus.

Genus **Bascanichthys** Jordan & Davis

Bascanichthys Jordan and Davis, 1892 : *Rept. U. S. Fish. Comm.* 1888, p. 621 (type-species, *Caecula bascanium* Jordan, by original designation).

Diagnosis.—Body extremely elongate, cylindrical. Abdomen rounded. Head long, compressed. Snout pointed. Mouth terminal, wide, cleft extending beyond posterior margin of orbit. Eyes supero-lateral in anterior part of head, moderate, not visible from below ventral surface. Lips thick. Jaws subequal. Conical teeth in a single *row on jaws and vomer, no teeth on premaxilla. Dorsal fin inserted on head a little before gill opening, far behind the rictus, extending to tail tip, but not confluent. Anal fin also extending to tail tip but not confluent.* Caudal fin projecting as a stiff point. Scales absent.

Distribution.—Indo-Pacific coasts. India : River Arasalar, Karaikkal, S. India. Sri Lanka.

Species visiting freshwater.—

1. *B. deraniyagalai* Menon—India : R. Arasalar, Karaikkal (type-locality).
2. *B. longipinnis* Kner & Steindachner*—Sri Lanka.

KEY TO SPECIES

1.	Anus nearer to snout than tip of tail. Teeth absent on premaxilla. ...	*B. deraniyagalai*
	Anus nearer tip of tail than to snout. Four paired teeth present on premaxilla. ...	*B. longipinnis**

Superorder CLUPEOMORPHA

Branchiostegals numbering as high as 15, usually fewer. Intra-cranial diverticula of air-bladder forming bullae within the ear capsule. Meso-coracoid arch invariably present. Hypurals on one to three centra. Cephalic lateral line canals extending over operculum. Usually no lateral line pores on trunk. (After Greenwood *et al.* 1966).

A single order Clupeiformes is dealt with here.

Order CLUPEIFORMES

Body short, oblong, not eel-like, with cycloid scales, sometimes edge pectinated. Abdomen with keeled scutes along ventral midline. Head scaleless. Margin of upper jaw formed by premaxillaries and

*This species is included on the basis of Deraniyagala's (1931) record from Sri Lanka. Menon (1961) doubts the identification and is of opinion that it may be his species *B. deraniyagalai*.

maxillaries ; one or two supramaxillaries. No gular plate. Branchiostegals numbering as high as 15 but usually fewer. Gill membranes separated, free from isthmus. *Radiating cutaneous canals on opercular bones.* Pseudobranchiae present. No suprabranchial organ. Teeth present or absent on jaws and palate. *A single dorsal fin, without spines,* may be absent in some genera. No adipose dorsal fin. Pelvic fins present or absent. Anal fin without spines. Mesocoracoids invariably present. Cephalic lateral line canals extending over operculum. No lateral line pores on trunk. Lateral line short, incomplete. Air-bladder divided into two large vesicles which are lodged within ossified bullae of prootic and pterotic bones ; thus the air-bladder is intimately connected intracranially with the inner-ear. A temporal foramina, a preepiotic fossae, and an auditory fenestrae are constant features in the skull. Hypurals on one to three centra.

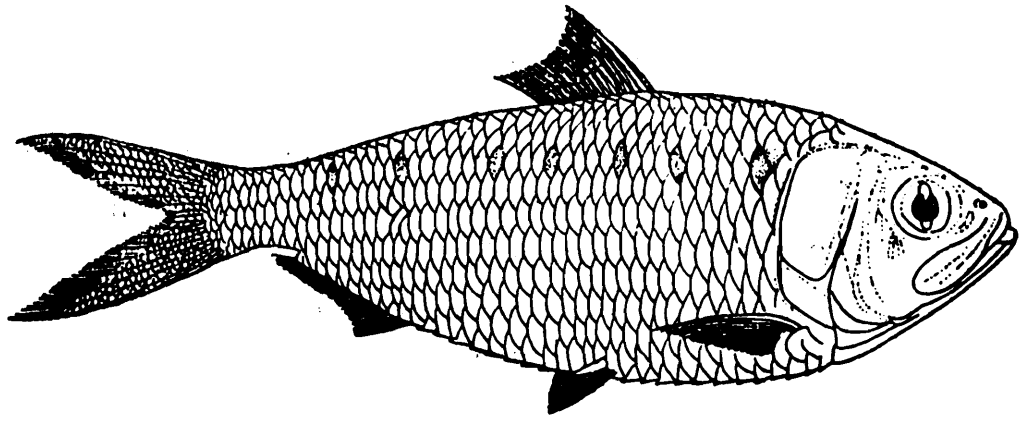


Fig. 22. Lateral view of *Hilsa kelee* (Cuvier) to illustrate family Clupeidae. (After Misra, K. S. 1962, text-fig. 39)

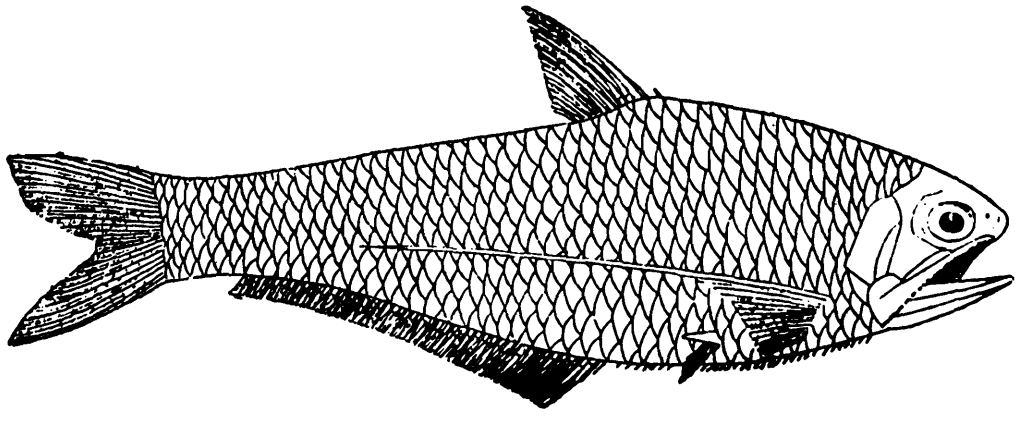


Fig. 23. Lateral view of *Setipinna taty* (Hamilton) to illustrate family Engraulidae. (After Misra, K. S. 1962, text-fig. 52).

A characteristically marine, pelagic and shoaling fishes with numerous freshwater representatives in tropical Africa and India.

Two families and 14 genera are dealt with here.

KEY TO FAMILIES*

1.	Upper jaw not projecting, not prominent. Articulation of lower jaw under or before eye. Mouth more or less terminal, snout not "Pig-like" ...	CLUPEIDAE (Fig. 22)
—	Upper jaw projecting, prominent. Articulation of lower jaw behind eye. Mouth underslung, snout "Pig-like" ...	ENGRAULIDAE (Fig. 23)

Family Clupeidae

Sardines, Shads

Maxillaries composed of three pieces not ossified together. Abdomen with scutes. Teeth when present, rudimentary and deciduous. Barbels absent. Gill membranes free. Opercular pieces four. A single dorsal fin with a few or a moderate number of weak rays. Anal fin long in some genera. Scales present on body, generally absent on head. Lateral line mostly absent. Pyloric appendages when present numerous.

Most of its members are marine, but a few either migrate into freshwater or often residents there itself.

Whitehead (1973) has provided an excellent synopsis. The arrangement proposed by him is followed here.

Four subfamilies, ten genera are dealt with here.

KEY TO SUBFAMILIES*

1.	Anal fin long with more than 30 rays. Pelvic fins with six or seven rays or absent. Lower jaw strongly prognathus. ...	PRISTIGASTERINAE
—	Anal fin short with less than 30 rays. Pelvic fins with seven to nine rays. ...	... 2
2.	Lower jaw with dentary flared outwards. Mouth inferior, last dorsal ray often filamentous. ...	DOROSOMATINAE
—	Lower jaw normal, dentary not flared outwards. Mouth terminal, last dorsal ray never filamentous. ...	... 3
3.	Upper jaw with a distinct notch at centre. ...	ALOSINAE
	Upper jaw without a notch at centre. ...	PELLONULINAE

Subfamily Pellonulinae

Belly keeled or rounded with prominent pre- and post-pelvic scutes,

*After Whitehead, P. J. P. 1973.

which may lack keels or absent entirely. Pre-dorsal scutes present or absent. Gill rakers present or absent on posterior face of 3rd epibranchial.

KEY TO GENERA

1.	Abdomen keeled, with pre- and post-pelvic scutes. ...	*Corica* Hamilton
—	Abdomen smooth, scutes without keels or entirely absent. ...	... 2
2.	Two enlarged scales at base of caudal fin present. ...	*Ehirava* Deraniyagala
—	No such enlarged scales at caudal base. ...	*Dayella* Talwar & Whitehead.

Genus **Corica** Hamilton

Corica Hamilton, 1822, *Fishes of the Ganges*, pp. 253, 283 (type-species, *Corica soborna* Hamilton, by monotypy).—Whitehead, 1973, *J. mar. biol. India*, **14** (1), p. 192.—Misra, 1976, *Fauna of India*, Pisces, Ed. 2, **2**, p. 67.

Diagnosis.—Body moderately elongated. *Abdomen keeled with 10 or 11 pre-pelvic and seven or eight post-pelvic scutes.* Head short, without scales. Snout obtuse. Mouth terminal, cleft oblique, not reaching orbit. Eyes large, in anterior part of head, not visible from below ventral surface and with no adipose eyelid. Lower jaw longer than upper ; teeth on jaws and palate rudimentary and deciduous. Dorsal fin inserted above pelvic origin with 15 or 16 rays. Anal fin with 14 or 15 rays. Caudal fin forked, lobes equal. Lateral line absent. *Scales small, 40—42 in lateral series.*

Distribution.—India : Orissa (Mahanadi river), W. Bengal. Bangladesh. Malaya. Sumatra. Borneo.

Species visiting freshwater.—Corica soborna Hamilton is the single species so far known.

Genus **Dayella** Talwar & Whitehead

Spratelloides Bleeker, 1851, *Nat. Tijds. Ned. Ind.* 2, p. 214.

Dayella Talwar & Whitehead, 1971, *Bull. Brit. Mus. nat. Hist.* (Zool.), **22** (2), p. 63 (type-species, *Spratelloides malabaricus* Day, in part, by original designation)—Whitehead, 1973, *J. mar. biol. Ass. India*, **14** (1), p. 195.

Diagnosis.—Body elongate, moderately compressed. Abdomen, rounded, fully scaled, *with one to four pre-pelvic* scutes only. Head

moderate, scaleless. Snout obtuse. Mouth upturned, cleft not wide, not reaching orbit. Eyes large, in middle of head, superior, not visible from below ventral surface ; no adipose eyelid. Upper jaw reaching to vertical from anterior eye border or anterior pupal margin. A single row of small conical teeth on pre-maxilla. Fine teeth present on tongue and palate. Gill rakers fine, slender, about seven, stumpy, *short gill rakers on posterior face of epibranchial. Cutaneous sensory canals branching over entire operculum and cheek.* Dorsal fin inserted ahead of pelvic insertion with 14 rays. Anal fin with 18 rays. Caudal fin forked. *Scales moderate, deciduous, 38 in lateral series.* Lateral line absent.

Distribution.—West coast of India ascending rivers and estuaries.

Species visiting freshwater.—Dayella malabarica (Day) is the only species known so far.

Genus **Ehirava** Deraniyagala

Ehirava Deraniyagala, 1924, *Spolia zeylan.*, **15**, p. 34, pl. 14. (type-species, *Ehirava fluviatilis* Deraniyagala, by monotypy).—Whitehead, 1973, *J. mar. biol. Ass. India*, **14** (1), p. 195.—Misra, 1976, *Fauna of India*, Pisces, Ed. 2, **2**, p. 25.

Diagnosis.—Body elongate, compressed. Abdomen rounded, smooth. Head long, compressed. Snout blunt. Mouth terminal, cleft wide just extending to anterior margin of eye. Eyes large, lateral, in middle of head, not visible from below ventral surface ; adipose eyelid present. Lips thin. Six to nine unkeeled pre-pelvic scutes may be present (Whitehead, 1973). Lower jaw longer than upper. Jaws and palate with small teeth. Gill rakers *absent on posterior face of 3rd epibranchial.* Dorsal fin inserted behind pelvics, with 13 rays. Anal fin with 15 rays. *Caudal fin with two enlarged scales at base.* Lateral line absent, *35—38 scales in lateral series.*

Distribution.—India : Kerala, Kanara in Karnataka. Sri Lanka rivers and estuaries up to 25 kms from sea.

Species visiting freshwater.—Ehirava fluviatilis Deraniyagala is the single species known so far.

Subfamily Alosinae

Scales varying in size and number in lateral series. Fronto-parietal region with or without longitudinal striae. Cleithral lobe small or big. Gill rakers on 2nd, 3rd, and 4th gill arch.

KEY TO GENERA*

1. Scales large 40-50 in lateral series	...	*Hilsa* Regan
— Scales very small 80-120 in lateral series.	...	*Gudusia* Fowler

Genus **Hilsa** Regan

Hilsa Regan, 1917, *Ann. Mag. nat. Hist.* (8) **19**, p. 303 (type-species, *Paralosa durbanensis* Regan = *Clupea keeles* (Cuvier).—Whitehead, 1973, *J. mar. biol. Ass. India*, **14** (1), p. 187.

Macrura van Hasselt, Misra, 1976, *Fauna of India*, Pisces, Ed. 2, **2**, p. 53 (earlier name proposed).

Diagnosis.—Body compressed, oblong. Abdomen serrated, with 15 or 16 pre-pelvic and 11 to 16 post-pelvic scutes present. *Head large, high, compressed.* Snout rounded. *Mouth terminal, cleft not extending to orbit.* Eyes large, lateral, with adipose lid, in anterior part of head and not visible from below ventral surface. Lips moderately thick. Jaws subequal. Upper jaw with a median notch at centre. Lower jaw not projecting beyond upper. Jaws and palate edentate. Dorsal fin

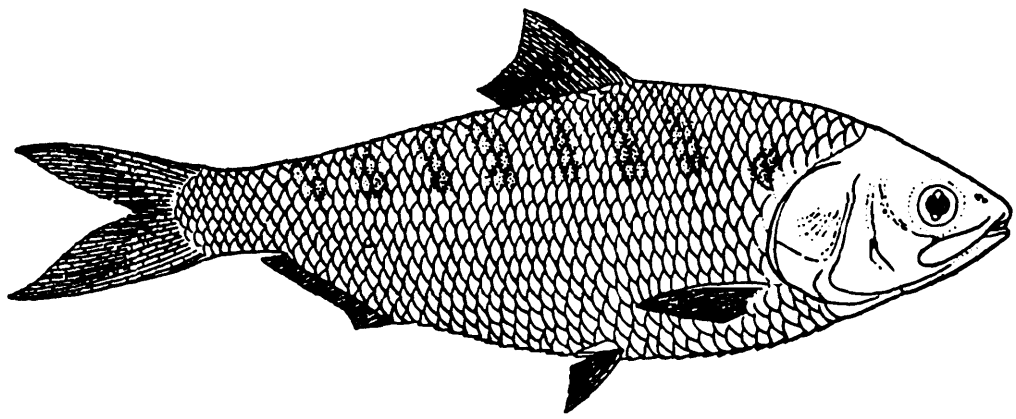


Fig. 24. Lateral view of *Hilsa ilisha* (Ham.). (After Misra, K. S. 1962, text-fig. 38)

inserted in advance of pelvics, with 11 to 16 branched rays. Anal fin short with 14 to 24 branched rays. Caudal fin forked. Scales large, 37 to 47 in lateral series. Lateral line absent.

Distribution.—Persian Gulf through West Pakistan to India, Bangladesh. Burma and China.

Species visiting freshwater.—

1. *H. ilisha* (Hamilton)—India : Ganga, Yamuna, Narmada, Tapi, Krishna, Godavary, Cauvery, Pennar rivers. Pakistan. Bangladesh. Burma. Sri Lanka.
2. *H. toli* (Valenciennes)—India. Pakistan.: Bangladesh. Sri Lanka. Malaya. Indonesia. Viet-Nam. China. Formosa.

*After Whitehead, 1973.

KEY TO SPECIES

1.	Caudal lobes as long as head		*H. ilisha*
—	Caudal lobes longer than head.		*H. toli*

Genus **Gudusia** Fowler

Gudusia Fowler, 1911, *Proc. Acad. nat. Sci. Philad.*, p. 207 (type-species, *Clupanodon chapra* Hamilton, by original designation).—Whitehead, 1973., *J. mar. biol. Ass. India*, **14** (1), p. 201:—Misra, 1976, *Fauna of India*, Pisces, Ed. 2, **2**, p. 61.

Diagnosis.—Body well compressed, oblong. Abdomen serrated with 18 or 19 pre-pelvic and eight to ten post-pelvic scutes. Head short, high, compressed. Snout rounded. Mouth slightly upturned, terminal, cleft not extending to orbit. Eyes large, lateral, in anterior part of head, not visible from below ventral surface and with a broad

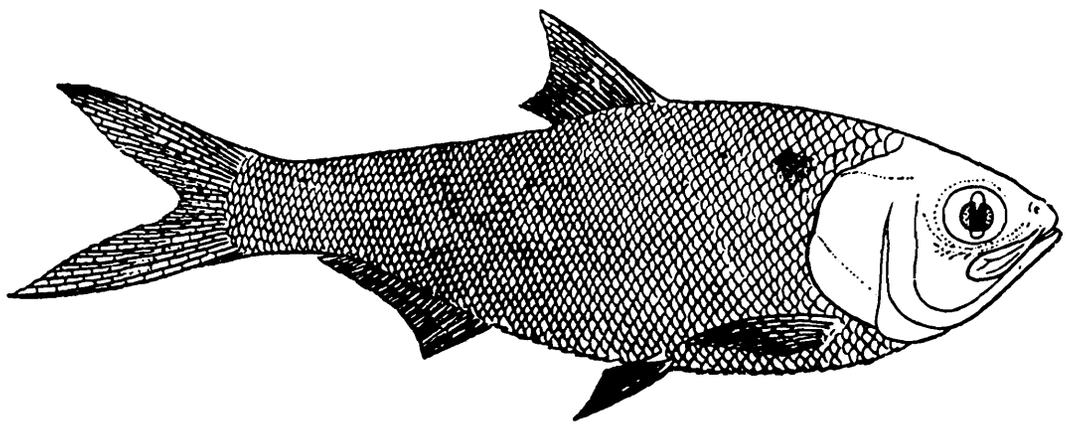


Fig. 25. Lateral view of *Gudusia chapra* (Hamilton). (After Misra, K. S. 1962, text-fig. 41)

adipose eyelid. Lips thin. Lower jaw not projecting over the upper. Dorsal fin inserted above pelvic origin, with 16 rays. Anal fin with 21—24 rays. Caudal fin forked. *Scales small, 80-120 in lateral series.* Lateral line absent.

Distribution.—India. Pakistan. Nepal. Bangladesh. Burma. Malaya.

Species.—

1. *G. chapra* (Hamilton)—As of the genus.
2. *G. variegata* (Day)—India : Gorakhpur, U. P. * Burma.

KEY TO SPECIES

1.	Anal fin with iii, 19-22 rays. Body without any cross bars on sides. ...	*G. chapra*
—	Anal fin with iii, 22-26 rays. Body with cross bars on sides. ...	*G. variegata*

*G. *godanahiai* Srivastava from Gorakhpur, U. P., considered a synonym of *G. variegata* by Talwar & Whitehead (1971) extends the range of this otherwise Burmese species to India.

Subfamily DOROSOMATINAE

Stomach gizzard-like. Dentary flared. Last dorsal ray may be filamentous or not. Pre-dorsal scales paired, may or may not be overlapping in mid-line.

KEY TO GENERA*

1.	Last dorsal ray filamentous ...	*Nematolosa* Regan
	—Last dorsal ray not filamentous. ...	... 2
2.	Predorsal scales paired, overlapping in midline. ...	*Goniolosa* Regan
	—Predorsal scales median, not overlapping. ...	*Anodontostoma* Bleeker

Genus **Nematolosa** Regan

Nematalosa Regan, 1917, *Ann. Mag. nat. Hist.*, (8) **19**, p. 312 (type-species, *Clupea nasus* Bleeker, by original designation).—Whitehead, 1973, *J. mar. biol. Ass. India*, **14** (1), p. 203 (revision).—Misra, 1976, *Fauna of India*. Pisces, Ed. 2, **2**, p. 99.

Diagnosis.—Body oblong, compressed. Abdomen keeled and serrated, with 15 pre-pelvic and 12 post-pelvic scutes. Mouth small, subinferior, transverse, cleft not extending to orbit. Eyes moderate, lateral, in anterior part of head, with a broad adipose lid, not visible from below ventral surface. Lips thin. Jaws subequal, upper jaw projecting over lower. Jaws and palate without teeth. Dorsal fin

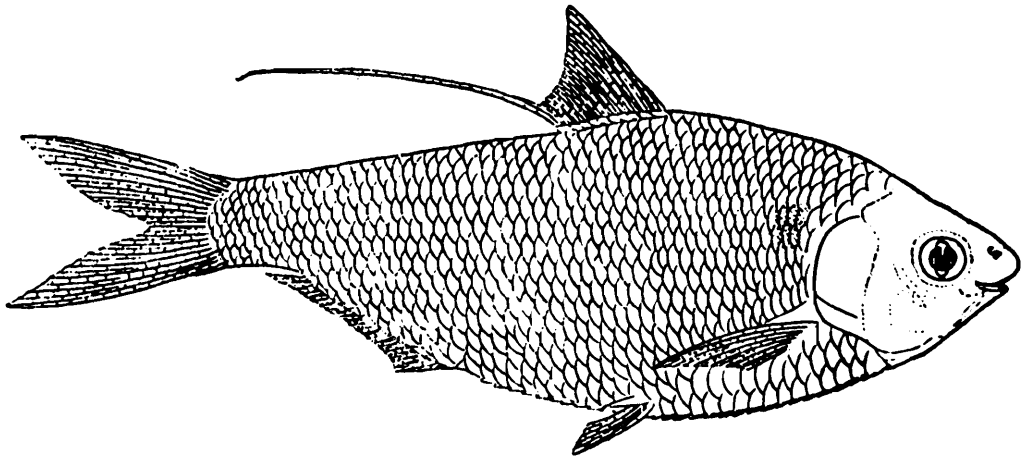


Fig. 26. Lateral view of *Nematalosa nasus* Bleeker. (After Misra, K. S. 1962. Text-fig. 48).

inserted above last quarter of pectoral fin, with 15—17 rays ; *last ray much prolonged, reaching caudal base*. Anal fin with 21—24 rays. Caudal fin deeply forked. Lateral line absent. Scales with serrated edges, regularly arranged.

*After Whitehead, 1973

Distiribution.—India. Pakistan. Bangladesh. Burma. Sri Lanka. Also in Iraq. Oman. S. Africa. Malaya. Indonesia. Thailand. Viet-Nam. China. Philippines.

Species Visiting in Freshwater.—*N. nasus* Bleeker—distribution as of the genus.

Genus **Goniolosa** Regan

Goniolosa Regan, 1917, *Ann. Mag. nat. Hist.* (8) **19**, p. 315 (type-species, *Chatoessus modestus* Day, by origfnal designation).—Whitehead, 1973, *J. mar. biol. Ass. India*, **41** (1), p. 205—Misra, 1976, *Fauna of India*, Pisces, Ed. 2, **2**, p. 95.

Diagnosis.—Body oblong, compressed. Abdomen serrated with 17 to 18 pre-pelvic and 11—13 post-pelvic scutes. Head short, compressed. Snout conical. Mouth transverse, small, subinferior, cleft not extending to eye. Eyes large, lateral, in middle of head if not slightly anterior, not visible from below ventral surface and with a broad adipose eyelid. Lips thin. Upper jaw projecting over lower. Jaws and

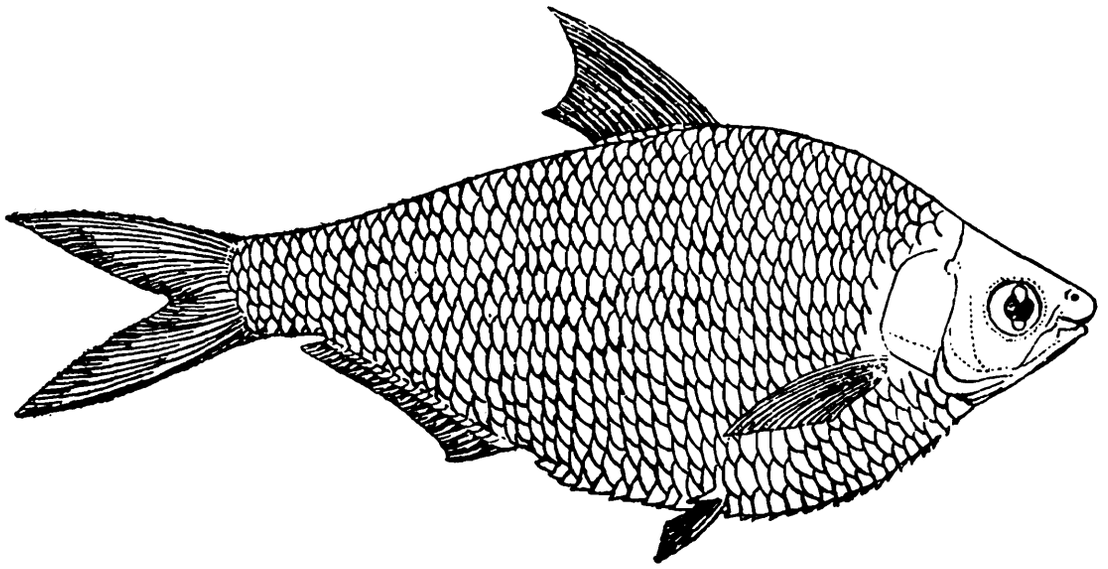


Fig. 27. Lateral view of *Goniolosa manmina* (Hamilton). (After Misra, K. S. 1962. Text-fig. 48).

palate without teeth. Dorsal fin inserted above half of pectoral fin with 14-16 *rays, last ray not produced.* Anal fin with 22-28 rays. Caudal fin forked. Scales small. 45-65 in lateral series. *Predorsal scales paired, overlapping in midline.* Lateral line absent.

Distribution.—India. Pakistan. Bangladesh and Burma.

Species visiting freshwater.—

1. *G. manmina* (Hamilton)—India. Pakistan. Bangladesh. Sri Lanka.
2. *G. modesta* (Day)—Burma.

KEY TO SPECIES

1.	45-47 scales in lateral series. Lateral transverse scales 16-18. ...	*G. modesta*
	55-65 scales in lateral series. Lateral transverse scales 21-25. ...	*G. manmina*

Genus **Anodontostoma** Bleeker

Anodontostoma Bleeker, 1849, *Verh. Bat. Genoot. Kunst., West.*, 22, p. 15 (type-species, *Anodontostoma hassettii* Bleeker = *Clupanodon chacunda* Hamilton).—Whitehead, 1973, *J. mar. biol. Ass. India*, **14** (1) p, 206.—Misra, 1976, *Fauna of India*, Pisces, Ed. 2, **2**, p. 101.

Diagnosis.—Body oblong, compressed. Abdomen serrated with 17 pre-pelvic and 10 or 11 post-pelvic scutes. Head short, high, compressed. Snout rounded. Mouth small, transverse, subinferior, cleft just falling short of anterior margin of orbit. Eyes large, in anterior part of head, lateral, not visible from below ventral surface. Lips thin. Upper jaw

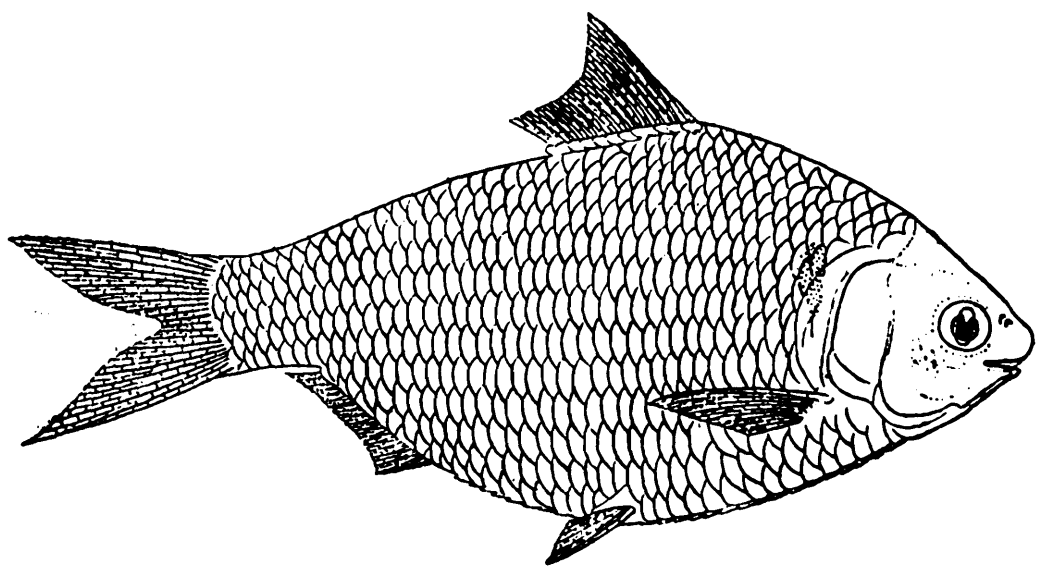


Fig. 28. Lateral view of *Anodontostora chacunda* (Hamilton). (After Misra, K. S. 1962, Text fig. 50).

projecting over lower. Jaws and palate without teeth. Dorsal fin inserted above half of pectoral fin, with 17-19 rays ; last ray not produced. Anal fin with 18-21 rays. Caudal fin forked. Scales moderately large *40-42 in lateral series. Predorsal scales not overlapping.* Lateral line absent.

Distribution.—India. Pakistan. Bangladesh. Burma. Thailand. Sri Lanka. Malay Peninsula through China to Philippines and Melanesia.

Species visiting freshwater.—*A. chacunda* (Hamilton)—As of the genus.

Subfamily PRISTIGASTERINAE

Hypomaxilla toothed or edentate. Pelvic fins present or absent, each with 6 or 7 rays. Dorsal fin present or absent. Maxilla rounded or tapering.

KEY TO GENERA

1. Occipital ridges converging behind or parrallel. Toothed hypo-maxilla present. ... *Pellona* Valenciennes
   Occipital ridges subparallel behind. Toothed hypo-maxilla absent. ... *Ilisha* Richardson

Genus **Pellona** Valenciennes

Pellona Valenciennes, 1847, *Hist. nat. Poiss.*, **20**, p.300 (typo-species, *Pellona orbignyana* Valenciennes, by subsequent designation).—Whitehead, 1973, *J. mar. biol. Ass. India*, **14** (1), p. 209.—Misra, 1976, *Fauna of India*, Pisces, Ed. 2, **2**, p. 84.

Diagnosis.—Body elongate, compressed. Abdomen serrated with 18-20 pre-pelvic and eight or nine post-pelvic scutes. Head long, compressed. Snout blunt. Mouth upturned, cleft not reaching orbit. Eyes large, lateral, in middle of head, not visible from below ventral surface and with a narrow adipose eyelid. Lips thin. Lower jaw longer than

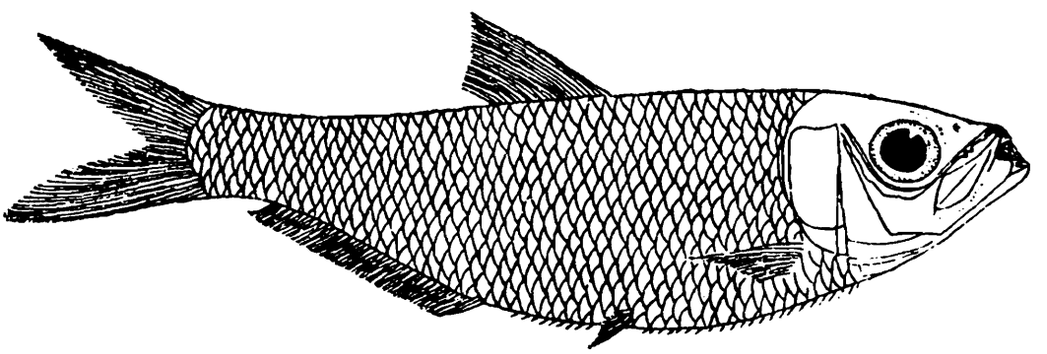


Fig. 29. Lateral view of *Pellone ditchela* Valenciennes. (After Misra, K. S. 1962, Text-fig. 45.)

upper, with minute uniserial teeth, palatines and pterygoids with teeth. *A toothed bone between maxillary and premaxillary present.* Occipital ridges parallel or converging behind. Dorsal fin inserted above tip of pectoral fin, or slightly behind, with 17 or 18 rays. Anal fin with 30-40 rays (31—38 branched). Caudal fin forked. Scales large 40-45 in lateral series. Lateral line absent.

Distribution.—India. Burma. Bangladesh. Sri Lanka. Thailand. Malaya. Viet-Nam. S. Africa. Madagascar.

Species visiting freshwater.—*Pellona ditchela* Valenciennes—As of the genus.

Genus **Ilisha** Richardson

Ilisha Richardson, 1846, *Ichthyol. Seas China Japan*, p. 306 (type-species, *Ilisha abnormis* Richardson = *Alosa elongata* Bennett, by monotypy).—Whitehead, 1973, *J. mar. biol. Ass. India*, **14** (1) p. 210. Misra, 1976, *Fauna of India*, Pisces, Ed. 2, 2, p. 69.

Diagnosis.—Body elongate, compressed. Abdomen serrated with 15-24 post-pelvic and 7-12 pre-pelvic scutes. Head short, compressed. Snout blunt. Mouth upturned, cleft not reaching orbit. Eyes large, lateral, in middle of head, not visible from below ventral surface, with an adipose eyelid. Lips thin. Lower jaw longer than upper. *Edge of upper jaw with a ligament extending from lateral end of pre-maxillary to middle of maxillary.* Jaws with uniserial minute teeth. Palatines

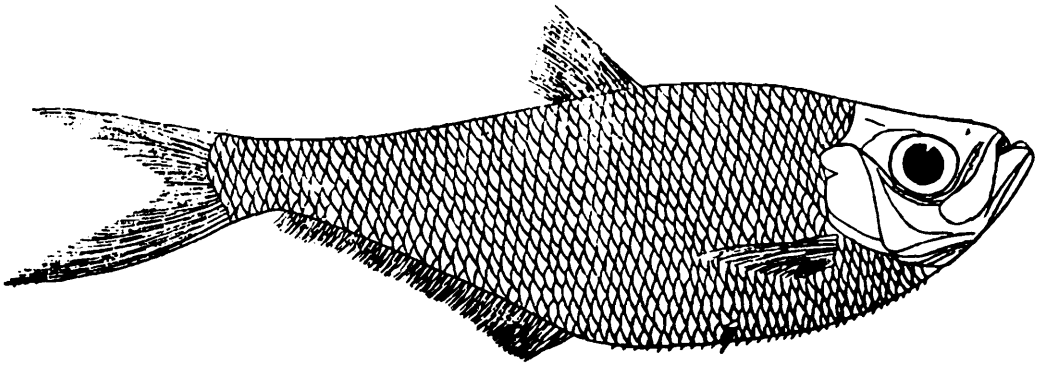


Fig. 30. Lateral view of *Ilisha*. (After Misra. K. S. 1962. Text-fig. 43).

and pterygoids with teeth. Occipital ridge, subparallel or diverging behind. Dorsal fin inserted above pelvic fin insertion, wth 16-18 rays. Anal fin long with 33-52 rays. Caudal fin forked. Scales large 43-50 in lateral series. Lateral line absent.

Distribution.—India. Sri Lanka. Pakistan. Burma. Malaya. Viet-Nam. Philippines, Formosa. China. Korea. Japan. Found in the East African coasts also.

Species visiting freshwater.—

1. *I. kampeni* (Weber & de Beaufort)—India : Kakinada, Porto Novo, Bay of Bengal. Java. Borneo.
2. *I. megaloptera* (Swainson)—India : Waltair, Madras, Porto Novo, Sunderbans, Bombay, Malabar Coast. Sri Lanka. Pakistan. Bangladesh. Indonesia. Burma.

3. *I. melastoma* (Schneider)=*I. indica* (Swainson)—India : Waltair, Madras, Porto Novo, Tuticorin, Vizhingam, Mangalore, Bombay, Sri Lanka. Pakistan. Burma. Malaya. Thailand. Viet-Nam. Hong-kong.

4. *I. sladeni* (Day)—Burma.

KEY TO SPECIES †

1.	Anal fin inserted below or in advance of middle of dorsal fin base. ...	*I. sladeni*
	Anal fin inserted below posterior half of dorsal fin. ...	... 2
2.	Air-bladder with a single extension on right side.	*I. megaloptera*
	Air-bladder with two tubular extension. ...	... 3
3.	Body depth 37-42% of SL. Pseudobranch exposed.	*I. melastoma*
	Body depth 26-30% of SL. Basal part of pseudobranch covered. ...	*I. kampeni*

Family ENGRAULIDAE

Anchovies

Maxillaries composed of two pieces, not ossified together. Mouth *set far back on the underside of head. Lower jaw inconspicuous.* Teeth uniserial, rarely canine. Small teeth on palatines, vomer, pterygoids and tongue. Gill membranes united, free from isthmus. A single dorsal fin with a few or a moderate number of weak rays. Anal fin long. Scales thin, cycloid, deciduous, generally absent on head.

This is also one of the economically valuable families of fishes, comprising the anchovies. Mostly marine, but many entering fresh and brackishwaters.

The synopsis of Whitehead (1973) is useful and has been adopted here.

Two subfamilies and four genera are dealt with here.

KEY TO SUBFAMILIES

1.	Body normal. Caudal fin bilobed. Caudal and anal fin not confluent. ...	ENGRAULINAE
	Body tapering, Caudal fin pointed, and united with anal fin. ...	COILIINAE
	...	Genus *Coilia* Gray

† After Ramaiyan, V. and Whitehead, P. J. P. 1975.

Subfamily ENGRAULINAE

Abdominal scutes present or absent. Posterior tip of maxilla blunt or projecting. Pre-pectoral scutes present or absent. First pectoral ray may be filamentous.

KEY TO GENERA

1.	Scutes present only before pelvic base. Anal fin short with less than 25 rays. ...	*Stolephorus* Lacépède
	—Scutes preseut both before and behind pelvic base. Anal fin long, with more than 25 rays. ...	... 2
2.	First pectoral ray normal not filamentous ...	*Thryssa* Cuvier
	—First pectoral ray filamentous. ...	*Setipinna* Swainson

Genus **Stolephorus** Lacépède

Stolephorus Lacépède, 1803, *Hist. nat. Poiss.*, **5**, p. 381 (type-species, *Stolephorus commersonii* Lacépède),—Whitehead, 1973, *J. mar. biol. Ass. India*, **14** (1) p, 218.

Anchoviella Fowler, Misra, 1976, *Fauna of India*, Pisces, Ed. 2, **2**, p. 119.

Diagnosis.—Body elongate, compressed. *Abdomen serrated slightly* before the pelvics, *with only one to eight needle like scutes between pectoral and pelvic fins.* Head moderately long, compressed. Snout slightly conical or obtusely round. Mouth subinferior, cleft wide, extending to posterior margin of eye. Eyes large, lateral, in anterior part of head, not visible from below venteral surface and with an adipose eyelid. Lips thin. Upper jaw longer than the lower. *Maxilla reaching the gill opening.* Jaws and palate with fine teeth. Dorsal fin inserted above pelvic insertion, with 16-17 rays. Anal fin with 14-25 rays. Caudal fin emarginate or forked, not very deeply. Scales moderately large, deciduous, 32-40 in lateral series. Lateral line absent.

Distribution.—Zanzibar. Red Sea. Arabia. S. Africa. Mauritius. India. Sri Lanka. Burma. Viet-Nam. Malaya. Thailand. Philippines. Formosa. China. Australia. Hawaii.

Species visiting freshwater.—*S. indicus* (van Hasselt)—India. Pakistan. Sri Lanka. Burma. Viet-Nam. Malaya. Thailand. Philippines. Formosa. China. Australia. Hawaii.

Genus **Thryssa** Cuvier

Thryssa Cuvier, 1816, *Regne Animal.*, Ed. 1, 2, p. 176 (type-species, *Clupea mystus* Linnaeus = *Coilia mystus*).—Whitehead, 1973. *J. mar. biol. Ass. India*, **14** (1), p. 228.

Thrissocles Jordan & Everman, Misra, 1976, *Fauna of India*. Pisces, Ed. 2, 2, p. 127.

Diagnosis.—Body elongate, compressed. Abdomen serrated with 14-18 pre-pelvic and 8-11 post-pelvic scutes. Head short, compressed.

Snout blunt or rounded. Mouth subinferior, cleft wide, extending to beyond posterior margin of orbit. Eyes large, lateral, in anterior part of head, not visible from below ventral surface and with an adipose eyelid. Lips thin. *Maxilla extended or produced.* Lower jaw slightly longer. *Jaws and palate with minute teeth.* Dorsal fin in between pelvic and anal, nearer pelvic than anal, with 14-17 rays. Anal fin long, with and 32-47 rays. Caudal fin forked. Scales moderate, deciduous, 35-47 in lateral series, Lateral line absent.

Distribution.—Red Sea. Arabia. Zanzibar. E. and S. Africa, Madagascar. Mauritius. Seychelles. India. Pakistan. Sri Lanka. Burma. Thailand. Malaya. Viet-Nam. China. Korea. Japan. New Guinea, Malaysia. Micronesia. Polynesia. Queensland. Philippines. Australia.

Species visiting freshwater.—

1. *T. hamiltonii* (Gray)—India. Pakistan. Bangladesh. Burma. Sri Lanka. Malaya. Singapore. Thailand. Viet-Nam. Korea. Philippines.
2. *T. kammalensis* (Bleeker)—India. Pakistan. Sri Lanka. Malaya.
3. *T. malabarica* (Bloch)—India. Pakistan. Sri Lanka.
4. *T. mystax* (Schneider)—India. Pakistan. Burma. Sri Lanka. Malaya. Singapore, Viet-Nam.
5. *T. purava* (Hamilton)—India. Pakistan. Bangladesh. Burma. Penang. Micronesia.
6. *T. setirostris* (Broussonet)—India. Pakistan. Burma. Sri Lanka. Malaya. Viet-Nam. Thailand. China.

KEY TO SPECIES

1,	Lower jaw with high coronoid process. Maxilla very long, reaching to beyond pectoral tip. ...		*T. setirostris*
	—Lower jaw slender. Maxilla not reaching beyond pectoral tip. ...	...	2
2.	Maxilla long, reaching to pectoral base or beyond.	...	3
	—Maxilla short, not reaching to pectoral base. ...	...	4
3.	Anal fin with 35-41 (29-37 branched) rays. Dorsal fin with 13-16 rays. Pre-pelvic scutes 16-20. ...		*T. mystax*
	—Anal fin with 43-49 (38-44 bronched) rays. Dorsal fin with 12-14 rays. Pre-pelvic scutes 15-17. ...		*T. purava*
4.	Anal fin with 38-43 rays. ...	...	5
	—Anal fin with 34 rays. ...		*T. kammalensis*

5. Lateral line scales 39-40. Pelvic fin inserted midway between pectoral fin base and anal fin origin. ... ... *T. malabarica*

—Lateral line scales 44-47. Pelvic fin inserted nearer to pectoral fin base than anal origin. ... ... *T. hamiltonii*

Genus **Setipinna** Swainson

Setipinna Swainson, 1839, *Nat. Hist. Anim.*, 2, p. 292 (type-species, *Setipinna megalura* Swainson = *Clupea phasa* Hamilton).—Whitehead, 1973, *J. mar. biol. Ass. India*, **14** (1), p. 821—Misra, 1976, *Fauna of India*, Pisces, Ed. 2, 2, p. 105.

Diagnosis.—Body elongate, *compressed*, tapering behind. Abdomen serrated with 15-23 pre-pelvic and 6-12 post-pelvic scutes. Head short, compressed. Snout obtuse. Mouth subinferior, cleft wide, extending to beyond posterior margin of eye. Eyes moderate, lateral, in anterior

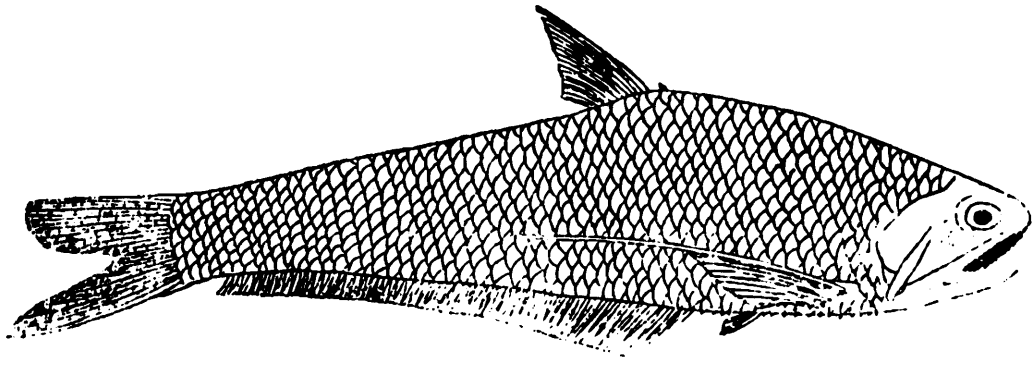


Fig. 81. Lateral view of *Setipinna phasa* (Hamilton). (After Misra, K. S. 1962. Text-fig. 51).

part of head, not visible from below ventral surface and with an adipose eyelid. Lips thin. *Maxilla extending behind eye*, but not up to gill opening. Lower jaw shorter than upper. Small teeth on jaws and palate. *Upper pectoral ray produced.*

Dorsal fin inserted behind pelvic and just above anal origin with 10-18 rays. *A free spine present before dorsal fin.* Anal fin very long, 48-78 rays. Caudal fin forked. Scales 42-56 in lateral series. Lateral line absent.

Distribution.—India. Bangladesh. Burma. Sri Lanka. Malaya. Viet-Nam. Thailand. China. Korea.

Species visiting freshwater.—

1. *S. breviceps* (Cantor)—India. Bangladesh. Burma. Malay Peninsula. Penang. Singapore. Indonesia. Viet-Nam.

2. *S. tenuifilis* Valenciennes (includes *S. godavari* Baburao)— India : Godavary estuary. North Borneo.
3. *S. phasa* (Hamilton)—India. Bangladesh. Burma.
4. *S. taty* (Valenciennes)—India. Bangladesh. Burma. Sri Lanka. Malaya. Thailand. Viet-Nam. Indonesia. Korea.

KEY TO SPECIES

1.	Dorsal fin inserted at mid point of body or nearer to caudal fin base. Mouth very oblique, lower jaw projecting. ...	*S. breviceps*
	—Dorsal fin inserted nearer to snout than to caudal fin base. Mouth slightly oblique.	2
2.	Anal fin rays 69-81. ...	*S. phasa*
	—Anal fin rays 48-64.	3
3.	Anal fin inserted behind dorsal fin origin. Gill raker serrae in distinct clumps of longer serrae. ...	*S. taty*
	—Anal fin inserted just below dorsal fin origin. Gill raker serrae not clumped. ...	*S. tenuifilis*

Subfamily Coiliinae

Longitudinal rows of pearly spots (light organs) on flanks present or absent. Pectoral fin filaments varying in number, may be free. Maxilla long or short. Pre-pelvic scutes present or absent. Maxillary teeth of varying length.

Genus **Coilia** Gray

Rat tailed Anchovies

Coilia Gray, 1831, *Illust. Ind. Zool. Hardw'* **1**, pl. 85 (2) (caption only).—1831, *Zool Misc.*, p. 9 (type-species, *Engra* (*Coilia*) *hamiltonii* Gray = *Mystus ramcarati* Hamilton, by monotypy).—Whitehead, 1973, *J. mar. biol. Ass. India.* **14**, (1) p. 240—Misra, 1976. *Fauna of India*, Pisces, Ed. 2, **2**, p. 111.

Diagnosis.—Body elongate, compressed. Abdomen serrated with five or six pre-pelvic and 6 to 12 post-pelvic scutes. Head short, compressed.

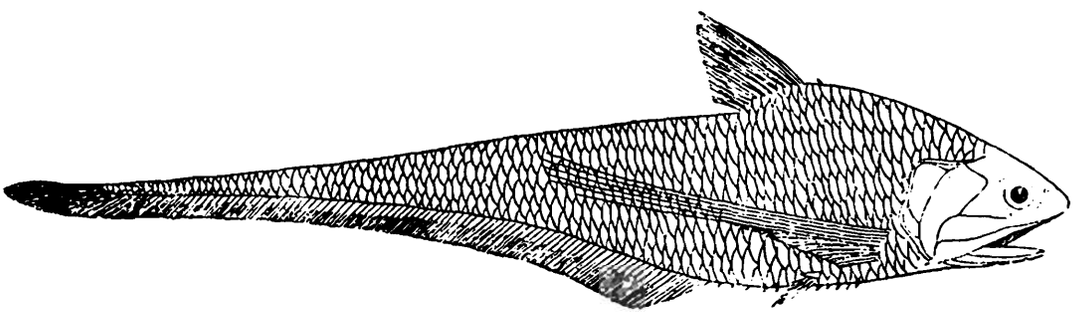


Fig. 32. Lateral view of *Coilia dussumieri* Valenciennes. (After Misra, K. S. 1962. (Text-fig. 53).

Snout conical. Mouth subinferior, cleft extending to beyond posterior, margin of eye. Eyes moderate, lateral, in anterior part of head not

visible from below ventral surface. Lips thin. Upper jaw prominent. Teeth on jaws and palate. Dorsal fin inserted ahead of pelvics, with 14 or 15 rays. *Pectoral fin with upper rays produced, and reaching beyond midbody.* Anal fin very long with 35-116 rays. *Caudal fin tapering, confluent with anal fin.* Scales small, deciduous, 55-88 in lateral series. Lateral line absent.

Distribution.—India. Pakistan. Sri Lanka. Burma. Malaya. Indonesia. Thailand. China. Japan, Korea.

Species visiting freshwater.—

1. *C dussumieri* Velenciennes—India. Pakistan. Bangladesh. Malaya. Penang. Singapore. Indonesia.
2. *C. ramcarati* (Hamilton)—India. Pakistan. Bangladesh. Burma. Viet-Nam.
3. *C. reynaldi* Valenciennes—India. Burma. Malaya. Singapore.

KEY TO SPECIES

1. Longitudinal rows of pearly spots (light organs) on flanks present.	...	*C. dussumieri*
—No such pearly spots present.	...	... 2
2. Pelvic fin rays i, 8-9	...	*C. ramcarati*
—Pelvic fin rays i, 6	...	*C. reynaldi*

Cohart ARCHAEOPHYLACES Greenwood *et al.* 1967

(Type-genus *Osteoglossum* Vandeli, 1829)

Premaxilla fused as a single bone. Maxilla well-toothed, simple, generally contributing to the gape but partially excluded in a few genera. Parasphenoid, glossohyal and pterygoid teeth developed. Elements in palatopterygoid arch fused. A paired tendon bones on the second hypobranchial or second hypobranchial and basibranchial present. Multiple intraosseous passages in the prootic bone (for the fifth and seventh cranial nerves and certain major blood vessels) absent. Caudal fin reduced and confluent with the dorsal and anal fins. Suboperculum reduced or lost. Upper intermuscular bones developed. A functional ductus pneumaticus present. Preopercular and infraorbital canals present and distinctly separated. (After Greenwood *et al.* 1966).

A single superorder is dealt with here.

Superorder OSTEOGLOSSOMORPHA

Premaxilla firmly bound to the ethmo-vomerine region. Primary bite of mouth between parasphenoid and glossohyal and basihyals.

Head of palatine without maxillary pores. Branchiostegals three to five. Suprascapulars not expansive. A lateral cranial foramen absent. Hypurals fused, apparently supported by at least two and a half centra. (After Greenwood *et al.* 1966)

A single order Osteoglossiformes is dealt with here.

Order OSTEOGLOSSIFORMES

Body and head scaled, strongly compressed. Abdomen non-keeled, non-serrated. *Caudal region very long, tapering. Maxillaries well toothed forming the greater part of the upper jaw. Maxilla and pre-maxilla firmly bound together and have restricted mobility.* Supra-maxillae absent.

Teeth on premaxillaries, maxillaries, vomer, palatines, pterygoid and tongue. No pharyngeal teeth. Gill membranes partly united. Branchiostegal three to five. Paired, usually ossified rods well developed at base of second gill arch. Pseudo-branchiae absent. Palatines fused with ectopterygoid. Dorsal fin present or absent. Pelvic fins abdominal. Barbels absent. Pectoral fins depressed. No adipose fin. *Anal fin long, confluent with caudal fin. No distinct caudal fin present.* Upper hypurals fused with the uroneurals and apparently with the vertebral column.

The air-bladder diverticula is closely applied to the lateral aspects of two otic region. Abdominal portion of air-bladder completely subdivided.

Predominantly tropical freshwater fishes of extraordinary diverse body form and size. Most species are insectivorous or piscivorous.

A single family and a single genus is dealt with here.

Family NOTOPTERIDAE

Feather backs

Freshwater fishes of extraodinary diverse body form and size. These are moderately large fishes, elongate, laterally compressed.

Diagnosis.—Body broad, strongly compressed laterally with fine scales on head also. *Abdomen serrated before the pelvic fins.* Dorsal profile not so convex as of ventral profile. Eyes large, superior. *Maxilla extends to below middle of orbit, cleft of mouth lateral. Maxillae well toothed, and firmly bound together with the premaxilla.* Suboperculum absent. No barbels. Dorsal fin single belonging to the caudal portion of the vertebral column. Pelvic fin rudimentary or absent. Lateral line present. Air-bladder present, subdivided internally.

No pseudobranchiae. Palatine fused with ecto-pterygoid. A large cranial foramen.

Freshwaters of tropical S. America, Africa, S. E. Asia, New Guinea and Australia.

A single genus in India.

Genus **Notopterus** Lacépède

Notopterus Lacépède. 1800, *Hist. nat. Poiss.*, 2, p. 189 (type-species, *Notopterus kapirat* Lacépède = *Gymnotes notopterus* (Pallas).

Diagnosis.—Body oblong, laterally compressed. *Abdomen with about 28 pre-pelvic double serrations*. Head compressed, cavernous (hollow). Snout obtuse and convex. Mouth wide, cleft of mouth extending *up to or beyond posterior border of eye*. Eyes moderate, superior, in part of head, not visible from below ventral surface. Lips thin. Jaws equal. Teeth on jaws and palate and also on tongue. Muciferous channels

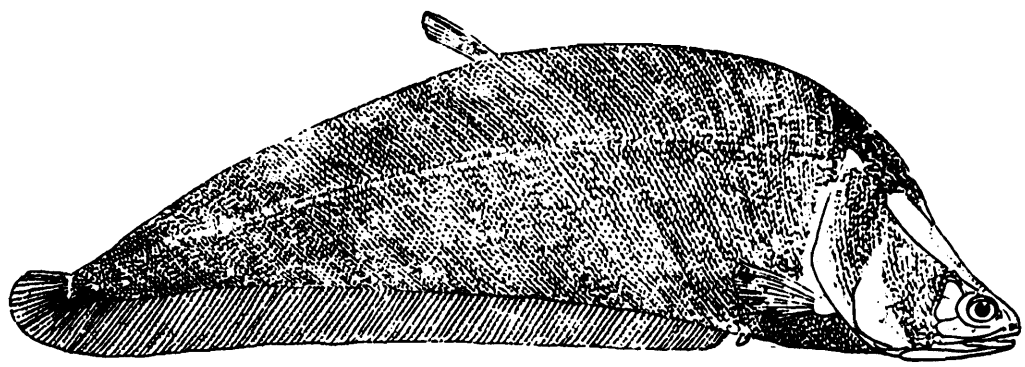


Fig. 33. Lateral view of *Notopterus chitala* (Hamilton). (After Hora, S. L. 1962. *J. Asiat. Soc. Beng.*, **17**, pl. 20).

on head well developed. Preopercle serrated. Gill membranes partly united. Dorsal fin small, tuft-like, inserted near middle of body with seven or eight rays. Anal fin very low, ribbon-like, with 100-110 rays, confluent with the caudal fin. Pelvic fin rudimentary. Caudal fin small. Scales small. Lateral line more or less arched with about 180 scales.

Distribution.—Fresh and brackishwaters of West Africa. India. Pakistan. Bangladesh. Thailand. Malaya.

Species.—

1. *N. chitala* (Hamilton)—India : North India. Pakistan. Bangladesh. Burma.
2. *N. notopterus* (Pallas) (Pl. III. fig. E)—India. Pakistan. Nepal. Bangladesh. Burma. Thailand. Malaya and Indonesia.

KEY TO SPECIES

1. Gape of mouth not extending beyond hind edge of orbit. ... ... *N. notopterus*
—Gape of mouth extending beyond hind edge of orbit. ... ... *N. chitala*

Cohart EUTELEOSTEI Greenwood *et al.* 1967.

(Type-genus, *Perca* Linnaeus)

Premaxilla large, frequently mobile completely or partially excluding the maxilla from the gape. Maxillary bone edentate. A functional supra-maxillae absent. Parasphenoid and pterygoid edentate. An os pharyngeus inferior and an os pharyngeus superior developed. A common passage (trigemino-fascialis chamber) developed in the basicranium for the passage of fift and seventh nerves and orbital, artery and head vein. Supraorbital bone absent. Infraorbital bones reduced in size. Number of bones on the dorsicranium reduced. Post-temporal fossa enlarged but without a roof. Epiaxial body muscles cover the posterior part of the dorsicranium. Pectoral fin base on the side elevated. Pelvic girdle forwardly migrated. Number of pectoral radial bones, vertebrae, pelvic and caudal fin rays reduced. Intermuscular bones reduced. Hypural bones reduced to a single unit on a terminal half-centrum.

Caudal fin variously shaped as a line of specialisation. Adipose fin, fins with spines, and ctenoid scales present in some genera. An otophysic connection involving the intercalation of bony elements developed. Ductus pneumaticus absent. Preopercular and infraorbital canal distinctly separated. A suprapreopercular bone is invariably present. A ramus lateralis accessorius of the seventh nerve developed along the trunk. (After Greenwood *et al.* 1966).

Four superorders are dealt with here.

Superorder PROTACANTHOPTERYGII

A wide spread trend towards the exclusion by premaxillae of the maxillae from the gape and the development of premaxillary processes. Upper jaw slightly protrusible in a few cases. Glossohyal teeth usually prominent. Branchiostegals very numerous. Hyoid and branchiostegal skeleton approaching paracanthopterygian and acanthopterygian form. Mesocoracoid present in generalised lines only. Baudelot's ligament to first vertebra present.

Pelvic fins commonly of more than six rays. Occasional trends towards elevation of the pectoral fin base on flank. Vertebrae, commonly more than 24. Hypurals on one to three centra. Adipose fin present in most species. A suprapreopercular (canal bearing ossicle above uppermost part of preopercular) present. (After Greenwood *et al.* 1966).

Two orders are dealt with here.

Order SALMONIFORMES

Body elongate to subcylindrical with cycloid scales. Head without scales. Abdomen non-keeled and non-serrated. Maxillae excluded by pre-maxillae in forming the gape of the mouth. No suprabranchial. Pseudobranchiae present. Branchiostegal rays numerous. Teeth conical on jaws, vomer, palatines and tongue, none on pterygoids. ***Rayed dorsal fin nearly opposite to pelvic fins. An adipose dorsal fin present.*** Pelvic fin with more than six rays. Lateral line present. Hypurals on one to three centra. Caudal fin commonly with more than 15 branched rays.

Predominantly slender fishes.

Two families and two genera are dealt with here.

KEY TO FAMILIES

1. Gape of mouth extending to almost head length. Scales moderate. Gill openings very wide. ... HARPADONTIDAE
—Gape of mouth not extending to half of head length. Scales very small. Gill openings moderate. ... SALMONIDAE

Family SALMONIDAE

Trouts

Body compressed with fine scales on body. Head without scales. Margin of upper jaw formed by premaxillaries and maxillaries. Dorsal profile moderately curved. Eyes large, superior. Maxilla enlarged, extending up to front border of orbit. Cleft of mouth wide. Dorsal fin two, *an adipose dorsal fin present.* Lateral line present. Air-bladder large, simple with a pneumatic duct.

Widely introduced in Europe, Africa, England, U.S.A., Australia.

A single genus is dealt with here.

Genus **Salmo** Linnaeus

Salmo Linnaeus, 1758, *Syst. Nat. Ed.* 10, **1**, p. 308 (type-species, *Salmo salar* Linnaeus).

Diagnosis.—Body elongate, subcylindrical. Abdomen rounded, smooth. Head moderate. Snout obtuse. Mouth wide, cleft of mouth

oblique, extending up to front border of eye. Eyes large, superior, in middle of head, not visible from below ventral surface. Lips thin. Jaws equal. Conical teeth present on jaws, palate and tongue. Rayed dorsal fin inserted above pelvic fin with 12 to 14 rays. *Adipose dorsal fin*

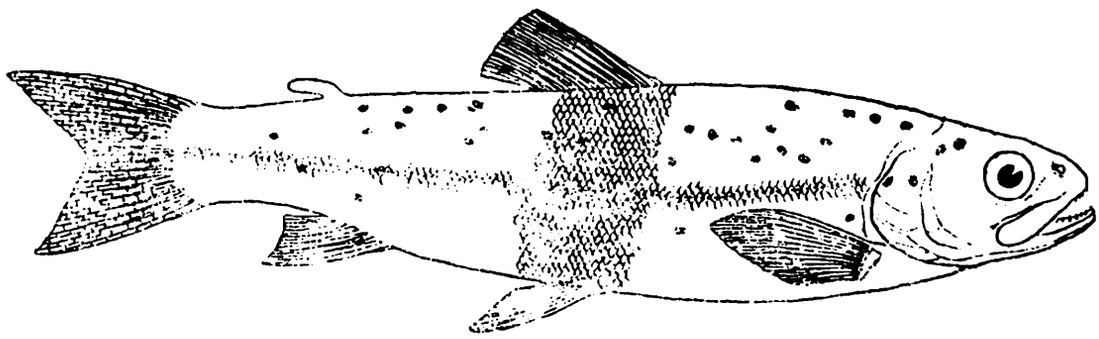


Fig. 34. Lateral view of *Salmo gairdnerii gairdnerii* Richardson. (After Misra, K. S. 1962. Text-fig. 59).

smooth, small, inserted above mid-anal. Anal fin short with 10 to 13 rays. Caudal fin forked. Lateral line straight with 115-160 small, cycloid scales. Body speckled. Pyloric appendages numerous.

Distribution.—India. Pakistan. Bangladesh. Sri Lanka. Burma. Introduced from their original home in North Atlantic and North Pacific.

Species.—

1. *Salmo gairdnerii gairdnerii* Richardson (Rainbow Trout)—Introduced into India. Pakistan. Sri Lanka. Bangladesh. Also in S. Africa. N. America and England.
2. *S. trutta fario* Linn. (Brown Trout)—Introduced into India, Pakistan, Bangladesh. Also in S. Africa, Australia, N. America. Naturally found in Eurasia.
3. *S. levenensis* Walker (Loch Leven) (Pl. I. fig. A.)—Introduced into India. Also in S. Africa, Australia. Naturally found in England, Scotland.

KEY TO SPECIES

1. Body without spots below lateral line, colour steel blue. Lateral line scales 127-160. ... *S. gairdnerii gairdnerii*
   —Body with many coloured spots below lateral line, coloured greenish or brownish. Lateral line scales 115-145. 2
2. Body coloured brownish. Lateral line scales 115-130. ... *S. trutta fario*
   —Body coloured greenish. Lateral line scales 120-130. ... *S. levenensis*

Family HARPADONTIDAE †

Bombay-duck

Body elongate, compressed or rounded. Head without scales. No photophores. Cleft of mouth wide, extending to operculum. Intermaxillary slender. *Maxillary absent.* Teeth prominent. A single rayed dorsal fin. *Adipose dorsal fin present.* Pelvics well developed with inner rays much longer than or equal to outer ones. Vent nearer to caudal or nearer to pelvic base. Anal fin below adipose dorsal fin. Lateral line present.

A single genus is dealt with here.

Genus **Harpadon*** Le Sueur

Harpadon Le Sueur, 1825, *J. Acad. nat. Sci. Philad.*, **5**, p. 48 (type-species, *Salmo* (*Harpadon*) *microps* Le Sueur=*Osmerus nehereus* Hamilton, by original designation).

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head short, thick. Snout short, bluntly rounded. Mouth terminal, very wide, its cleft extending almost to half of head length. Eyes small, superior in the anterior part of head, not visible from below ventral surface. Lips thin. Jaws subequal, lower jaw longer. Jaws unequal,

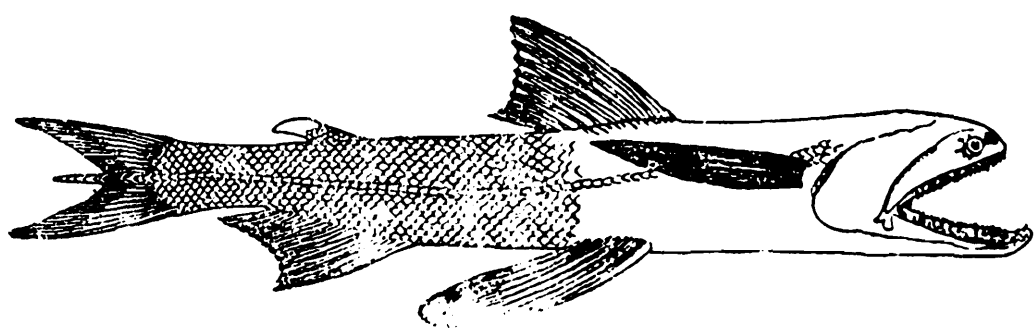


Fig. 35. Lateral view of *Harpadon nehereus* (Hamilton), (After Misra, K. S. 1962, Text fig. 62).

partly covered teeth in a band on jaws ; teeth in one or two rows on palate also ; those on lower jaw with inner ones enlarged and conspicuously spear-headed. Gill openings extremely wide. Dorsal fin inserted above last quarter of pectoral fin, with 12-14 rays. Adipose dorsal fin smooth, free. Pectoral fin long. Pelvic fin very long, reaching

† Misra (1976, p. 286) has placed this genus under Synodidae, Bapat (1970) under Scopelidae. The classification by Greenwood *et al.* (1966) is adopted here, which is after Jordan, 1923.

*Most authors use the spelling *Harpodon* overlooking the original spelling *Harpadon* which is not invalid on any account.

beyond anal origin. Anal fin with 13-15 rays. *Caudal fin trilobed.* Lateral line continuous with the central lobe. Scales deciduous.

Distribution.—India. Pakistan. Bangladesh. Burma. Malaya. Indonesia. China. Korea. Also Zanzibar.

Species visiting freshwater.—

H nehereus (Hamilton)—India. Pakistan. Bangladesh. Burma. Zanzibar. Malaya. Indonesia. China. Korea. Abundant in the estuaries of W. Bengal, Bangladesh, Burma and Malacca straits. Seen in small numbers along the Coromandal coast, most common in Bombay.

Order GONORHYNCHIFORMES

Body oblong, with small firm cycloid scales. Head without scales. Upper jaw formed by premaxillaries only. Premaxilla a thin splint or scale like bone. Supramaxillaries absent. Orbitosphenoid and basisphenoid absent. Palate and jaws without teeth. Pseudobranchiae moderately present. *A suprabranchial organ present.* A suprapreopercular bone present. A single dorsal fin. No adipose dorsal fin. Lateral line present. Air-bladder transversely subdivided.

A supratemporal commissure in the cephalic lateral line system present. One or more cephalic ribs associated with the *first three specialised* cervical vertebrae. A large very deep post-temporal fossa in the occipital region present.

Uroneural and lower-most hypural in caudal skeleton form a V-shaped wedge around four or five smaller, hypural elements, the whole unit stemming from a terminal half centrum.

Marine fishes entering estuaries and tidal rivers. A single family and a single genus is dealt with here.

Family CHANIDAE

Milkfish

Body elongate compressed. Scales cycloid, rather small only on body. Some scales enlarged over nape. Branchiostegal rays four. Abdomen rounded, smooth. Mouth small. Eyes large, placed at centre of head. Dorsal fin single. Lateral line distinct. Lower jaw with small symphysial tubercles. Maxillaries short, wide. *Supramaxillaries, gular plate absent. No teeth. A suprabranchial organ present.*

Air-bladder with a constriction.

Distribution.—Indian and Pacific Ocean.

A single genus is dealt with here.

Genus **Chanos** Lacépède

Chanos Lacépède, 1803, *Hist. nat. Poiss.*, p. 395 (type-species, *C. arabicus* Lacépède).

Diagnosis.—Body moderately elongated and compressed. Abdomen rounded, smooth. Head conically pointed, compressed. Snout slightly conical. Mouth small, terminal, non-protractile, transverse. Eyes superior, large, in anterior part of head, not visible from below ventral surface, with a large adipose eyelid. Lips thin. Upper jaw slightly

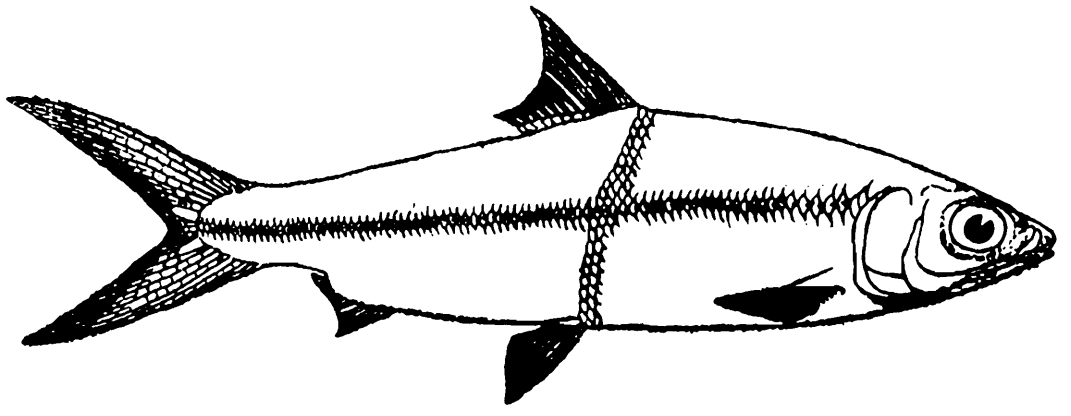


Fig. 36. Lateral view of *Chanos chanos* (Forskal). (After Misra, K. S. 1962, text fig. 58).

projecting over lower. *Teeth absent.* An accessory branchial organ present in a recess behind the true gill cavity. Rayed dorsal fin short with nine to 11 rays. Caudal fin deeply forked. Lateral line straight, distinct, with 75-90 scales. Scales small. Pyloric appendages many.

Distribution.—Indian and Pacific Oceans, entering rivers and estuaries up to tidal influence.

Species visiting freshwater.—*Chanos chanos* (Forskal) acclimatised to freshwater tanks and brackish water rivers is the only species.

Superorder OSTARIOPHYSI

Upper jaw protrusible in many species. Major trends towards reduction in number of jaw teeth, may be absent also. Lower pharyngeal bones usually well developed. Branchiostegals generally few in number but as many as 15 in some species. Pelvic fins abdominal. Hypurals on one centrum. Fin spines present in most instances. Scales present or absent, when present cycloid in most instances, ctenoid in a few, and in certain forms replaced by bony plates. Adipose fin in many groups present. Otophysic connections involving the intercalation of bony elements in all. Air-bladder primitively subdivided, reduced in many species. Suprapreopercular (ossicle above uppermost part of preopercular canal) present in numerous species. (After Greenwood *et al.* 1966).

Two orders are dealt with here.

Order CYPRINIFORMES

Body oblong, compressed, with small to large scales. *Head without scales. Bony plates never developed.* Maxillaries reduced. Premaxilla excludes the maxilla from the gape. Pre-ethmoid and median rostral are variously present or absent. *Jaws, palatine and pterygoid bones are toothless.* Orbital bones often reduced to simple tube bones. The lower pharyngeals have a reduced number of teeth, and the non-opposed upper pharyngeal are toothless. No supra- branchial organ. A metapterygoid-quadrate fenestra absent. Subtemporal fossae often well developed, may be reduced. Post-temporal fossae variously developed. A single dorsal fin. *No adipose dorsal fin.* Barbels often present around the mouth. Lateral line present. Air-bladder free or often closed in a bony capsule in bottom dwelling forms. Weberian apparatus mostly modified, commonly as a fusion of the second and third centra.

A widely distributed group of economic value.

Four families, 61 genera are dealt with here.

KEY TO FAMILIES

1.	Paired fins horizontally inserted. Two or more anterior rays of pectoral fins simple. ...	...	2
	—Paired fins laterally inserted. Not more than one anterior ray of pectoral fins simple. or may be all branched. ...	...	3
2.	Barbels absent. Air-blrdder free in the abdominal cavity. ...		PSILORHYNCHIDAE
	—Barbels present. Air-bladder partly enclosed in a bony capsule. ...		HOMALOPTERIDAE
3.	Two to four or no barbels. ...		CYPRINIDAE
	—Six to eight barbels. ...		COBITIDAE

Family Cyprinidae

Carps

Body with scales, generally compressed, abdomen rounded or cutting. Eyes never covered with skin. Mouth transverse, superior, inferior or terminal, with or without a sucker more or less protractile and toothless. Lower jaw may be prominent, sharp of rounded, sometimes provided with a knob at the symphysis, which may be movable. Lips developed in various stages ; sometimes absent from one of the jaws or closely infesting both jaws or reflected from one of the other. A labial fold continuous or interrupted present. Occasionally a few genera have a horny cartilaginous covering to either of the lips or both. No subocular

spine. Gill openings wide. Opercular bones well developed. Barbels one or two pairs, present or absent. Last undivided dorsal fin ray osseous or articulated. No adipose dorsal fin. Pharyngeal teeth one to three series. Lateral line complete or incomplete.

Air-bladder usually large and divided into an anterior and a posterior chamber not surrounded by a bony capsule.

A very large and most common group of primary freshwater fishes. Freshwaters of Africa, Eurasia, North and Central America up to Guatemala.

Six subfamilies and 46 genera are dealt with here.

KEY TO SUBFAMILIES

1.	Abdomen or part of abdomen compressed into a sharp keel like edge. No barbels. ...	... 2
	Adbomen rounded or flat, not compressed. Barbels one or two pairs present or absent ...	... 3
2.	Abdomen entirely keeled from throat to vent. Gill rakers fused into a spongious plate. Scales do not extend to the interorbital space.	HYPOPHTHALMICHTHYINAE
	Abdomen partly keeled. Gill rakers free. Scales extend to the interorbital space. ...	CULTRINAE
3.	Scales small, vent and base of anal fin enclosed by a tile-like row of scales. ...	SCHIZOTHORACINAE
	—Scales small or large, vent and anal base without any tile-like or sheath of scales. ...	... 3
4.	Upper lip continuous with skin of snout. Mouth conspicuously inferior. Lower lip with or without an adhesive disk. ...	GARRINAE
	—Upper lip separate from skin of rostrum by a deep groove. Mouth anterior, subinferior or inferior. Lower lip without an adhesive disk. ...	... 4
5.	A knob at symphysis or junction of two arms of lower jaw (exception *Aspidoparia*) fitting into an emargination or incision of upper jaw. Dorsal fin with 6—16 branched rays without any osseous simple ray. Lateral line when complete with an abrupt downward curvature anteriorly, running in lower half of caudal peduncle. ...	RASBORINAE
	—No knob at symphysis or junction of two arms of lower jaw. Dorssal fin with 7—30 branched rays with or without an osseous simple ray. Lateral line complete or incomplete running along middle of caudal peduncle.	CYPRININAE

Subfamily SCHIZOTHORACINAE

Snow Trouts

Mouth inferior or slightly anterior. A suctorial disc on chin may be present. Pharyngeal teeth in two or three rows. Dorsal fin with or without a spine. *A tile like row of scales present, enclosing vent and anal fin base.*

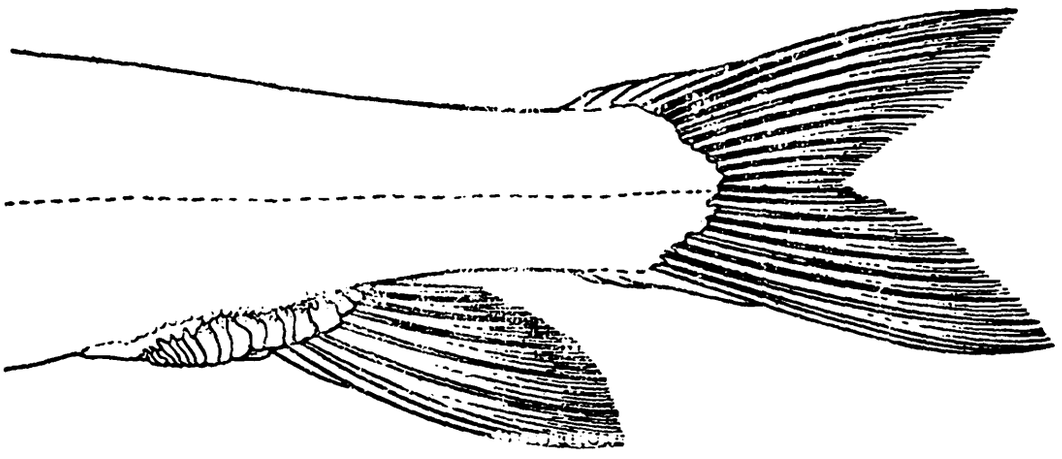


Fig. 37. Outline sketch of tail portion of a Schizothoracine fish to show tile like row of scales over anal fin base.

KEY TO GENERA

I.	Barbels present. ...	...	2
	Barbels absent. ...	...	6
2.	Lower lip modified into a papillated sucker ; mouth more or less crescentic. ...		*Schizothorax* Heckel
	Lower lip not modified into a papillated sucker ; mouth more or less horse-shoe shaped.	...	3
3.	Two barbels present. ...	...	4
	Four barbels present. ...	...	5
4.	Dorsal fin inserted opposite pelvics. Scales covering the body uniformly. Lateral line scales 95. ...		*Ptychobarbus* Staindachner
	Dorsal fin inserted anterior to pelvics. Scales scattered along upper two thirds of body, thoracic region, sides and caudal fin. Lateral line scales 80-90. ...		*Diptychus* Steindachner
5.	Lateral line decurved on the caudal peduncle. Lateral lins scales 54-58. (Periyar Lake, Kerala) ...		*Lepidopygopsis* Raj
	Lateral line straight. Lateral line scales 150—160. (Himalaya, Afghanistan) ...		*Schizopyge* Heckel

6. Pharyngeal teeth biserial. Body nearly or fully naked without any scales. Anal fin with 5 branched rays. 7

Pharyngeal teeth triserial. Scales present on lateral sides of body. Anal fin with 6 branched rays. ... *Schizocypris* Regan

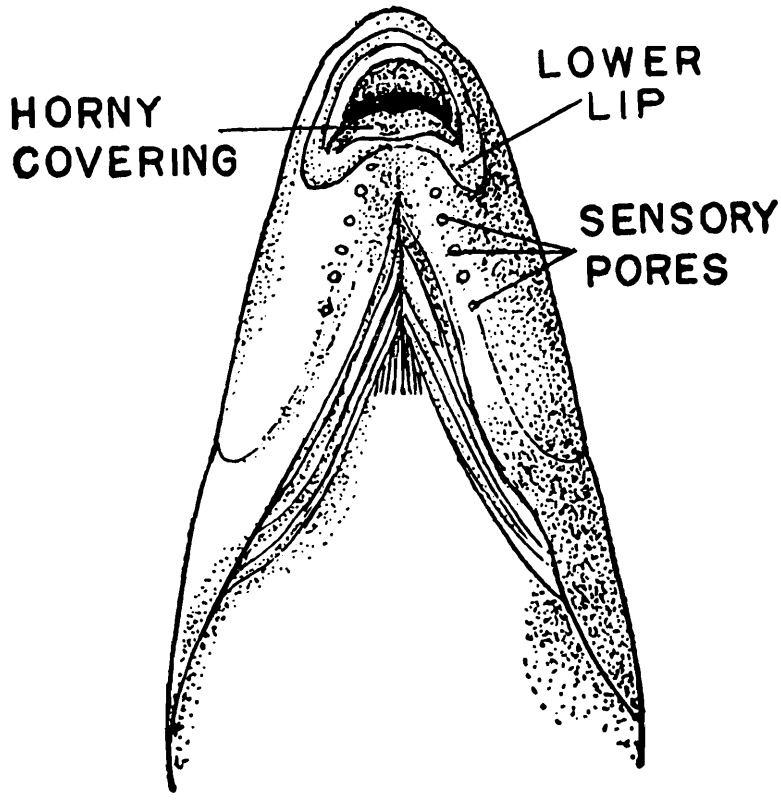


Fig. 38. Outline sketch to illustrate horny covering on lower lip.

7. Lower lip without any horny covering, margin of lower jaw simple. ... *Gymnocypris* Günther

Lower lip with a horny covering, margin of lower jaw cutting and transverse. ... *Schizopygopsis* Steindachner

Genus **Schizopyge** Heckel

Schizopyge Heckel, 1843, *Ichthyologie von Syrien* IN : Russegger's Reisen in Europa..., pt. 2, p. 285 (type-species, *Schizothorax curvifrons* Heckel as restricted by Bleeker in 1863).

Schizothoraichthys Misra, 1959, *Rec. Indian Mus.*, 57, p. 48 (type-species, *Schizothorax esocinus* Heckel).

Diagnosis.—Body elongate, subcylindrical, with both profiles arched. Abdomen rounded. Head large, pointed anteriorly. Snout generally smooth, obtuse, but in some may be studded with sharp wart-like protuberances. Mouth inferior, greatly arched. Lips thick, fleshy and continuous at angles of mouth, lower lip non-suctorial ; *no suctorial*

disc present. Eyes laterally placed, not visible from below ventral surface. Lower lip may be with one to three lobes. Lower jaw with or without a thick horny sheath. Barbels four. Dorsal fin inserted opposite pelvic fins with 11 or 12 rays, and one spine. Anal fin wtih seven or eight rays. Caudal fin forked. Scales small, *base of anal fin in a sheath covered by an enlarged row arranged like tiles.* Lateral line complete with 150-160 scales. Air-bladder free, long.

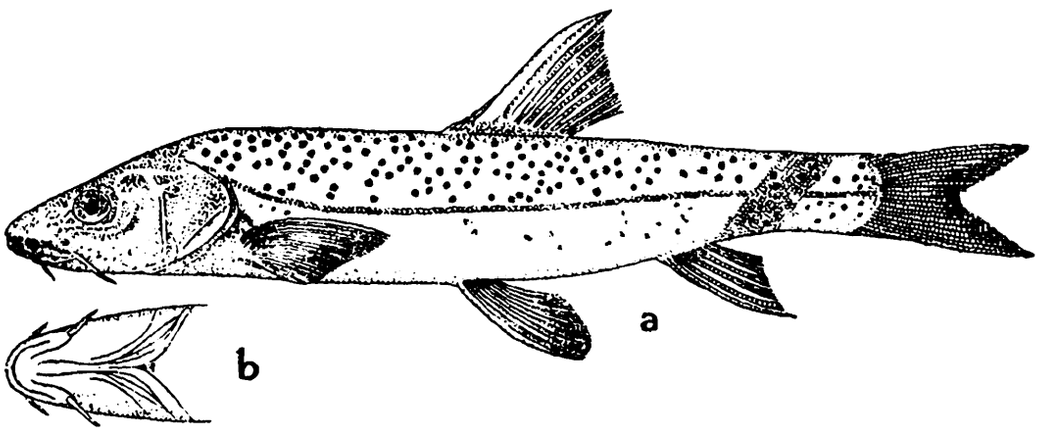


Fig. 39. Lateral view of *Schizothorax esocinus* Heckel (After Misra, K, S. 1962, text fig. 88).

Distribution.—India : Punjab, Kashmir, Assam, E. Himalaya. Southern Tibet. Pakistan. Afghanistan. Eastern Iran and western province of China.

Species.—1. *S. curvifrons* Heckel—India : Kashmir.

2. *S. esocinus* Heckel—India : Kashmir, Ladakh, Leh. Pakistan : Chitral Valley, N. W. F. Province.
3. *S. hugelii* Heckel—India : Kashmir.
4. *S. labiatus* (McClelland)—Pakistan : Pushat near Kunar river near Jallalabad, Chitral river.
5. *S. longipinnis* Heckel—India : Kashmir. Pakistan : R. Indus at Skardu.
6. *S. micropogon* Hackel—India : Kashmir.
7. *S. nasus* Heckel—India : Kashmir. Pakistan : Northern areas.
8. *S. niger* Heckel—India : Kashmir.
9. *S. planifrons* Heckel—India : Kashmir.
10. *S. progastus* (McClelland)—India : Himalaya, from headwaters of Ganga to Sadiya in Assam. Nepal.

Remarks : On the basis of the presence or absence of the labial sucker, these snow trouts were assigned to different genera by various

authors. Heckel (1838) proposed the genus *Schizothorax* for some species of snow trouts with four barbels and with or without a labial sucker described by him from the Kashmir Valley. McClelland (1839) proposed the name *Oreinus* for the species with a labial sucker and restricticted the name *Schizothorax* Heckel for those without it. In 1842, he proposed the name *Racoma* for some snow trout species described by him from Afghanistan. Heckel (1843) proposed another name *Schizopyge*, for the snow trouts without a sucker. Bleeker (1863) designated *Schizothorax plagiostomus* Heckel as the type species of the genus *Schizothorx* Heckel. Since *S. plagiostomus* possesses a well developed labial sucker, the name *Oreinus* McClelland becomes a junior synonym of *Schizothorax* Heckel. Bleeker (1863) also proposed *Schizothorax curvifrons* Heckel, 1838 as the type species of *Schizopyge* Heckel and *Racoma labiata* as the type species of *Racoma* McClelland. But most of the authors, including Day and Hora continued the use of the name *Oreinus* McClelland for the snow trouts with the labial sucker, and *Schizothorax* Heckel for those without the labial sucker. Misra (1962) advocated the use of the name *Schizothorax* Heckel instead of *Oreinus* McClelland and coined a new name *Schizothoraichthys* (with *Schizothorax esocinus* Heckel, 1838 as the type species), for the fishes which were included in the genus *Schizothorax* by Day and others. Since the name *Schizopyge* Heckel is already available for these fishes, the name *Schizothoraichthys* Misra becomes a junior synonym of the former. (Mirza & Awan 1979 p. 14).

In view of the present situation,snow trouts with four barbels and with or without the labial sucker should be included in the genus *Schizothorax* Heckel.

KEY TO SPECIES*

1.	Anal fin when laid flat reaches caudal fin base.		2
	Anal fin when laid flat does not reach caudal fin base.		7
2.	Dorsal fin inserted midway between root of caudal fin and tip of snout.		3
	Dorsal fin inserted nearer root of caudal fin than tip of snout.		4
3.	Rostral barbels shorter than eye diameter. Tiled row of scales over anal fin half as deep as orbit.		*S. nasus*
	Rostral barbels as long as eye. Tiled row of scales over anal fin not half as broad as orbit.		*S. progastus*

*The Key provided is purely artificial. Many species may be synonymous when a thorough revision of the genus is done.

4.	Lower jaw with a thin layer of cartilaginous covering. ...		*S. planifrons*
	Lower jaw without any horny covering. ...		5
5.	Barbels longer than eye. ...		*S. esocinus*
	Barbels shorter than eye. ...		6
6.	Tile row of scales over anal fin very large, largest broader than eye diameter. ...		*S. hugelii*
	Tile row of scales over anal fin not much developed, largest being less than half as broad as eye. ...		*S. longipinins*
7.	Lower jaw with a cartilaginous covering on the inner side. ...	...	8
	Lower jaw without any cartilaginous covering to inner side. ...	...	9
8.	Barbels shorter than eye. Dorsal fin nearer root of caudal fin than to end of snout. Lower lip bilobed. ...		*S. niger*
	Barbels longer than eye. Dorsal fin equidistant between tip of snout and caudal fin base. Lower lip trilobed. ...		*S. labiatus*
9.	Body depth 4·0 times in standard length. Barbels short. but well developed. ...		*S. curvifrons*
	Body depth 5·0 times in standard length. Barbels minute. ...		*S. micropogon*

Genus **Lepidopygopsis** Raj

Lepidopygopsis Raj, 1941. *Rec. Indian Mus*, **43**, p. 210 (type-species, *Lepidopygopsis typus* Raj, by monotypy and original designation).

Diagnosis.—Body elongate, subcylindrical. Abdomen rounded. Head moderately large, conical. Snout bluntly rounded, swollen and over-hanging the mouth. Mouth inferior, transverse. Eyes moderately large, round, laterally placed, *visible from below ventral surface.* Upper lip continuous with the lower. Lower lip covered internally by thin, deciduous horny covering and with no suctorial disc. *Two pairs of barbels, one pair each rostral and maxillary.* Dorsal fin inserted opposite pelvic fins, with 11 rays and a strong serrated spine. Anal fin short with eight rays, and with a sheath of tile-like scales covering its base. Caudal fin forked. *Lepidosis irregular, scattered, scales thin, cycloid. Lateral line complete,* but decurved on the caudal penduncle and with 55—58 scales. Air bladder free, tripartite.

Distribution.—India : Periyar Lake, Kerala.

Species.—*L. typus* Raj is the only species known so far.

Remarks.—Stomach contents are reported to consist of insects, crustaceans, diatoms and vegetable matter.

Genus **Schizothorax** Heckel.

Schizothorax Heckel, 1838, *Fish Cashmir*, p 11 (type-species, *Schizothorax plagiostomus* Heckel designated by Bleeker, 1863)—Mukerji, 1936, *Mem. Conn. Acad.*, **10**, pp. 333-346 (Yale North India collection report, Kashmir adjacent areas).—Talwar, 1978, *Bull. zool. Surv. India* **1** (1) p. 84 (reclassification).

Oreinus McClelland, 1839, *Asiat. Res.*, **19** pt. ii, p. 273 (type species, *Oreinus guttatus* McClelland).

Diagnosis.—Body elongate, subcylindrical. Abdomen rounded. Head large and pointed anteriorly. Snout rounded. Mouth inferior, transverse. Eyes large, laterally placed not visible from below ventral surface. Lips thick, fleshy. *Lower lip with a free posterior edge forming a sucker.* Barbels two pairs, one each rostral and maxillary. Lower jaw with a hard, horny covering inside. Dorsal fin inserted slightly ahead of pelvics, slightly nearer root of caudal than tip of snout, with 11 or 12 rays *and with a spine which may be articulated, smooth or serrated.* Anal fin short, with seven or eight rays. Caudal fin forked. Vent and anal fin in a sheath covered by an enlarged row of scales. Scales very small. Lateral line complete with 98-110 scales. Air bladder free, long and tripartite.

Distribution.—India : Kashmir, Punjab. Afghanistan. Pakistan. Tibet.

Species.—1. *S. kumaonensis* (Menon)—India : Kumaon hills.

2. *S. nigromarginalis* Das & Subla. 1966*

3. *S. richardsoni* (Gray)—India : Sub-himalayan range, Bhutan. Nepal. Pakistan.
   =S. *guttatus* McClelland and S. *plagiostomus* are synonyms.

4. *S. sinuatus* (Heckel)—India : W. Himalyan rivers. Afghanistan.

5. *S. skarduensis* Mirza & Awan—Pakistan : R. Indus at Skardu.

Remarks.—Inhabitants of fast streams, these fishes live on Chironemid larvae and purly vegetable matter. According to Day (1889) the ova were fully developed and of large size in May.

KEY TO SPECIES

1,	Body uniformly silvery, without any black spots (in alcohol preserved specimens).	*S. kumaonensis*
	Body dark brown with black spots on body (in alcohol preserved specimens).	2

*Saxena (1968) cites the species, the original reference of which is not traceable.

2.	Head length less than five times in standard length. ...	...	3
	Head length more than five times in standard length. ...	...	*S. sinuatus*
3.	Body depth 4·5—4·7 in standard length. Barbels smaller than eye diameter. Snout length 2·02-2·4 in head length. Dorsal fin inserted nearer tip of snout than caudal base. ...	...	*S. richardsonii* = *S. plagiostomus*
	Body depth 4·94-4·98 in standard length. Barbels longer than eye diameter. Snout length 2·66-2 68 in head length. Dorsal fin inserted equidistant between tip of snout and caudal base. ...	...	*S. skarduensis**

Genus **Schizopygopsis** Steindachner

Schizopygopsis Steindachner, 1866, *Verh. zool. Bot. Ges. Wien.*, **16**, p. 786 pl. xvi, fig. 2 (type-species, *Schizopygopsis stoliczkae* Steindachner).—Mukerji, 1936, *Mem. Conn. Acad.*, **10**, pp. 351-354 (Ladakh.)

Diagnosis.—Body elongate, subcylindrical. Abdomen rounded. Head large and pointed anteriorly. Snout obtusely conical. Mouth inferior, transverse. Lips thick, fleshy and continuous at angles of mouth. Eyes laterally placed, not visible from below ventral surface. Lower lip with a horny covering. *Barbels absent.* Dorsal fin inserted midway between tip of snout and caudal base, with 10 or 11 rays and a finely serrated spine. Anal fin with seven rays, *and a sheath* of tile-like scales. Caudal fin forked. Scales small, few, covering only the shoulder region. Lateral line complete. Air-bladder, free, large, bipartite.

Distribution.—Baluchistan and Pamirs to the E. Himalayas, including the upper waters of Helmund, Oxus, Indus, Sutlej and Brahmaputra (Ysang-po) rivers. Recorded from Chumbi valley, upper Yangtze and Hwang ho in China also.

Remarks.—Young and small adults live in shallow streams and pools whereas large individuals live in the main river. Eggs are comparatively large 2 mm. in size. Young ones feed on nymphs and larvae of insects such as of Plecoptera, Diptera etc. Adults feed on vegetable matter.

Species.—*Schizopygopsis stoliczkae* Steindachner is the only species known from this area, although 17-20 species are known from Central and Wast Asia.

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*Mirza, M. R. and Awan, A. A. 1978. *Biologia*, **24** (2), pp. 199-203.

Genus **Gymnocypris** Günther

Gymnocypris Günther, 1868, *Cat. Fish. Brit. Mus.*. **7**, p. 169 (type-species, *Gymnocypris dobula* Günther. by original designation)—Talwar, 1978, *J. Bombay nat. Hist. Soc.*, **74**, pp. 501-505 (new species).

Diagnosis.—Body elongate, slightly compressed. Abdomen rounded. Head moderate, conical. Snout blunt, tip distinctly above level of lower margin of eye. Mouth terminal, transverse. Lips thin ; *lower lip with a horny covering on the inner side* only. Eyes large, in anterior half of head, not visible from below ventral surface. Margin of lower jaw rounded, its inner margin with a horny covering. Barbels absent. Dorsal fin inserted slightly anterior to pelvic base, slightly nearer to tip of snout than to caudal base, with eight rays and a coarsely serrated spine. Anal fin with six rays. Caudal fin forked. Scales small, present only above pectoral fin axil and on the commencement of the lateral line. Base of anal fin with a scaly sheath of 17 to 20 enlarged tiled scales. Lateral line curved anteriorly.

Distribution.—Central Asia to India (Ladakh), Lake Balkash, rivers Tchu, Tarym, Hwang ho.

Species.—*G. biswasi* Talwar—India : Chushuli, Ladakh.

Remarks.—This genus is included because of the record and description of *G. biswasi* from Ladakh by Talwar, 1978.

Genus **Diptychus** Steindachner

Diptychus Steindachner, 1866, *Verh. zool. biol. Ges. Wien.*, **16**, p. 787 fig. 6 (type-species, *Diptychus maculatus* Steindachner).—Mukerji, 1936, *Mem. Conn. Acad.* **10**, pp. 354-356 (Ladakh).

Diagnosis.—Body elongate, subcylindrical. Abdomen rounded. Head large, and pointed anteriorly. Snout obtuse. Mouth inferior, transverse, curved. Eyes laterally placed, not visible from below ventral surface. Lips continuous, lower lip with a mesially interrupted labial fold and a horny covering. *A pair of maxillary barbels.* Dorsal fin inserted nearer snout than caudal base, with 10 or 11 rays and without any spine. Anal fin with seven rays and with the *scaly sheath up to vent.* Caudal fin forked. *Scales small scattered along upper two third of body, the thoracic region and sides and tail.* Lateral line complete. Air-bladder free, with long posterior chamber extending up to vent.

Distribution.—A common species found in Indus and Yarkand river system. Also found in Tibet and Nepal. Pakistan : northern areas.

Species.—*Diptychus maculatus* Steindachner is the only species known so far.

Remarks.—An inhabitant of rapids. Spawning takes place during May to August. Young and immature stages feed on nymphs and larvae of Ephemeroptera, Plecoptera and Diptera. Adults live on slime, filamentous algae and other vegetable matter.

Genus **Ptychobarbus** Steindachner

Ptychobarbus Steindachner, 1866, *Verh, Zool. bot. Ges. Wien.*, **16**, p. 789 pl. xvii, fig. 4 (type-species, *P. conirostris* Steindachner).—Mukerji, 1936, *Mem. Conn. Acad* **18**, p. 356-359 (Ladakh, Upper Indus).

Diagnosis.—Body elongate, subcylindrical. Abdomen round. Head large and pointed anteriorly. Snout conical. Mouth anterior or inferior, arched. Eyes laterally placed, but not visible from below. Lips thick, fleshy, lower labial fold very broad, uninterrupted. *A pair of maxillary barbels present.* Dorsal fin inserted above posterior tip of pectoral fins with ten rays *and without any spine. A well developed thick fleshy appandage present in the axillae of the pelvic fins.* Anal fin with seven or eight rays and with a basal sheath of small tile-like scales ; scales small, covering the body. Caudal fin forked. Air-bladder free, simple, long. Lateral line complete.

Distribution.—Headwaters of Indus (Ladakh) and western border of Tibet. Pakistan : Rivers Yasin and Gilgit in northern areas.

Species.—*P conirostris* Steindachner is the only species occurring in the area dealt in this work.

Remarks.—Mainly an inhabitant of rivers at an altitude of *ca* 2566 meters. Appears to be a mixed feeder, since gut contents indicated slime, algae mixed with mud and sand, and chironemid larvae.

Cenus **Schizocypris** Regan

Schizocypris Regan, 1914, *Ann. Mag. nat. Hist.*, (8) **13**, p. 262 (type-species, *Schizocypris brucei* Regan, by orginal designation).

Diagnosis.—Body short, cylindrical. Abdomen rounded. Head large rounded anteriorly. Snout short, bluntly rounded, appearing somewhat swollen in lateral view. Mouth wide, transverse. Eyes large laterally placed, not visible from below ventral surface. Lips thin, no labial fold. *Barbels absent or vestigial.* Lower jaw prominent, but not very sharp with a spatulate appearance from below. Dorsal fin inserted ahead of pelvics, with 8 simple rays and a denticulated spine. *Anal fin short with six branched rays.* Caudal fin forked. *Scales poorly developed towards the tail, small along the sides, and moderate along the scapular region, abdomen naked.* Lateral line arched.

Distribution.—Pakistan : Waziristan, Baluchistan. Afghanistan.

Species.—*S. brucei* Regan is the only species known from this region.

Subfamily CULTRINAE †

Chilwas

A symphysial knob on lower jaw present or absent. A part or whole of abdominal edge cutting. Mouth directed upwards. Pharyngeal teeth in two or three rows. Dorsal fin without osseous ray, placed in posterior half of body. Lateral line concave. No barbels.

KEY TO GENERA*

1.	A knob at the symphysis of lower jaw absent. Predorsal scales do not extend to inter-orbital space. ...	*Chela* Hamilton
	—A knob at the symphysis of lower jaw present. Predorsal scales extend to interorbital space. ...	... 2
2.	Lateral line scales 120-160. (Abdominal keel below pectoral base hardened, head oblique to body axis and a muscular mass covered by scales extends on the head dorsal face to front of eyes)** ...	*Securicula* Günther
	Lateral line scales less than 120 (40-115) ...	... 3
3.	Lateral line scales 110-115. Pelvic fins not very posterior. ...	*Hypophthalmichthys* Bleeker
	—Lateral line scales 40-112. Pelvic fins posterior. ...	*Salmostoma* Swainson

Genus **Chela** Hamilton

Chela Hamilton, 1822, *Fish Ganges* pp. 258, 383 (type-species, *Cyprinus* (*Chela*) *cachius* Hamilton, as restricted by Bleeker).—Silas, 1958, *J. Bombay, nat. Hist. Soc.*, **55**(1) pp. 54—99 (revision).—Banarescu, 1969, *Ann. Mus. Stor. nat. Genoa*, **77** : 53-64 (revision).

Laubuca Bleeker, 1860, *Ichth. Archipel. Indici. Prodr.*, **2**, Cyprini (type-species, *Perilampys guttatus* McClelland = *Cyprinus* (*Chela*) *laubuca* (Hamilton).

Diagnosis.—Body long, compressed. Abdomen keeled from below pelvic origin to anus. Head short, compressed. Snout blunt. Mouth

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†Banarescu, 1967, Mirza, 1975 use the name Cultrinae in place of Abramidinae. Banarescu (1967) is of the opinion that "the East Asian genera with abdominal keel belong to a distinct subfamily and are not related to the European and American so called "Abramidinae" which actually belong to the Leuciscinae" (p. 297)

*The characters used in the Key namely the scales on lateral line is rather difficult to measure since in many cases the scales are deciduous and can be seen only through a powerful binocular microscope.

**The classification adopted is after the valuable studies of Banarescu (1967, 1968, 1969).

oblique, cleft reaching to below front margin of eye. Eyes large, lateral, in middle of head, may be visible from below ventrrl surface. Sub-orbital bones brood. Lips thin. Lower jaw without a knob at its symphysis. Dorsal fin inserted slightly behind anal origin, with 9—11 rays (2—3

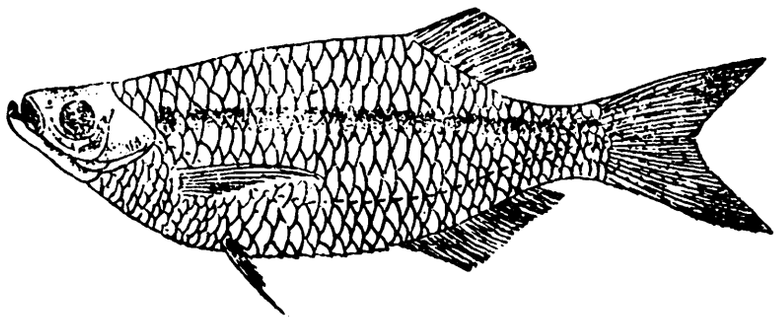


Fig. 40. Lateral view of *Chela laubuca* (Hamilton). (After Misra, K. S. 1962, Text-fig. 65).

simples). Pelvic fins inserted nearer to pectoral than to anal. Outer pelvic ray elongated. Anal fin with 13—25 rays. Caudal lobes equal. Predorsal scales do not extend to space between eyes. *Lateral line curved downwards, with 34—68 scales.*

Distribution.—India. Pakistan. Bangladesh. Burma. Sri Lanka. Peninsular. Thailand. Malaya. Sumatra.

Species.—1. *C.* (*Chela*) *cachius** (Hamilton)—India. Pakistan. Nepal. Bangladesh. Burma.

2. *C.* (*Chela*) *laubuca* (Hamilton)—India : Andhra Pradesh, Orissa, West Bengal, Madhya Pradesh, Assam, Pakistan. Nepal. Bangladesh. Burma. Sri Lanka.

3. *C.* (*Neochela*) *dadyburjori* Menon—India : Cochin. Kerala. *includes *C. atpar* (Hamilton)

KEY TO SUBGENERA

1. Lateral line incomplete or absent.	...	*Neochela* Silas (*N. dadyburjori* Menon)
— Lateral line complete and present.	...	*Chela* (sensu stricto)

KEY TO SPECIES

1. Lateral line incomplete or absent (A broad moniliform dark stripe interrupted in 3—5 places extends from opercle to caudal base).	...	*C.* (*Neochela*) *dadyburjori*
— Lateral line complete	...	2

C. atpar (Hamilton) is a synonym of this species according to Silas, (1958).

2. Lateral line scales 51—68, small much more numerous on body. Body depth 4.0 to 4.25 in total length ... *C. (Chela) cachius*
Lateral line scales 34-37, large not many on body. Body depth 3.5 to 4.5 in total length. ... *C. (Chela) laubuca*

Genus **Securicula** Günther

Securicula Günther, 1868, *Cat. Fish. Brit. Mus.*, **7**, p. 332 (type-species, *Cyprinus gora* Hamilton).—*Pseudorygaster* Banarescu, 1967, *Rev. Roum. Biologie, Zoologie*, **12** (5), p. 303 (type-species, *Cyprinus gora* Hamilton, by original designation).—Mirza. 1975, *Biologia*, **16** (2), p. 92.

Diagnosis.—Body elongated, strongly compressed. *Abdomen strongly and sharply keeled*, not covered by scales *extending from below opercle to anal origin*, the keel is supported anteriorly by an extension of the pectoral girdle. Head moderate, axis somewhat oblique comparatively to body axis ; *a muscular mass covered by skin and scales extends on the dorsal face of head to nostrils.* Snout blunt. *Mouth oblique, almost vertical*, cleft reaching anterior border of orbit. Eyes moderate, superolateral, in anterior part of head, not visible from below ventral surface. Sub-orbital bones broad. Lips thin. Jaws subequal, *a strong symphysial knob on lower jaw with a corresponding notch on upper.* Dorsal fin short, very posterior, inserted above anal fin with ten rays (seven branched). Pectoral fins low, pointed, with a well developed elongated and rather pointed scaly flap above on inner side of fin, and with three rows of of scales covering the base on the outer side of the fin. Pelvic fins inserted nearer to anal than to pectoral. Anal fin with 17 or 18 rays (13 to 15 branched). Caudal fin deeply forked. Scales very small. Lateral line bent gently downwards, complete with 120 scales.

Distribution.—India : North India up to Orissa and Assam. Pakistan : Punjab, Sind, N. W. F. Provinces. Nepal. Bangladesh.

Species.—*S. gora* (Hamilton) is the only species so far known—distribution as of the genus.

Genus **Salmostoma** Swainson

Salmostoma Swainson, 1839, *Nat. Hist. Fish.*, **2**, p. 184 (type-species, *Cyprinus bacaila* Hamilton, by subsequent designation).—Banarescu, 1968, *Rev. Roum. Biol Zool.*, **13** (1), pp. 3—14 (revision).

Diagnosis.—Body elongated, compressed. Abdomen keeled from below pectoral fin to anus, *keel not hardened.* Head moderate to long, compressed. Snout blunt, may be short, or long and pointed (*S. bacaila*). Mouth oblique to body axis, cleft reaching anterior margin of orbit or

slightly ahead. Eyes moderate or large, lateral or supero-lateral, not visible from below ventral surface. Sub-orbital bones broad. Lips thin. Lower jaw longer, with a knob at the junction (=symphysis) of the two bones ; *symphysial knob varying strong to very rudimentary but always present*. Dorsal fin short, inserted mostly opposite anal fin, ahead in some (*S. boopsis*), with nine or ten rays (seven branched). Pectoral fins long may or may not reach the pelvic fins. Pelivic fin outer ray generally not elongated. Anal fin short with 14—22 rays (three simple). Caudal fin deeply forked. Scales small to moderate, often deciduous. Lateral line complete, generally decurved with 42—112 scales.

Distribution.—India. Pakistan. Bangladesh. Burma.

Species.—

1. *S. acinaces* (Valenciennes)*—India : Cauvery river system, Bhavani river, Wynaad, W ghats, S. India, also R. Hooghly, W. Bengal.
2. *S. boopsis* (Day)—India : W. ghats, S. Canara, Mutha-Mula river, Poona.
3. *S. bacaila* (Hamilton)—India : Ganga, Brahmaputra, Mahanadi river system. Pakistan : Indus drainge. Nepal. Bangladesh.
4. *S. clupeoides* (Bloch)—India : Narbada, Tapi, Krishna, Godavary and Cauvery river system. Recorded from Nasik, Deolali, Jabalpur, Also Burma according to Day (1878).
5. *S. horai* (Silas)—India : Cauvery river, Coorg, Karnataka.
6. *S. novacula* (Valenciennes)—India : W. ghats, Krishna and Godavary river system. Recorded from Deolali, Nasik, Beale Dam, Deolali, Poona.
7. *S. phulo phulo* (Hamilton)—India : Ganga, Brahmaputra river system. Bangladesh.

7. 1. *S. phulo orissaensis*—Banarescu, 1968—India : Mahanadi lower reaches in Orissa.

7. 2. *S. phulo punjabensis* (Day)—Pakistan : Indus river, Sind, Lahore, Punjab.

8. *S. sardinella* (Valenciennes)—India : Orissa, W. Bengal. Bangladesh. Burma : Pegu, Rangoon, Moulmein.
9. *S. sladoni* (Day)—Burma : Bhamo.
10. *S. untrahi* (Day)—India : Mahanadi river system, Orissa ; Cauvery river system, S. India.

**Chela argentea* Day in a synonym of this specis (*vide* Banarescu P. 1968, p. 9.)

KEY TO SPECIES

1.	Lateral line scales above 70 (74-112). ...	... 2
—	Lateral line scales below 70 (39-64). ...	... 8
2.	Body with vertical dark stripes on sides. ...	*S. horai*
—	Body without vertical dark stripes on sides.	... 3
3.	Gill rakers 76-94. Anal fin with 14-17 branched rays.	*S. novacula*
	—Gill rakers less than 30. Anal fin with 11-19 branched rays. ...	... 4
4.	Anal fin with 11-14 branched rays. ...	... 5
	—Anal fin with 14-19 branched rays. ...	... 6
5.	Number of scales between lateral line and pelvic fin base three or four. Gill rakers 24-29. ...	*S. clupeoides*
	Number of scales between lateral line and pelvic fin base four to six. Gill rakers 17-21. ...	*S. bacaila*
6.	Anal fin with 14-16 branched rays. Gill rakers 17 or 18. ...	*S. phulo punjabensis*
	Anal fin with 17-19 branched rays. Gill rakers 13-16. ...	... 7
7.	Lateral line scales 76-86. ...	*S. phulo orissaensis*
	Lateral line scales 99-112. ...	*S. phulo phulo*
8.	Anal fin with 12-15 branched rays. ...	... 9
	Anal fin with 16-19 branched rays. ...	... 11
9.	Anal fin with 12-14 branched rays. Lateral line with 39-42 scales. Dorsal fin inserted in advance of anal fin. ...	*S. boopsis*
	Anal fin with 14-15 branched rays. Lateral line with 42-53 scales. Dorsal fin inserted above anal fin.	... 10
10.	Lateral line with 42-46 scales. Symphysial knob on lower jaw rudimentary. Lateral line slightly curved. ...	*S. acinaces*
	Lateral line with 59-63 scales. Symphysial knob on lower jaw strong. Lateral line strongly bent. ...	*S. untrahi*
11.	Lateral line with 47-52 scales. Symphysial knob on lower jaw quite rudimentary. ...	*S. sardinella*
	Lateral line with 61-64 scales. Symphysial knob on lower jaw normal. ...	*S. sladoni*

Subfamily Hypophthalmichthyinae

Abdomen strongly keeled from breast to vent. No barbels. Scales do not extend to interorbital space.

Genus **Hypophthalmichthys** Bleeker

Silver carp

Hypophthalmichthys Bleeker, 1859, *Nat. Tijdschr. Ned. India*, **20**, p. 493 (type-species, *Leuciscus molitrix* Valenciennes by original designation).

Diagnosis.—Body stout, compressed. *Abdomen strongly compressed with a sharp keel from breast to vent.* Head moderate. Snout bluntly round. Mouth anterior, large, wide, cleft not extending to anterior margin of eyes. Eyes rather small, anterior, subinferior, *visible from below ventral surface.* Lips thin. Upper jaw a little protruded upward a little longer than the lower ; lower jaw with a tubercle. *No barbels present.* Dorsal fin inserted behind pelvic fins, or above tip of pectoral fins *with ten rays* (seven branched). Anal fin with 14—17 rays (12—14 branched). Caudal fin forked. *Scales minute. cycloid. Luteral line decurved, continuous with 110-115 scales.*

Distribution.—Amur river drainage, U. S. S. R. China : Yangtze, West river, Kwangsi, Kwangtung in south and central China. Introduced into India in 1959 and elsewhere.

Species.—*Hypothalmichthys molitrix* (Valenciennes)—distribution as of the genus. Introduced into India and elsewhere.

Subfamily Rasborinae

A symphysial knob on lower jaw usually present or may be absent (*Horadandia*). Mouth oblique or directed upwards. Pharyngeal teeth in one to three rows. Dorsal fin without an osseous ray. Barbels present or absent. Lateral line curved and in lower half of caudal peduncle, may be absent (*Horadandia*).

KEY TO GENERA

1.	Lower lip absent. Lower jaw with a sharp crescentic edge. ...	*Aspidoparia* Heekel
	—Lower lip present. Lower jaw with or without a symphysial knob ...	... 2
2.	Maxillary barbels very long. No symphysial knob on lower jaw. ...	*Esomus* Swainson
	—Maxillary barbels short or absent. A symphysial knob present on lower jaw ...	... 3
3.	Cleft of mouth often extending beyond anterior margin of eye. ...	*Barilius* Hamilton
	—Cleft of mouth not extending beyond anterior margin of eye. ...	... 4

4.	Upper lip absent. Lateral line incomplete ...	*Amblypharyngodon* Bleeker	
	—Upper lip present. Lateral line complete, when present. ...	...	5
5.	Lateral line absent. Barbels absent. ...	...	6
	—Lateral line present. Barbels present or absent. ...	...	7
6.	Anal fin with nine rays. (Sri Lanka). ...	*Horadandia* Deraniyagala	
	—Anal fin with 13-16 rays. (Burma). ...	*Microrasbora* Annandale	
7.	Anal fin with 13-20 rays. Dorsal fin inserted opposite interspace between anal and pelvic fins. ...	*Danio* Hamilton	
	—Anal fin with seven or eight rays. Dorsal fin inserted behind origin of pelvic fin. ...	*Rasbora* Bleeker	

Genus **Esomus** Swainson

Flying Barb

Esomus Swainson, 1839, *Nat. Hist. Fishes.* **2**, p. 285 (type-species, *Esomus vittatus* Swainson = *Cyprinus danrica* Hamilton, by monotypy). Ahl, 1923, *Mitt. zool. Mus. Berlin*, **11**, pp. 38-43 (revision).

Diagnosis.—Body elongate, strongly compressed. Abdomen rounded. Head small, blunt. Snout blunt. Mouth small, *obliquely directed upwards.* Eyes placed inferiorly, visible from below ventral surface. Lips thin. Lower jaw prominent. Two pairs of barbels, *maxillary pair very long extending up to anal fin.* Pharyngeal teeth in a single row. Dorsal fin inserted in the interspace between anal and pelvic fins, nearer anal than pelvic, with six branched rays and no spine. Anal fin with

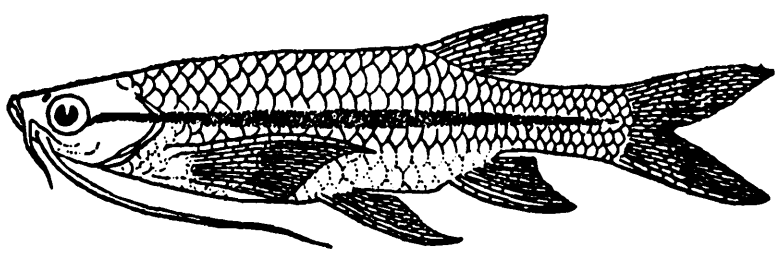


Fig. 41. Lateral view of *Esomus danricus* (Hamilton). (After Misra, K. S. 1962, Text-fig. 69).

five branched rays. Caudal fin forked. Scales of moderate size. Lateral line present or absent ; when present, strongly arched anteriorly, and runs in lower half of caudal peduncle, and with 27—34 scales.

Distribution.—Throughout India. Pakistan. Nepal. Bangladesh. Sri Lanka. Malaya. Thailand. South Viet-Nam (Mekong basin).

Species.—1. *E. ahli* Hora & Mukerji—Burma.

2. *E. altus* (Blyth)—Burma.

3. *E. barbatus* (Jerdon)—India : Tamil Nadu, Karnataka.

4. *E. danricus* (Ham.) †—Throughout North India. Pakistan. Nepal. Bangladesh. Burma. Sri Lanka.

5. *E. thermoicos* (Val.)*—Sri Lanka.

KEY TO SPECIES**

1.	Lateral line complete or nearly so extending to atleast the base of anal fin.	2
	—Lateral line absent or nearly so, piercing only four to six scales anteriorly.	4
2.	A black spot above base of pectoral fin present. Body depth 2.9 to 4.0 in standard length. ...	*E. altus*
	—No black spot above base of pectoral fin. Body depth 3.7 to 4.5 in standard length.	3
3.	Side with black, broad lateral bands. Predorsal scales 19 or 20. ...	*E. thermoicos*
	—Sides plain without any bands. Pre-dorsal scales 17. ...	*E. barbatus*
4.	A well defined precaudal spot present. Sides without lateral bands. 12 scales round caudal peduncle. ...	*E. ahli*
	—No precaudal spot present. Sides with broad, lateral bands. 14 scales round caudal peduncle.	*E. danricus*

Remarks.—These are of larvicidal value and also used as aquarium pets. They are gregarious and spend much of their time at the surface. They live in shallow waters of ponds, tanks, pools, paddy fields, ditches, etc., where they breed freely.

Gsnus **Danio** Hamilton

Zebra Fishes

Danio Hamilton, 1822, *Fishes of the ganges*, pp. 321, 390 (type-species *Cyprinus dangila* Hamilton).—Hora & Mukerji, 1933. *Rec. Indian Mus.*, 39 (1) pp. 130-133 (Key).

Diagnosis.—Body elongate, compressed, subcylindrical. Abdomen rounded. Head moderate, blunt. Snout obtuse. *Mouth anterior, cleft of mouth shallow* not protractile, directed obliquely upwards, the end of

† Rao and Sharma (1972) have described *E. danricus jabalpurensis* a new subspecies from Pariat river, Jabalpur which is a synonym.

* Silas (1952) considers this as a subspecies of *E. barbatus*.

** After Hora & Mukerji, 1928. *Rec. Indian Mus.* 30(1), pp. 41-50.

the lower jaw in line with the dorsal profile. Eyes large, centrally placed not visible from below ventral surface. Lips thin and simple. Lower jaw prominent, with a knob at the symphysis. One or two pairs of barbels, rudimentary, or none. Pharyngeal teeth hooked. Dorsal fin inserted opposite interspace between anal and pelvic fins, nearer to caudal base than to tip of snout, with 7-19 rays. Anal fin with 13-20 rays. Caudal fin emarginate, lunate or forked. Scales moderate. Lateral line concave, complete, incomplete or absent, with 26-65 scales when complete. *Body coloured with longitudinal bands.*

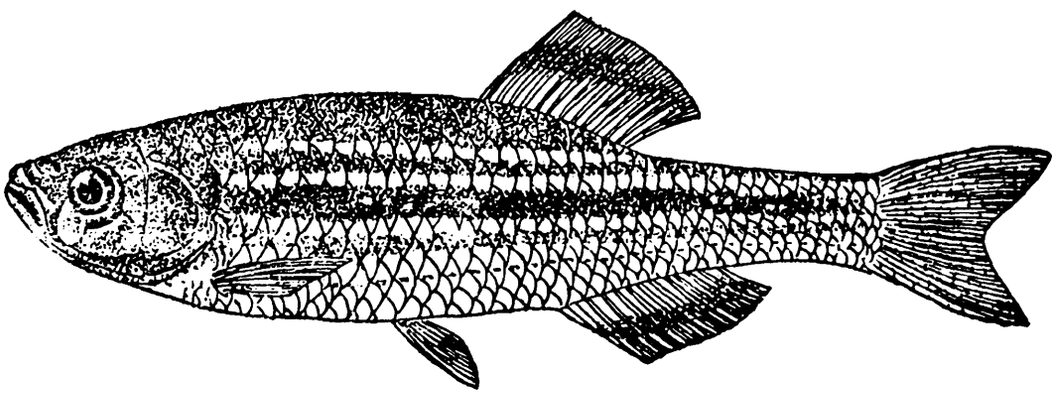


Fig. 42. Lateral view of *Danio aequipinnatus* McClelland (After Misra, K. S. 1962, Text-fig. 68).

Distribution.—Throughout India, Pakistan. Nepal. Bangladesh. Sri Lanka. Burma. Thailand. Malaya. Sumatra. Yunnan province, China.

Species.*—Two subgenera *Danio* and *Brachydanio* differentiated as under.—

Danio : Dorsal fin with 12-16 branched rays. Lateral line complete.

Brachydanio : Dorsal fin with seven branched rays. Lateral line incomplete or absent.

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*A number of species of *Danio* previously described have been synonymised as under.—

1. *D. analipunctata* Boulenger (Burma) = *D. albolineatus* vide Hora & Mukerji, 1934, *Rec. Indian Mus.* **36**, p. 130.
2. *D. browni* Regan (Burma) = *D. aequipinnatus* vide Hora & Mukerji, 1934. *Rec. Indian Mus*, **36**, pp. 131-132.
3. *D. chrysops* (Valenciennes) (Burma) = Generic position uncertain ; vide Hora & Mukerji, 1934. *Rec. Indian Mus.*, **36**, p. 134.
4. *D. lineatus* Day (Burma) = *Rec. Indian Mus*, **31**, pp. 205, 206.
5. *D. lineolatus* Blyth (Burma) = *D. aequipinnatus* vide Prashad & Mukerji, 1929. *Rec. Indian Mus.*, **31** (3), pp. 181-223.
6. *D. micronema* Günther (Burma) = *D. aequipinnatus* vide Chaudhuri, 1919. *Rec. Indian Mus.*, **16**, p. 283.
7. *D. malabaricus* Jerdon (S. India) = *D. aequipinnatus* vide Hora & Nair, 1941. *Rec. Indian Mus.*, **43**, p. 371.
8. *D, strigilifer* Myers (S. India) = *D. aequipinnatus* vide Hora & Nair, 1941. *Rec. Indian Mus.*, **43**, p. 371.

Subgenus *Danio* :

1. *D. aequipinnatus* McClelland-India : Eastern Himalaya, Meghalaya and Deccan. Nepal. Bangladesh. Burma : Tenasserim provinces. Thailand. Sri Lanka.
2. *D. annandalei* Chaudhuri—Burma : Dawna hills.
3. *D. dangila* (Hamilton)—India : Bihar, Bengal, E. Himalaya. Bangladesh. Nepal. Burma : Akyab.
4. *D. devario* (Hamilton) (Pl. 2, Fig. A)—India : North India, Krishna-Godavary river system, Deccan. Bangladesh. Nepal. Pakistan.
5. *D. fraseri* Hora & Mukerji—India : R. Darna, Deolali, Maharashtra.
6. *D. kakhiensis* Anderson—Burma.
7. *D. naganensis* Chaudhuri—India : Naga hills, Manipur.
8. *D. neilgherriensis* (Day)—India : Nilgiri hills, S. India.
9. *D. sinosus* Day—Burma.

Subgenus *Brachydanio* :

1. *D. acuticephala* Hora—Burma.
2. *D. albolineatus* (Blyth)—Burma : Moulmein.
3. *D. choprae* Hora—Burma.
4. *D. feegradei* Hora—Burma : Sandoway.
5. *D. nigrofasciatus* (Day)—Burma : Pegu, Moulmein.
6. *I rerio* (Hamilton)—India : Eastern India from Bengal up to Krishna river system. Nepal. Bangladesh. Pakistan.
7. *D. shanensis* Hora—Burma.
8. *D. sondhii* Hora—Burma.

Subgenus **Danio**

KEY TO SPECIES*

1.	One or two spines along anterior margin of orbit below nostrils. ...	*D. (D) spinosus*
	No spines along anterior margin of orbit. ...	... 2
2.	Barbels absent. Lateral line scales 35-38. ...	*D. (D) devario*
	Barbels present. ...	... 3
3.	Barbels not well developed. Maxillary barbels, if present rudimentary. Rostral barbels short.	... 4
	Barbels well developed. ...	... 6

*After Hora & Mukerji. 1934. *Rec. Indian Mus.*, 36,pp. 133-134.

4.	Lower lip hypertrophied forming a broad, loose flap along the lower jaw. Lateral line scales 37-40. ...		*D. fraseri*
	Lower lip not hypertrophied, simple. Lateral line scales 32-37. ...	...	5
5.	Lateral line scales 32. L. tr. 11 ...		*D. (D) kakhiensis*
	Lateral line scales 35-37. L. tr. 9 ($6\frac{1}{2}/2\frac{1}{2}$) ...		*D. (D) neilgherriensis*
6.	Lateral color bands breaking up anteriorly to from a mottled pattern. ...	...	7
	Lateral color bands not breaking up anteriorly to form a mottled pattern. ...	...	8
7.	Both pairs of barbels much longer than eye diameter. Lateral line scales 36-42. ...		*D. (D) dangila*
	Both pairs of barbels equal to or shorter than eye diameter. ...		*D. (D) annandalei*
8.	Several well marked and uniform lateral bonds. Lateral line scales 34-36. ...		*D. (D) aequipinnatus*
	A single lateral band well marked posteriorly. Lateral line scales 38-40. ...		*D. (D) naganensis*

Subgenus **Brachydanio**

KEY TO SPECIES*

1.	Lateral line complete or rudimentary. ...	...	2
	Lateral line totally absent. ...	...	7
2.	Lateral line complete or extending beyond anal fin. ...	...	3
	Lateral line incomplete, not extening to anal fin. ...	...	4
3.	Maxillary barbels longer than head. Lateral line with 39 scales, 20 predorsal scales. ...		*D. (B) feegradei*
	Maxillary barbels shorter than head. Lateral line with 34 scales. Predorsal scales 17. ...		*D. (B) shanensis*
4.	Two pairs of well developed barbels present. ...	...	5
	Barbels absent. ...	...	6
5.	Lateral line extending beyond pectoral fin, but not reaching base of pelvic fin. Lateral line scales 31-33. ...		*D. (B) albolineatus*
	Lateral line short, not extending beyond pectoral fin. Lateral line scales 28-30. ...		*D. (B) rerio***

*After Hora & Mukerji, 1944, *Rec. Indian Mus.*, 36, pp. 130-131.

**As the lateral line in this species is highly variable, it is indicated in both the possible combination of the key.

6.	A well defined black mark near upper angle of gill opening present. Lateral line scales 32-34. ...	*D. (B) sondhii*
	No such black mark near upper angle of gill opening. Lateral line scales 30. ...	*D. (B) acuticephala*
7.	Only one pair of maxillary barbele present. ...	*D. (B) nigrofasciatus*
	Two pairs of maxillary barbels present. ...	... 8
8.	Maxillary barbels longer than head. Lateral line scales 28-30. ...	*D. (B) rerio***
	Maxillary barbels shorter than head. Lateral line scales 30-32. ...	*D. (B) choprae*

Genus **Horadandia** Deraniyagala

Horadandia Deraniyagala, 1943, *J. Ceylon. br. roy. Asiat. Soc.*, (4) 35, p. 1 (type-species, *Horadandia atukorali* Deraniyagala, by monotypy).—Brittan 1954, *Monogr. Inst. Sci. & Tech, Manila* 3, Reprinted, T. F. H. Publication p. 202.

Diagnosis.—Similar to *Rasbora* but differing as below.—

Symphysial knob absent. Pharyngeal teeth in two rows (1 or 2, 4-4, 2 or 1) and slightly ridged. *Lateral line absent.* No lateral stripes. Anal fin with three simple and six branched rays. *No barbels.*

Distribution—Sri Lanka.

Genus **Microrasbora** Annandale

Microrasbora, Annandale, 1918, *Rec. Indian Mus.*, **14**, p. 50 (type-species, *Microrasbora rubescens* Annandale, by original designation).

Diagnosis.—Similar to *Rasbora* but differing in having *no lateral line* or a very rudimentary one and anal fin with 13-16 (8—13 branched) rays. *No prominences are present on the lower jaw. No barbels.* Very tiny in size.

Distribution.—Burma : Inle Lake.

Species.—1. *M. erythromicron* Annandale—Burma : Inle Lake.
2. *M. rubescens* Annandale—Burma : Inle Lake.

KEY TO SPECIES

1.	Lateral line scales 29-32. Anterior border of dorsal fin in advance of anal and immediately above vent. Pectoral fins extend beyond base of pelvic fin. ...	*M. rubescens*
	—Lateral line scales 21-25. Anterior border of dorsal fin in advance of vent. Pectoral fins hardly extend to pelvic fin base. ...	*M. erythromicron*

Genus **Rasbora** Bleeker

Rasbora Bleeker, 1860, *Acta Soc. Sci. Indo-Neerl.* **7**, p. 435 (type-species, *Cyprinus rasbora* Hamilton, by tautonymy)—Brittan, 1954, *Monog. Inst. Sci. & Techn. Manila*, **3**, p. 134 (revision).

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head large, pointed. Snout slightly pointed. Mouth large, cleft oblique. Eyes placed laterally, not visible from below. Lips thin. Lower jaw prominent, *with one central and two internal prominences*, one on each side fitting into corresponding emargination on upper jaw. Barbels

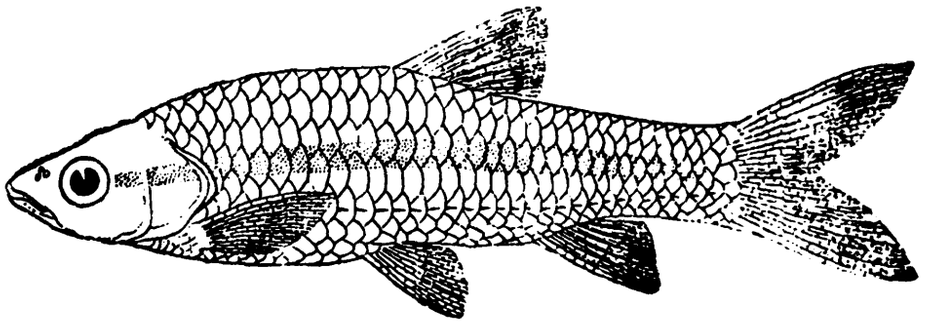


Fig. 43. Lateral view of *Rasbora daniconius* (Hamilton). (After, Misra, K. S. 1962, Text-fig. 70).

one rostral pair or none. Pharyngeal teeth one or two rows. Dorsal fin inserted behind origin of pelvic fin, with nine (seven branched) rays, and no spine. Anal fin with seven or eight rays (five or six branched). Caudal fin emarginate or forked. Scales large or moderate. Lateral line concave, complete, with 26—44 scales.

*Distribution**.—Throughout India, Pakistan, Nepal, Bangladesh, Burma, Sri Lanka, Thailand, Viet-Nam, South China and Malaysia.

KEY TO SUBGENERA†

1. Anal fin with three simple and six branched rays (Sri Lanka). ...		*Rasboroides* Brittan (*R. R. vaterifloris*) single species
—Anal fin with three simple and five branched rays. ...	...	2
2. A pair of small maxillary barbels present. Lateral line with 40 to 44 scales. ...		*Megarasbora* Günther (*R.* (*R.*) *elanga*) single species
—Barbels absent. Lateral line with less than 36 scales. ...		*Rasbora* Bleeker

*Records of *Rasbora* species from Africa are based on misidentifications. The genus is not found in Africa.

† After Brittan, M. R. 1954.

Subgenus **Rasbora** Bleeker

1. *R. caverii* (Jerdon)—India : Southern India, notably Karnataka, especially the Cauvery basin. Sri Lanka.

2. *R daniconius daniconius* (Hamilton) (Pl. II, Fig. B)—Throughout India. Pakistan. Nepal. Bangladesh. Sri Lanka. Burma. Malay Archipelago. Zanzibar.

3. *R. daniconius labiosa* Mukerji—India : Deolali, Nasik dist. Maharashtra.

4. *R. kobonensis* Chaudhuri—India : Kobo, Abor, Arunachal Pradesh.

5. *R. rasbora* (Hamilton)—India : Gangetic provinces and the Coromandel coast. Pakistan. Bangladesh. Burma. Thailand.

Subgenus **Megarasbora** Günther

6. *R. elanga* (Hamilton)—India : W. Bengal, Assam. Bangladesh. Burma.

Subgenus **Rasboroides** Brittan

7. *R. vaterifloris* Deraniyagala—Sri Lanka : Kaluganga river near Glukvattai ferry on Ratnapura to Gilimale Road, Sabaragamuwa province.

KEY TO SPECIES

1.	Anal fin with 3 simple and six branched rays. (Sri Lanka). ...	*R. (Rasboroides) vaterifloris*
	—Anal fin with 3 simple and five branched rays. ...	... 2
2.	A pair of small maxillary barbels present. 40 to 44 scales along lateral line. ...	*R. (Megarasbora) elanga*
	—No barbels. Lateral line scales less than 36.	... 3
3.	Pores in lateral line about 19. Lateral line ... scales 30. ...	*R. (Rasbora) kobonensis*
	—Pores in lateral line more than 21. Lateral line scales 28 to 35. ...	... 4
4.	Lower lip hypertrophied, projecting beyond upper jaw and with three distinct lobe-like structures. First doroal fin rays with fleshy sheaths. ...	*R. (Rasbora) daniconius labiosa*
	—Lower lip simple. Fins without fleshy sheaths. ...	... 5

5. Distance from anterior base of dorsal fin to end of hypural plate when carried forward falling behind the posterior margin of eye. ... *R. (Rasbora) caverii*

—Distance from anterior base of dorsal fin to end of hypural plate (=dorsal-hypural distance) when carried forward falling before the posterior margin of eye of at its anterior border. 6

6. Lateral line with 32 to 34 scales. A black lateral stripe along centre of body present. ... *R. (Rasbora) daniconius*

—Lateral line with 28 to 31 scales. Caudal fin with well defined blackish hind-border. ... *R. (Rasbora) rasbora*

Genus **Aspidoparia** Heckel

Aspidoparia Heckel, 1843, In : *Fenzl. Abdild. Thiere Pill. Syr. Fische.* p. 186 (type-species, *Aspidoparia sardina=Aspidoparia morar* (Ham.)).

Diagnosis.—Body elongate, subcylindrical. Abdomen rounded. Head moderate, rounded anteriorly. Snout obtuse. Mouth small, inferior. Eyes lateral, not visible from below ventral surface. Lips thin. *Lower jaw without any lip* and with a sharp crescentic bony edge. No barbels. Pharyngeal teeth plough-shaped, and in two or three rows. Dorsal fin inserted behind pelvics, with 9 or 10 rays and without any spine. Anal fin with 9—12 rays. Caudal fin forked. Scales of moderate size. Lateral line greatly decurved, running in lower half of caudal peduncle with 38—60 scales.

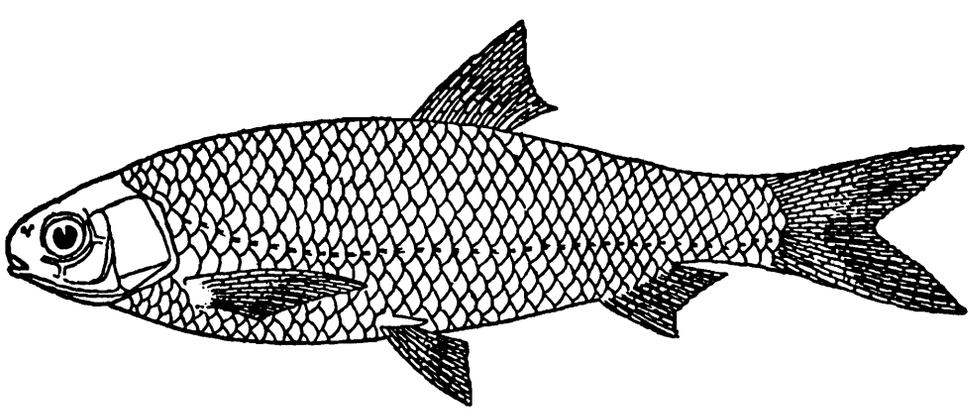


Fig. 44. Lateral view of *Aspidoparia morar* (Hamilton). (After Misra, K. S. 1962, Text-fig. 71).

Distribution.—Throughout Northern India. Nepal. Pakistan. Bangladesh. Burma. The Southern limit in India is the Krishna river system.

Species.—1. *A. jaya* (Hamilton)—India : Haridwar, U. P., Assam. Nepal. Bangladesh.

2. *A. morar* (Hamilton)—As of the genus.

KEY TO SPECIES

1. Lateral line scales 52—60. Anal fin with nine rays 4½ rows of scales between lateral line and base of pelvic fin. ... *A. jaya*

—Lateral line scales 38-42. Anal fin with 10-12 rays. 2½ to 3 rows of scales between lateral line and base of pelvic fin. ... *A. morar*

Genus **Amblypharyngodon** Bleeker

Amblypharyngodon Bleeker, 1860, *Ichth. Arch Ind. Prodr.*, 2, p. 403 (type-species, *Cyprinus mola* Hamilton, by original designation).

Diagnosis.—Body moderately elongate, subcylindrical. Abdomen rounded. Head conical, compressed. Snout with thin integuments, obtusely rounded. Mouth wide, antero-lateral, not protractile. Eyes large, centrally placed, not visible from below ventral surface. *Upper lip absent.* Lower lip with a short labial fold. Lower jaw prominent. Pharyngeal teeth molariform. No barbels. Dorsal fin inserted slightly behind insertion of pelvic fin, with nine rays and no spine. Anal fin short with seven rays. Caudal fin forked. Scales small. Lateral line incomplete, with 55—75 scales.

Distribution.—Throughout India. Pakistan. Nepal. Bangladesh. Burma. Sri Lanka.

Species.—1. *A. atkinsonii* (Blyth)—Burma.

2. *A. melettina* (Val)—India : W. ghats, Tamil Nadu. Sri Lanka.

3. *A. microlepis* (Bleeker)—India : Eastern and Southern India. Bangladesh.

4. *A. mola* (Hamilton) (Pl. II, fig. C)—India : Throughout except Kerala. Nepal. Bangladesh. Burma. Pakistan.

KEY TO SPECIES

1. Four or five rows of scales between lateral line and base of pelvic fin. 2

—Nine or ten rows of scales between lateral line and base of pelvic fin. 3

2. Head length less than 5 times in total length (4.75-5.0). A broad silvery lateral band present. ... *A. microlepis*

—Head length more than 5 times in total length (5-5.5). No such lateral band. Greenish along back becoming silvery on sides beneath. A bright greenish yellow band divides the colours of the back ... *A. melettina*

3. Lateral line scales 55-65. Body depth 3·3 in total length. No lateral band. A golden gloss about the head present. ... *A. atkinsonii*

—Lateral line scales 65-75. Body depth 4 to 4. 25 in total length. A silvery lateral band with dark markings on dorsal, anal and caudal fins present. ... *A. mola*

Genus **Barilius** Hamilton

Hill Trouts

Barilius Hamilton 1822. *Fish Ganges*, p. 384 (type-species, *Cyprinus barila* Hamilton, by tautonymy).

Diagnosis.—Body moderately elongate, compressed, subcylindrical. Abdomen rounded. Head sharply pointed. Snout compressed, pointed, may be with "pearl-organs" and tubercles. Mouth anterior, or obliquely directed upwards, not protractile. Eyes large, superior, in the anterior half of head not visible from below ventral surface. Lips thin and simple. Upper jaw longer than lower, lower with a knob above the symphysis and an emargination to receive it in the upper jaw. One or two rows hooked. Dorsal fin inserted opposite interspace between pelvic and anal fin, nearer caudal fin base than tip of snout, with 9—13

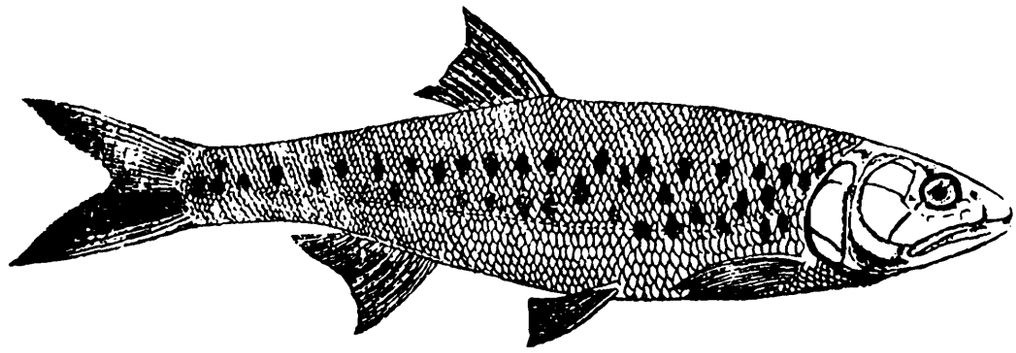


Fig. 45. Lateral view of *Barilius bola* (Hamilton). (After Misra, K. S. 1962, Text-fig 67).

rays and no spine. Anal fin with 9—17 rays. Caudal fin forked. Scales moderate. Lateral line concave, complete or incomplete or absent; with 38—94 scales when present. Air-bladder large, free, extending to entire length of abdomen. *Body generally coloured with vertical bands or cluster of dots.*

Distribution.—Throughout India, Pakistan, Nepal, Bangladesh, Sri Lanka, Burma, up to Malaysia. Also found in Egypt. West Africa, Zambesi river.

Species†.—

1. *B. auropurpureus* Annandale—Burma.*
2. *B. bakeri* Day—India : Kerala high ranges.
3. *B. barila* (Hamilton)—India : North India and Orissa. Nepal.
4. *B. barna* (Hamilton)—India : Ganga, Brahmaputra river system, also Mahanadi. Bangladesh. Nepal.
5. *B. bendelisis bendelisis* Hamilton—India : throughout except Kerala. Nepal. Pakistan. Sri Lanka.

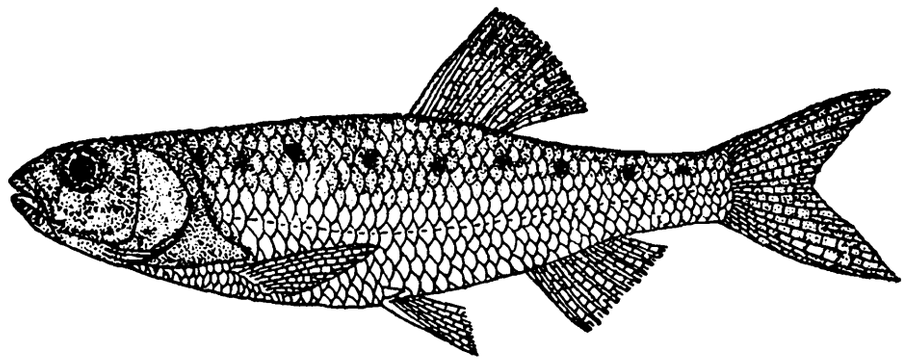


Fig. 46. Lateral view of *Barilius bendelisis* (Hamilton). (After Misra, K, S. 1962, Text-fig. 66).

5. 1. *B. bendelisis chedra* Hora**—India : Naga hills, Nagaland. Bangladesh.
6. *B. bola* (Hamilton)—‡India : North India up to Orissa. Bangladesh. Nepal. Burma. Pakistan.

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*B. *auropurpureus* Annandale has been segreagted under a separate genus *Inlecypris* by Howes (1980. *Bull. Br. Mus. Nat. Hist.* (Zool.) 38(3) : 171-173). In differs from *Barilius* in having the dorsal fin inserted above anal fin and in the possession of a ventral keel, obliquely angled mouth, pointed snout and a large eye. This is not included in the key.

**Considered a synonym of *B. bendelisis bendelisis* by Menon 1974.

†The following species known from the area of study have been synonymised as under.—

1. *B. bonarensis* Chaudhuri (Bonar, Garwal, U. P.) = *B. barila* vide Menon, A. G. K. 1974, p. 10.
2. *B. goha* Hamilton (Kosi, Yamuna, Son rivers) = *B. bola* vide Hors, S. L. 1937, *J. Bombay nat. Hist.*, 39 (2), pp. 201-202.
3. *B. modestus* Bleeker (Sind, Pakistan = *B. vagra*), vide Menon, A. G. K. 1974, p. 14.
4. *B. piscatorius* Bleeker (Salt Range, Pakistan) = *B. vagra* vide Menon, A. G. K. 1974, p. 14.
5. *B. radiolatus* Günther (Madhya Pradesh, India) = *B. bola* vide Hora, S. L. 1937, *JBNHS* 39 (2) p. 203.

‡ *B. bola* and *B. guttatus* have been segregated under a separate genus *Raiamas* Jordan by Howes (1980).

7. *B. canarensis* (Jerdon)—India : W. ghats.
8. *B. dogarsinghi* Hora—India : Manipur.
9. *B. evezardi* Day—India : Poona.
10. *B. gatensis* (Valenciennes)—India : W. ghats.
11. *B. ornatus* Sauvage—Burma. Thailand.
12. *B. radiolatus* (Günther)—India : Madhya Pradesh.
13. *B. guttatus* (Day)—Burma : Irrawaddy river.
14. *B. shacra* (Hamilton)—India : Ganga, Yamuna, Brahmaputra rivers. Nepal. Bangladesh.
15. *B. tileo* (Hamilton)—India : W. Bengal, Assam. Pakistan : Indus river system. Nepal. Bangladesh.
16. *B. vagra vagra* (Hamilton) –India : North India (Indus, Ganga, Yamuna and Brahmaputra river system). Nepal. Bangladesh. Sri Lanka. Pakistan.

16. 1. *B. vagra pakistanicus* Mirza & Sadiq—Pakistan : Fort Monro reservoir, D. G. Khan dist.

Remarks.—Some species such as *B. bola* are game fish taking fly well. *B. bola* is often called the "*Indian trout*"

KEY TO SPECIES

1.	Barbels present. ...	...	2
	Barabels absent. ...	...	7
2.	Four barbels. ...	...	3
	Two barbels. ...	...	6
3.	Lateral line scales 56-70. ...	...	4
	Lateral line scales 40-44. ...	...	5
4.	Lateral line scales 56-62. No vertical bars. ...		*B. radiolatus*
	Lateral line scales 60-70. 12 vertical bars. ...		*B. shacra*
5.	Anal fin short with 9-11 rays, no vertical bars, each scale with a black spot. ...		*B. bendelisis bendelisis*
	Anal fin long with 13-17 rays, 10 vertical bars. ...		*B. vagra vagra**
6.	Lateral line scales 38-39. ...		*B. dogarsinghi*
	Lateral line scales 43-46. ...		*B. barila*
7.	Body without vertical bars. ...	...	8
	Body with vertical bars. ...	...	13

B. vagra pakistanicus Mirza & Sadiq (Biologia, 24 (1), pp. 1-4, 1978) differs from the nominate species in having deep vertical bars reaching to lateral line or below it. Body depth is also 5.53-7.40 in standard length.

8.	Body uniformly silvery.	...	*B. evezardi*
	Body with rows of spots.	...	... 9
9.	With single row of large spots.	...	*B. hakeri*
	With two rows of spots.	...	... 10
10.	Lateral line scales 38-48.	...	... 11
	Lateral line scales 70-94.	...	... 12
11.	Lateral line scales 38.	...	*B. canarensis*
	Lateral line scales 44-48.	...	*B. guttatus*
12.	Lateral line scales 70-95.	...	*B. tileo*
	Lateral line scales 83-95.	...	*B. bola*
13.	Body with 7-9 vertical bars.	...	*B. barna*
	Body with more than 12 vertical bars	...	... 14
14.	Lateral line scale 39—41.	...	*B. gatensis*
	Lateral line scales 45.	...	*B. ornatus*

Subfamily CYPRININAE

Abdominal edge rounded. Barbels present or absent. Dorsal fin of varying length, with or without spines, generally in middle or anterior half of body. A symphysial knob on lower jaw present or absent. Lateral line complete or incomplete, generally straight in middle of body. Jaws with or without a horny cover. Pharyngeal teeth one to three rows.

KEY TO SPECIES

1.	Anal fin with anterior rays osseous, third spine serrated.	...	... 2
	—Anal fin with anterior rays not osseous.	...	... 3

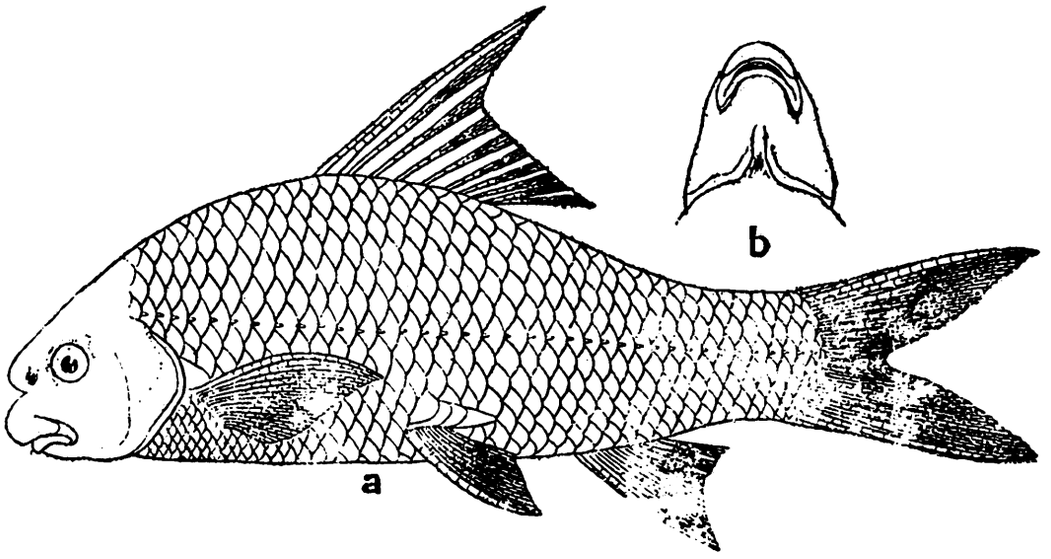


Fig. 47. Lateral view of *Schismatorhynchus nukta* (Sykes). (After Misra. K. S. 1962, Text-fig. 84).

2.	Two pairs of barbels present. Upper jaw more or less projecting, but not protractile.	...	*Cyprinus* Linnaeus
	—Barbels absent. Lower jaw more or less projecting and protractile.	...	*Carassius* Nilsson

3. Snout projecting over mouth, horizontally divided by a deep groove passing from one orbit to opposite one giving the appearance of a blunt compressed knob between and before the orbit. ... *Schismatorhynchus* Bleeker

—Snout plain, not divided. 4

4. A short, smooth, anteriorly directed precumbent predorsal spine present. 5

—No precumbent predorsal spine. 6

5. Barbels absent. Lateral line scales over 80. Anal fin with eight branched rays. Dorsal fin inserted above pelvic fin. ... *Rohtee* Sykes

—Barbels present. Lateral line scales below 40 (30-39). Anal fin with 6 to 10 branched rays. Dorsal fin inserted ahead of pelvic fins. *Mystacoleucus* Günther

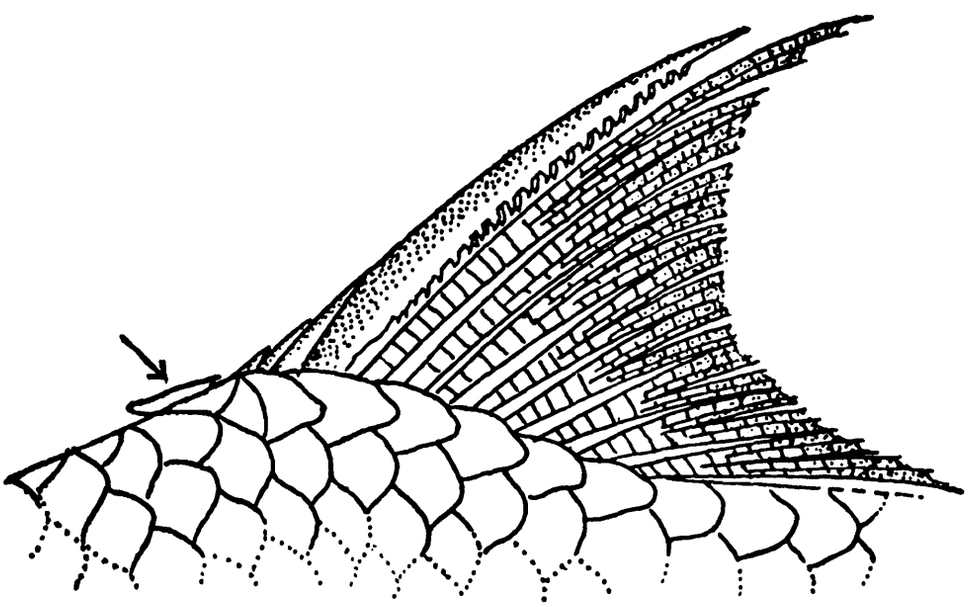


Fig. 48. Sketch diagram to illustrate precumbent predorsal spine.

6. Dorsal fin inserted posterior to pelvic fin in the interspace between pelvic and anal fins, generally extending to over anal fins. ... *Osteobrama* Heckel

Dorsal fin inserted above pelvic fin or slightly anterior to it. 7

7. Lateral line scales more than 90 (90-120). 8

Lateral line scaless less than 90. 9

8. Upper lip absent. Caudal fin forked ; median and paired fins not rounded. ... *Thynnichthys* Bleeker

Upper lip present. Caudal fin truncate ; median and paired fins rounded. ... *Tinca* Cuvier

9. A knob or a horny tubercle present at the symphysis of lower jaw. 10

No such symphysial knob present. 13

10. Dorsal fin with 9-19 rays. 11

Dorsal fin with 24—28 rays. 12

11. A groove posterior to lower lip present. Lower lip closely adnate to lower jaw or separated by a superficial sulcus. Barbels present. Dorsal fin without spines. ... *Cirrhinus* Oken

No groove posterior to lower lip present, which is continuous with skin of throat. No barbels. Dorsal fin with a spine. ... *Soaphiodonichthys* Vinciguerra

12. Dorsal fin without a spine. Snout without pores, moderately depressed. Body not very deep. Mouth more or less inferior, lower jaw with a tubercle above the symphysis. Barbels present. ... *Labiobarbus* van Hasselt =*Dangila* Valenciennes

Dorsal fin with a spine. Snout thick and prominent with a row of open pores. Body deep. Mouth inferior with a knob at the symphysis. Barbels absent. ... *Semiplotus* Bleeker

13. Upper lip absent. Scales large (40—43 along lateral line). ... *Catla* Valenciennes

Upper lip present. 14

14. Lower lip with an uninterrupted posterior groove, continuous around corners of mouth. 15

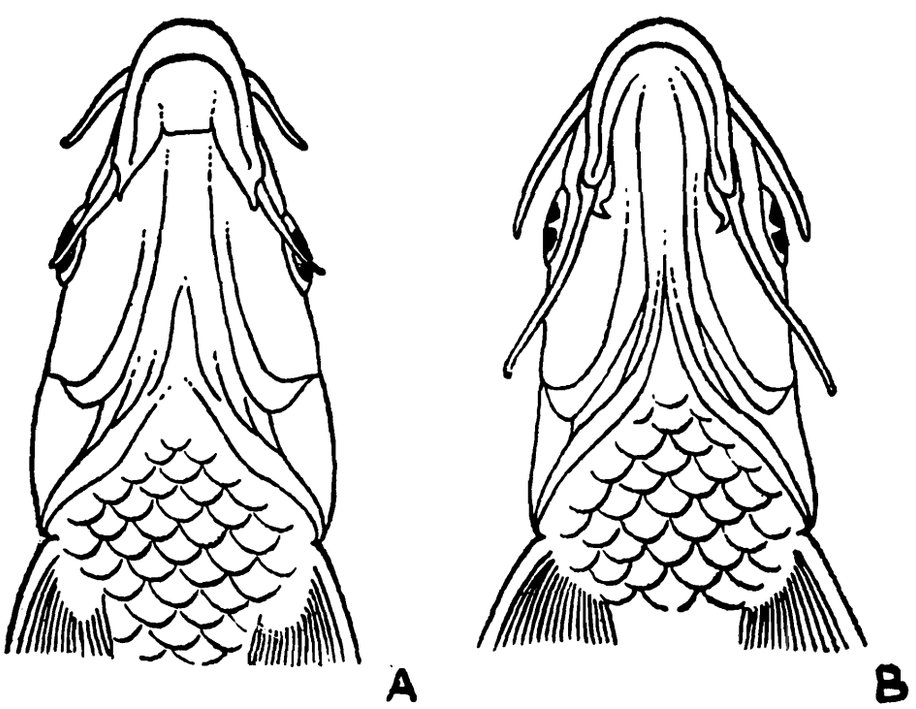


Fig. 49. Outline illustration of ventral part of head of A. Mahseer to show continuous labial groove B. Katli to show interrupted labial groove.

Lower lip with posterior groove interrupted in middle when a groove is present ; or without any groove. 17

15.	Lateral line complete.	...	... 16
	Lateral line incomplete.	...	*Oreichthys* H. M. Smith
16.	Barbels present. Dorsal fin with a spine.	...	*Tor* Gray
	Barbels absent. Dorsal fin without a spine	...	*Ctenopharyngodon* Steindachner
17.	Lower lip conspicuously separated from lower jaw which has a horny covering,	...	*Accrossocheilus* Oshima
	Lower lip closely adnate to lower jaw or very thinly separate.	...	... 18

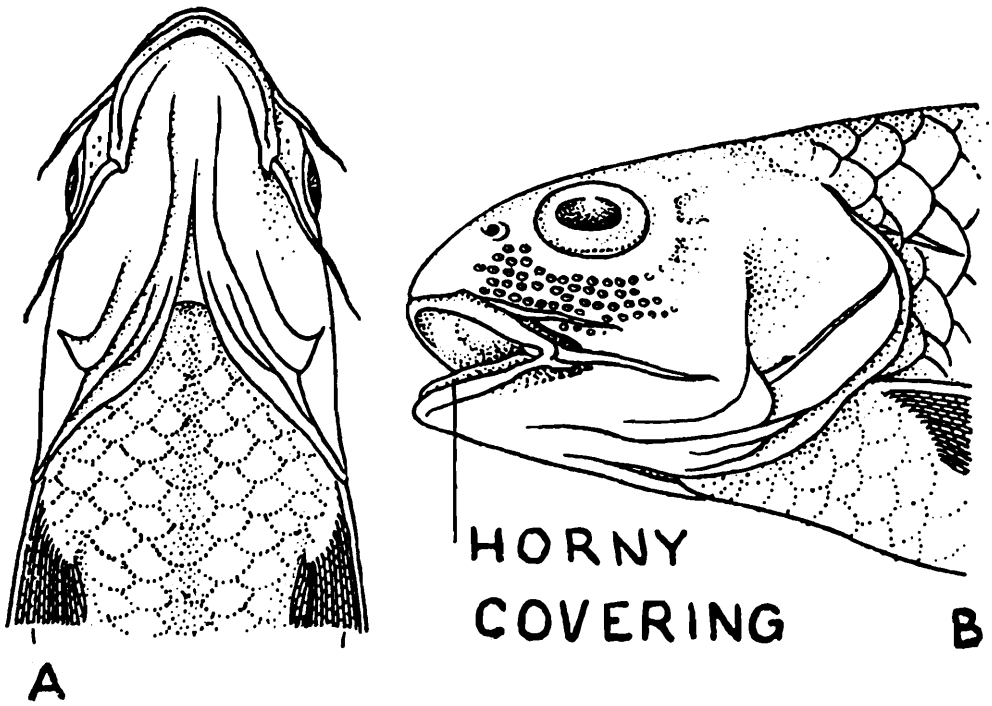


Fig. 50. Outline view of mouth parts of Katli to show A, labial groove ; B. horny covering inside.

18.	Snout with median and lateral lobes. Snout and cheeks beset with horny tubercles in both sexes. Anal rays elongated in males, normal in females.	...	*Chagunius* H. M. Smith
	Snout entire without any lobes. Cheeks free from tubercles. Snout rarely tuberculated. Anal rays not elongated.	...	... 19
19.	No horny covering on the inner side of the lips*. Lips distinct.	...	... 20
	A horny covering on the inner side of one or both lips pressent.	...	... 21
20.	Body with scales.	...	*Puntius* Hamilton
	Body without scales.	...	*Sawbwa* Annandale

*Exception *Puntius lithopidos* (Day) from South Canara, with a thin horny covering to either jaw.

21.	Lower jaw not covered by lip. Attachment of of lower lip to lower jaw at some distance from mouth. ...	*Osteocheilus* Günthor
	Lower jaw covered by lip. Lower lip attached to lower jaw along entire mouth. ...	... 22
22.	A scaleless furrow or a ridge like elevation between occiput and origin of dorsal fin present. Dorsal fin with a spine ...	*Cyprinion* Heckel
	No such scaleless furrow. Dorsal fin without a spine. ...	.. 23
23.	A faint rudimentary disc-like adhesive apparatus below lower lip present. Paired fins horizontally placed and fan-shaped. ...	*Parapsilorhynchus* Hora
	No such adhesive disc present. Paired fins laterally inserted. ...	*Labeo* Cuvier

Genus **Cyprinus** Linnaeus

"Common Carp"

Cyprinus Linnaeus, 1758, *Systema Naturae*, Ed. **10**, **1**, p. 320.

Diagnosis.—Body robust anteriorly, more or less compressed. Abdomen rounded. Head moderate. Snout obtusely rounded. Mouth terminal, oblique, cleft not extending to anterior margin of eyes. Eyes moderate, superolateral, in anterior part of head, not visible from below ventral surface. Lips fleshy. Upper jaw more or less projecting. *Maxillary protractile, reaching to anterior nostril. Barbels two pairs, one pair each of rostral and maxillary. Dorsal fin very long inserted above tip of pectoral fins ; with three spines and 17 rays, third spine strongest serrated. Anal fin short with three spines and five rays.* Caudal fin deeply emarginate, lobes pointed. Scales large, pentagonal, cycloid. Lateral line straight with 36 scales.

Distribution.—Naturally found all through China. Korea. Japan. Taiwan. Europe. America.

Species.—1. *Cyprinus carpio carpio* Linnaeus—distribution as of the genus. Introduced into India, in 1939, Three "varieties" are known.

1. 1. *Cyprinus carpio communis* (Scale carp) (Pl. I. fig. c.) —Body fully covered by regularly arranged rows of scales. This is supposed to be the original form.

1. 2. *Cyprinus carpio specularis* Lacépède (Mirror Carp) —Body coverd unevenly with a few large and bright scales. A large area of the body however is without scales.

1. 3. *Cyprinus carpio nudus* Bloch (Leather Carp)—Body almost without scales except for a single row of degenerate along base of dorsal fin occasionally extending as far as scales tail or even from head to caudal fin. Base of other fins may also be covered with small scales.

Genus **Carassius** Nilsson

"Gold Fish"

Carassius Nilsson, 1832, *Prodr. ichthyo. Scandinaviae*, 4, p. 290 (type-species, *Cyprinus carassius* Linnaeus).

Diagnosis.—Body stout, rather high, compressed. Abdomen rounded. Head small, top slightly depressed. Snout blunt. Mouth terminal, small, oblique, cleft not extending to anterior margin of eyes. Eyes large, superior, hind margin about midway in head, not visible from below ventral surface. Lips thick and fleshy. Lower jaw protractile, more or less projecting. *No barbels present.* Dorsal fin inserted ahead of pelvic fins, *with two spines and 16-18 rays*, second spine stout, with inner edge serrated. *Anal fin short, with three spines and seven rays*, third spine serrated on its inner edge. Caudal fin forked, both lobes equal. Scales semi-cycloid. Lateral line straight, with 28 scales. 3

Distribution.—Naturally found all over China, Korea, Japan, Taiwan. Also Europe, Siberia, East Asia, South to North Vietnam.

Species.—1. *Carassius auratus* Linnaeus. (Pl. I. Fig. B) Introduced all over as aquarium pet. (Wild form).

2. *Carassius carassius* (Linnaeus)—distribution as of the genus. (Introduced in India).

KEY TO SPECIES

1. Dorsal fin edge straight. Lateral line with 29 scales. Caudal fin forked. ... *C. auratus*

—Dorsal fin edge curved. Lateral line with 34 scales. Caudal fin slightly emarginate. ... *C. carassius*

Genus **Semiplotus** Bleeker

King-Fish

Semiplotus Bleeker, 1869, *Nat. Tijdschr. Ned. Indel.*, **20**, p. 424 (type species, *Cyprinus semiplotus* McClelland).

Diagnosis.—Body short, deep and compressed. Abdomen rounded. Snout thick, prominent, broad, obtuse and overhanging the mouth.

A row of about six open pores passing across snout towards orbit present. Mouth wide, transverse, inferior. Eyes large, placed above middle of head, not visible from below ventral surface. Lips thick, covering the jaws. Lower jaw with a knob at the symphysis and with a thin cartilaginous covering. No barbels. *Dorsal fin long* inserted above posterior third of pectoral fins, *with 24-28 rays (20-25 branched) and with smooth serrated spine.* Anal fin short with nine or ten rays (six or seven branched). Caudal fin forked. Scales large. Lateral line complete with 27-34 scales.

Distribution.—India : N. E. India, Assam, Meghalaya. Nepal. Burma.

Species.—1. *Semiplotus modestus* (Day)—Burma.

2. *Semiplotus semiplotus* (McClelland)—India : Assam, Meghalaya.

KEY TO SPECIES

1.	Lateral line scales 32-34. Dorsal spine serrated.	*S. modestus*
	Lateral line scales 27. Dorsal spine smooth. ...	*S. semiplotus*

Genus **Scaphiodonichthys** Vinciguerra

Scaphiodonichthys Vinciguerra, 1889-90, *Ann. Mus. Civ. Storia Nat. Genova*, (2) **9**, p. 285 (type-species, *Scaphiodonichthys burmanicus* Vinciguerra).

Diagnosis.—Similar to *Semiplotus* Bleeker, but differing in having less number of branched dorsal fin rays 9 to 12 *vs* 20-25.

Distribution.—Burma and Thailand.

Species.—*S. burmanicus* Vinciguerra—Lower Burma. Thailand.

Genus **Oreichthys** H. M. Smith

Oreichthys H. M. Smith, 1933, *J. Siam Soc. nat. Hist. Suppl.*, 9, p. 63 (type-species, *Oreichthys parvus* Smith),—Hora, 1937, *Rec. Indian Mus.*, 39 (4), pp. 321-323.

Diagnosis.—Body short, deep. Abdomen rounded. Snout obtusely rounded. *Sides of head with numerous fine, parallel sensory folds.* Mouth small, transverse, terminal. Eyes large, dorso-lateral, not visible from ventral surface. Lips thin and plain. No barbels. Dorsal fin inserted above posterior half of pectoral fins, *its height being greater than body depth*, and with 11 rays (eight branched) *and without any spine.* Anal fin short with seven rays (five branched). Caudal fin forked. *Scales along lateral line larger than others*, each scale generally with a black base or tinge. Lateral line incomplete.

Distribution.—India : W. Bengal, Madhya Pradesh, Maharashtra, W. ghats as low as Kerala. Pakistan. Bangladesh. Thailand.

Species.—*Oreichthys cosuatis* (Hamilton)—India : W. Bengal, Madhya Pradesh, Maharashtra, Karnataka, Kerala. Pakistan : N. W. Frontier Provinces. Bangladesh. Thailand.

Genus **Sawbwa** Annandale

Sawbwa Annandale, 1918, *Rec. Indian Mus.*, **14**, p. 48 (type-species, *Sawbwa resplendens* Annandale, type by monotypy).

Diagnosis.—Very similar to *Puntius* but differing as below :—

Body compressed, not elevated. Abdomen rounded. Head moderate. Eyes large, visible from below ventral surface. Mouth small, oblique, terminal. *Upper jaw protrusible. No barbels.* Dorsal fin with nine or ten rays (seven branched) and a serrated spine. Anal fin with seven rays (five branched). *Body without scales.*

Distribution.—Burma : Inle Lake.

Species.—*Sawbwa resplendens* Annandale is the only species so far known.

Genus **Puntius** Hamilton

Puntius Hamilton, 1822, *Fish Ganges*, pp. 310, 388 (type-species, *Cyprinus sophore* Hamilton).

Diagnosis.—Body short to moderately elongate, deep, compressed. Abdomen rounded. Head short. Snout obtuse, conical or pointed,

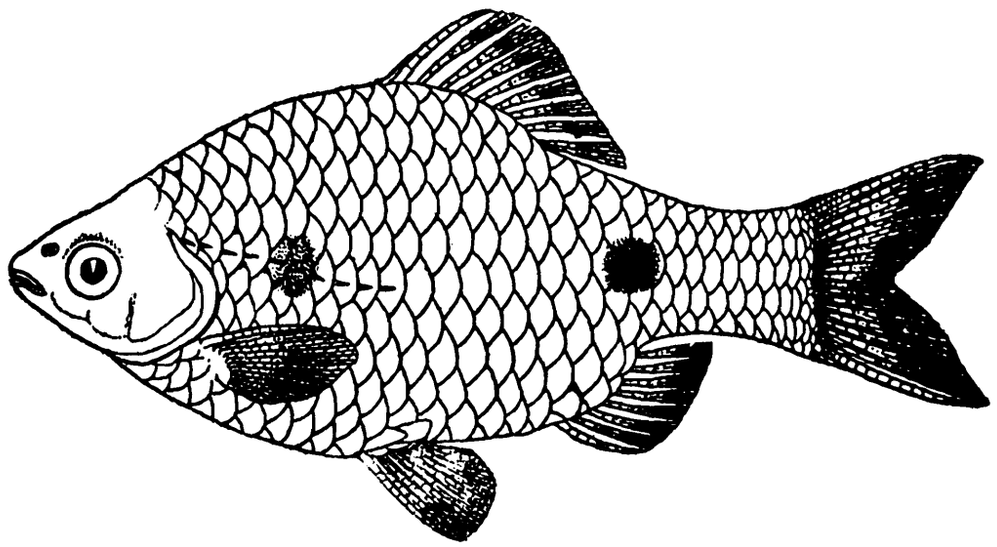


Fig. 51. Lateral view of *Puntius conchonius* (Hamilton), After Misra, K.S. 1962, Text-fig. 76).

may or may not be overhanging the jaw. Mouth arched, anterior or inferior, not protrusible. Eyes moderate to large, dorso-lateral, not

visible from below ventral surface. Lips thin covering the jaws, may have leathery lobes, *but without any horny covering. Jaws simple, covered by lips*, pharyngeal teeth 5 or 4, 3 or 4, 2 or 3/3, or 2, 3 or 4, 4 or 5, *without any knob or tubercle at the symphysis.* Barbels four, two or none. Dorsal fin short, inserted nearly opposite pelvic fins, with 9-13 rays (seven to nine branched) with or without a spine. Anal fin short with seven to nine rays (five or six branched). Caudal fin forked. Scales small, moderate or large, with few and strongly divergent striae. Lateral line complete or incomplete, with 20-47 scales.

Distribution.—Throughout India, Pakistan, Nepal, Bangladesh, Sri Lanka, Burma, Thailand, Malay Archipelago. Also found in Southern continental China and adjunct islands and Africa.

Remarks.—Fishes included under the genus *Barbus* Cuvier, are very common in our country. There is hardly any body of freshwater where

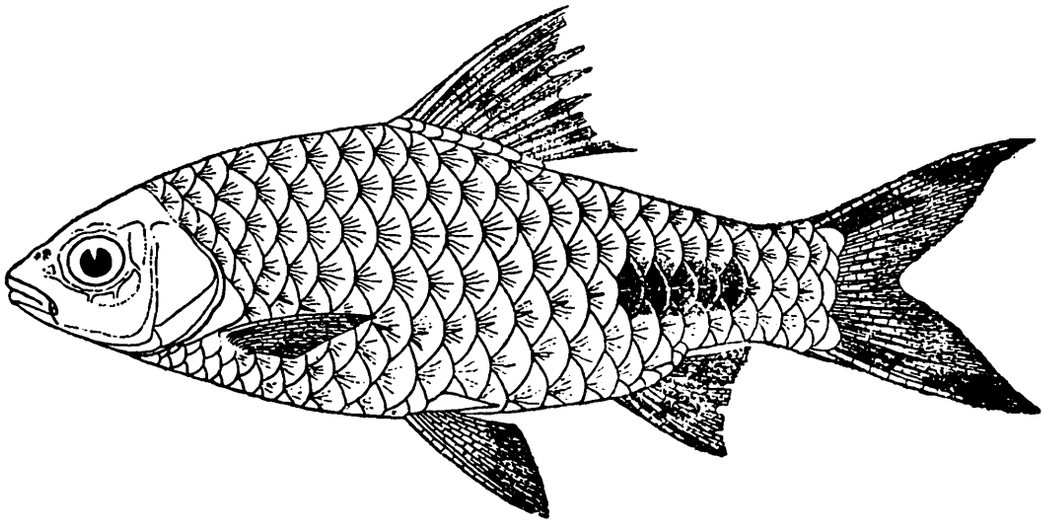


Fig. 52. Lateral view of *Puntius filamentosus* (Val.). (After Misra, K. S. 1962, Text-fig. 78).

one can fail to encounter some species or other of these "garden fishes". Though most of them do not grow to large sizes, they compensate with their abundance, and thus are economically important. Despite such prominence unfortunately their taxonomy is in utter confusion. The generic name *Barbus* has been in usage for over 100 years ; though strictly according to Nomenclatural rules and provisions of the Code, many species with barbels cannot be included under this name, but under *Puntius* Bleeker. The exact relationship between these groups, their species composition, the precise specific and generic limits can be solved only when a thorough revision is made. Even the key characters used here may hold good only in some cases ; since many species are known by single typical specimens and have not been recorded subsequently either from their type-locality or from areas

which are normally within their geographical range. Pending such a study, I have used the name *Puntius* in its widest sense.

Species.—

1. *Puntius amphibius* (Valenciennes)—India : Peninsular India up to Orissa and Rajasthan. Sri Lanka.
2. *Puntius apogon* (Valenciennes)—Burma to Malay Archipelago.
3. *Puntius arenatus* (Day)—India : Madras.
4. *Puntius arulius arulius* (Jerdon)—India : Cauvery river system, Wynaad, Nilgiri hills, as far south as Kottayam in Kerala.

4. 1. *Puntius arulius tamraparniei* Silas—India : Tampraparny river, Tamil Nadu, S. India.

5. *Puntius bimaculatus* (Bleeker)—Sri Lanka.
6. *Puntius blythii* (Day)—Burma : Tenasserim.
7. *Puntius bovanicus* (Day)—India : Cauvery river system.

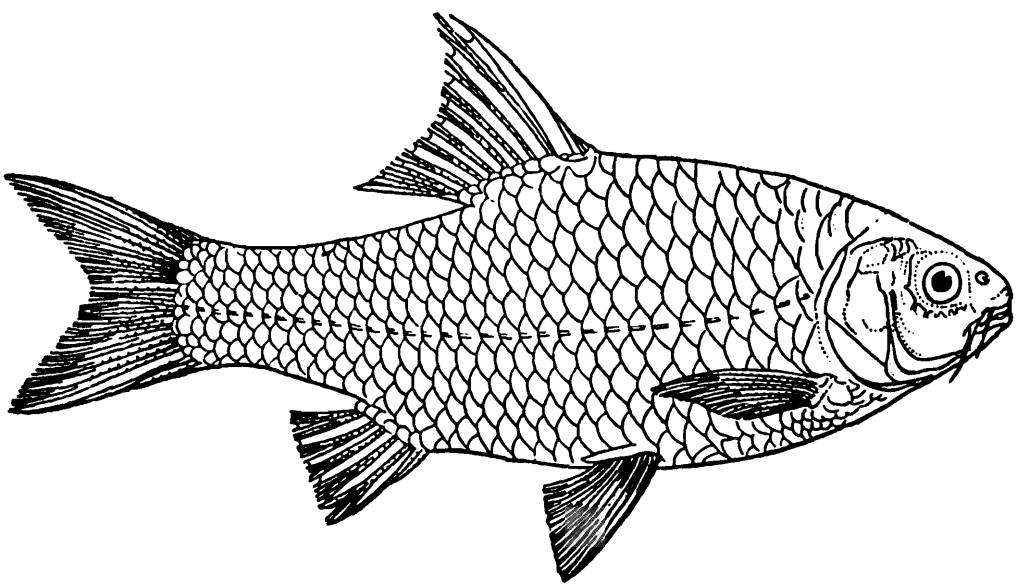


Fig. 53. Lateral view of *Puntius sarana sarana* (Hamilton), (After Hora, S. L. 1951. *J. Asiat. Soc. Beng.*, **17**, pl. 21.).

8. *Puntius burmanicus* (Day)—Burma.
9. *Puntius carnaticus* (Jerdon) (Pl. IV. Fig. A)—India : Cauvery, Krishna river system, Nilgiri, Wynaad and Canara hills.
10. *Puntius cauveriensis* (Hora)—India : Cauvery river, Coorg, Karnataka.
11. *Puntius chilinoides* (McClelland)—India : Himalayan foot hills, Ganga river system.

12. *Puntius chola* (Hamilton)*—Throughout India, Pakistan, Nepal, Bangladesh, Burma, Sri Lanka.

13. *Puntius chrysopterus* (McClelland)—India : Assam, W. Bengal. Pakistan : N. W. Provinces, Punjab, Sind. Bangladesh.

14. *Puntius clavatus clavatus* (McClelland)—India : North Bengal below the himalayan foot hills, Sikkim. Nepal. Bangladesh.

14. 1. *Puntius clavatus burtoni* Mukerji—Burma : Mali Hka, Sahmaw, Myitkyina dist.

15. *Puntius compressus* (Day)—Burma : Myitkyina district.

16. *Puntius conchonius* (Hamilton)—India : Ganga, Brahmaputra, Mahanadi river system in U. P., Bihar, W. Bengal, Assam, Orissa. Pakistan : Punjab. Nepal. Bangladesh. Also found in Cauvery river system, S. India.

17. *Puntius cumingii* (Günther)—Sri Lanka.

18. *Puntius curmuca* (Hamilton) (Pl. VI. Fig. B)—India : rivers of W. ghats.

19. *Puntius denisonii* (Day)—India : Mundikayum, Travancore hill ranges, Kerala.

20. *Puntius dorsalis* (Jerdon)**—India : Cauvery and Krishna river system, S. India. Sri Lanka. Recorded from Rajasthan (Datta and Majumdar, 1970).

21. *Puntius dubius* Day—India : Bhavani river at foot of Nilgiri hills.

22. *Puntius dukai* (Day)—India : North Bengal, Teesta river system.

23. *Puntius filamentosus* (Valenciennes) †—India : Cauvery river system, S. India, Goa. Sri Lanka.

24. *Puntius fraseri* (Hora & Misra)—India : Dharna river, Deolali.

25. *Puntius gelius* (Hamilton)—India : Bihar, Orissa, W. Bengal, Assam. Bangladesh. Pakistan.

26. *Puntius goniosoma* Bleeker—Burma to Malay Archipelago. Sumatra.

**B. tetrarupagus* Day is a synonym of this species (Menon, A. G. K., 1974).

***B. puckelli* Day is a juvenile from of *P. dorsalis* (Hora, S. L., 1936. *Rec. Indian Mut.*, 38, p. 2).

†*B. mahecola* (Valenciennes) is the female of this species (Hora, S. L. 1937. *Rec. Indian Mus.*, 39, pp. 22-24.).

27. *Puntius guganio* (Hamilton)†—India : Ganga and Brahmaputra river systems in Gangetic provinces and Assam. Bangladesh.

28. *Puntius hexastichus* (McClelland)—India : Himalayan foot hill rivers, from Kashmir to Sikkim and Assam.

29. *Puntius innominatus* (Day)—Sri Lanka.

30. *Puntius jerdoni* (Day)*—India : Rivers in Canara, Karnataka, Krishna river at Wai, Maharashtra.

31. *Puntius kolus* (Sykes)—India : Krishna, Godavary and Cauvery river systems, S. India. Also Madhya Pradesh.

32. *Puntius lithopidos* (Day)—India : S. Canara, Karnataka.

33. *Puntius macrolepidotus* (Day)—Burma : Tavoy. Malay Peninsula.

34. *Puntius malabaricus* Jerdon—India : W. ghats from S. Canara to Travancore hills.

35. *Puntius masyai* H. M. Smith—Burma. Thailand : Ban Ang on Kao Sabap, S. E. Thailand.

36. *Puntius melanampyx melanampyx* (Day)**—India : Wynaad, Nilgiri, Travancore range of hills. Cauvery river.

36. *Puntius melanampyx pradhani* Tilak—India : Goa.

37. *Puntius melanostigma* (Day)—India : Cauvery river system, Wynaad, Bhavani river, S. India.

38. *Puntius micropogon* (Valenciennes)—India : W. ghats from Canara to Nilgiri hills.

39. *Puntius muzaffarpurensis* Srivastava, Verma & Sharma—India : R. Bhagmati at Saidpur, Muzaffarpur, Bihar.

40. *Puntius narayani* Hora—India : Cauvery river, Coorg, Karnataka.

41. *Puntius neilli* (Day)—India : Thungabhadra river, Krishna river system.

42. *Puntius nigrofasciatus* (Günther)—Sri Lanka.

43. *Puntius parrah* Day—India : Kerala, Karnataka, Tamil Nadu.

44. *Puntius paucisquamatus* H. M. Smith—Burma. Thailand : Kao Luang, Nakom Sritamarat.

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†*B. ambassis* Day is a synonym of this species (Das, K. N. 1939. *Rec. Indian Mus.*, **41**, pp, 442-444. Also Hora, S. L. 1940. *Rec, Indian Mus.*, **42** (2) p. 373).

B. dobsoni* Day, *B. jerdoni maciveri* Annandale are synonyms of this species (Hora, S. L. & Misra, K. S. 1942. *J. Bombay nat. Hist. Soc.*. **43 (2), p. 220,)

**Silas, 1956, has proposed an earlier name *fasciatus* for this species.

45. *Puntius phutunio* (Hamilton)—India : Orissa, W. Bengal, Assam, Goa. Burma. Bangladesh. Pakistan.

46. *Puntius pleurotaenia* Bleeker—Sri Lanka.

47. *Puntius pulchellus* (Day)—India : S. Canara, Karnataka.

48. *Puntius punjabensis* (Day)—Pakistan : Sind, Ravi river near Lahore, Punjab. Also India : Jabalpur.

49. *Puntius puntio* (Hamilton)—India : W. Bengal. Burma. Bangladesh.

50. *Puntius roloffi* Klausewitz—Burma. Thailand.

51. *Putius roseipinnis* (Valenciennes)—India : Pondicherry.

52. *Puntius sahyadriensis* Silas—India : Yenna river, Mahabaleshwar, Satara dist., Maharashtra.

53. *Puntius sarana orphoides* (Val.)—India : Loktak Lake, Imphal, Manipur, Goa. Burma. Malaya. Thailand. Java and Borneo.

53. 1. *Puntius sarana sarana* (Hamilton) (Pl. VI. Fig. E).—India : throughout, except peninsular India south of Krishna river. Pakistan. Nepal. Bangladesh. Burma.

53. 2. *Puntius sarana spilurus** (Günther)—India except peninsular India south of Krishna river. Pakistan.

53. 3. *Puntius subnasutus*** (Val.)—India : Peninsular India south of Krishna river, Goa. Sri Lanka.

54. *Puntius shalynius* Yazdani & Talukdar—India : Barapani lake, Mawpat, Mylliem, Khasi hills, Jowai, Jaintia hills, Meghalaya.

55. *P. shanensis* (Hora & Mukerji)—Burma : Lawksawk canal at Lawksawk, S. Shan states.

56. *Puntius singhala* (Duncker)—Sri Lanka.

57. *Puntius sophore* (Hamilton) †—India : throughout. Pakistan. Nepal. Bangladesh. Burma. Yunnan.

58. *Puntius spinulosus* (McClelland)—India : Sikkim.

59. *P. stevensonii* (Day)—Burma : Akyab.

60. *Puntius stracheyi* (Day)—Burma : Akyab, Moulmein.

P. chrysopoma* Bleeker is a synonym of this species (Menon, A. G. K., 1963. *Spolia zeylanica*, **30 (1), p. 67)

***B. pinnauratus* (Day) is a synonym of this species (Menon, A. G. K., 1963, *op. cit.*)

†*B. stigma* (Valenciennes), *B. carletoni* Fowler, *B. annandalei* Fowler are synonyms of this species (Chaudhuri, B. L. 1916. *Mem. Indian Mus.*, **5**, p. 436 ; Menon, A. G. K., 1974. *op. cit.*)

61. *Puntius terio* (Hamilton)—India : Orissa, Assam, W. Bengal to Punjab. Bangladesh. Pakistan.

62. *Puntius thermalis* (Valenciennes)—Sri Lanka.

63. *Puntius thomassi* (Day)—India : S. Canara, Karnataka.

64. *Puntius ticto punctatus* Day—India : Kerala and Coromandel coasts.

64. 1. *Puntius ticto stoliczkanus* (Day)—Burma.

64. 2. *Puntius ticto ticto* (Hamilton)‡—India : throughout. Nepal. Pakistan. Sri Lanka. Bangladesh. Burma. Thailand.

65. *Puntius titteya* Deraniyagala—Sri Lanka.

66. *Puntius unimaculatus* (Blyth)—Burma : Sittang river.

67. *Puntius vittatus* Day—India : Karnataka, Kerala, Tamil Nadu, Goa, Cutch. Recorded from Rajasthan (Datta & Majumdar, 1970). Sri Lanka. Pakistan.

68. *Puntius waagenii* (Day)—Pakistan : Choya Saidan Shah, Salt Range, Punjab.

69. *Puntius wynaadensis* (Day)—India : Vithry in Wynaad, Kerala.

KEY TO SPECIES

1.	Barbels present. ...	...	2
—	Barbels absent. ...	...	50
2.	Four barbels (two pairs) present. ...	...	3
—	Two barbels (one pair) present. ...	...	32
3.	Dorsal spine strong, osseous. ...	...	4
—	Dorsal spine weak, articulated. ...	...	17
4.	Dorsal spine serrated. ...	...	5
—	Dorsal spine smooth. ...	...	10
5.	Dorsal spine as long as body depth. Lateral line scales 42. ...		*P. clavatus clavatus**
—	Dorsal spine equal to or shorter than body depth. Lateral line scales less than 40 ...	...	6

‡*B. punctatus* Day and *B. stoliczkanus* Day were considered synonyms of this species by Hora, S. L., Misra, K. S., Malik, G. M., 1939. *Rec. Indian Mus.*, **41**, p.263. Silas, E. G. 1952 (*Proc. nat. Inst. Sci. India.* **18** (5). pp. 431-432) however resurrected them to subspecific levels. This classification is adopted here. See also Murty, V. S. 1977, p. 132.

P. clavatus burtoni* Mukerji, 1934. (*J. Bombay nat. Hist. Soc.*, **37 (1), pp. 64-67) from Burma differs from the nominate species in having 35-38 scales along lateral line, 6½/3½ row of scales in transverse series and by its longer snout. It grows to a larger size also.

6.	Lateral line scales 22-24. ...	...	7
—	Lateral line scales 26-38. ...	...	8
7	Dorsal spine slightly bent. Lateral line scales 22. Barbels thin and long. ...		*P. roseipinnis**
—	Dorsal spine straight. Lateral line scales 24. Barbels stout and short not extending beyond orbit. ...		*P. goniosoma*
8.	Dorsal fin inserted midway between tip of snout and base of caudal fin. A black band from eye to termination of central rays present. ...		*P. pleurotaenia*
—	Dorsal fin inserted either nearer caudal base or tip of snout. No lateral color band present.	...	9
9.	Dorsal fin inserted nearer caudal fin base than tip of snout. Lateral line scales 36-38, 15 or 16 predorsal scales. ...		*P. shanensis*
—	Dorsal fin inserted nearer tip of snout than to caudal base. Lateral line scales 26-34, 10 or 11 predorsal scales. ...		*P. sarana***
10.	Scales between lateral line and pelvic fin base 3-5 rows. ...	...	11
—	Scales between lateral line and pelvic fin base 2 to 2½ rows. ...	...	14
11.	Lateral line scales 30-35. ...	...	12
—	Lateral line scales 39-42. ...	...	13
12.	Lower lip with a continuous transverse fold. Lateral line scales 32-35. Dorsal fin with iii simple rays (Base of Himalaya, N. India) ...		*P. chilinoides*
—	Lower lip with an interrupted labial fold. Lateral line scales 30-32. Dorsal fin with iv simple rays. (W. ghats, S. India) ...		*P. carnaticus*

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*After Jerdon, T. C. 1842. *Madras J. Lil. Sci.*, p. 314.

**Four subspecies of *P. sarana* are known (Menon, A G K. 1963, *Spolia seylanica*, 30 (1). pp. 65-70).

They are differentiated as under :

1.	Lateral line scales 26-28. (Endemic in Sri Lanka) ...	*P. sarana spilurus*
2.	Lateral ilne scales 29-31. ...	*P. sarana subnasutus*
3.	Lateral line scales 28-34. Scales between midline of back and lateral line 8 or 9. ...	*P. sarana orphoides*
4.	Lateral line scales 30-34. Scales between midline of back and lateral line 4½ to 6½. ...	*P. sarana sarana*

13.	$4\frac{1}{2}-5$ rows of scales between lateral line and pelvic fin base. No pores on snout. Dorsal fin inserted nearer snout than base of caudal fin.		*P. dubius*
—	$3-3\frac{1}{2}$ rows of scales between lateral line and pelvic fin base. Pores on snout and cheeks. Dorsal fin inserted midway between tip of snout and caudal fin base. ...		*P. micropogon*
14.	Dorsal fin inserted nearer snout than to caudal fin base. ...	...	15
—	Dorsal fin inserted midway between tip of snout and caudal fin base. ...	...	16
15.	Sides of snout and cheeks with large open tubercles. Scales with many horizontal striae.		*P. dukai*
—	No tubercles on snout and cheeks. Scales without any horizontal striae. ...		*P. hexastichus*
16.	Body depth 4.5 in total length. L. Tr. 3/2/5. Lower labial fold interrupted (Burma). ...		*P. stracheyi*
—	Body depth 3.7 in total length. L. Tr. $4\frac{1}{2}/4\frac{1}{2}$. Lower labial fold continuous (Bhavani river, base of Nilgiri hills, S. India). ...		*P. bovanicus*
17.	Scales between middle of back and lateral line 5–8. ...	...	18
—	Scales between middle of back and lateral line $3\frac{1}{2}-4\frac{1}{2}$. ...	...	23
18.	A thin cartilaginous covering present on inside of jaws. ...		*P. lithopidos*
—	No such cartilaginous covering on inside of jaws. ...	...	19
19.	Lateral line scales 27-34. ...	...	20
—	Lateral line scales 38-42. ...		*P. curmuca*
20.	Dorsal fin shorter than body depth. ...	...	21
—	Dorsal fin equals body depth. ...	...	22
21.	Dorsal fin 2/3 body depth. Head length 6 to 6.5 in total length. Lateral line scales 30-32.		*P. pulchellus**
—	Dorsal fin 4/5 body depth. Head length 5 to 5.25 in total length. Lateral line scales 27-28. (Each scale with a red lunule). ...		*P. jerdoni***

*This species has been considered as a synonym of *P. jerdoni* by Hora & Misra (1942). I have kept this separate on the basis of my studies.

**Silas (1953) has recorded *Puntius jerdoni maciveri* (Annandale) from Krishna river at Wai, which Hora & Misra (1942) synonymised with the nominate species.

22.	Head length 5.0 in total length. Eyes placed before middle of head length. (Sikkim). ...	*P. spinulosus*	
—	Head length 5.75 to 6.25 in total length. Eyes high up. (S. Canara, Karnataka). ...	*P. thomassi*	
23.	Scales between lateral line and pelvic fin base 1½ rows. Labial fold uninterrupted with a median lobe. ...	*P. malabaricus*	
—	Scales between lateral line and pelvic fin base 2-3½. Labial fold without a median lobe. ...	...	24
24.	Lateral line scales 19-22. ...	...	25
—	Lateral line scales 24-28. ...	...	29
25.	Scales in transverse series (L. Tr.) 4/5. Scales between lateral line and pelvic fin base 2½. ...	*P blythii*	
—	Scales in transverse series (L. Tr.) 4/3 or 3½/2.	...	26
26.	Lateral line scales 22. Head length 3.5, body depth 3 to 3.25 in standard length. (Thailand, Burma). ...	*P. paucisquamatus*	
—	Lateral line scales 19-20. Head length 3.2 to 3.58, body depth 2.5-2.8 in standard length. (W. ghats, S. India). ...	...	27
27.	Eye diameter equal to interorbital width. Height of dorsal fin 3.5 to 3.75 (males) and 4.0-4.5 (females) in total length. ...	*P. melanampyx melanampyx*	
—	Eye diameter 1.14-1.28 in interorbital width. Height of dorsal fin 4-6 (males) and 4.7-5.2 (females) in total length.	*P. melanampyx pradhani*	
28.	Labial fold uninterrupted, but continuous, without any lobe. ...	*P. neilli*	
—	Labial fold interrupted. ...	...	29
29.	Predorsal scales 10. A dark band running from behind eye to middle of base of caudal fin (Wynaad, Kerala). ...	*P. wynaadensis*	
—	Predorsal scales 9. No such dark band running from behind eye to middle of caudal fin base.	...	30
30.	Head length 3.5, body depth 3.5 in total length. 3 scales between lateral line and pelvic fin base (Sri Lanka). ...	*P. innominatus*	
—	Head length 4.5–5.0, body depth 4.0-4.5 in total length. ...	...	31
31.	Head length 4.5, body depth 4.5 in total length. L. Tr. 4½/5 (Burma). ...	*P. stevensonii*	
—	Head length 5.0, body depth 4.0 in total length. L. Tr. 4½/2½ (Burma). ...	*P. compressus*	

32.	Dorsal spine strong osseous. ...	...	33
—	Dorsal spine weak, articulated. ...	...	40
33.	Dorsal spine serrated. ...	...	34
—	Dorsal spine smooth. ...	...	35
34.	Lateral line scales 42-45 (Poona. W. ghats, India). ...		*P. fraseri*
—	Lateral line scales 26. (Burma to Malay Archipelago) ...		*P. macrolepidotus*
35.	Scales between middle of back and lateral line 5 or $5\frac{1}{2}$. ...	...	36
—	Scales between middle of back and lateral line $3\frac{1}{2}$ to $4\frac{1}{2}$. ...	...	37
36.	Predorsal scales 10-12. A dark blotch from the 23 to 25th scales of the lateral line. A dark spot along base of first to fourth anterior dorsal ray, and occasionally a dark mark behind gill opening. ...		P. *chola*
—	Predorsal scales 8. A diffused black spot on lateral line from 20th to 22nd scale. ...		*P. parrah*
37.	Scales between middle of back and lateral line $3\frac{1}{2}$ rows (Sri Lanka). ...		*P. binaculatus*
—	Scales between middle of back and lateral line 4 or $4\frac{1}{2}$ rows. ...	...	38
38.	Scales between lateral line and pelvic fin base $3\frac{1}{2}$. ...		*P. cauveriensis*
—	Scales between lateral line and pelvic fin base 2 or $2\frac{1}{2}$. ...	...	39
39.	Dorsal fin inserted opposite of pelvic fin. Predorsal scales 10 (Burma). ...		*P. burmanicus*
—	Dorsal fin inserted ahead of pelvic fin. Predorsal scales 8 or 9. ...		*P. dorsalis*
40.	Lateral line scales 40-43. L. Tr. 10/8. Scales between lateral line and pelvic fin base 4 or 5.		*P. kolus*
—	Lateral line scales not more than 28. L. Tr. not more than 5/6. Scales between lateral line and pelvic fin base not more than $3\frac{1}{2}$. ...	...	41
41.	Lateral line incomplete, with 19 or 20 scales.		*P. titteya*
—	Lateral line complete with 21-28 scales. ...	...	42
42.	Lateral line scales 21-24. ...	...	43
	Lateral line scales 26-28. ...	...	47
43.	Body plain without any color spot, blotches. ...		*P. roloffi*
—	Body with black color blotches, spots, bands. ...	...	44

44.	A deep black oval mark on lateral line above anal fin present. Body depth 3 to 3.5 in total length. ...	*P. filamentosus*	
—	No such deep black oval spot over anal fin. A dark band along side or horizontally may be present. Body depth 3.5-5.5 in total length. ...	...	45
45.	Body depth 4.5 to 5.0 in total length. Lateral line scales 23-24. A dark lateral band along side present. A black spot just anterior to caudal base may be present. ...	*P. amphibius*	
—	Body depth 3.75 to 5.6 in total length. Lateral line scales 21-23. ...	...	46
46.	Body depth 3.75 to 4 in total length. Only two blotches ; oval in shape, one below dorsal fin and another above anal fin present. ...	*P. arulius arulius*	
—	Body depth 3.4 to 5.6 in total length. Three wide vertical bands, (like in *Botia*) one below origin of dorsal fin, another below end of dorsal fin and another at caudal base present.	*P. arulius tambraparnei*	
47.	Lateral line scales 28. Scales between lateral line and pelvic fin base $2\frac{1}{2}$. ...	*P. denisonii*	
—	Lateral line scales 26. Scales between lateral line and pelvic fin base 3 ro $3\frac{1}{2}$. ...	...	48
48.	Body without any markings. A dark band on dorsal fin may be present (Madras). ...	*P. arenatus*	
—	A black spot on caudal base. ...	...	49
49.	A deep black blotch on side of tail; commencing on 21 or 22nd scale. A light band along side may be present (Wynaad, Kerala). ...	*P. melanostigma*	
—	A round black spot smaller than eye on middle of caudal peduncle. A black blotch on dorsal fin. (Thailand, Burma). ...	*P. masyai*	
50.	Dorsal spine strong, osseous. ...	...	51
—	Dorsal spine weak, articulated. ...	...	66
51.	Dorsal spine serrated. ...	...	52
—	Dorsal spine smooth. ...	...	62
52.	Lateral line scales 36 or 37. ...	...	53
—	Lateral line scales less than 30. ...	...	54
53.	Lateral line complete. Dorsal fin inserted behind pelvic origin (Burma). Each scale with a dark spot at its base. ...	*P. apogon*	
—	Lateral line incomplete. Dorsal fin inserted before pelvic origin (India). Scales without any black spot. ...	*P. guganio*	
54.	Body without any vertical black coloured bands. ...	...	55
—	Body with vertical black coloured bands. ...	...	59

55. Branched rays in dorsal fin seven (7). Only 6 or 7 rows of transverse scales. A horizontal blue line on body and two spots on tail present. ... *P. shalynius*

— Branched rays in the dorsal fin eight (8). About 12 rows of transverse scales. No band on body. 56

56. Body depth 2.4 in total length. Predorsal scales 9. Lateral line incomplete, mostly extending up to 18 scales. ... *P. conchonius*

— Body depth 3 to 3.5 in total length. Predorsal scales 8-11. 57

57. Lateral line incomplete (perforated scales 6-16). Predorsal scales 11. 4 or 5 rows of scales between lateral line and pelvic fin. ... *P. ticto ticto*

— Lateral line complete. Predorsal scales 8-10. 59

58. Pectoral fin with 14 rays. Lateral line scales 25. $3\frac{1}{2}$ rows of scales between lateral line and pelvic fin. ... *P. ticto stoliczkanus*

— Pectoral fin with 15 rays. Lateral line scales 23-24. 3 rows of scales between lateral line and pelvic fins. ... *P. ticto punctatus*

59. L. Tr. row of scales 8/10. Body with four vertical black bands, first from back to opposite middle of pectoral fins, second from back to posterior end of anal base, third from centre of dorsal and fourth at caudal base. ... *P. phutunio*

— L. Tr. row of scales less than 8/10. ($3\frac{1}{2}-4\frac{1}{2}$ /$3\frac{1}{2}-5$). Body with 2 or 3 vertical bands. 60

60. Body with two vertical bands, one from back to pectoral and another across the free portion of tail (Sri Lanka). ... *P. cumingii*

— Body with three vertical bands. 61

61. Lateral line complete (Sri Lanka). ... *P. nigrofasciatus*

— Lateral line incomplete (India) ... *P. gelius*

62. Lateral line incomplete. 63

— Lateral line complete. 64

63. Dorsal fin nearly as high as body depth. Each scale with a number of fine black spots, most numerous at the anterior margin. A black blotch over posterior extremity of anal fin, sometimes extended in median line as far as tail. (India) ... *P. terio*

— Dorsal fin shorter than body depth. Scales without any black spots. A round black finger mark on either side of free portion of tail (Sri Lanka). ... *P. thermalis*

64. $2\frac{1}{2}$ rows of scales between lateral line and pelvic fin base. Lateral line scales 20-22. L. Tr. $4\frac{1}{2}/2\frac{1}{2}$ (Sri Lanka). ... *P. singhala*

— 3-$3\frac{1}{2}$ rows of scales between lateral line and pelvic fin base. Lateral line scales 23-27 (India). 65

65. Body depth 3.5 to 3.75 in total length. Body not very deep. A round black blotch more or less distinct at root of caudal fin present. ... *P. sophore*

— Body depth 3 in total length. Body deep. A dark mark at base of third to seventh dorsal rays present. ... *P. chrysopterus*

66. Lateral line scales 43. Predorsal scales 14. .. *P. punjabensis*

— Lateral line scales 22-25. Predorsal scales 8-12. ... 67

67. Lateral line complete. 68

— Lateral line incomplete. 69

68. Dorsal fin inserted in advance of pelvic fin origin. Three vertical blotches on sides of body. Body depth 2.5 in standard length. ... *P. narayani*

— Dorsal fin inserted opposite or slightly behind pelvic fin origin. Seven vertical blotches on sides of body. Body depth 2.6 to 3.0 in standard length. ... *P. sahyadriensis*

69. Predorsal scales 12. $4\frac{1}{2}$ rows of scales between lateral line and pelvic fin base. ... *P. waageni*

— Predorsal scales 8 or 9. $2\frac{1}{2}$ to 4 rows of scales between lateral line and pelvic fin base. 70

70. A wide black band encircles free portion of tail including tip of anal fin. Dorsal fin tipped black. ... *P. puntio*

— No such band, except blotches. 71

71. Lateral line scales 24 or 25. Transverse row of scales $4\frac{1}{2}/4\frac{1}{2}$. Dorsal fin with iii simple rays. *P. unimaculatus*

— Lateral line scales 20-22. Transverse row of scales 3/4. Dorsal fin with ii simple rays. 72

72. Four black spots on side of body. Eye diameter 2 to 3 in head length. (S. India, Sri Lanka). .. *P. vittatus*

— Two black spots on side of body. Eye diameter 3.1 to 3.7 in head length (N. India). ... *P. muzaffarpurensis*

Genus **Rohtee** Sykes

Rohtee Sykes, 1839, *Proc. zool. Soc. Lond.*, 1838, part 6, p. 161 (type-species, *Rohtees ogilbii* Sykes).—Hora & Misra, 1940, *Rec. Indian Mus.*, **42**, pp. 155-172 (revision).—Silas, 1952, *Proc. nat. Inst. Sci. India* **18** (5), pp. 430-431 (definition of genus).

Diagnosis.—Body short, compressed, deep. Abdomen rounded. Snout bluntly rounded. Mouth small, somewhat directed upwards and forwards. Eyes large, lateral, may be visible from below ventral surface. Lips thin, plain. Upper jaw slightly longer. *Barbels absent.* Dorsal fin inserted above pelvic fins, with 11 rays (eight branched) and a strong

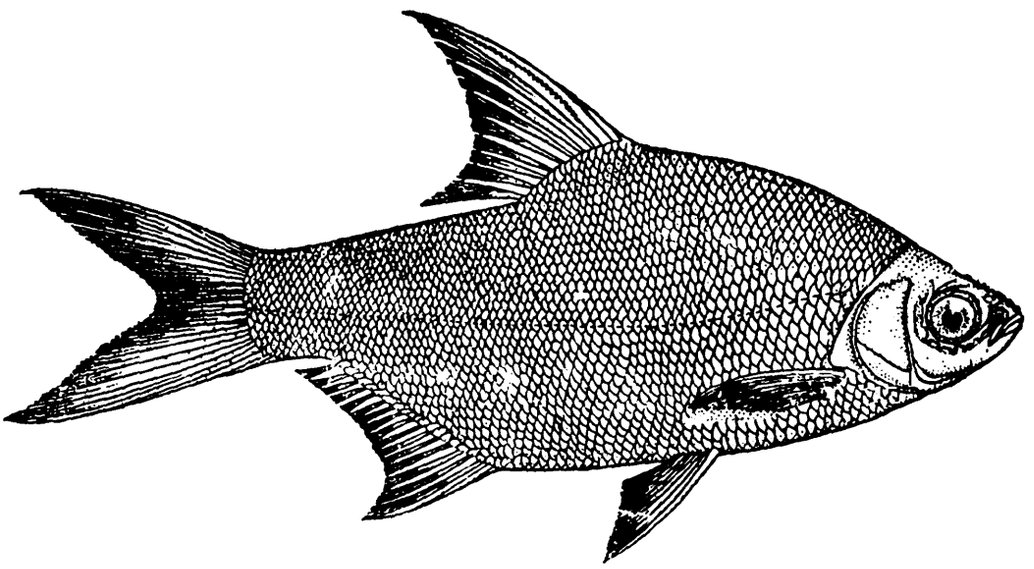


Fig. 54. Lateral view of *Rohtee ogilbi* (Sykes). (After Misra, K. S. 1962, Text-fig. 86).

serrated spine. *A procumbent predorsal spine present.* Anal fin long, with 16 rays (thirteen branched). Caudal fin forked with lobes in its last two thirds. Scales moderate. Lateral line complete with 55 scales.

Distribution.—India : Peninsular India.

Species.—*Rohtee* (*Rohtee*) *ogilbii* Sykes—India : Krishna, Godavary river systems, S. India.

Genus **Mystacoleucus** Günther

Mystacoleucus Günther, 1868, *Catalogue Fish. Brit. Mus.*, **7**, p. 206 (type-species, *Systomus* (*Capoeta*) *padangensis* Bleeker).

Diagnosis.—Very similar to *Rohtee* but differing as below.—Barbels present. Dorsal fin inserted ahead of pelvic fins, in the interspace in between pectoral and pelvics ; with nine rays (eight branched) and a strong serrated spine, *and a procumbent forwardly directed dorsal spine.* Anal fin with 6 to 10 branched rays. Lateral line scales 30-39.

Distribution.—Burma. Thailand.

Species.—1. *Mystacoleucus argenteus* (Day) = *Matsya argentea* Day—Burma.

2. *Mystacoleucus marginatus* (Valenciennes)—Burma. Thailand. Malay Peninsula. Indo-Australian Archipelago.

KEY TO SPECIES

1. Branched anal fin rays six. Lateral line scales 33 to 35. Predorsal scales 12 or 13. ... *M. argenteus*

— Branched anal fin rays 7 to 10. Lateral line scales 24 to 29. Predorsal scales 9 or 10. ... *M. marginatus*

Remarks.—Silas (1952) considered *Mystacoleucus* as a subgenus of *Rohtee*. Since the differences in lepidosis and fin ray counts and geographical distribution are very marked, I have followed Smith (1945) in keeping this separate.

Genus **Osteobrama** Heckel

Osteobrama Heckel, 1842, *Ichth. Russegger's Reisen in Europe. Asian und Africa.* 1, p. 1033 (type-species, *Cyprinus cotio* Hamilton).

Diagnosis.—Body short, deep, compressed. Abdomen rounded. Head short. Snout bluntly rounded. Mouth small, somewhat directed

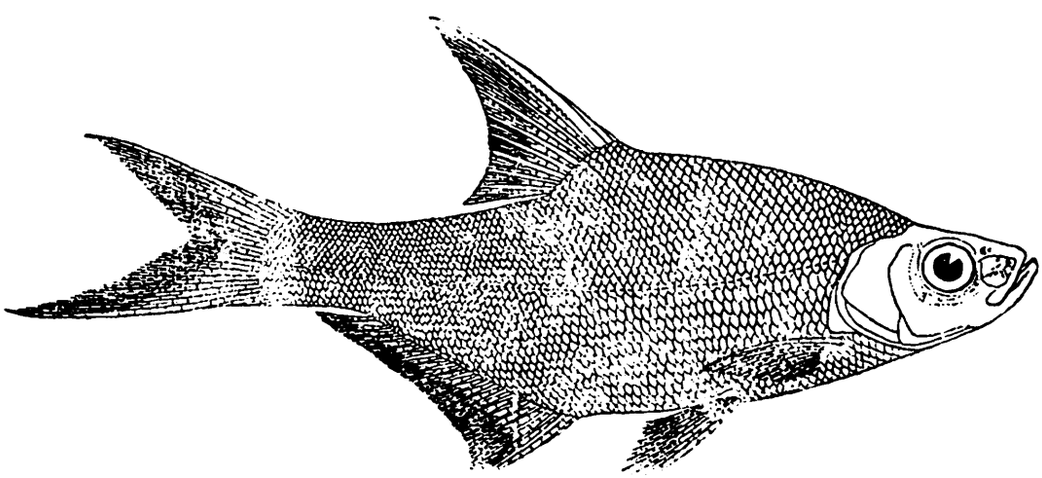


Fig. 55. Lateral view of *Osteobrama vigorsii* (Sykes). (After Misra, K. S. 1962, Text-fig. 85).

upwards and forward. Eyes large, lateral, may be visible from below ventral surface. Lips thin, plain. Upper jaw slightly longer. Barbels four or two or none. *Dorsal fin inserted slightly behind pelvic fins with 11 or 12* rays (*eight or nine branched*) *and a strong serrated spine. Anal fin*

long, with 14—36 rays (11—33 branched). Caudal fin deeply forked. Scales moderate. Lateral line complete with scales.

Distribution.—Throughout India, Nepal, Burma, Yunnan.

Species.—

1. *Osteobrama bakeri* (Day)—India : Kottayam, Kerala.
2. *Osteobrama belangeri* (Valenciennes)—India : Manipur. Burma. Yunnan.
3. *Osteobrama cotio cotio* (Hamilton)—India : North India. Nepal. Pakistan. Bangladesh.

3. 1. *Osteobrama cotio cunma* (Day)—India : Manipur. Burma.

4. *Osteobrama dayi* Hora & Misra—India : Godavary river, S. India.
5. *Osteobrama feae* (Vinciguerra)—Burma. Yunnan.
6. *Osteobrama neilli* (Day)—India : Bhavani river, Nilgiri hills, S. India.
7. *Osteobrama vigorsii* (Sykes) (Pl. V, Fig. C)—India : Krishna, Godavary river systems, Poona.

KEY TO SPECIES*

1.	Barbels absent. ...	...	2
—	Barbels present. ...	...	4
2.	Anal fin with less than 20 branched rays. Abdominal edge keeled throughout. ...		*O. belangeri*
—	Anal fin with more than 20 branched rays. Abdominal edge keeled only between pelvic and anal fins. ...	...	3
3.	Predorsal scales 18-24. Lateral line scales 42-58. Scales between lateral line and pelvic fin 7½-9½ (N. India). ...		*O. cotio cotio*
—	Predorsal scales 24-28. Lateral line scales 57-70. Scales between lateral line and pelvic fin 10½-13. (Burma and Peninsular India). ...		*O. cotio cunma*
4.	Four well defined barbels present. ...	...	5
—	Two rudimentary maxillary barbels only. ...	...	7
5.	Anal fin with more than 20 branched rays. Lateral line scales more than 60. ...		*O. feae*
—	Anal fin with less than 20 (17) rays. Lateral line scales less than 60. ...	...	6

*After Hora, S. L. & Misra, K. S. 1940, *Rec. Indian Mus.*, **42**, pp. 155-172.

6.	Lateral line scales 59. 17 branched rays in anal fin. ...	*O. neilli*
—	Lateral line scales 44. Only 11 branched rays in anal fin. ...	*O. bakeri*
7.	Lateral line scales 73-85. Anal fin with 21-27 branched rays. ...	*O. vigorsii*
—	Lateral line scales 68-70. Anal fin with 16-18 branched rays. ...	*O. dayi*

Genus **Thynnichthys** Bleeker

Sandkhol Carp

Thynnichthys Bleeker, 1859, *Nat. Tijdschr. Ned.*, **20**, p. 417 (type-species, *Leuciscus thynnoides* Bleeker).

Diagnosis.—Body moderately elongate, tail compressed. Abdomen rounded. Head somewhat compressed. Snout slightly pointed, with thin integuments over it. Mouth rather wide, antero-lateral. Eyes large, in the middle of head, visible from below ventral surface. *Upper*

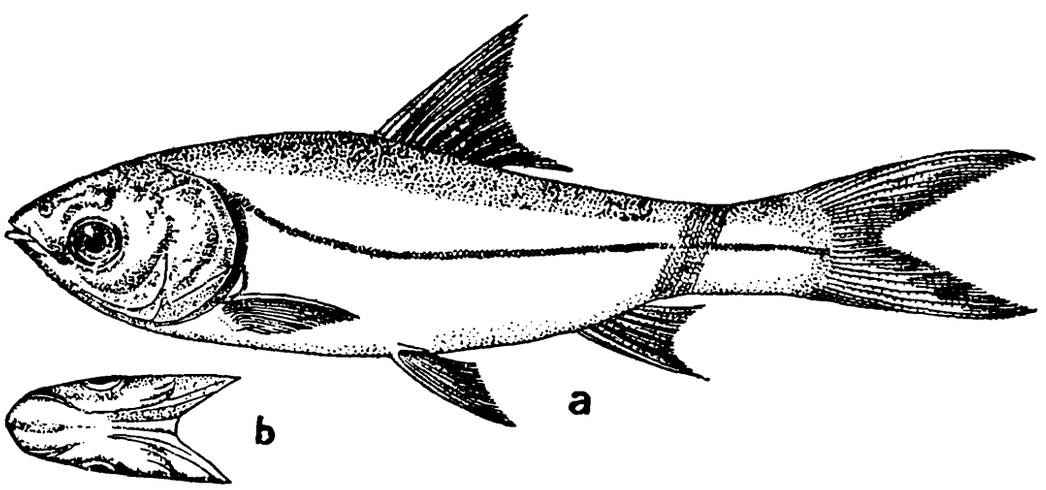


Fig. 56. Lateral view of *Thynnichthys sandkhol* Sykes. (After Misra, K. S. 1962, Text-fig. 90),

lip absent. Lower lip thin, with a short labial fold on the sides. Lower jaw somewhat prominent. No barbels. Dorsal fin inserted ahead of pelvic fins, with 12 rays (nine branched), and no spine. Anal fin short with eight rays (five branched). Caudal fin forked. Scales small. Lateral line complete with 120 scales, running to the centre of the base of the caudal fin a little below.

Distribution.—India : S. India, Krishna and Godavary river systems only. Also found in Malaysia, Islands of Western Indonesia.

Species.—*Thynnichthys sandkhol* Sykes—S. India.

Remarks.—This zoogeographically interesting species is found in tanks also besides rivers.

Genus **Tinca** Cuvier

The Tench. Shoemaker

Tinca Cuvier, 1817, *Regne Anim.*, Ed. 1, **2**, p. 193 (type-species, *Cyprinus tinca* Linnaeus).

Diagnosis.—Body robust, high up to dorsal fin, compressed. Abdomen rounded. Head moderate. Snout obtuse. Mouth anterior, wide, cleft extending to posterior nostrils. Eyes large, supero-lateral, in middle of head, not visible from below ventral surface. Lips thick. Jaws equal. Small barbels present. Dorsal fin short rounded, inserted above last third of pectoral fins, or above end of base of pelvic fins, with 12 or 13 rays and no spine. Anal fin short, with nine or ten rays. In the males, the first or even more of the pelvic rays are thicker than in the female. *Caudal fin truncate.* Scales small. Lateral line gradually descending above base of pelvic fin, but continued to centre of caudal fin base with 90 to 115 scales.

Distribution.—Freshwaters of Europe and Western Siberia and a part of Aral Sea basin.

Species.—*Tinca tinca* (Linnaeus)—distribution as of the genus. Introduced into India in Ootacamund Lakes, Nilgiris, S. India by McIvor in 1874 and is found only there now.

Genus **Schismatorhynchus** Bleeker

Schismatorhynchus Bleeker, 1855, *Nat. Tijdschr. Ned. Ind.*, **9** pp. 258, 269 (type-species, *Schismatorhynchus heterorhynchus* Bleeker).—Hora, 1942, *Rec. Indian Mus.*, **44**, p. 10.

Diagnosis.—Body moderately elongated. Abdomen rounded. Head compressed. *Snout projecting over mouth and having a deep groove passing from one orbit to another, with two short horns or projections on the space between the eyes.* Mouth of moderate width, sub-terminal. Eyes large, dorso-lateral, not visible from below ventral surface. Lower lip reflected, not continuous with upper lip (subgenus *Schismatorhynchus*) or continuous with upper lip and with large papillae (subgenus *Nukta*). Lower jaw separated from the lower lip by the post-labial groove. Post labial groove divided by a longitudinal fleshy frenulum in a median and lateral part (*Schismatorhynchus*) or without such prolongations (*Nukta*). A pair each of maxillary and rostral barbels (*Schismatorhynchus*) or absent (*Nukta*). Dorsal fin inserted much ahead of pelvic fins with 11 rays (nine branched). Caudal fin deeply forked. Scales moderate. Lateral line complete with 37 or 38 scales.

Distribution.—India : Deccan, Peninsular India, notably rivers in Maharashtra, Andhra Pradesh. Sumatra and Borneo.

Species.—Two subgenera each with one species :

S. (*Nukta*) *nukta* Sykes.—India : Peninsular India.

Remarks.—Though the nominate subgenus* is absent from the area of this work, characters are given for zoogeographical importance and for sake of comparison.

Genus **Labeo** Cuvier

Labeo Cuvier, 1817, *Regne Animal.*, 2, ed. 1, p. 194 (type-species, *Cyprinus niloticus* Forskal).

Diagnosis.—Body moderately elongated. Abdomen rounded. Head fairly large. Snout truncated or rounded, generally projecting beyond mouth, mostly covered with tubercles or a groove across, and overhang-

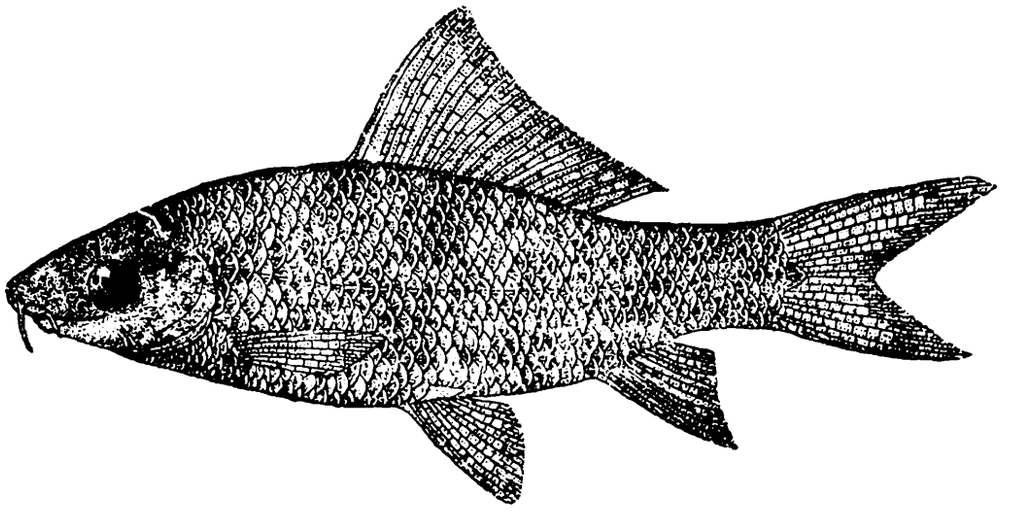


Fig. 57. Lateral view of *Labeo calbasu* (Hamilton). (After Misra, K. S. 1962, Text-fig. 82).

ing the mouth. Mouth narrow, or moderate, somewhat inferior. Eyes moderately large, generally situated in the commencement of the posterior half of the head, not visible from below ventral surface. *Lips thick, fleshy, fringed, covering both jaws, continuous at angle of mouth forming a labial fold.* Jaws with a sharp margin, and with a soft movable horny *covering which may be thick or thin.* Barbels four, two or none. Pharyngeal teeth hooked, in 3 rows, generally 5, 4, 2/2, 4, 5. Dorsal fin inserted ahead of pelvic fins with 11—26 rays (two to four simple) and without any spine. Anal fin short with seven or eight rays (two or three simple). Caudal fin deeply forked or emarginate. Scales large,

*S. (*Schismatorhynchus*) heterorhynchus* Bleeker is found in Sumatra, Borneo.

moderate or small, with numerous parallel striae. Lateral line complete, with 36-85 scales.

Distribution.—Throughout India. Pakistan. Nepal. Bangladesh. Sri Lanka. Burma. Malaysia. Also found in Tropical Africa and Syria.

Species.—

1. *L. angra* (Hamilton)*—India : Bengal, Orissa, Assam. Bangladesh. Nepal.
2. *L. ariza* (Hamilton)—India : Nilgiri hills and Cauvey river system, S. India.

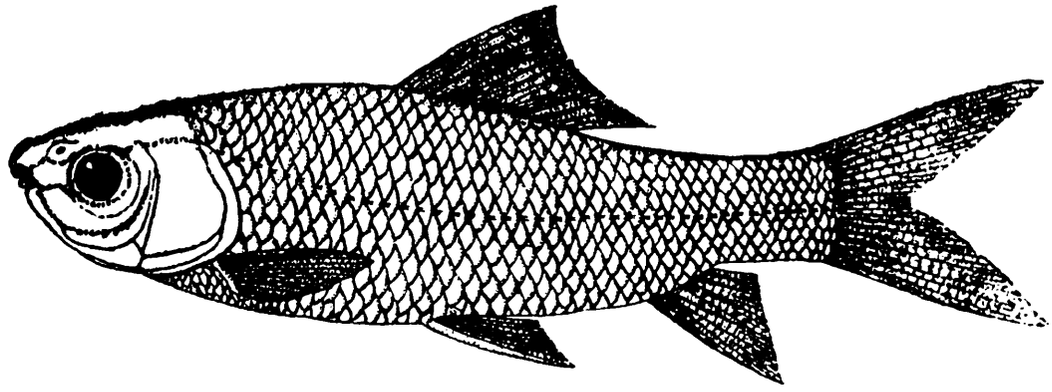


Fig. 58. Lateral view of *Labeo rohita* (Hamilton). (After Misra, K. S. 1962, Text-fig. 83).

3. *L. bata* (Hamilton)—Throughout India. Bangladesh. Nepal.
4. *L. boga* (Hamilton)—India : U. P., Bihar, W. Bengal, Deccan. Bangladesh. Nepal. Burma. Pakistan.
5. *L. boggut* (Sykes) (Pl. III, fig. C)—Throughout North India and up to Cauvery river system. Pakistan.
6. *L. caeruleus* Day—Pakistan : Sind.
7. *L. calbasu* (Hamilton)—Throughout India. Pakistan. Burma. Bangladesh. Nepal.
8. *L. devdevi* Hora—Burma. Thailand.
9. *L. dero* (Heckel)—India : All along Himalaya. Nepal. Pakistan : Sind hills. Burma.
10. *L. dyocheilus dyocheilus* McClelland.—India : Doon valley, Kashmir, Poonch, Sikkim, Assam. Nepal. Pakistan : Sind hills. Bangladesh.

10. 1. *L. dyocheilus pakistanicus* Mirza & Awan—Pakistan : Qadh Wala stream, Son-Sakesar valley ; Azad Kashmir. W. Himalaya.

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*Menon (1974) considers this as a synonym of *L. pangusia.*

11. *L. dussumieri* (Valenciennes)[+]—India : W. ghats up to N. Canara. Sri Lanka.

12. *L. fimbriatus* (Bloch) (Pl. VI, fig. D)—India : W. Bengal, S. India (not found in W. ghats). Nepal. Burma. Pakistan.

13. *L. fisheri* Jordan & Starks—Sri Lanka.

14. *L. gonius* (Hamilton)—Throughout India, Pakistan, Nepal, Bangladesh, Burma.

15. *L. kawrus* (Sykes)—India : Poona.

16. *L. kontius* (Jerdon)—India : Cauvery river system. S. India.

17. *L. microphthalmus* Day[++]—India : W. Himalaya. Pakistan.

18. *L. nandina* (Hamilton)—India : W. Bengal, Assam. Bangladesh. Burma.

19. *L. nigripinnis* Day—Pakistan : Sind.

20. *L. nigrescens* Day—India : Canara, Karnataka.

21. *L. pangusia* (Hamilton)—India : Deccan, W. Bengal, Assam. Pakistan : Sind. Bangladesh.

22. *L. porcellus* (Heckel)—India : Poona, Maharashtra. Sri Lanka.[+++]

23. *L. potail* (Syles)—India : Deccan, Poona to Thungabhadra river.

24. *L. rohita* (Hamilton)—Throughout India. Pakistan. Nepal. Bangladesh. Burma. Not reported from W. ghals in the natural state.

25. *L. sindensis* (Day)—India : Hardwar and Poona. Pakistan : Sind. Nepal.

26. *L. stoliczkae* (Steindachner)—Burma.

KEY TO SPECIES

1.	Dorsal fin rays not more than 13. Only one pair of barbels.	...	...	2
—	Dorsal fin rays more than 13. Mostly two pairs of barbels (*L. stoliczkae, L. potail, L. caeruleus*, with one pair).	...	...	14

+Menon (1974) considers this as a synonym of *L. rohita.*

++Menon, 1974 considers these species as a synonyma of *L. dero.*

+++Silas (1952) considers the Sri Lanka form as *Labeo porcellus lankae* Deraniyagala.

2.	Lateral line scales 60-65. Scales between pelvic fin base and lateral line 8 or 9. ...	*L. boggut*	
—	Lateral line scales not more than 45. Scales between pelvic fin base and lateral line not more than 7. ...	...	3
3.	Scales between pelvic fin base and lateral line 6½-7. ...	...	4
—	Scales between pelvic fin base and lateral line less than 6. ...	...	6
4.	Snout with a very indistinct lateral lobe. Pores generally absent. Dorsal fin higher than body depth. ...	*L. microphthalmus*	
—	Snout without any lateral lobe. Pores generally present. Dorsal fin shorter or equal to body depth. ...	...	5
5.	Snout with a distinct, deep groove across. Dorsal fin inserted above last quarter of pectoral fins. Scales between LL and pelvic base may be 6 occasionally. ...	*L. dero*	
—	Snout without any groove, if present not very deep. Dorsal fin inserted above tip of pectoral fin. ...	*L sindensis*	
6.	Scales between lateral line and pelvic fin base 4½. ...	*L. kawrus*	
—	Scales between lateral line and pelvic fin base 5-6. ...	...	7
7.	Pectoral fin reaching pelvic fin. ...	...	8
—	Pectoral fin not reaching pelvic fin. ...	...	9
8.	Eyes 6 to 9 in head length. ...	*L. dyocheilus dyocheilus* †	
—	Eyes 4.0 to 4.3 in head length. ...	*L. bata*	
9.	Snout with a distinct lateral lobe. ...	...	10
—	Snout without any lateral lobe. ...	...	12
10.	Eye diameter less than 6.0 in head length. ...	...	11
—	Eye diameter 7.0 in head length (Sri Lanka).	*L. fisheri*	
11.	Eye diameter 3.5 to 4.5 in head length. Lips continuous and labial fold uninterrupted. ...	*L. angra*	
—	Eye diameter 4.5 to 5.5 in head length. Lips with a distinct inner fold which is interrupted.	*L. pangusia*	

†*L. dyocheilus pakistilnicus* Mirza & Awan, 1976 (*Biologia*, **22** (1) : 43-47) is differentiated from the nominate species by snout contained 1.88-2.00 in head length (*vs.* 2.5-3.0 in *L. dyocheilus dyocheilus*), cleft of mouth extending below level of nostrils (*vs.* up to level of anterior margin of eye), 8½ rows of scales between dorsal fin and lateral line (*vs.* 9½-10½ rows).

12.	Dorsal fin inserted slightly posterior to tip of pectoral fin. ...	*L. ariza*	
—	Dorsal fin inserted above tip or slightly anterior to tip of pectoral fin. ...	...	13
13.	Head length 5.0 to 5.25 in total length. Lateral line scales 40-42. ...	*L. nigripinnis*	
—	Head length 5.25 to 5.5 in total length. Lateral line scales 37-39. ...	*L. boga*	
14.	Dorsal fin rays 19-26. ...	...	15
—	Dorsal fin rays 13-18. ...	...	16
15.	Dorsal fin rays 24-26. Scales between lateral line and pelvic base 5. ...	*L. nandina*	
—	Dorsal fin rays 19-22. Scales between lateral line and pelvic base 6 or 7. ...	*L. fimbriatus*	
16.	Lateral line scales more than 50 (50-85). ...	...	17
—	Lateral line scales less than 50 (38-47). ...	...	18
17.	Lateral line scales 71-84. Scales between lateral line and pelvic fin base 9-13. ...	*L. gonius*	
—	Lateral line scale 53-60. Scales between lateral line and pelvic fin base 5-5½. ...	*L. dussumieri*	
18.	Scales between lateral line and pelvic fin base 4½. Lateral line scales 36. ...	*L. nigriscens*	
—	Scales between lateral line and pelvic fin base 5-7. Lateral line scales 38-44. ...	...	19
19.	Simple unbranched rays in dorsal fin three or four. ...	...	20
—	Simple unbranched rays in dorsal fin two. ...	...	23
20.	Scales between lateral line and pelvic fin base seven. ...	*L. stoliczkae*	
—	Scales between lateral line and pelvic fin base 5-6½. ...	...	21
21.	Snout blunt, truncated with a fleshy lateral prolongation. Head length 6 to 7 in total length. ...	*L. kontius*	
—	Snout not truncated, without any lateral lobes. ...	...	22
22.	Scales between lateral line and pelvic fin base 5½-6. ...	...	23
—	Scales between lateral line and pelvic fin base. 6-6½. ...	*L. rohita*	

23.	Dorsal fin with 16 to 18 rays. One pair each of rostral and maxillary barbels present. ...	*L. calbasu*
—	Dorsal fin with 14 rays. One pair of maxillary barbels only. ...	*L. devdevi*
24.	Snout without any lateral lobe. ...	... 25
—	Snout with a lateral lobe. (Head length 5.5 in total length. $5\frac{1}{2}$ scales between lateral line and pelvic fin base. Dorsal fin with 13 or 14 rays). ...	*L. potail*
25.	Head length 4.75 in total length. Six scales between lateral line and pelvic fin base. Dorsal fin with 14 rays. ...	*L. caeruleus*
	—Head length 6.0 in total length. Five scales between lateral line and pelvic fin base. Dorsal fin with 15 or 16 rays. ...	*L. porcellus*

Genus **Labiobarbus** van Hasselt

Dangila Valenciennes, 1842, *Hist. nat. Poiss.* **16**, p. 229 (type-species, *Dangila cuvieri* (Valenciennes).

Labiobarbus van Hasselt, 1823, *Alg. Konst. Letterbode*, 2, p. 132 (type-locality, *Labiobarbus peptocheilus* van Hasselt).—Smith, 1945, *Bull. U. S. nat. Mus.*, (188), p. 221.

Cyrene Heckel, 1843, *Ichthyologie von Syrien In* : Russeger's : *Reisen in Europa*, p. 284 (type-species, *C. ocellata* Heckel).

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head moderately large. Snout obtusely rounded. Mouth transverse, more or less inferior. Eyes superior, not visible from below ventral surface. Upper lip fringed, lower lip covering the lower jaw, thin, simple. *Lower jaw sharp with a tubercle at the symphysis.* Four small barbels. One pair each of maxillary and mandibular. *Dorsal fin long, inserted above posterior half of pectoral fin, with 26-28 rays (18-27 branched) and without any spine.* Anal fin short with seven rays (five branched). Caudal fin deeply forked. Scales large, small or moderate size. Lateral line complete, with 31-40 scales.

Distribution.—Burma. Thailand. Malay Archipelago.

Species.—

1. *Labiobarbus berdmorei* (Blyth)—Burma : Tenasserim.
2. *Labiobarbus burmanicus* (Day)—Burma : Moulmein, Tavoy. Thailand.

KEY TO SPECIES

1.	Body with dark longitudinal streaks following rows of scales. Lateral line scales 39 or 40. ...	*L. burmanicus*
—	Body plain. Lateral line scale 31. ...	*L. berdmorei*

Genus **Accrossocheilus** Oshima

Katli

Accrossocheilus Oshima, 1919, *Ann. Carnegie Mus.*, **12**, p. 206 (type-species, *Gymnostomus formosanus* Oshima).—Hora, 1940, *J. Bombay nat. Hist. Soc*,, **14**, pp. 78-88.

Diagnosis.—Body elongate, not very deep, compressed. Abdomen rounded. *Head* short, broad, *with several rows of horny tubercles on sides and in front of anal below the eyes ; these may be absent in some examples, they may be represented by pores when the tubercles have fallen off.* Snout obtusely rounded, slightly overhanging jaw. Mouth moderate, horizontal, subterminal. Eyes moderate, lateral in position, not

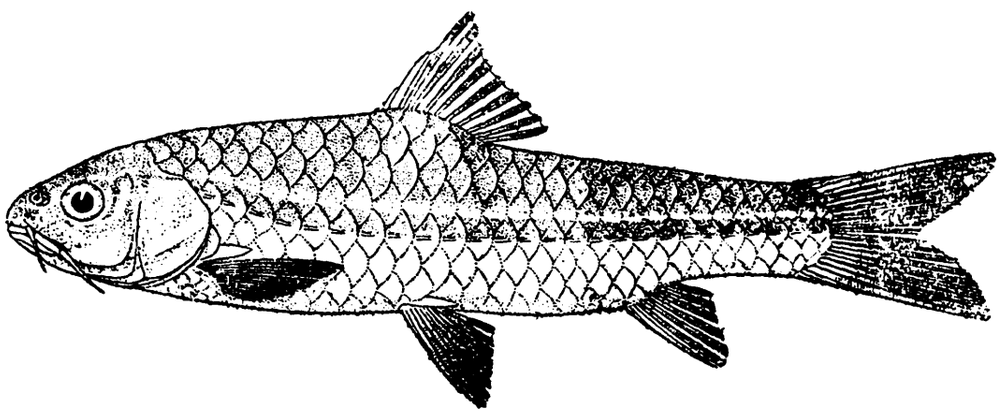


Fig. 59. Lateral view of *Accrossocheilus hexagonolepis* (McClellend). (After Misra, K. S. 1962, Text-fig. 72).

visible from below ventral surface. Lips thick, continuous round the angle of mouth. Labial fold interrupted in the middle. *Lower lip may be separated into two lateral parts, leaving the median portion of the lower jaw exposed* ; this may be variable. *Upper lip separated from snout by a groove.* Lower jaw covered by a sharp horny covering. Four barbels, a pair each of rostral and maxillary. Dorsal fin inserted opposite to or slightly ahead of pelvic fin, with 13 rays (nine branched) and with a smooth spine. Anal fin short, with eight rays (five branched). Caudal fin deeply forked with pointed lobes. Scales large. Lateral line complete with 22-32 scales. A scaly appendage is present before each pelvic fin.

Distribution.—India : North India. Bangladesh. Nepal. Pakistan. Burma. Thailand. Viet-Nam. China. Malaya. Sumatra.

Species.—Accrossocheilus hexagonolepis (McClelland)—India : E. Himalaya, Assam, Meghalaya, Arunachal Pradesh. Nepal. Burma. Thailland. Malaya. Sumatra.

Genus **Chagunius** H. M. Smith

Chagunius H. M. Smith, 1938, *Proc. biol. Soc. Washington*, **15**, p. 157 (type-species, *Cyprinus chagunio* Hamilton).—Jiwan Shreshta & Majupuria 1976, *Matsya*, 2 pp. 75-77 (Nepal).

Diagnosis.—Body elongated. Abdomen broadly rounded. Head compressed with flat sides. *Snout overhanging, divided into a central and two lateral lobes by a groove extending upward and forward from the base of each rostral barbels. Snout and cheek in male beset with short, horny tubercles which are smaller and fewer in females.* Mouth subterminal, U-shaped, with two ends directed backwards. Eyes large, superior, not visible from below ventral surface. Lips thick, rough with fine papillae. Barbels four ; a pair each of rostral and maxillary, well developed. Dorsal fin inserted slightly ahead of pelvic fins with 11 rays (eight branched) and a stout, strong, serrated spine. Anal fin short with eight rays (five branched). Caudal fin forked. Scales large. Lateral line complete with 44-48 scales.

Distribution.—India : North India along base of Himalaya. Nepal. Pakistan. Bangladesh. Burma. Thailand.

Species.—*Chagunius chagunio* (Hamilton)—distribution as of genus.

Genus **Tor** Gray

Mahaseers

Tor Gray, 1833-34, *Illustrations of Indian Zoology*, 2, p. 96 (type-species. *Cyprinus tor* Hamilton).

Diagnosis.—Body elongate, moderately compressed. Abdomen rounded. Head small, broadly pointed. Snout angularly rounded.

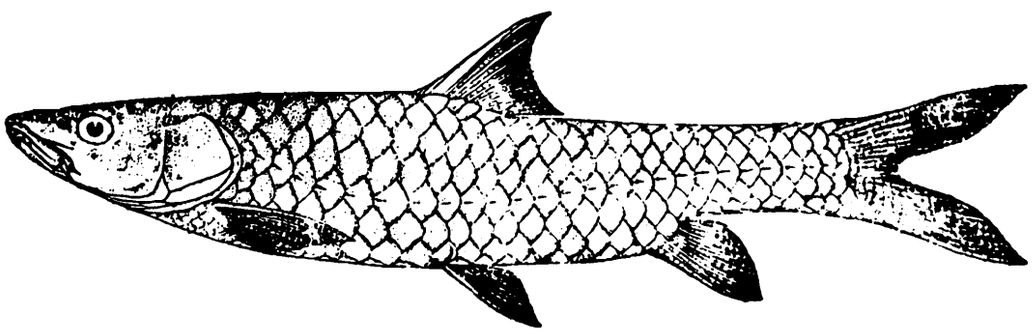


Fig. 60. Lateral view of *Tor putitora* (Ham.). (After Misra, K. S. 1962, Text-fig. 74).

Mouth inferior, arched. Eyes far forward, large, and not visible from below ventral surface. *Lips fleshy, continuous at angles of mouth ; posterior lip with or without a median lobe and the post-labial groove contin-*

uous ; lip condition variable. Pharyngeal teeth in 3 rows 5, 3, 2. Four barbels, a pair each of maxillary and rostral. Dorsal fin inserted above pelvic fins, with 12-13 rays (eight or nine branched) and a strong, stout, smooth spine. *A scaly sheath present at base of dorsal fin.* Anal fin with

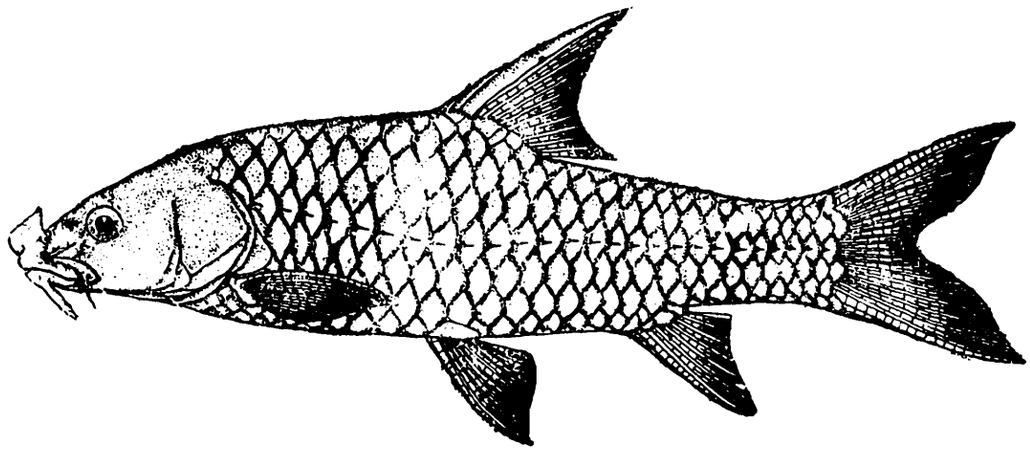


Fig. 61. Lateral view of *Tor tor* (Hamilton). (After Misra, K. S. 1962. Text-fig. 75).

seven or eight rays (five branched). Caudal fin deeply forked. Scales large, with numerous parallel striae. Lateral line complete with 23-28 scales.

Distribution.—Throughout India, Pakistan. Nepal. Bangladesh. Burma. Thailand. China. Also Syria, Israel, most of Arabian peninsula south to Yemen. ? Africa.

Species.—

1. *Tor khudree* (Sykes)* (Pl. III. Fig B)—India : Peninsular India, especially Karnataka, Kerala, Maharashtra hill streams. Sri Lanka.
2. *Tor mosal* (Hamilton)—Burma.
3. *Tar mussullah* (Sykes)—Pl. IV, Fig C.—India : Cauvery, Bhavani rivers, S. India. Also Poona.
4. *Tor putitora* (Hamilton)—India : All along the Himalaya. Nepal. Pakistan. Bangladesh.
5. *Tor progenius* McClelland.—India : Assam, Arunachal Pradesh, Naga hills, Nagaland.
6. *Tor tor* (Hamilton)—India : Foothills of Himalaya. Madhya Pradesh, Bihar, N. Bengal, Assam. Pakistan. Bangladesh.
7. *Tor zhobensis* Mirza—W Pakistan : Zhob river.

*Silas (1952) considers the Sri Lanka population as *T. khudree longispinis* (Günther).

KEY TO SPECIES

1, Length of head considerably shorter or more or less equal to body depth. 2

— Length of head considerably greater than body depth. ... *T. putitora**

2. A fan shaped, rounded structure behind upper lip present. ... *T. progenius* (Fig. 62, A, D)

— No such fan shaped structure behind upper lip (though lips may be hypertrophied). 3

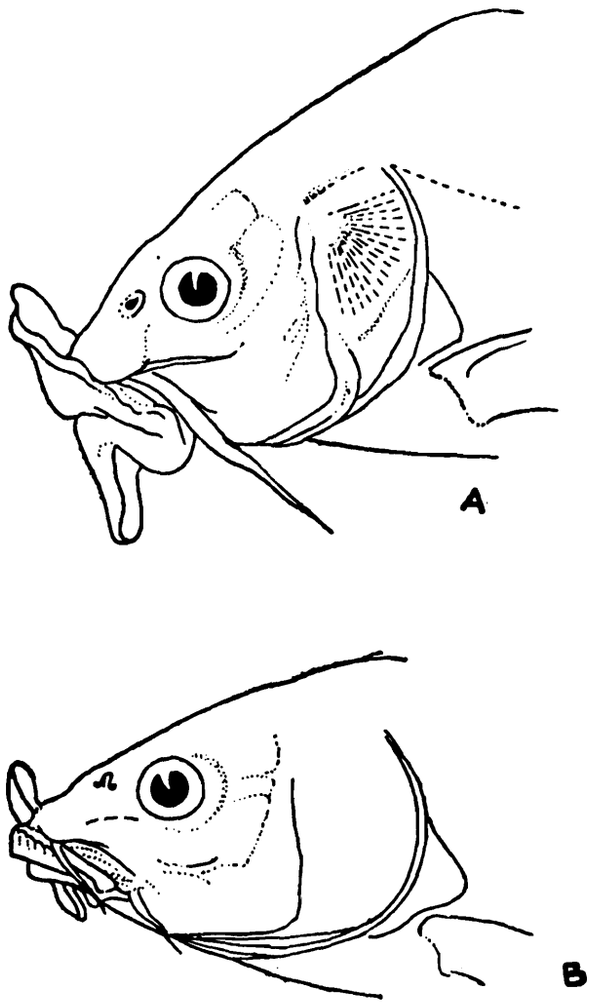


Fig. 62. Illustration of head and anterior part of *Tor progenius* McClelland to show the fan-shaped structure on the snout. (After Hora, S. L. 1941. *J. Bombay nat. Hist. Soc.*, **42** (3), p. 529).

3, $3\frac{1}{2}$ rows of scales between lateral line and base of pelvic fins. ... *T. mussullah*

— $2\frac{1}{2}$ rows of scales between lateral line and base of pelvic fins. 4

*T. *zhobensis* Mirza also has the head length greater than body depth. I am unable to place it in the key for want of further details.

4.	Dorsal and ventral profiles slightly and more or less equally arched (S. India). ...	*T. khudree*
—	Dorsal and ventral profiles not equally arched.	... 5
5.	Ventral profile more arched than dorsal (N. India). ...	*T. tor*
—	Dorsal profile more arched than ventral (Burma only). ...	*T. mosal*

Genus **Cirrhinus** Oken*

Cirrhinus (Oken), Cuvier, 1817, *Regne Animal.*, 2, ed, 1, p. 193 (type-species, *Cyprinus cirrhosus* Bleeker).

Diagnosis.—Body moderate, elongate, compressed. Abdomen rounded. Head short. Snout obtusely rounded, with thin skin covering it, may be with pores. Mouth broad, transverse. Eyes moderately large, in the anterior half or middle of head, not visible from below ventral surface. Upper lip fringed or entire, not continuous

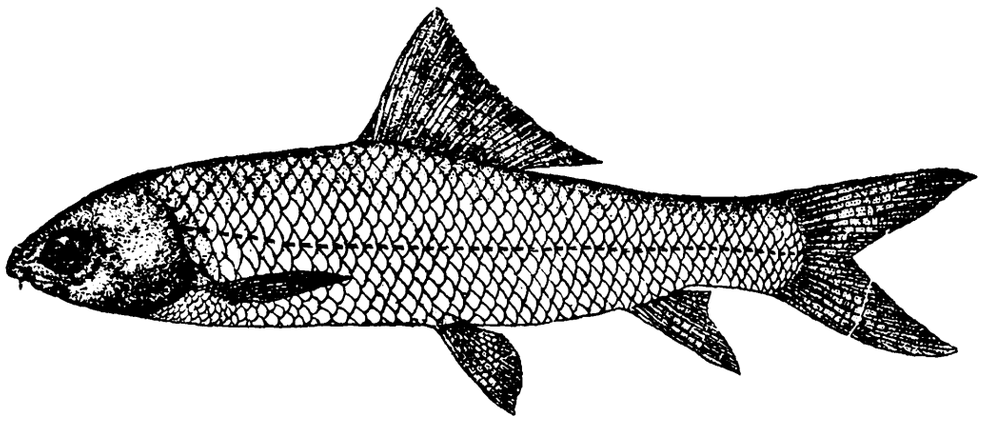


Fig. 63. Lateral view of *Cirrhinus mrigala* (Hamilton). (After Misra, K. S. 1962, Text-fig. 80).

with lower. Lower lip reflected off from the mandible and may or may not cover the lower jaw. Lower jaw *sharp with a small tubercle at the symphysis, and without any cartilaginous covering inside the jaw* which may be thinly present in some species. Barbels small, four, two or none. Dorsal fin inserted ahead of pelvic fins, with 10-19 rays (two to four simple) and without any spine. Anal fin, short, with seven or eight rays (two or three simple). Caudal fin forked or lunate. Scales of varying sizes. Lateral line complete with 35-45 scales.

Distribution.—Throughout India, Pakistan, Nepal, Bangladesh, Burma and East Indies.

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*Oken 1817 emended the name *Cirrhina* originally erected by Cuvier in 1817 to *Cirrhinus*. This emendation is adopted here.

Species.—

1. *C. cirrhosa* (Bloch)—India : Cauvery, Krishna and Godavary river systems, S. India.
2. *C. fulungee* (Sykes)—India : Poona and Deccan, Karnataka.
3. *C. horai* Lakshmanan—India : Godavary river, Rajahmundry.
4. *C. mrigala* (Hamilton)—Throughout North India. Pakistan. Nepal. Bangladesh. Burma. Introduced in S. India.
5. *C. reba* (Hamilton) (Pl. III, Fig. D)—Throughout India. Pakistan. Nepal. Bangladesh.

KEY TO SPECIES

1.	Dorsal fin with 8 branched rays. ...	...	2
	Dorsal fin with 11 or more than 11 branched rays. ...	...	3
2.	Dorsal fin nearly as high as body. Lateral line scales 48. ...		*C. fulungee*
	Dorsal fin less than body height. Lateral line scales 35-38. ...		*C. reba*
3.	Four barbels. ...		*C. cirrhosa*
	Two barbels. ...	...	4
4.	Dorsal fin with 17-19 rays in total. Lateral line scales 44-46. ...		*C. horai*
	Dorsal fin with 15-16 rays in total. Lateral line scales 40-45. ...		*C. mrigala*

Genus **Osteocheilus** Günther

Osteochilus Günther, 1868, *Cat. Fish. Brit. Mus.*, **7**, p. 40 (type-species, *Rohita melanopleura* Bleeker), —Hora, 1942, *Rec. Indin Mus.*, **44** pp. 1-10 (revision).

Diagnosis.—Body short, deep. Abdomen rounded. Head short, compressed. Snout obtusely rounded. Snout and cheek sometimes with pores, or horny tubercles or with oblique grooves. Mouth inferior or subinferior. Eyes large, placed in middle of head, visible from below ventral surface. Lips thick, fringed or crenulated. *Lower lip broadly confluent with isthmus.* No labial fold. *Lower jaw with a sharp transverse bony edge, may or may not be covered by lip.* No knob or tubercles present at the symphysis. Barbels one or two pairs or none.

Dorsal fin inserted almost above tip of pectoral fin, with 13-21 (10-18 branched), and with a spine (subgenus *Kantaka* Hora) or without a spine (subgenus *Osteochilichthys*). Anal fin short with seven or eight rays (five or six branched) Caudal fin forked. Scales large or moderate

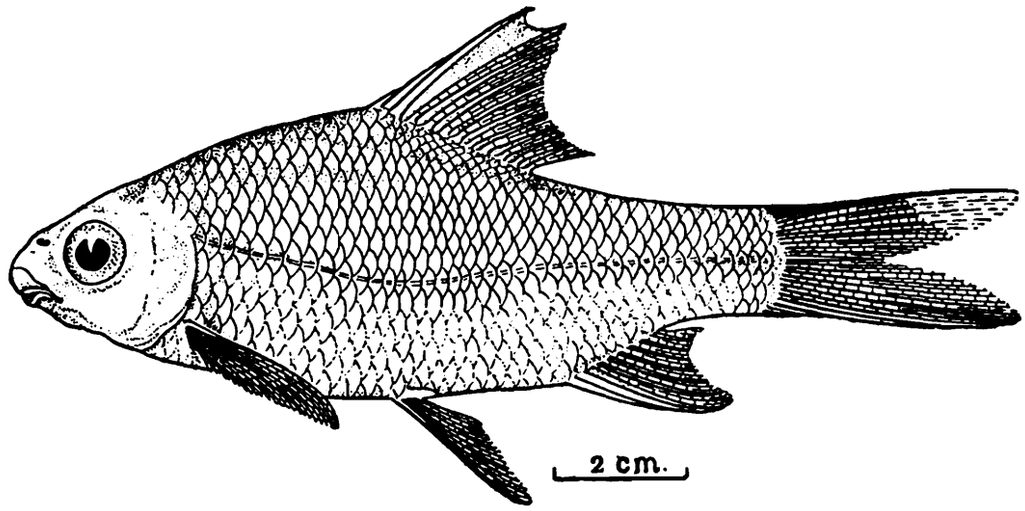


Fig. 64. Lateral view of *Osteocheilus brevidorsalis*

sometimes irregularly dispersed. Lateral line complete with 33-43 scales.

Distribution.—India : South India. Burma. Thailand. S. China. Malay Peninsula, Indo-Australian Archipelago.

KEY TO SUBGENERA

1.	Lateral line scales 33 or 34. Barbels four. ...	*Osteocheilus* Günther
—	Lateral line scales 39-43. Barbels present or absent. ...	... 2
2.	Dorsal fin with a serrated spine. ...	*Kantaka* Hora
—	Dorsal fin without any spine. ...	... 3
3.	Lower jaw not covered by lip. ...	*Osteochilichthys* Hora
	Lower jaw covered by lip. ...	*Neorohita* Fowler

Subgenus **Osteocheilus** Günther

Species.—

1. *O. neilli* (Day)—Burma : Mandalay.
2. *O. vittatus* (Valenciennes)—Burma : Mergui dist. Thailand.

Subgenus **Osteochilichthys** Hora

3. *O. nashii* (Day)—India : Bhavani river, Coorg, Wynaad, S. India.
4. *O. thomassi* (Day)—India : S. Canara.
5. *O. godavariensis* Rao—India, Godavary river basin, Kirkee Nalla, Chandpas, Nagar dist., Maharashtra.
6. *O. brevidorsalis* (Day)—India : Nilgiri hills, S. India.

Subgenus **Neorohita** Fowler

7. *O. sondhii* Hora—Burma : Salween river.

KEY TO SPECIES

1.	Dorsal fin with a strong serrated spine. Barbals absent. ...	*O. (Kantaka) brevidorsalis*	
	Dorsal fin without any osseous ray. Barbels present or absent. ...	...	2
2.	Lower jaw covered by lip. Two short maxillary barbels present (Burma). ...	*O. (Neorohita) sondhii*	
	Lower jaw not covered by lip. ...	...	3
3.	Lateral line scales 38-43. ...	...	4
	Lateral line scales 33 or 34. ...	...	6
4.	Barbels absent. Dorsal fin rays 14 or 15. No black blotches on lateral line below the dorsal origin. ...	...	5
	Two pairs of barbels present (one pair rostral and one pair maxillary). One or two black blotches on the lateral line below the dorsal origin. Dorsal fin rays 17 or 18.	*O. (Osteochilichthys) godavariensis**	
5.	Lateral line scales less than 40. Body depth 3.5 in total length. No black band along middle of body. A dark band along dorsal fin present. ...	*O. (Osteochilichthys) thomassi*	
	Lateral line scales more than 40. Body depth 4.0 or more in total length. A black band from eye to centre of caudal fin present. ...	*O. (Osteochilichthys) nashii*	
6.	Snout acute. Maxillary barbels shorter than eye diameter. Eye diameter 3.5 in head length. ...	*O. (Osteochilichthys) vittatus*	
	Snout rounded. Maxillary barbels as long as as or just equal to eye diameter. Eye diameter 3.0-4.0 in head length. ...	*O. (Osteochilus) neilli*	

*Babu Rao, 1977, *Sci & Cult.* **43**, pp. 491-493 has placed this new species described by him under genus *Osteochilichthys*.

Genus **Cyprinion** Heckel

Cyprinion Heckel, 1842, *Ichthyologic In* : Russeger's *Reisen in Europe Asian und Africa*, part 1, p. 1015 (type-species, *Cyprinion macrostomus* Heckel).—Hora 1941, *Rec. Indian Mus.*, **44** (1), pp. 1-10 (revision).

Diagnosis.—Body moderately elongate, deep. Abdomen rounded. Head large, compressed. Snout rounded. Mouth transverse, inferior. Eyes large, situated in the last part of the anterior half of head, not visible from below ventral surface. Lips thin, plain. No labial fold on lower lip. *Lower jaw without any knob above the symphysis, and bent angularly inwards. A horny layer inside lower jaw.* Upper jaw equal to lower jaw. One pair of maxillary barbels. Dorsal fin inserted ahead of pelvic fins, with 9-16 branched rays and a serrated spine. Anal fin short with nine rays (seven branched). Caudal fin forked. Scales subcircular. Lateral line complete with 33-36 scales. *A scaleless furrow between the occiput and the origin of the dorsal* fin present. Posterior chamber of air-bladder long and narrow.

Distribution.—Pakistan : Sind hills, Salt range, Punjab. Afghanistan. Also Iran, Tigris-Euphrates, parts of Syria and eastern corner of Arabian Peninsula.

Species.—

1. *Cyprinion irregularis* (Day)—
2. *Cyprinion watsoni* (Day)— } Distribution as of the genus.
3. *Cyprinion millesi* (Day)*—Pakistan.

KEY TO SPECIES**

1. Pectoral fin almost as long as long as head. Lower lobe of caudal fin longer. 9 rows of scales between lateral line and base of pelvic fin. Arrangement of scales above lateral line irregular. No marks on the body. ... *C. irregularis*

— Pectoral fin considerably shorter than head. Lobes of caudal fin equal. 6 rows of scales between lateral line and base of pelvic fin. Arrangement of scales above lateral line regular. Various and very irregular black spots on body. ... *C. watsoni*

*Status doubtful. Not included in key.

After Hora, S. L. 1923. *Rec. Indian Mus.*, **25, p. 381.

Genus **Catla** Valenciennes

Catla

Catla Valenciennes, 1844, *Hist. Nat. Poss.*, **18**, 140 (type-species, *Cyprinus catla* Hamilton, type by monotypy).—Natarajan *et al.* 1978, *Matsya*, **3**, pp. 46-59 (subspecies).

Diagnosis.—Body short, deep. Abdomen rounded. Head broad, large. Snout bluntly rounded, may be with pores, with thin skin covering. Mouth wide, anterior, arched, Eyes large, in anterior half of head, visible from below ventral surface. *Upper lip absent.* Lower lip moderately thick, continuous and with a free posterior margin.

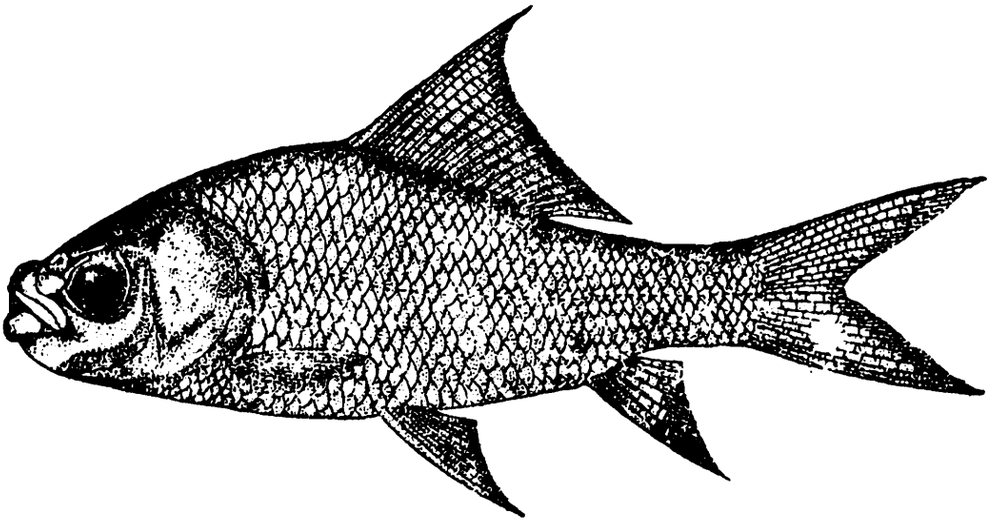


Fig. 65. Lateral view of *Catla catla* (Hamilton). (After Misra, K. S. 1962, Text-fig. 79.)

Lower jaw with a *movable articulation at the symphysis but without a prominent knob.* No barbels. *Dorsal fin long, inserted above tip of pectorl fin with* 17-19 *rays* (*three or four simple*) *and witout any spine.* Anal fin short, with eight rays (five branched). Caudal fin forked. Scales moderate. Lateral line complete with 40-43 scales.

Distribution.—Throughout India up to Krishna river, but introduced into the Cauvery river system. Pakistan. Nepal. Bangladesh. Thailand.

Species.—*Catla catla* (Hamilton)—is the only species so far known.

Genus **Ctenopharyngodon** Steindachner

Grass Carp, White Amur

Ctenopharyngodon Steindachner, 1866, *Verh. zool. Bot. Ges. Wien*, **16**, p. 782 (type-species, *Ctenopharyngodon laticeps* Steindachner, by orginal designation).

Diagnosis.—Body moderately elongate, sub-cylindrical anteriorly, and compressed posteriorly. Abdomen rounded. Head depressed and flattened. Snout obtusely rounded. Mouth terminal, cleft not exten-

ding to anterior margin of eyes. Eyes large, lateral, in anterior part of head, may or may not be just visible from below ventral surface. Lips thin, without any lobes. Upper jaw slightly longer than lower, and protractile. *No barbels present. Dorsal fin inserted slightly ahead of pelvics nearer tip of snout than caudal base, with ten rays (three simple, seven branched) and without a spine.* Anal fin short, with ten rays, eight branched. Caudal fin well forked. Scales large, cycloid. Lateral line continuous, slightly decurved, with 40-42 scales.

Distribution.—Naturally found in Amur region (Siberia and Manchuria). North China to South China. U. S. S. R. lower reaches of R. Amur. Introduced into India in 1959.

Species.—Ctenopharyngodon idella (Valenciennes)—distribution as of genus.

Genus **Parapsilorhynchus** Hora

Parapsilorhynchus Hora, 1921, *Rec. Indian Mus.*, **22**, p. 13 (type-species, *Parapsilorhynchus tentaculatus* Annandale).—Hora & Misra, 1938, *J. Bombay nat. Hist Soc.*, **40** (1), pp. 32-35.

Diagnosis.—Body considerably depressed. Head broadly pointed anteriorly, with sensory pores. Snout conical, smooth or with pores. Mouth small, inferior, and horizontal. Eyes fairly prominent, lateral, and visible from below ventral surface. Lips thick, upper lip covered by a prominent rostral fold fringed and covered with minute tubercles ; lower lip finely papillated, slightly emarginate and is with a callous area behind a small rudimentary disc, behind lower lip. Pharyngeal teeth sickle shaped, in two rows 4, 4/4, 4. Two short, stumpy barbels present. Dorsal fin inserted opposite pelvic with 8 branched rays and no spine. *Pectoral fins with no simple rays*, outer rays with adhesive pads ventrally. Anal fin short with 5 branched rays. Caudal fin deeply forked. Scales small. Anal fin short with 5 branched rays. Caudal fin deeply forked. Scales small, firmly adherent, with a network of radii, all originating from base, directed distally, and circuli with small rhomboidal areas. Lateral line with 34-47 scales. Air-bladder large.

Distribution.—India : Poona, Maharashtra ; Pachmarhi, Madhya Pradesh.

Species.—

1 *P. prateri* Hora & Misra.—India : Deolali ; Poona, Maharashtra.

2. *P tentaculatus* Annandale (Synonym *P discophorus* Hora).—India : Pophili, Vashishti Valley, Ratnagiri district ; Poona, Maharashtra.

KEY TO SPECIES

1. Lateral line with 34 scales. Body depth 4.1 in standard length. Scales with a well defined nucleus from which radii are given both towards the base and to outer margin. ... *P. tentaculatus*

   Lateral line with 43-47 scales. Body depth 5.3-6.0 in standard length. Scales with a net work of radii, all originating from base and directed distally, and circuli enclosing small rhomboidal areas. ... *P. pralori*

Subfamily GARRINAE

Mouth inferior. A suctorial disc on ventral surface of head present or absent. Pharyngeal teeth in three rows. Pectoral fins laterally inserted. Upper and lower lip may or may not be connected.

KEY TO GENERA

1. Lower lip modified into a circular or elliptical sucking disc. Upper and lower lip continuous. *Garra* Hamilton

— Lower lip simple without any modification. Upper and lower lip not connected. ... *Crossocheilus* van Hasselt.

Genus **Crossocheilus** van Hasselt

Crossocheilus van Hasselt, 1823, *Algem. Konst. Letterbode*, 2, p. 132 (type-species, *Crossocheilus oblongus* van Hasselt).—Mukerji, 1934, *J. Bombay nat. Hist. Soc.*, **37** (1), pp. 49-54.

Diagnosis.—Body more or less elongate. Ventral profile horizontal or slightly curved. Abdomen rounded. Head small. Snout very promi-

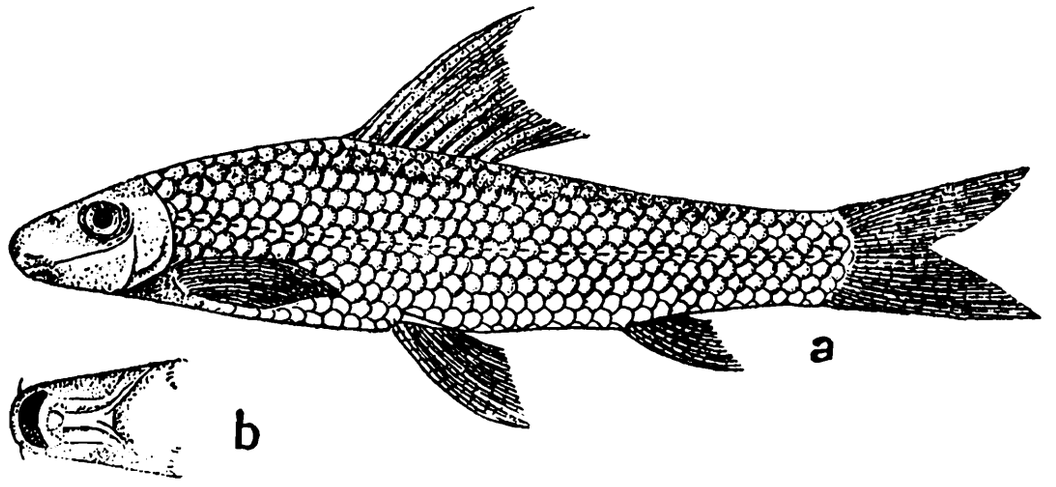


Fig. 66. Lateral view of *Crossocheilus latius latius* (Hamilton). (After Misra, 1962, Text-fig. 89).

nent, obtusely pointed, smooth and overhanging the mouth but may be variable, Mouth inferior. Eyes large, behind middle of head, not

visible from below ventral surface. Postlabial groove generally present. *Upper and lower lip not continuous. Lower lip without any suctorial disc.* A pair of rostral barbels present. Dorsal fin inserted midway between pectoral and pelvic fins, considerably nearer tip of snout than base of caudal fin, with 10 or 11 rays and without any spine. Anal fin short, with seven rays. Caudal fin deeply forked. Lateral line continuous with 38-40 scales.

Distribution.—Gangetic watershed of the Himalaya (Punjab, Northern U. P. Bihar, W. Bengal, Assam), Peninsular India. Nepal. Burma. Also Thailand, Malaya, Indonesia.

Species.—

1. *C. burmanicus* Hora—India : Manipur ; Tizu river, Naga hills, Nagland. Burma.
2. *C. latius latius* (Hamilton)—India : Ganga, Brahmaputra river systems, Deolali, Maharashtra. Nepal. Bangladesh. Pakistan.

2. 1 *C. latius punjabensis* Mukerjii—India : Indus river system, Punjab. Pakistan.

KEY TO SPECIES

1.	Head length less than 5.0 times (4.3-5.0) in standard length.	2
—	Head length more than 5.0 times in standard length (5.0-5.2). 18 or 19 scales round caudal peduncle. Lateral line scales 37-42. ...	*C. latius latius*
2.	Eyes 3.5-3.6 in head length. Lateral line scales 35. ...	*C. burmanicus*
	Eyes 4.2-4.7 in head length. Lateral line scales 35. ...	*C. latius punjabensis*

Genus **Garra** Hamilton

Garra Hamilton, 1822, *Fish Ganges* pp. 343, 393 (type-species, *Cyprinus lamta*, by monotypy).—Menon, 1964, *Mem. Indian Mus.*, **14** (4), pp. 173-260, 13 pls (world-revision).

Diagnosis.—Body short, compressed. Abdomen rounded. Head slightly depressed anteriorly. Snout blunt, much diversified, smooth or with pores, with or without a deep transverse groove like depression. Mouth inferior, transverse, semi-circular. Eyes small, in the posterior half of head, lateral, not visible from below ventral surfacc. Lips thick, fleshy, upper and lower lip continuous, without any lateral lobes. A probosis may or may not be present. *A suctorial disc of semi-cartilaginous pad present* on the chin, formed on the lower lip. Jaws subequal.

Gill openings restricted to sides. One or two pairs of barbels (exception *G. imberbis* from Burma). Dorsal fin inserted slightly ahead of pelvics, with 9 to 12 rays and no spine. Paired fins horizontal and not plaited. Anal fin short with six to eight rays. Caudal fin slightly emarginate.

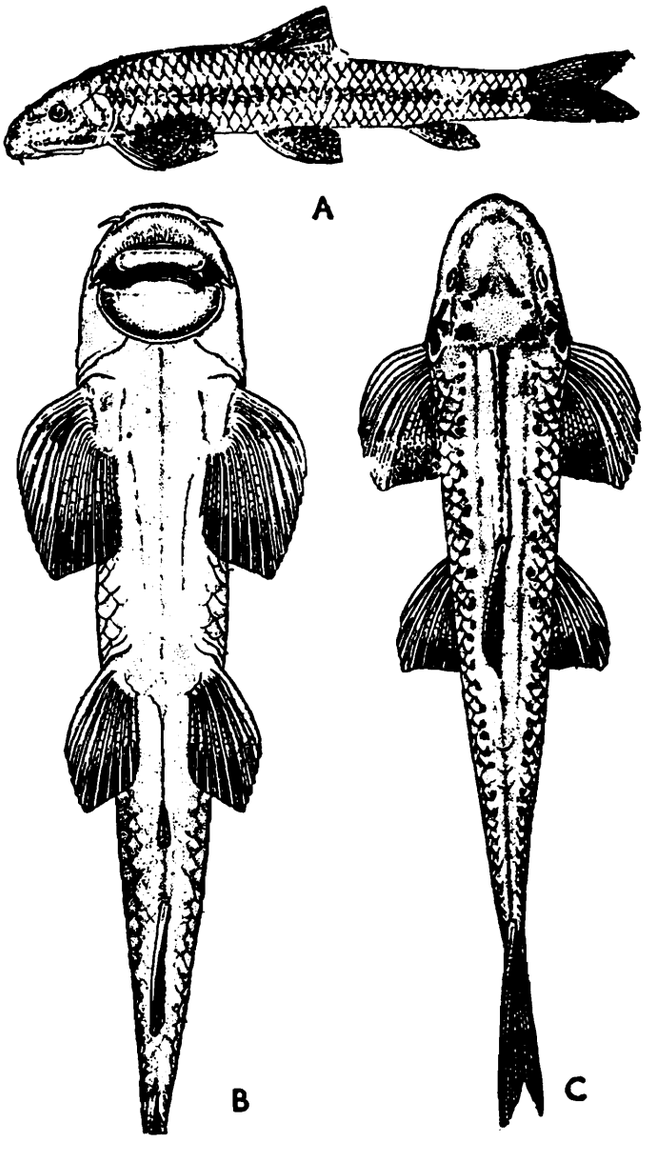


Fig. 67. *Garra hughi* Silas. A. Lateral view ; B, Ventral view ; C, Dorsal view. (After Silas, E. G. 1955, *Rec, Indian Mus.*, **52**, pl. 4).

Scales moderate, no sheath like row anywhere. Lateral line complete with 32-36 scales. Air-bladder reduced, but free.

Distribution.—India. Pakistan. Nepal. Bangladesh. Burma. Sri Lanka. Also found in S. China. Hainan. Borneo. Malaysia. Thailand. S. W. Asia. East Central and West Africa.

Species.—

1. *G. annandalei* Hora—India : Darjeeling Himalaya. Nepal : Kosi drainage. Bangladesh.
2. *G. bicornuta* Rao—India : Thunga river system, Karnataka.

3. *G. ceylonensis ceylonensis* Bleeker—Sri Lanka.

3. 1. *G. ceylonensis phillipsi* Deraniyagala—Sri Lanka : Gammaduwa.

4. *G. gotyla gotyla* (Gray)—India : Assam all along the Himalaya. Chota Nagpur plateau and the Vindhya Satpura mountains of the peninsula. Nepal. Bangladesh. Burma. Pakistan : Peshawar.

4. 1. *G. gotyla stenorhynchus* (Jerdon)—Indian : Cauvery and Krishna river systems, W. ghats.

5. *G. gravelyi* (Annandale)—Burma, S. Shan state.

6. *G. hughi* Silas— India : Cardamon and Palni hills, W. ghats.

7. *G. imberbis* (Vinciguerra)—Burma : Karin hills. Viet Nam.

8. *G. kempi* Hora—India : Abor hills, Arunachal Pradesh.

9. *G. lamta* (Hamilton)—India : Darjeeling and Kumaon Himalayas. Assam and Sikkim. Nepal. Pakistan.

10. *G. lissorhynchus* (McClelland)—India : Brahmaputra river system, Assam Himalaya.

11. *G. mcClellendi* (Jerdon)—Indian : Cauvery drainage, Nilgiri dist.

12. *G. mullya* (Sykes)—India : Throughout Indian except Assam and the Himalaya.

13. *G. naganensis* Hora—India : Naga hills, Nagaland.

14. *G. nasuta* (McClelland)—India : Assam, Burma. S. China. Viet-Nam.

15. *G. notata* (Blyth)—Burma : Tenasserim.

16. *G. rupecula* (McClelland).—India : Manipur and Mishmi hills.

17. *G. satyendranathi* Ganguly and Datta.—India : Subarnarekha river, W. Bengal.

Remarks.—Mostly inhabitants of rapid running waters, maintaining themselves against swift currents by clinging to the substratum by their suctorial disc and also by the horizontally placed paired fins, especially the pectorals. To suit such a life in fast flowing waters, many modifications are seen in the form and body structure. The flattening of the head and anterior part is as a result of efforts to utilise more and more of the anterior part of body for adhesion. Similarly the air-bladder is reduced to lessen buoyency. The proboscis and the tubercles help to lessen the velocity and impact of the rushing torrents against which these fishes stay attached to the substratum.

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*Ganguly, D. N. and Dutta. N. C. 1973. *Indian Biologist.* 5, pp-91-94.

KEY TO SPECIES*

1.	Barbels absent (Burma) ...	*G. imberbis*	
—	Barbels present, one or two pairs. ...	...	2
2.	Proboscis present. ...	...	3
—	Proboscis absent. ...	...	7
3.	Proboscis trilobed. ...	...	4
—	Proboscis a single projection without lateral lobes. ...	...	5
4.	A single pair of barbels present (Karnataka). ...	*G. bicornuta*	
—	Two pairs of barbels present. (Khasi hills, Burma, S. China and Viet-Nam). ...	*G. nasuta*	
5.	Proboscis weakly developed without lateral tubercular area. (S. Shan States, Burma). ...	*G. gravelyi*	
—	Proboscis well developed with well defined lateral tubercular area. ...	...	6
6.	Body depth less than 5 times in standard length. (Himalaya, Chota-Nagpur, Vindhya Satpuras). ...	*G. gotyla gotyla*	
—	Body depth about 5 times or more in standard length. (W. Ghats, S. India). ...	*G. gotyla stenorhynchus*	
7.	A series of dark spots at base of branched dorsal fin rays present. Vent located close to the base of anal fin. Distance of vent from base of anal fin more than 5 times in that between anterior origins of pelvic and anal fins. (Tenasserim, Burma). ...	*G. notata*	
—	No such dark spots at base of branched dorsal fin rays. Vent located at considerable distance in advance of base of anal fin. Distance of vent from base of anal fin 5 or less than 5 times in that between anterior origins of pelvic and anal fins. ...	...	8
8.	LL scales 34 or fewer. ...	...	9
—	LL scales 35-40. ...	...	16
9.	Tip of snout marked off by a transverse groove. A dark lateral band bordered above and below by light pale stripes especially in the posterior region present. ...	...	10
—	Tip of snout not marked off by a deep transverse groove. A pale lateral band without any lateral stripes present. ...	...	13

*After Menon, A. G. K., 1964. *Mem. Indian Mus.*, **14**, (4) : 173-260.

10. Distance of vent from base of anal fin less than 4 times in that between anterior origins of anal and pelvic fins. 11

— Distance of vent from base of anal fin more than 4 times, but less than 5 times in that between anterior origins of pelvic and anal fins. (Himalaya, India) ... *G. lamta*

11, Head length about 4 times in standard length. ... 12

— Head length less than 4 times in standard length. (Sri Lanka) ... *G. ceylonensis phillipsi*

12. Interorbital width about 2 times in head length. Width of disc about 2 times in width of head. (Peninsular India). ... *G. mullya*

— Interorbital width more than 2 times in head length. Width of disc less than 2 times in width of head. (Sri Lanka). ... *G. ceylonensis ceylonensis*

13. Dorsal fin with a light black bar across, and caudal fin with broad W-shaped bands. 14

— Dorsal and caudal fins without any such markings. (Nepal and Darjeeling, Himalaya, India). 15

14. Back and post-pelvic regions scaled. (Assam, India). ... *G. lissorhynchus*

— Back and post-pelvic regions naked. (Assam, India). ... *G. rupceula*

15. Distance between vent to anal fin 2.62.-3.21 in that between origins of pelvic and anal fins. Caudal peduncle length 1.0-1.4 in head length. *G. annandalei*

— Distance between vent to anal fin 3.7-4.0 in that between origins of pelvic and anal fins. Caudal peduncle length 1.6-1.7 in head length. *G atyendranathi*

16. Dorsal fin inserted distinctly nearer tip of snout than base of caudal fin. (Cauvery river system, W. ghats, S. India) ... *G. mcClellandi*

— Dorsal fin inserted almost midway between tip of snout and base of caudal fin. 17

17. Back naked. LL scales 36-38. (Cardamon, Palni hills. W. ghats). ... *G. hughi*

— Back scaled. LL scales 38-40. 18

18. Vent situated almost midway between anterior origin of anal and pelvic fins. (Assam, India). ... *G. kempi*

— Vent not situated midway between anterior origin of anal and pelvic fins. (Assam, India). *G. naganensis*

Remarks.—Mostly inhabitants of rapid running waters, maintaining themselves against swift currents by clinging to the substratum by their suctorial disc and also by the horizontally placed paired fins, especially the pectorals. To suit such a life in fast flowing waters, many modifications are seen in the form and body structure. The flattening of the head and anterior part is as a result of efforts to utilise more of the anterior part of body for adhesion. Similarly the air-bladder is reduced to lessen buoyency. The proboscis and the tubercles help to lessen the velocity and impact of the rushing torrents against which these fishes stay attached to the substratum.

Family PSILORHYNCHIDAE

Body flattened on ventral surface, covered with small scales. Head and ventral surface of body without scales. Jaws and palate without teeth. Gill openings narrow. Gill membranes united with isthmus. No pseudobranchiae. Pharyngeal bones slender with four teeth on each side arranged in a single row. Barbels absent. Paired fins horizontally placed, with outer rays simple ; alteast four of pectoral and two of pelvic rays are simple. Lateral line complete. Air-bladder greatly reduced ; either free or partially enclosed by bones ; posterior chamber of air-bladder very small and anterior covered by a thick fibrous coat.

Basipterygium plate-like, well developed for attachment of muscles.

A single genus is dealt with here.

Genus **Psilorhynchus** McClelland

Psilorhynchus McClelland, 1839, *Asiatic Researches*, **19**, pp. 300-428, pl. (type-species, *Cyprinus balitora* Hamilton).—Hora, 1925, *Rec. Indian Mus.*, **27**, p. 457 (new family provided).—Mukerji, 1938, *J. Bombay nat. Hist. Soc.*, **36** (4), pp. 823-831 (description of species).

Diagnosis.—Body subcylindrical, with ventral surface flattenned. Abdomen rounded. Head short and somewhat depressed. Snout flat, obtusely pointed anteriorly. A shallow depression may be present across, in front of the eyes. Tubercles may be present on cheek. Mouth small, inferior, transverse. Eyes large, dorso-lateral in posterior half of head, not visible from below ventral surface. *Lips entire, fleshy, continuous at angle of mouth, reflected off from both jaw, and with glands and folds. A distinct lateral groove on either side from the post-labial groove passing to the sides of the snout may be present. Upper lip exposed.* Jaws with sharp cutting horny edges. Upper jaw overhangs the mouth. Jaws and palate without teeth. *Barbels absent. Dorsal fin inserted ahead of*

pelvic fins with 10-12 rays (seven to nine branched). Anal fin short, with seven rays (five branched). Caudal fin forked, upper lobe longer. Scales fairly large along lateral line. Lateral line complete with 32-34 scales. Air-bladder much reduced; anterior chamber partly covered with thick fibrous tissue.

Distribution.—India : N. Bengal, Delhi, Arunachal Pradesh, Meghalaya. Nepal. Bangladesh. Burma.

Species.—

1. *Psilorhynchus balitora* (Hamilton)—India : Yamuna river in Delhi, R. Gomti, Lucknow, U. P., N. Bengal, Assam. Bangladesh. Burma.
2. *Psilorhynchus homaloptera* Hora & Mukerjee—Nepal : Vagal Hills.
3. *Psilorhynchus pseudecheneis* Menon & Datta –Nepal Himalaya.
4. *Psilorhynchus sucatio* (Hamilton)—India : Darjeeling, Assam. Himalaya. Bangladesh.

KEY TO SPECIES*

1.	Body spindle-shaped. Eyes large, lateral in position. Ventral surface behind pectoral fin base with scales. Pectoral fins with four simple rays. ...	*P. sucatio*
	Body not spindle-shaped, Eyes small, dorso-lateral in position. Ventral surface behind pectoral fin base without scales or with irregularly distributed scales. Pectoral fins with more than four simple rays. ...	... 2
2.	Ventral surface behind pectoral fin base with irregularly distributed scales. Pectoral fins with six simple rays. Lateral line with less than 40 scales. ...	*P. balitora*
	Ventral surface behind pectoral fin base without scales. Pectoral fins with more than six simple rays. Lateral line with more than 40 scales. ...	... 3
3.	Pectoral fins with eight simple rays. Lateral line with 42-44 scales. ...	*P. homaloptera*
	Pectoral fins with ten simple rays. Lateral line with 48-50 scales. ...	*P. pseudecheneis*

Remarks.—Found in fast streams and shallow rivers, specially where the river bed is rocky.

*After Menon. A. G. K. and Datta, A. K. 1961. *Rec. Indian Mus.*, 59, pp. 253-255.

Family HOMALOPTERIDAE

Body moderately or greatly depressed, ventral surface flattened. Body covered with small cycloid scales. Head and part or whole of ventral surface without scales. Jaws and palate edentate. Gill openings either greatly restricted and situated above base of pectoral fins or of moderate size extending to ventral surface for a short distance. Gill membranes united with isthmus. Pseudobranchiae absent. *Paired fins horizontally placed with at least two simple or unbranched rays. Outer rays of paired fins provided with adhesive pads on ventral surface.* Lateral line well marked and complete. Air-bladder divided and enclosed in a bony capsule, formed by the dorsal ribs of the second and fourth vertebrae.

Subtemporal fossa deep. Basipterygium provided with a lateral foramen and without any lateral horn. Operculam elongated. Pre-operculam reduced. Posterior process of quadrate large. (After Silas, 1952).

Four genera are dealt with here.

KEY TO GENERA

1. Gill openings small and situated entirely above base of pectoral fins. ... *Bhavania* Hora
— Gill openings of moderate size extending to the ventral surface for a short distance. 2
2. Pectoral fins with 19 to 21 rays. 8 to 10 outer rays unbranched. ... *Balitora* Gray
— Pectoral fins with 14 to 20 rays, three to eight outer rays unbranched. 3
3. Rostral groove in front of mouth absent or very poorly developed. Rostral fold absent or very slightly developed. Rostral barbels four. ... *Homaloptera* van Hasselt
— Rostral groove in front of mouth present, overhung by rostral fold. Rostral barbels seven or more. ... *Travancoria* Hora

Genus **Bhavania** Hora

Bhavania Hora, 1920, *Rec. Indian Mus.*, **19**, p, 202 (type-species, *B. australis* (Jerdon)).—Silas, 1952, *Rec. Indian Mus.*, **50**, p. 183 (revision).

Diagnosis.—Body and abdomen greatly depressed. Ventral surface in front of anal fin flattened. Head flat, depressed. Snout broadly pointed and with more or less trenchant margins. Mouth small, inferior, transverse, lunate. Eyes dorso-lateral, not visible from below ventral surface. Lips fleshy, covering the jaws partly continuous at angles of mouth. Lower lip divided into one central and two lateral

portions ; central part followd by two prominent papillae. Jaws sharp and covered by horny substance. Jaws and palate without teeth. Six short stumpy barbels, four rostral and two maxillary. Dorsal fin inserted slightly behind the pelvic fins, with nine to eleven rays (seven to nine branched). Anal fin with nine or ten rays (seven or eight branched). Paired fins broad, horizontal, wing-like. *Pectoral fin mith six to eight simple, and nine to eleven branched rays.* Pelvic fins with two simple and seven or eight branched rays. Caudal fin forked, lower lobe considerably longer longer than upper. Lateral line complete with 70-75 scales. Scales small.

Distribution.—Hill streams in Mysore, Nilgiri, Kerala, S. India.

Species.—*B. australis* Jerdon—distribution as of genus.

Genus **Homaloptera** van Hasselt, *emend* van der Hoeven

Homaloptera van Hasselt, 1823, *Algem, konst.* en *Letterbode*, **2**, p. 130 (type-species, *Homaloptera ocellata* van der Hoeven).—Silas, 1952. *Rec. Indian Mus.*, 50, pp. 185 (revision).

Diagnosis.—Body and abdomen subcylindrical, ventral surface flattenned. Head flat, feebly or moderately depressed. Snout broad and round or long and pointed. Mouth inferior, transverse, slightly arched. Eyes superior or dorso-lateral not visible from below ventral surface. Lips full, plain and continuous at angles of mouth. *Jaws strong, uncovered by lips, and with horny substance.* Six barbels, *four rostral,* and two maxillary. Jaws and palate without teeth. Dorsal fin inserted above pelvic fins, or slightly ahead or behind, with nine rays (seven branched). Anal fin short with seven rays (five branched). *Pectoral fins with two to eight simple and* 8-12 *branched rays.* Pelvic fins with two simple and five to eight branched rays. Paired fins broad and horizontal. Caudal fin emarginate or deeply forked. Scales small. Lateral line complete with 44-46 scales.

Distribution.—Peninsular India (Anaimalai Hills). Burma. Thailand. Viet-Nam. Laos. Malaya. Sumatra. Java. Borneo.

Species.—

1. *H. bilineata* Blyth—Burma : Meetan, Tenasserim.
2. *H. modesta* Vinciguerra—Burma : Meetan.
3. *H. montana* Herre (Pl VII, VIII)—S. India : Anaimalai hills.
4. *H. rupicola* Prashad & Mukerji—Burma : Myitkyina.

KEY TO SPECIES*

1.	Dorsal fin inserted behind pelvic fin origin. ...	... 2
—	Dorsal fin inserted opposite or ahead of pelvic fin origin. ...	*H. bitineata*
2.	Lateral line scales 40 to 54. ...	... 3
—	Lateral line scales 55 to 73. ...	*H. montana*
3.	Dorsal fin inserted equidistantly from tip of snout and base of caudal. ...	*H. rupicola*
—	Dorsal fin inserted nearer tip of snout than caudal base. ...	*H. modesta*

Genus **Travancoria** Hora

Travancoria Hora, 1941, *Rec. Indian Mus.*, **43**, p. 288 (type-species, *Travancoria jonesi* Hora by monotypy).—Silas, 1952, *Rec. Indian Mus.*, **50**, p. 203 (revision).

Diagnosis.—Body and abdomen greatly depressed, ventral surface in front of anal fin flattened. Head flat, greatly depressed. Snout narrowly rounded in front. Mouth small, inferior, transverse, greatly arched. Eyes dorso-lateral, not visible from below ventral surface. Lips full, plain, continuous round angles of mouth ; middle part of posterior lip separated from sides, followed by two well developed papillae which may appear as short barbels in some specimens. *Upper jaw covered by lip, lower jaw uncovered, shovel like,* sharp, strongly covered with horny substance. Four short rostral barbels, and a pair. of short maxillary barbels. Jaws and palate without teeth. Dorsal fin inserted opposite pelvic fins, with nine rays (seven or eight branched). Anal fin with eight or nine rays (six or seven branched). *Pectoral fins with six simple and nine or ten branched rays.* Pelvic fins with two simple and six or seven branched rays. Paired fins broad, wing like, horizontal. Caudal fin emarginate. Scales small. Lateral line complete with 75-77 scales.

Distribution.—India : High Ranges of northern Travancore, Anaimalai Hills, Kerala.

Species.—

T. jonesi Hora is the single species so far known.

Genus **Balitora** Gray

Balitora Gray 1832, *Ill. Ind. Zool.* **1**, pl. 88, fig. 1 (type-species *Balitora brucei* Gray). —Silas, 1952, *Rec. Indian Mus.*, **50**, p. 205 (revision).

Diagnosis.—Anterior part of body and abdomen greatly depressed, ventral surface flattened. Head flat, depressed. Snout broad, rounded,

*After Silas, E. G. 1953. *Rec. Indian Mus.*, **50** (2), pp. 188-190.

provided with trenchant margins, covered with small sharp tubercles. Mouth small, inferior, transverse and slightly arched. Eyes dorso-lateral, not visible from below ventral surface. Lips on lower jaw continuous with the upper one at angle of mouth and papillated, does not cover the lower jaw. Lower jaw sharp, strong, with a horny substance. Jaws and palate without teeth. Four short thick rostral barbels and one pair maxillary. Dorsal fin inserted above or slightly ahead of pelvic fins and with 12 rays (nine branched). Anal fin short with seven rays (five branched). Paired fins broad and horizontal. *Pectoral fins with* 19-21 rays (8-10 simple and 11-12 branched). Pelvic fins with 11 rays (two simple and nine branched). Caudal fin forked. Lateral line complete with 68-70 scales. Scales small.

Distribution.—S. India : Mysore ; N. India : N. Bengal. Nepal. Bhutan. Bangladesh : Chittagong hills. Burma.

Species.—

1. *Balitora brucei brucei** Gray—India : Darjeeling, Assam. Nepal. Bangladesh : Chittagong. Burma : Pegu.
2. *Balitora maculata* Gray—India : Darjeeling.
3. *Balitora mysorensis* Hora—India : Cauvery and Thunga river system, Karnataka.

KEY TO SPECIES

1.	Pectoral fins extend beyond commencement of pelvic fins. Caudal fin to be almost of equal length. ...	*B. maculata*
—	Pectoral fins do not extend or just reach pelvic fins. Caudal fin lobes unequal, lower lobe the longer. ...	... 2
2.	Head length 5.0-6.4 in total length. Lateral line scales not more than 65 (64 or 65). ...	*B. mysorensis*
—	Head length 6.5 in total length. Lateral line scales more than 65 (65-68). ...	*B. brucei brucei*

Family Cobitidae

Loaches

Body short, low, more or less cylindrical, compressed posteriorly, but never depressed. Body with small cycloid scales when present, usually immersed in mucus ; may be present on head also. Lips thick, fleshy,

*Menon *et al.* (1977) have considered *B. brucei burmanicus* Hora as a synonym of this species and have elevated *mysorensis* to a specific rank. This classification is adopted here.

papillated. Jaws and palate edentate. Barbels present. Pharyngeal teeth few and in one row. *An erectile spine near orbit may or may not be present.* Pseudobranchia absent. Gill membranes free from each other. *Vertical fins without any spines.* Pelvic fins may be absent. Lateral line present. Air-bladder entirely or partially enclosed in a bony capsule.

Three subfamilies and nine genera are dealt with here.

KEY TO SUBFAMILIES

1.	No spine under or before eye. ...	NOEMACHEILINAE
—	An erectile spine arising from the ethmoid bone and concealed in a groove under or before each eye. ...	... 2
2.	Two pairs of rostral barbels placed very close to each other. Caudal fin well forked. ...	BOTINAE
—	Only one pair of rostral barbels. Caudal fin rounded or slightly emarginate (exception *Acanthopsis*) ...	COBITINAE

Subfamily NOEMACHEILINAE

Body usually cylindrical, compressed. No spine under or before eye. Anterior nostril simple or tubular. *Upper part of caudal peduncle may be with an adipose keel.* Dorsal fin moderately long with 7-20 rays.

KEY TO GENERA

1.	Vent situated far forwards and the pelvic fins extend considerably beyond the anal opening.	*Aborichthys* Chaudhuri
—	Vent situated nearer anal opening. Pelvic fins do not extend to anal. ...	... 2
2.	Anterior nostril prolonged into a long nasal barbel. A well developed adipose keel on upper part of caudal peduncle in continuation with caudal fin. ...	*Oreonectes* Günther
—	Anterior nostril simple. No adipose keel on peduncle. ...	*Noemacheilus* van Hasselt

Genus **Aborichthys** Chaudhuri

Aborichthys Chaudhuri, 1913, *Rec. Indian Mus.*, **8**, p. 244 (type-species, *Aborichthys kempi* Chaudhuri).—Hora, 1925, *Rec. Indian Mus.*, **27**, pp. 231-236.

Diagnosis.—Body greatly elongated, and compressed. Abdomen rounded, *vent situated far forwards. Nostril openings with barbel like outgrowths. A preorbital spine absent.* Head flatttened slightly, anteri-

orly rounded. Snout conical or broadly rounded. Mouth inferior, narrow, transverse. Eyes small, situated dorsally, in middle of head, not visible from below ventral surface. Lips thick, papillated, continuous at angle of mouth. Lower lip discontinuous in middle. Jaws and palate without teeth. Barbels six, two pairs maxillary and one pair rostral excluding the nasal. Dorsal fin inserted slightly behind pelvic fins with six or seven branched rays, and without any spine. Anal fin short with seven rays (five branched). Pelvic fins extend beyond anal. *All fins greatly removed from one another. Paired fins horizontal and provided with adhesive pads on ventral aspect.* Caudal fin lunate. Scales small, elliptical. Lateral line incomplete, indistinct.

Distribution.—India : Abor, Garo hills, Darjeeling Himalaya, Meghalaya. Upper Burma.

Species.—

1. *Aborichthys elongatus* Hora—India : Darjeeling Himalaya.
2. *A. garoensis* Hora— India : Garo hills, Meghalaya.
3. *A. kempi* Chaudhuri—India : Abor, Garo hills, Meghalaya. Upper Burma.

KEY TO SPECIES*

1.	Vent almost equidistant between tip of snout and base of caudal fin or slightly nearer to tip of snout than to caudal fin base. ...	*A. garoensis*
—	Vent distinctly *nearer caudal fin* base than tip of snout. ...	... 2
2.	Vent *nearer tip of snout* than caudal fin base. Barbels much longer than eye diameter. Black bands narrower than yellow interspace.	*A. kempi*
—	Vent equidistant between tip of snout and end of caudal fin. Barbels as long as or slightly longer than eye diameter. Black bands broader than yellow interspace. ...	*A. elongata*

Remarks.—These fishes seem to be better adapted for life in rapid running waters. They fix themselves to rocks and stones and rapid currents by means of their horizontal paired fins. The elongated tail and rounded caudal fin form an oar-like structure with which they are able to dart from one place to another.

*After Hora, S. L. 1925, *Rec. Indian Mus.*, **27**, pp. 231-236.

Genus **Oreonectes** Günther

Oreonectes Günther, 1868, *Cat. Fish. Brit. Mus.*, **7**, p 369 (type-species, *O. platycephalus* Günther).—Banarescu & Nalbant, 1968, *Mitt. Hamburg Zool. Mus. Inst.*, **65**, p. 339.

Diagnosis.—Body sub-cylindrical, low. Abdomen rounded. Head depressed, wider than deep. *Anterior nostrils prolonged in to a long nasal barbel.* Snout obtusely rounded. Mouth inferior, narrow, slightly arched. Eyes small, dorsal, not visible from below ventral surface. Lips fleshy, narrow, moderately furrowed, both lips interrupted in middle. *No suborbital spine present.* Jaws and palate without teeth. Eight barbels, a pair each of nasal, two rostral and one maxillary. Dorsal fin inserted above origin of pelvic fins nearer caudal base than tip of snout, with ten rays (seven branched) and no spine. Anal fin short, with seven rays (five branched). Caudal fin truncate. Scales small. Lateral line complete.

Distribution.—India : W. ghats near Bombay, Pachmarhi hills, Bailadila range, Bastar, Travancore hills, Kerala. Also known from Japan, Amur drainage, Korea, North and South China except Yangtse-kiang.

Species.—

1. *O.* (*Indoreonectes*) *keralensis* Rita—India : Kerala.
2. *O.* (*Oreonectes*) *evezardi* (Day)—distribution as of the genus. =*N. evezardi* Day

KEY TO SUBGENERA AND SPECIES

1. Nostrils distant, anterior ones in front of eyes. Lateral line absent. Body without crossbars, but with dots or a longitudinal stripe. ... *O.* (*Oreonectes*) *evezardi*

— Nostrils close to each other. Lateral line present. Body with crossbars on sides. ... *O.* (*Indoreonectes*) *keralensis**

Genus **Noemacheilus** van Hasselt

Noemacheilus van Hasselt, 1823, *Alg. konst. Letterbode* **2** (35), p. 133 (type-species *Nomeacheilus fasciatus* van Hasselt).—Banarescu & Nalbant, 1968, *Mitt. Hamburg. Zool. Mus. Inst.*, **65**, pp. 328-329 (revision).—*Nemachilichthys* Day, 1878, *Fish. India*, p. 611 (type-species, *Cobitis ruppelli* Sykes).

Diagnosis.—Body almost cylindrical and somewhat depressed. Head cylindrical pointed anteriorly. *No preorbital spine pressent* on head. Snout obtusely rounded. Mouth small, inferior, transvarse. Eyes

*Rita, S. D. *et al* (1978). *Trav. Mus. Hist. nat. Grigore Antipa*, **19**, pp. 185-188.

minute to small, or moderate, superior, generally not visible from below ventral surface. Lips thick, fleshy, papillated, continuous at angle of mouth. Lower lip interrupted in middle. Jaws and palate without teeth. Barbels four, six or eight. Dorsal fin short, inserted

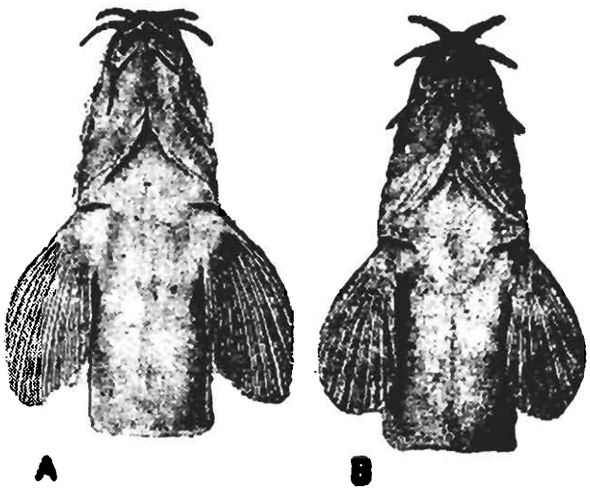


Fig. 68. Ventral view of A. *Noemacheilus horai* Menon, and B, *N. kankrae* Menon to show lip structure. (After Menon, A. G. K. 1952. *Rec. Indian Mus.*, 49, pl. 7).

opposite pelvic fins, with 8-20 rays (7-20 generally branched) and without any spine. Anal fin short with six to eight rays (five or six branched). Caudal fin emarginate, truncate or lunate. Scales minute. Lateral line complete or incomplete.

Distribution.—Hill streams throughout India, Pakistan, Nepal, Bangladesh, Sri Lanka, Burma, Thailand, Malaya, Viet-Nam, China. Also found in Afghanistan.

KEY TO SUBGENERA*

1.	Body rather deep, mouth terminal. ...	*Eonemacheilus* (single species *N. (E) brevis* in Burma)
	Body elongate, mouth inferior. ...	... 2
2.	Lower lip with numerous papillae arranged on a pad on each half of the lower jaw. Dorsal fin with 10-18 branched rays. ...	*Acanthocobitis*
	Lower lip not as above. Dorsal fin with 7-12 branched rays. ...	... 3

*An eighth subgenus *Paracobitis* to accommodate *N. cristatus* (Berg) has also been proposed. Originally included as occurring in Pakistan (Mirza, 1975) it is now excluded from that area (Mirza *in litt.*, May, 1979).

3.	In males sides of head with numerous breeding tubercles and pectoral rays broadened. No scales. Lateral line usually complete. No movable suborbital flap in males. ...	*Triplophysa*
	Sexual dimorphism present or absent; if present there is a movable suborbital flap in males but no breeding tubercles on sides of head. Scales present or absent, lateral line complete or incomplete.	4
4.	Lower lip represented by two thick pads separated along the middle line by a deep and narrow groove. Anterior lip greatly hypertrophied with edges raised.	Subgenus* Banarescu & Nalbant (Single species *N. peguensis*)
	Lower lip normal. Anterior lip not hypertrophied.	5
5.	Dorsal fin with 10 or 11 branched rays. Body with oblique stripes, the shape and outer edge of which differ in males and females. ...	*Nemachilichthys*
	Dorsal fin usually with 7-9 branched rays (exception *N. striatus* and *N. pulchellus* with 10 rays), colour pattern variable, no differences between sexes in colour.	6
6.	Caudal fin deeply forked, upper lobe usually longer. Dorsal fin margin notched, the third pectoral ray in males elongated and with tubercles on body sides. ...	*Noemacheilus* (sensu stricto)
	Caudal fin truncate or slightly emarginate. Dorsal fin margin straight or even slightly convex. Males in many species have the pectoral fin rays broadened and covered by tubercles, but the third ray is not longer than the other and the tubercles do not extend on body sides.	*Schistura*

I. Subgenus **Noemacheilus** van Hasselt, 1823 (s. stricto)

Type species *N. fasciatus* van Hasselt

1. Dorsal fin with 7-9 branched rays.
2. Dorsal fin edge straight or slightly concave.
3. Dorsal fin inserted ahead or opposite pelvic fins.
4. Scales present.
5. Lateral line complete or almost complete.
6. Body with irregular bands or with a single longitudinal stripe.

*To be named and described by Banarescu & Nalbant.

4 species can be assigned to this subgenus as under :

1. *N. anguilla*
2. *N. corica* (Dorsal fin with 10 branched rays)
3. *N. monilis* (Dorsal fin with 7 branched rays)
4. *N. poonaensis*

II. Subgenus **Nemachilichthys** Day, 1878

Type species *N. rueppelli*

2 species can be assigned to this subgenus as under :

1. *N. rueppelli* (Dorsal fin with 10 or 11 branched rays)
2. *N. shimogensis* (Dorsal fin with 12 branched rays)

III. Subgenus **Acanthocobitis** Peters, 1861

Type species *A. longipinnis* (= *A. pavonaceus*)

1. Dorsal fin with 10-18 (rarely 8-9) branched rays.
2. Dorsal fin edge convex or straight.
3. Dorsal fin inserted ahead of pelvic fins.
4. Scales mostly present.
5. Lateral line complete, rarely incomplete.
6. Body without well defined bands, but blotched with spots and/or stripes.

5 species can be assigned to this subgenus as under :

1. *N. botia botia*

1. 1. *N. botia aureus* Day*

2. *N. microps*
3. *N. pavonaceus*
4. *N. rubidipinnis*
5. *N. zonalternans*

IV. Subgenus **Eonemachilus**

1. *N. brevis*

V. Subgenus **Triplophysa** Rendahl, 1933

= Subgenus *Hedinichthys* Rendahl, 1933

Type species *N. stoliczkai* Steindachner

1. Dorsal fin with 7-8 branched rays.
2. Dorsal fin edge notched or straight.

*Considered as synonymous with *N. botia botia* by Banarescu (*in litt.*,) hence not given in key.

3. Dorsal fin inserted ahead of pelvic fins.
4. Scales mostly absent.
5. Lateral line usually complete or almost complete.
6. Body with blotches or plain or rarely with bands.

14 species can be assigned to this subgenus as under :

1. *N. brahui* (Dorsal fin with 7 branched rays)
2. *N. choprai*
3. *N. deterrai* (Scales absent)
4. *N. gracilis* (Body with colour bands)
5. *N. griffithi naziri*

5.1. *N. griffithi hazarensis* (Dorsal fin with 7 branched rays)

6. *N. hutchinsoni* (Scales absent)
7. *N. kashmirensis* (Scales absent)
8. *N. ladacensis* (Scales absent)
9. *N. marmoratus* (Dorsal fin with 7 branched rays)
10. *N. panguri* (Scales absent)
11. *N. peguensis* (proposed to be kept under a new subgenus by Banarescu & Nalbant)
12. *N. stoliczkae*
13. *N. tenuicauda* (Scales absent, dorsal fin with 8 branched rays)
14. *N. yazsnensis*

VI. Subgenus **Schistura** McClelland, 1839
(includes subgenus *Acoura*)
Type species *S. rupecula* McClelland.

1. Dorsal fin with 7-9 branched rays.
2. Dorsal fin edge straight or convex.
3. Dorsal fin inserted ahead or opposite pelvic fins.
4. Scales mostly present.
5. Lateral line complete or almost complete.
6. Body with well defined bands.

50 species can be assigned to this subgenus as under :

1. *N. acuticephalus*
2. *N. alepidotus alepidotus* (Scales absent)

2. 1. *N. alepidotus nalbanti*
3. *N. altipedunculatus*
4. *N. anambarensis*
5. *N. baluchiorum* (Dorsal fin with 8 branched rays)
6. *N. beavani*
7. *N. bhimachari*
8. *N. brunneanus*
9. *N. carletoni*
10. *N. cincticauda*
11. *N. dayi*
12. *N. denisoni* (Dorsal fin with 10 branched rays)
13. *N. devdevi*
14. *N. guentheri**
15. *N. guttatus*
16. *N. harnaensis*
17. *N. horai*
18. *N. kangjuphkulensis*
19. *N. kangrae*
20. *N. kessleri* (Scales absent)
21. *N. machensis*
22. *N. montanus* (Dorsal fin with 8 branched rays)
23. *N. multifasciatus*
24. *N. manipurensis*
25. *N. notostigma* (Dorsal fin with 8 branched rays)
26. *N. nasseri* (Scales absent)
27. *N. pakistanicus* (Scales absent)
28. *N. paucifasciatus*
29. *N. prashadi*
30. *N. prashari prashari*
30. 1. *N. prashari lindbergi* (Scales absent)
31. *N. punjabensis* (Scales absent, body bands not well defined).
32. *N. pulchellus**
33. *N. rajasthanicus*
34. *N. raoe*
35. *N. rendahli* (Dorsal fin with 8 branched rays)
36. *N. rivulicola*
37. *N. rupicola rupicola inglsi* (Dorsal fin with 7 branched rays)
37. 1. *N. rupicola rupicola* (Dorsal fin with 7 or 8 branched rays)
38. *N. savona*
39. *N. scaturigina*
40. *N. semiarmatus*
41. *N. shanensis*
42. *N. shebbeari*
43. *N. sikmaiensis* (Dorsal fin with 8 branched rays)
44. *N. sinuatus*
45. *N. striatus*
46. *N. triangularis**
47. *N. subfusca*
48. *N. vinciguerrae*
49. *N. vittatus*
50. *N. zonatus*

*These three (Nos. 14, 32 & 46) and few more still undescribed species will be placed under a new subgenus by Banarescu (*in litt*).

VII. Species Inquirande

The systematic position of the under mentioned species is doubtful.—

1. *N. blythii* (Body bands not well defined). 2. *N. monoceros*
3. *N. spilopterus* (Scales absent).

Species.—

1. *Noemacheilus acuticephalus* Hora—Burma : Hwe-gna-sang river, Pazi Township, Hsipaw state, N. Shan states.
2. *Noemacheilus alepidotus alepidotus* Mirza & Banarescu—Pakistan : Swat river drainage, Panjar, Jhelum drainage, W. Pakistan.

2. 1. *Noemacheilus alepidotus nalbanti* Banarescu & Mirza—Pakistan : Rawalkot ; Azad Kashmir, Jhelum drainage.

3. *Noemacheilus altipedunculatus* Banarescu & Nalbant—India : Mandurli, N. Canara, Kati river drainage.
4. *Noemacheilus anambarensis* Mirza & Banarescu—Pakistan : Anambar river at Loralai, Nari Bolan headwaters, Baluchistan ; N. W. Province.
5. *Noemacheilus anguilla* Annandale—India : Yenna river at Medha, Satara dist., Maharashtra.
6. *Noemacheilus baluchiorum* Zugmayer—Pakistan : Panjgur on Rakhshan river, Baluchistan.
7. *Noemacheilus beavani** Günther—India : Garo hills, Meghalaya, Darjeeling, N. Bengal, U. P. Nepal.
8. *Noemacheilus bhimachari* Hora—India : Cauvery river, Coorg, Karnataka.
9. *Noemacheilus blythii* Day—Burma : exact locality unknown.
10. *Noemacheilus botia aureus* Day**—India : Ganga, Yamuna, Brahmaputra river systems. Sri Lanka.

10. 1. *Noemacheilus botia botia**** (Hamilton)—India : All over Northern India. Nepal. Burma. Pakistan : Aba-Sinh division, N. W. F. province. Bangladesh. Sri Lanka.

**N. beavani* of Day (*Fish India* p. 620, pl. 156, fig. 8, 1878) is referable to *N. denisonii* Day.

***Tilak* (1967) considers this subspecies as a "intraspecific varient of *botia*" and has synonymised it with the nominate species.

****N. sinuatus* Day and *N. aureus* Day are considered synonyms of this species by Hora, S. L. & Misra, K. S. 1938. *J. Bombay nat. Hist. Soc.* **40** (1). *N. mackenziei* Chaudhuri is a synonym of this species (Menon, 1974).

11. *Noemacheilus brahui* Zugmayer—Pakistan : Kalat, Quetta, Baluchistan.

12. *Noemacheilus brevis* Boulenger—Burma : Inle Lake, Fort Stedman ; He-ho plain ; White crow Tank at base of Tongyi hill.

13. *Noemacheilus brunneanus* Annandale—Burma : Yawnghwe valley, Inle Lake, S. Shan States.

14. *Noemacheilus carletoni* Fowler—India : Kangra valley, Punjab.

15. *Noemacheilus choprai* Hora*—Pakistan : Lutkuh river, Mastuj river, Chitral river, Chitral Valley.

16. *Noemacheilus cincticauda* (Blyth)—Burma : Dawna hill, Tenasserim Provinces.

17. *Noemacheilus corica* (Hamilton)—India : E. Himalaya, Assam, Punjab. Nepal. Pakistan : Aba-Sinh division. Bangladesh.

18. *Noemacheilus dayi* Hora—Pakistan : N. W. Provinces. Bangladesh (Rahman, 1974).

19. *Noemacheilus denisonii* Day**—India: Nilgiri, Coorg hills, Kerala, Karnataka.

20. *Noemacheilus deterrai* Hora—India : Ladakh, Man lagoon. (14,008 ft.). Also Sikkim (Tilak, 1968).

21. *Noemacheilus devdevi* Hora—India : small streams below Darjeeling, E. Himalaya. Sikkim.

22. *Noemacheilus gracilis* Day—India : Kashmir valley. Pakistan : Yasin river, Lukong river, Basgo, headwaters of Indus.

23. *Noemacheilus griffithi hazaraensis* Omer & Mirza ++—Pakistan : Ilyasi Masjid springs, Hazara dist.

23. 1. *Noemacheilus griffithi naziri* Ahmad & Mirza—Pakistan : Swat state, W. Pakistan.

24. *Noemacheilus guentheri* Day—India : Nilgiri hills.

25, *Noemacheilus guttatus* McClelland—India : Jorhat, Assam.

26. *Noemacheilus harnaiensis* Mirza & Nalbant—Pakistan : Harnai, Kaman—Beji river drainage, W. Pakistan.

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*Mirza, M. R. (1975, *Bijdr. Dierk.* **45** (2) p. 169) considers this species as a subspecies of *N. stenurus*.

**Banarescu & Nalbant (1968, pp. 333-334) have listed material from Rihand river, and Orissa as belonging to this species. Hora (1940), Das (1939) also erroneously referred material from North India to this species, which Hora (1941) subsequently showed that they belong to *N. dayi* Hora. *N. denisonii* is known only from W. ghats, S. India.

++The nominate species *griffithi griffithi* is found in Afghanistan.

27. *Noemacheilus horai* Menon—India : Kangra valley, Punjab.

28. *Noemacheilus hutchinsoni* Hora—India : Ladakh, Mugleb, Tsar Tso, Lukung (14,164 ft).

29. *Noemacheilus kanjjupkhulensis* Hora—India : Manipur valley, Naga hills. Burma : Chindwin river.

30. *Noemacheilus kangrae* Menon—India : Kangra valley, Punjab.

31. *Noemacheilus kashmirensis* Hora—India : Harwan, Kukar-nag spring, Kashmir.

32. *Noemacheilus kessleri* Günther—Pakistan : Nushki, Quetta, Pishin, Baluchistan. Also known from Lora river to Murgab and East Iran.

33. *Noemacheilus ladacensis* Günther--India : Kashmir, Ladakh. Gnari Khorsum, Tibet. Karakash valley, Tarim river system.

34. *Noemacheilus machensis* Mirza & Nalbant—Pakistan : Nari Bolan head-water, Indus drainage.

35. *Noemacheilus manipurensis* Chaudhuri—India : Manipur valley, Naga hills.

36. *Noemacheilus marmoratus* (Heckel)—India : Kashmir. Central Asia.

37. *Noemacheilus microps* Steindachner—India : Phirse-Bagh, Leh. Tibet : Tso-Moriri, Rupshu province. Pakistan : Indus river system. Karakash valley, Tarim river system.

38. *Noemacheilus monilis* Hora—India : Bhavani river, Mettupalayam, Nilgiri hills.

39. *Noemacheilus monoceros* (McClelland)—India : Assam.

40. *Noemacheilus montanus** (McClelland)—India : Kangra, Simla hills.

41. *Noemacheilus multifasciatus* Day—India : Darjeeling, E. Himalaya, Assam.

42. *Noemacheilus nasseri* Ahmad & Mirza—Pakistan : Swat state, W. Pakistan.

43. *Noemacheilus notostigma* Bleeker—Sri Lanka.

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*The species described by Day (1878, 1889) as *N. montanus* is composite. The synonymy is as below.—

N. montanus McClelland—specimens from Teesta N. Bengal referred by Day under this species belong to *N. devdevi* Hora.

44. *Naemacheilus pakistanicus* Mirza & Banarescu—Pakistan : Kum Karez, Hindubagh, Zhob valley Baluchistan, N. W. F. Province.

45. *Noemacheilus panguri* Hora—India : Ladakh, Pangur Tso, Tso Nyak.

46. *Noemacheilus paucifasciatus* Hora—Burma : Hwe-gnv-sang river, Pazi Township, Hsipaw state, N. Shan states.

47. *Noemacheilus pavonaceus* (McClelland)*—India : Assam.

48. *Noemacheilus peguensis* Hora—Burma : Pegu Yoma.

49. *Noemacheilus poonaensis* Menon—India : Anshi, North Canara, probably in Gangwali river drainage ; Moola Mutha river, Poona.

50. *Noemacheilus prashadi* Hora—India : Thonagpal tank, Manipur.

51. *Noemacheilus prashari lindbergi* Banarescu & Mirza—Pakistan : Nari Bolan headwaters, Baluchistan ; N. W. F. Province.

51. 1. *Noemacheilus prashari prashari* Hora—Pakistan : Kohat, N. W. Province.

52. *Noemacheilus pulchellus* Day—India : Bhavani and Cauvery river systems, S. India.

53. *Noemacheilus punjabensis* Hora—Pakistan : Salt Range, Punjab.

54. *Noemacheilus rajasthanicus* Mathur & Yazdani—India : Pratap Sagar, Kallana Lake, Takhat Sagar. Jodhpur.

55. *Noemacheilus raoe* Hora—Burma : Mongyai, S. Shan States.

56. *Noemacheilus rendahli* Banarescu & Nalbant—India : Nandur, Madhmeswar, Canara.

57. *Noemaeheilus rivulicola* Hora—Burma : Yawnghwe valley, He-Ho plain, S. Shan states.

58. *Noemacheilus rubidipinnis* (Blyth)—Bangladesh. Burma : Kokrait, Mandalay, Meetan, Tenasserim.

59. *Noemacheilus rupecola inglisi* Hora—India : E. Himalaya, Sikkim. Bangladesh.

59. 1. *Noemacheilus rupecola rupecola* (McClelland)—India : Simla, Kashmir, Doon, Poonch Valleys, W. Himalaya, Naga hills, Nagaland, E. Himalaya. Nepal.

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*Menon (1974) considers this as a synonym of *N. botia botia* (Hamilton). Banarescu & Nalbant (1968) consider this as a "taxonomically most isolated species" with a very long dorsal (14-18 branched rays) fin.

60. *Noemacheilus ruepelli* (Sykes)—India : Krishna river system, Poona and Deccan.

61. *Noemacheilus savona* (Hamilton)—India : Kosi river and streams below base of Darjeeling Himalaya, N. Bengal. Nepal. Bangladesh.

62. *Noemacheilus scaturigina* (McClelland)—India : E. Himalaya, Assam, Meghalaya, U. P. Nepal.

63. *Noemacheilus semiarmatus* Day—India : Nilgiri hills. Mysore.

64. *Noemacheilus shanensis* Hora—Burma : Thale—u-strem near Fort Stedman, S. Shan states.

65. *Noemacheilus shebbeari* Hora—India : Darjeeling, N. Bengal.

66. *Noemacheilus shimogensis* Rao*—India : Thunga river, Shimoga town, Shimoga dist., Karnataka.

67. *Noemacheilus sikmaiensis* ** Hora—India : Sikmai stream near Palel on Burma Road, Manipur. Burma : Kamaing. Myitkyina dist.

68. *Noemacheilus sinuatus* Day—India : Wynaad, Kerala.

69. *Noemacheilus spilopterus* Valenciennes—India : Assam.

70. *Noemacheilus stoliczkae* (Steindachner)—India : Leh, Ladakh, Indus river. Tibet. Pakistan : Yarkand river, Aba-Sinh division.

71. *Noemachilus striatus* Day—India : Wynaad, Kerala.

72. *Noemacheilus subfusca* (MClelland)†—India : Naga hills, Nagaland ; Mishmi, Khasi hills, Meghalaya.

73. *Noemacheilus tenuicauda* (Steindachner)—India : Leh, Ladakh, Nubra velley. Also from W. Tibet : Sta-rtsak puk Tso (14, 885 ft.) Indus river system.

74. *Noemacheilus triangularis* Day—India : Travancore hills, Kerala.

75. *Noemacheilus vinciguerrae* Hora—Burma. Thailand.

76. *Noemacheilus vittatus* (Heckel)—India : Wular Lake, Shadipur, Kashmir.

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*Banarescu & Nalbant (1969) opine that this species may by conspecific with *N. ruepelli* (Sykes).

**The specific name has been erroneously spelt by many authors as *sikmaensis*, *sikmainsis* etc.

†Hora, S. L. (*Rec. Indian Mus.*, **37**, p. 64-65, 1935) synonymised this species with *N. scaturigina*, but later Hora & Mukerji (*Rec. Indian Mus,*, **37**, p. 401, 1935) after examination of fresh material considered it as distinct.

77. *Noemaeheilus yasinensis* Alcock—Pakistan : High Asian division, (Central Asia) ; Chitral, Swat, Kaghan Valleys, N. W. F. Province : Yasin river, Jhelum drainage.

78. *Noemacheilus zonalternans* (Blyth)—India : Manipur. Burma : Tenasserim.

79. *Noemacheilus zonatus* (McClelland)—India : Yamuna, Ganga river system in Bihar, W. Bengal, Assam, also Orissa. Bangladesh.

Key to the species of the Subgenus **Noemacheilus** sensu stricto

1.	Body without any lateral stripes. ...		*N. corica*
	Body with lateral stripes. ...	...	2
2.	Lateral line incomplete. Body with a dark lateral stripe. ...		*N. poonaensis*
	Lateral line complete. ...	...	3
3.	Body without any vertical bands. A well developed moniliform lateral black band along lateral line in middle of body from caudal fin base to tip of snout. Band continued as black streak along middle of caudal fin (Nilgiri hills, S. India). ...		*N. monilis*
	Body with a row of large blackish spots or blotches running along mid lateral line and sometimes coalescing, extending on to caudal fin. (W. ghats, Maharashtra). ...		*N. angulla*

Key to the species of the subgenus **Noemachilichthys**

1.	Dorsal fin with 10 or 11 branched rays. Body with 11-16 vertical bands. ...		*N. rueppelli*
	Dorsal fin with 12 branched rays. Body with 15-20 vertical bands. ...		*N. shimogensis*

Key to the species of the subgenus **Acanthocobitis**

1.	Dorsal fin with 7-12 branched rays. ...	...	2
	Dorsal fin with 13-18 branched rays. ...	...	4
2.	Scales absent. Dorsal fin with 7 branched rays. ...		*N. microps*

	Scales present. Dorsal fin with 9-12 branched rays. ...	...	3
3.	Body with irregular blotches. Lateral line complete. ...	*N. botia botia**	
	Body with 10 or 11 bands. Lateral line incomplete. ...	*N. zonalternans*	
4.	Dorsal fin with 14-18 branched rays. Caudal fin emarginate. Body with 20 vertical bars. ...	*N. pavonaceus*	
	Dorsal fin with 13-14 branched rays. Caudal fin entire. Body with 12-16 vertical bars. ...	*N. rubidipinnis*	

Key to the species of the subgenus **Triplophysa**

1.	Body with scales. ...	*N. peguensis*	
	Body without scales or if present very indistinct. ...	...	2
2.	Caudal fin emarginate. ...	...	3
	Caudal fin rounded or truncate. ...	...	10
3.	Lateral line continued anteriorly over the head and dividing into two branches behind eyes. ...	*N. stoliczkae*	
	Lateral line not as above. ...	...	4
4.	Least height of caudal peduncle less than 4.0 times in its length. ...	...	5
	Least height of caudal peduncle more than 4.0 times in its length. ...	...	6
5.	Least height of caudal peduncle 3.0-3.9 in its length. ...	*N. kashmirensis*	
	Least height of caudal peduncle 1.2-1.4 in its length. ...	*N. griffithi hasarensis*	
6.	Dorsal fin longer than head. ...	*N. hutchinsoni*	
	Dorsal fin as long as head or shorter than head.	...	7
7.	Least height of caudal peduncle 7.0 to 7.6 in its length. ...	*N. panguri*	
	Least height of caudal peduncle less than 6.0 in its length. ...	...	8
8.	Body with 16-18 vertical bands. ...	*N. ladacensis*	
	Body without any vertical bands. ...	...	9

*Includes. *N. botia aureus* Day also.

9.	Body plain. Dorsal fin edge straight. Least height of caudal peduncle 5.0-5.5 in its length. ...	*N. yasinensis*	
	Body with blotches. Dorsal fin edge notched. Least height of caudal pedunele 4.5-5.2 in its length. ...	*N. choprai*	
10.	Caudal fin rounded. ...	...	11
	Caudal fin truncate or tut square. ...	...	12
11.	Dorsal fin inserted ahead of pelvic fin. ...	*N. deterrai*	
	Dorsal fin inserted behind pelvic fin. ...	*N. gracilis*	
12.	Lateral line incomplete. ...	...	13
	Lateral line complete. ...	...	14
13.	Pelvic fin extending considerably beyond anal opening. ...	*N. brahui*	
	Pelvic fin extending as far as or just reaching anal opening. ...	*N. tenuicauda*	
14.	Dorsal fin inserted much ahead of pelvic fin origin, last ray of dorsal fin nearly opposite pelvic fin base. Head length 5.1-6.2 in total length. Body blotches not prominent. ...	*N. griffithi naziri*	
	Dorsal fin inserted not much ahead of pelvic fin origin, second or third dorsal fin ray opposite pelvic fin base. Head length 4.75 to 5.0 in total length. Body blotches prominent. ...	*N. marmoratus*	

Key to the species of the Subgenus **Schistura**

1.	Dorsal fin with 9 to 12 branched rays. ...	...	2
	Dorsal fin with, 7 or 8 branched rays. ...	...	8
2.	Dorsal fin with 12 branched rays. ...	*N. bhimachari*	
	Dorsal fin with 9 or 10 branched rays ...	...	3
3.	Lateral line complete. ...	...	4
	Lateral line incomplete ...	...	6
4.	Body with blotches and not with any bars or bands. ...	*N. pulchellus*	
	Body with narrow vertical bands. ...	...	5
5.	Body with 8 or 9 bars along lateral line (Burma). ...	*N. shanensis*	
	Body with 12 to 16 bands along sides (W. ghats, S. India) ...	*N. striatus*	
6.	Caudal fin rounded or truncate. ...	*N. vittatus*	
	Caudal fin emarginate or forked. ...	...	7

7.	Dorsal fin edge concave. Scales rudimentary.		*N. raoe*
	Dorsal fin edge straight. Scales well developed.		*N. brunneanus*
8.	Lateral line complete.	... ...	9
	Lateral line incomplete.	... ...	30
9.	Scales absent or rudimentary	... ...	10
	Scales present.	... ...	14
10,	A precessus dentiformes present.	... ...	11
	No such processus.	... ...	12
11.	Body depth 10.2-13.8 in standard length. Body with 11-16 vertical stripes.	...	*N. alepidotus alepidotus*
	Body depth 9.7-12.3 in standard length. Body with 10-12 vertical stripes.	...	*N. alepidotus nalbanti*

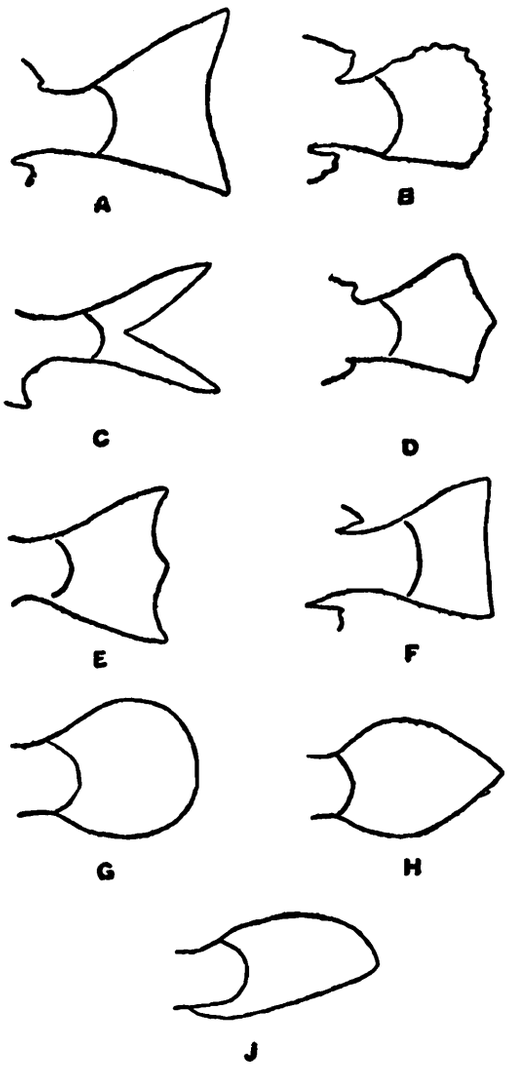


Fig. 69. Diagrams to show different caudal fin shapes. A, slightly emarginate or furcate ; B, rounded with wavy margins ; C, forked, D, wedge or paddle-shaped ; E. notched : F, truncate or cut-square ; G. rounded ; H, lanceolate, and J, ovate.

12.	Caudal peduncle with an adipose crest.	...	*N. pakistanicus*
	Caudal peduncle without an adipose crest.	...	... 13

13.	Pectoral fin longer than head length and is separated from the pelvic fin by a distance equal to half of its own length. ...	*N. punjabensis*	
13a.	Pectoral fin shorter than head length and is separated from the pelvic fin by a distance nearly equal to its own length. ...	*N. nasseri*	
14.	Caudal fin rounded, truncate or slightly furcate. ...	...	15
	Caudal fin forked or emarginate. ...	...	17
15.	A processus dentiformes present. ...	*N. rupicola rupicola*	
	No processus dentiformes. ...	...	16
16.	Nasal barbels prominent. Scales reduced. ...	*N. rupicola inglisi*	
	Nasal barbels absent. Scales well marked. ...	*N. manipurensis*	
17.	Four to six bands present only in caudal region of body. ...	*N. lorai*	
	Bands present all over body. ...	...	18

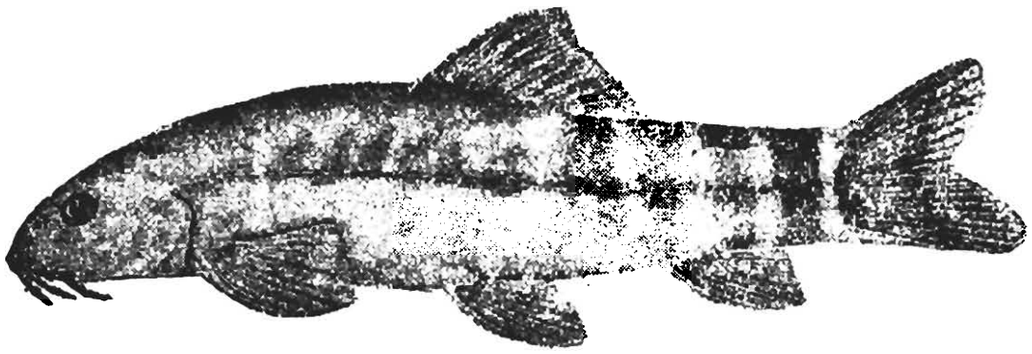


Fig. 70. Lateral view of *Noemacheilus lorai* Menon. (After Menon, A G K. 1952. *Rec. Indian Mus.*, **46**, pl. 7).

18.	A prominent black ocellus at superior edge of caudal fin. Seven black edged bands on body and head each bent angularly at lateral line. ...	*N. triangularis*	
	No such black ocellus at caudal base. ...	...	19
19.	Only two pairs of barbels. Caudal fin cut square. ...	*N. guttatus*	
	Three pairs of barbels. Caudal fin forked or emarginate. ...	...	20
20.	Caudal fin plain without any bands. ...	*N. sikmaiensis*	
	Caudal fin with bands. ...	...	21
21.	Interspace between bands narrow, about half the width of bands. ...	...	22
	Interspace between bands wide, nearly double or equalling width of bands. ...	...	23

22. Pelvic and anal fins without any markings. Body with nine broad vertical bands. ... *N. savona*

Pelvic and anal fins with bands or markings. Body with nine or ten vertical bands. ... *N. dayi*

23. Bands on body six or seven, all of uniform pattern, nearly of same width and well formed. *N. beavani*

Bands on body more than ten, irregular not of uniform pattern and width. 24

24. Head speckled with round spots or blotches. Only four well defined bands behind dorsal fin. *N. vinciguerrae*

Head plain. More than four bands on body. 25

25. Bands or colour markings on body extending across lateral line, along centre of body, though not up to ventral surface. 26

Bands or colour markings on body extending only up to lateral line or a little below, not on the whole body. 28

26. Black band at caudal fin base prominent, complete. Bands start a little below back of body. Space between back and beginning of bands with many diffused spots. ... *N. carletoni*

Black band at caudal fin base not prominent, incomplete. Bands start from back of body. 27

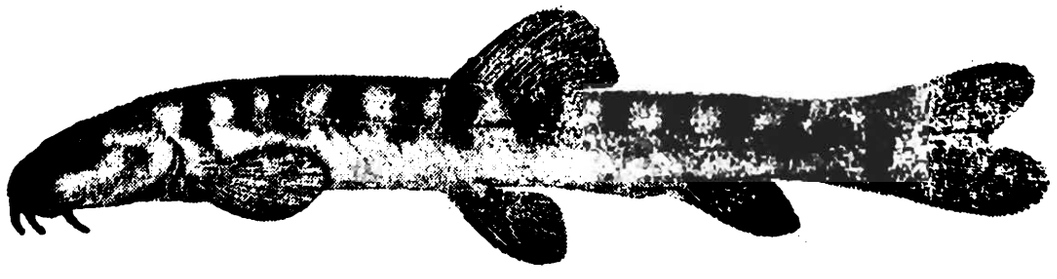


Fig. 71. Lateral view of *Noemacheilus kangrae* Menon. (After Menon, A. G. K. 1952. *Rec. Indian Mus.*, **46**, pl. 7).

27. Scales feebly developed and totally absent in anterior region. Lateral line fairly extensive when incomplete (usually lateral line present). Colour bands more broad, complete and numerous. ... *N. subfusca*

Scales well marked all over the body. Lateral line complete. Colour bands narrow, complete and less in number. ... *N. scaturigina*

28.	Body with numerous irregularly shaped spots and bars procedding from back up to lateral line. A dark line runs along the centre of the back (Nilgiri hills, S. India), ...	*N. semiarmatus*	
	Body with fully formed bands. No dark line along centre of the back. ...	...	29
29.	About 15 brown bands, one third as wide as ground colour descend from back *below* lateral line. Bands narrow, not of uniform length. Body short. Caudal fin without a band at its base. ...	*N. zonatus.*	
	About 8-11 bands half as wide as ground colour descend from back but very little below lateral line. Bands wide, of uniform width and length. Body long. Caudal fin with a black band at its base. ...	*N. kangrae*	
30.	Scales absent or rudimentary. ...	...	31
	Scales present. ...	...	34
31.	Dorsal fin inserted opposite pelvic fins. ...	...	32
	Dorsal fin inserted ahead of pelvic fins. ...	...	33
32.	Body depth 10.9% to 14.51% of standard length. No adipose crest on caudal peduncle or only a small indication of it. Bands at caudal base almost continuous. ...	*N. kessleri*	
	Body depth 13.7% to 16.9% of standard length. A well developed thick dorsal crest with sharp upper edge on caudal peduncle present. Bands at base not continuous. ...	*N. prashari lindbergi*	
33.	Body with 15-17 cross bars of dark olive colour. Bands not of uniform width. An oblique band in middle of dorsal fin present. ...	*N. prashari prashari*	
	Body with 8-10 brown bars. Bands of uniform width. No band on dorsal fin except two or three rows of minute spots. ...	*N. machensis*	
34.	Caudal fin rounded or truncate. ...	...	35
	Caudal fin emarginate or forked. ...	...	36
35.	Body with blotches and no bands. Caudal fin cut square (W. ghats). ...	*N. sinuatus*	
	Body with vertical bands. Caudal fin rounded or slightly furcate (E. Himalaya, Sikkim). ...	*N. devdevi*	
36.	Body plain without any bands or blotches. ...	*N. shebbeari*	
	Body with blotches or bands. ...	...	37
37.	Dorsal fin inserted behind pelvic fins. ...	*N. cincticauda*	
	Dorsal fin inserted opposite or ahead of pelvic fins. ...	...	38

38.	Body with blotches and no vertical bands or bars. ...	*N. guentheri*	
	Body with vertical bands or bars. ...	...	39
39.	Dorsal fin edge straight. ...	...	40
	Dorsal fin edge concave, convex or notched. ...	...	47
40.	Body with 15-18 brownish spots on sides (incomplete bands) which extend neither to back nor to ventral side. No spot on dorsal base (W. Himalaya, Pakistan) ...	*M. harnaiensis*	
	Body with vertical bands which are complete or nearly complete extending from back to ventral profile. ...	...	41
41.	Body with 7 to 11 broad black bands, all complete. ...	...	42
	Body with 9 to 14 incomplete bands. ...	...	43
42.	Dorsal fin with 6 or 7 branched rays. ...	*N. kangjupkhulensis*	
	Dorsal fin with 8 branched rays. ...	*N. rivulicola*	
43.	9-12 vertical stripes on body sides not reaching to ventral surface. Upper lip furrowed. ...	*N. anambarensis*	
	Vertical stripes on body reach ventral surface. Upper lip simple. ...	...	44
44.	Body with 11-14 (mostly 13) well marked almost vertical (slightly oblique) brownish stripes, some of them interrupted or incomplete. ...	*N. baluchiorum*	
	Body with well defined bands. ...	...	45
45.	Caudal fin with faint bands. Body with 11 or 12 vertical bands. ...	*N. rajasthanicus*	
	Caudal fin with well marked bands. Body with 10 to 14 vertical bands. ...	...	46
46.	A dark mark at base of caudal, a black spot at base of anterior dorsal rays and a bar across the lower portion of the fin in its last half, a single band across its centre (Sri Lanka) ...	*N. notostigma*	
	12 vertical bands on body, a black band at caudal base, with three bars across the fin (Simla). ...	*N. montanus*	
47.	Edge of both lips sharp, trenchent, practically no lips (W. ghats). ...	*N. rendahli*	
	Edge of both lips papillated or fimbriated, lips present. ...	..	48

48.	Caudal fin plain without any bands or spots. ...	...	49
	Caudal fin with vertical or oblique bands, or spots. ...	...	50
49.	Width of head almost equals height of head at occiput. A prominent black blotch in middle of base of caudal fin. Body with 12 or 13 faint bands. ...		*N. acuticephalus*
	Width of head considerably greater than height of head at occiput. A vertical black bar at base of caudal fin. Bands on body faint. Three narrow vertical bars of a deep reddish-brown colour present in the middle of the body in the region of the interspace. ...		*N. paucifasciatus*
50,	Caudal fin with four or more distinct bands. Body encircled by a number of bands. ...	...	51
	Caudal fin with one or two bands. Bands on body not encircling. ...		52
51.	Bands on body of uniform width, 9 to 12 in number. Anterior bands may coalesce on back (W. ghats, S. India) ...		*N. denisoni*
	Bands on body not of uniform width, those anterior to dorsal fin narrow, coalescing (E. Himalaya). ...		*N. multifasciatus*
52.	Body above lateral line marked by characterstic reticulations. Two dotted bands across the caudal fin (Manipur, India) ...		*N. prashadi*
	No such reticulations. Body with 9-12 brownish vertical stripes. A stripe from eye to snout. Caudal fin with few rows of minute and hardly distinct spots. ...		*N. altipedunculatus*

Key to the species of **Noemacheilus** on basis of their zoogeographical distribution.

A : Species from Western Himalaya areas, drained by the Indus river system. Includes Baluchistan. N. W. F. Provinces, Ladakh, Leh, Kashmir, Kangra Valley.

1.	A prominent downwsrd extension of the premaxillary bone (Processus dentiformis) present on the upper jaw, with a corresponding notch in the mandible. ...	...	2
	No such processrs dentiformis present. ...	...	4

2.	Dorsal face of head uniformly dark. Snout narrow. Body with 9 or 10 dark, broad vertical stripes extending from back over body sides to lateral line. ...		*N. pakistanicus*
	Dorsal face of head covered by distinct round brownish spots. Body with 10-16 vertical stripes extending to below lateral line. ...	...	3
3.	Body depth 10.2-13.8 in standard length. Body with 11-16 vertical stripes. ...		*N. alepidotus alepidotus*
	Body depth 9. 7-12. 3 in standard length. Body with 10-12 vertical stripes. ...		*N. alepidotus nalbanti*
4.	Dorsal fin with nine or ten branched rays. ...		*N. villatus*
	Dorsal fin with seven or eight branched rays. ...		5
5.	Caudal fin truncate, rounded or entire or out square. ...	...	6
	Caudal fin emarginate or forked. ...	...	12
6.	Scales on body present. ...		*N. montanus*
	Scales on body absent. ...	...	7
7.	Lateral line incomplete. ...	...	8
	Lateral line complete. ...	...	9
8.	Pelvic fin extending considerably beyond anal opening. ...		*N. brahui*
	Pelvic fin not extending as far as or just reaching anal opening. ...		*N. tenuicauda*
9.	Dorsal fin inserted behind pelvic fin origin. ...		*N. gracilis*
	Dorsal fin inserted ahead of pelvic fin origin.	...	10
10.	Dorsal fin with seven branched rays. ...	...	11
	Dorsal fin with eight branched rays. ...		*N. deterra*
11.	Dorsal fin inserted much ahead of pelvic fin origin, last ray of dorsal fin nearly opposite pelvic fin base. Head length 5.1 to 6.2 in total length. Body blotches not prominent. ...		*N. griffithi naziri*
	Dorsal fin inserted not much ahead of pelvic fin origin, second or third dorsal fin ray opposite pelvic fin base. Head length 4.75 to 5 in total length. Body blotches prominent. ...		*N. marmoratus*
12.	Lateral line incomplete. ...	...	13
	Lateral line complete. ...	...	19
13.	Scales on body absent. ...	...	14
	Scales on body present. ...	...	16

14.	Dorsal fin inserted ahead of pelvic fin. Body depth 14.5-19.0% of standard length. ...	*N. machensis*	
	Dorsal fin inserted opposite pelvic fin. Body depth 10.9-16.9% of standard length. ...	...	15
15.	Body depth 10.9-14.51% of standard length. No adipose crest on caudal peduncle or only a small indication of it. Band at caudal base almost continuous. ...	*N. kessleri*	
	Body depth 13.7-16.9% of standard length. A well developed thick dorsal crest with sharp upper edge on caudal persent. Bands at caudal peduncle present. Bands at caudal base not continuous. ...	*N. prashari lindbergi*	
16.	Body with bands more or less well defined almost reaching ventral surface. ...	...	17
	Body with bands not well defined, not reaching ventral surface. ...	...	18
17.	Body with 11-14 (mostly 13) almost verticai (slightly oblicue) brownish stripes, some of them interrupted or incomplete. Dorsal fin without a band. ...	*N. baluchiorum*	
	Body with 15-17 bands. An obliqus band in middle of dorsal fin present. ...	*N. prashari prashari*	
18.	Body with 9-12 broad bands. upper lips slightly furrowed. ...	*N. anambarensis*	
	Body with 15-18 brownish spots (incomplete bands) on sides. Upper lips not furrowed. ...	*N. harnaiensis*	
19.	Body without any well defined bands, plain or blotched. ...	...	20
	Body with well defined vertical bands. ...	...	25
20.	Lateral line continued anteriorly over the head and dividing into two branches behind eyes. ...	*N. stoliczkae*	
	Lateral line not so continued anteriorly. ...	...	21
21.	Least height of caudal peduncle less than 4. 0 times in its length. ...	...	22
	Least height of caudal peduncle more than 4.0 times in its length. ...	...	23
22.	Least height of caudal peduncle 3.0-3.9 in its length. ...	*N. kashmirensis*	
	Least height of caudal peduncle 1.2-1.4 in its length. ...	*N. griffithi hazarensis*	
23.	Dorsal fin longer than head. ...	*N. hutchinsoni*	
	Dorsal fin as long as head or shorter than head. ...	...	24

24.	Least height of caudal peduncle 4.5-5.2 in its length. ...	*N. choprai*	
	Least height of caudal peduncle 7.0-7.6 in its length. ...	*N. panguri*	
25.	Scales on body present. ...		26
	Scales on body absent. ...	...	30
26.	Upper jaw produced into a beaklike process with a broad, truncate apex while the lower jaw is deeply incised to receive this process. ...	*N. rupicola rupicola*	
	No such beak—like process present. ...	...	27
27.	Only four to six bands present in caudal region of the body only. ...	*N. horai*	
	Bands present all over the body. ...	...	28
28.	Bands on body start a little below back of body ; space between back and beginning of bands, with many diffussd spots. ...	*N. carletoni*	
	Bands on body start from back and well formed. ...	...	29
29.	Eight to 11 bands half as wide as ground colour present on body, but do not descend below lateral line very much. ...	*N. kangrae*	
	Body with nine or ten well defined bands descending below lateral line, encircling the body. ...	*N. dayi*	
30.	Dorsal fin edge concave. Dorsal fin inserted opposite pelvic fin. ...	...	31
	Dorsal fin edge straight. Dorsal fin inserted ahead of pelvic fin ...	...	32
31.	Anal fin separated from caudal by a distance almost equal to its length. ...	*N. microps*	
	Anal fin separated from caudal by a distance considerably less than its own length. ...	*N. yasinensis*	
32.	Bands discontinuous, not well developed. No black band at caudal fin base or black spot at dorsal fin base. Caudal peduncle long and narrow. ...	*N. ladacensis*	
	Bands continuous, well developed. Caudal fin with a dark band at base. Dorsal fin with a dark spot at its base of first two rays. Caudal peduncle short, broad. ...	...	33

33.	Pectoral fin longer than head length and is separated from the pelvic fin by a distance equal to half of its own length. ...	*N. punjabensis*
	Pectoral fin shorter than head length and is separated from the pelvic fin by a distance nearly equal to its own length. ...	*N. nasseri*

B : Species from the Eastern Himalaya areas drained mainly by the Ganga, Yamuna, Brahmaputra river systems. Includes Northern India, Assam, E. Himalaya, Bangladesh, up to Deccan plateau, excluding the Western ghats.

1.	Dorsal fin with 14-18 branched rays. ...	*N. pavonaceus*	
—	Dorsal fin with less than 12 branched rays. ...	...	2
2.	Dorsal fin with 9-12 branched rays. ...	...	3
—	Dorsal fin with 6-8 branched rays. ...	...	5
3.	Lateral line incomplete. Nasal barbels well developed. ...	*N. botia aureus*	
—	Lateral line complete. Nasal barbels not well developed. ...	...	4
4.	A black ocellus near upper margin of base of caudal fin present. Caudal fin with seven irregular bars bent at an angle. ...	*N. botia botia*	
—	No such black ocellus near upper margin of base of caudal fin. Caudal fin with numerous small brown bars. ...	*N. monoceros*	
5.	Caudal fin rounded, cut square or truncate. ...	...	6
—	Caudal fin emarginate or forked. ...	...	10
6.	Lateral line complete. ...	...	7
—	Lateral line incomplete. ...	...	9
7.	Only two pairs of barbels. ...	*N. guttatus*	
—	Three pairs of barbels. ...	...	8
8.	Nasal barbels prominent. Caudal fin truncate.	*N. rupicola inglisi*	
—	Nasal barbels not prominent. Caudal fin rounded. ...	*N. spilopterus*	
9.	Body with few broad irregular bands, wider than interspace between them and descending mostly up to lateral line only. ...	*N. devdevi*	
—	Body with many narrow bands, narrower than interspace between them and descending up to ventral surface. ...	*N. manipurensis*	

10.	Lateral line incomplete. ...	...	11
—	Lateral line complete. ...	...	15
11.	Body without bands, plain. ...	*N. shebbeari*	
—	Body with vertical bands. ...	...	12
12.	Dorsal fin with six or seven branched rays. (Body with seven to eleven broad black complete bands). ...	*N. kangjupkhulensis*	
—	Dorsal fin with eight or nine branched rays.	...	13
13.	Body above lateral line marked by characteristic reticulations. ...	*N. prashadi*	
—	Body uniformly with vertical bands. ...	...	14
14.	Bands on body of uniform width, not coalescing. ...	*N. rajasthanicus*	
—	Bands on body not of uniform width, those anterior to dorsal fin narrow, coalescing. ...	*N. multifasciatus*	
15.	Body blotched, with one or two longitudinal series of spots. ...	*N. corica*	
—	Body with colour bands. ...	...	16
16.	Interspace between bands wide, nearly double or equalling width of bands. ...	...	17
—	Interspace between bands narrow, about half the width of bands or less. ...	*N. sovona*	
17.	Body with bands descending up to ventral surface or encircling it. ...	...	18
—	Body with bands not descending up to ventral surface and not encircling it. ...	...	19
18.	Scales feebly developed and in anterior region of body totally absent. Caudal fin notched, slightly emarginate. Caudal fin without any bands. ...	*N. subfusca*	
—	Scales well developed. Caudal fin deeply emarginate or forked and with oblique bands.	*N. beavani*	
19.	Bands on body not continuous from back but disjointed and not descending to ventral surface. Caudal fin with a V-shaped band. ...	*N. scaturigina*	
—	Bands on body continuous from back and not descending to ventral surface. Caudal fin plain. ...	*N. zonatus*	

C : Species from Burma drained by Chindwin, Irrawaddy, Sittang and other rivers.

1.	Dorsal fin with 13 or 14 branched rays. ...	*N. rubidipinnis*	
—	Dorsal fin with not more than eleven branched rays. ...	...	2

2.	Dorsal fin with 9—11 branched rays. ...	...	3
—	Dorsal fin with 6—8 branched rays. ...	...	7
3.	A black ocellus near superior margin of base of caudal fin present. ...	*N. zonalternans*	
—	No such black ocellus near superior margin of base of caudal fin present. ...	...	4
4.	Lateral line complete. ...	...	5
—	Lateral line incomplete. ...	...	6
5.	Anterior lip greatly hypertrophied and edges raised forming a funnel-shaped structure. ...	*N. peguensis*	
—	Antertor lip normal. No such funnel shaped structure. ...	*N. shanensis*	

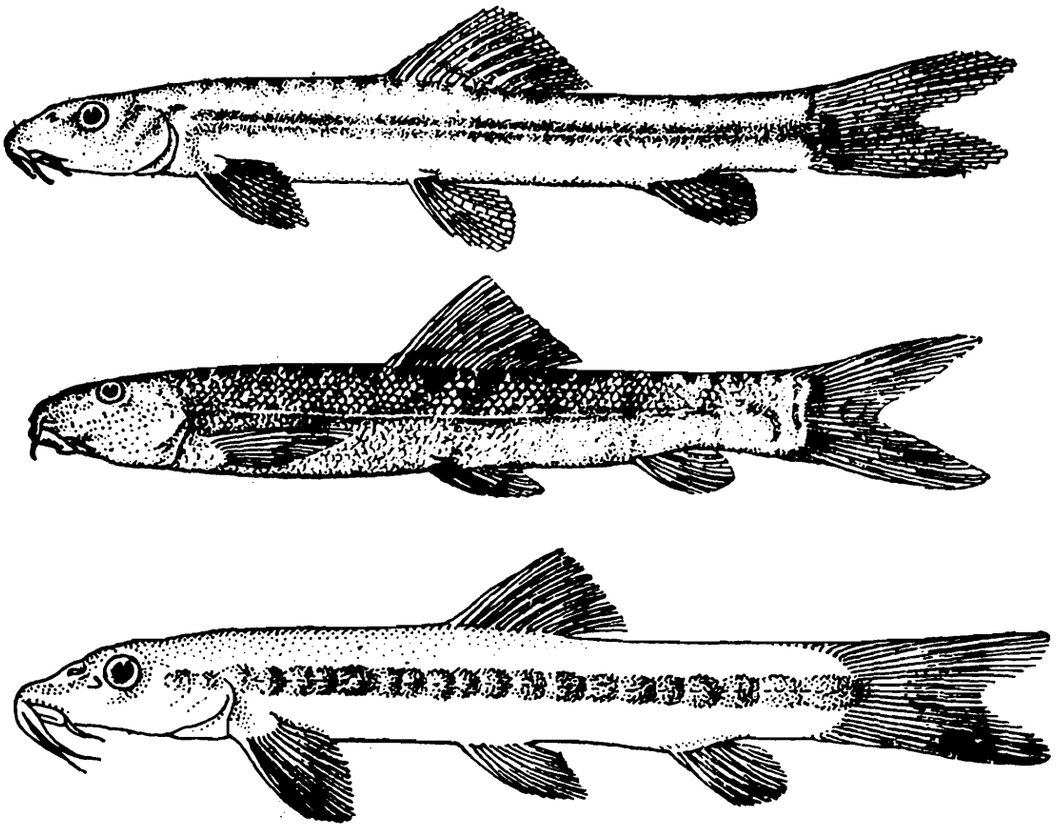


Fig. 72. Lateral view of A, *Noemacheilus poonaensis* Menon. B, *N. anguilla* Annandale, C, *N. monilis* Hora. (After Menon, A. G. K. 1949. *Rec. Indian Mus.*, **47**, text-fig. 1, p. 227).

6.	Body covered with rudimentary scales, snout more than 1.5 times diameter of eye. ...	*N. raoe*	
—	Body covered with well marked intricate scales, snout equal to or only slightly longer than eye. ...	*N. brunneanus*	
7.	Anterior nostril in a long flap-like tube ; eye large and visible from below ventral surface....	*N. brevis*	
—	Anterior nostril normal or slightly tubular ; eye not visible from below ventral surface. ...	...	8

8.	Lateral line incomplete. ...	...	9
—	Lateral line complete. ...	...	11
9.	Pelvic fin extending considerably beyond anal opening. ...	*N. cinclicauda*	
—	Pelvic fin just reaching or not extending as far back as anal opening. ...	...	10
10.	Width of head almost equalling height of head at occiput. A prominent black blotch in middle of base of caudal fin present. ...	*N. aculicephalus*	
—	Width of head considerably greater than height of head at occiput. A vertical black bar at base of caudal fin present. ...	*N. paucifasciatus*	
11.	Dorsal fin with seven branched rays. ...	*N. blythii*	
—	Dorsal fin with eight branched rays. ...	...	12
12.	Caudal fin plain without any bars. Body with 12 or 13 black bands encircling the body, nearly up to base of pectoral fin. ...	*N. sikmaiensis*	
—	Caudal fin with oblique bands. Body with six to eight complete bands, encircling only up to pelvic or anal fin base. ...	...	13
13.	Head speckled with dark spots. Bands coalescing below dorsal fin. ...	*N. vinciguerrae*	
—	Head plain. Bands coalescing before dorsal fin. ...	*N. riculicola*	

D : Species from Western ghats, South India. Includes the Cauvery, Krishna, Godavary drainage system.

1.	Dorsal fin with ten or more than ten branched rays. ...	...	2
—	Dorsal fin with less than ten branched rays. ...	...	5
2.	Dorsal fin with 12 branched rays. ...	...	3
—	Dorsal fin with 10 or 11 branched rays. ...	...	4
3.	Lateral line incomplete. Snout elongated. ...	*N. bhimachari*	
—	Lateral line complete. ...	*N. shimogensis*	
4.	Body with 11—16 vertical bands. Median pair of lobes of upper lip letter developed and prolonged posteriorly. ...	*N. rueppelli*	
—	Two rows of large, vertical, Canary-yellow spots with deep black margins present along sides between head and middle of dorsal fin. Posterior to dorsal fin they become wide vertical bands. A deep black spot at caudal fin base, caudal fin with three or four oblique black bands. ...	*N. pulchellus*	

5.	Lateral line incomplete. ...	...	6
—	Lateral line complete. ...	...	12
6.	Caudal fin truncate and cut square. ...	*N. sinuatus*	
—	Caudal fin emarginate or forked. ...	...	7
7.	Body with blotches and no regular bands. ...	...	8
—	Body with bands. ...	...	9
8.	Body with 21 brownish spots on back. A broad dark-brownish stripe from angle of opercle to caudal fin base present. A small black spot on middle of caudal fin. (W. ghats, N. Canara). ...	*N. poonaensis*	
—	Body with three rows of pale spots with faint indications of pale bands in tail region. A well defined black spot on caudal base present. (Kerala, Travancore). ...	*N. guentheri*	
9.	Edge of both lips sharp, trenchent ; practically no lips (W. ghats). ...	*N. rendahli*	
—	Edge of both lips papillated or fimbriated, with lips present. ...	...	10
10.	Body with 9—12 vertical bands. ...	...	11
—	Body with 12—14 vertical bands, which may be broken into blotchets. Dorsal fin inserted opposite pelvic fin (Sri Lanka). ...	*N. notostigma*	
11.	Bands on body encircling. Anterior bands may coalesce on back. Dorsal fin edge straight. ...	*N. denisonii*	
—	Bands on body not encircling. Dorsal fin edge convex. Upper fip slightly furrowed, with a median incision. ...	*N. altipedunculatus*	
12.	A prominent black ocellus at superior edge of caudal fin present. Seven black edgd bands on body and head, each bent angularly at lateral line (Travancore hills, Kerala). ...	*N. triangularis*	
—	No such black ocellus at caudal fin base. ...	...	13
13.	Dorsal fin with nine, or ten branched rays. ...	*N. striatus*	
—	Dorsal fin with seven or eight branched rays. ...	...	14
14.	A dark line running the *centre of the back* : Body with numerous irregularly shaped spots and bars proceeding from back up to lateral line. ...	*N. semiarmatus*	
—	A dark stripe along lateral line or body present. ...	...	15

15. A well developed moniliform lateral black band along lateral line in middle of body from caudal fin base to tip of snout present, interrupted by the eye in its course. Band continued as a black streak along middle of caudal fin. Dorsal fin with seven branched rays. ... *N. monilis*

— A row of large blackish spots or blotches running along mid lateral line and sometimes coalescing, extending on to caudal fin present. Dorsal fin with eight branched rays. ... *N. anguilla*

Subfamily BOTINAE

Body oblong, short. compressed. An erectile spine arising from the ethmoid bone and concealed in a groove under or before each eye present. Two pairs of rostral barbels placed very close to each other. Caudal fin well forked. Anterior nostrils tubular or simple. No ridge on upper part of caudal peduncle. Dorsal fin with 10—15 rays.

Genus **Botia** Gray

Botia Gray, 1831, *Zool. Misc.*, p. 8 (type-species, *Botia almorhae* Gray).—Hora, 1922, 1922, *Rec. Indian Mus.*, **24**, pp. 313-321 (revision)—Banarescu & Nalbant, 1968, *Mitt. Hamburg Zool. Mus. Inst.*, **65**, p. 341 (revision).

Diagnosis.—Body oblong, short. moderately deep. Abdomen rouuded. Head long, pointed. Snout conical, ventrally flattened. Mouth small, subinferior, narrow. Eyes moderately large; superior, in mid part of head *without any skin covering them*, not visible from below ventral surface. Anterior nostrils tubular, lips thick. fleshy. Jaws equal, without any teeth. A bifid erectile *suborbital spine below or in front of eyes present. Barbels six or eight (B. hymenophysa) four rostral, united at their bases*, and two on upper jaw ; when eight extra pair on mandibular which are not barbels but only mental lobes. Jaws and palate without teeth. Dorsal fin inserted above origin of pelvics or slightly ahead with 10—15 rays (8—13 branched). Anal fin short with seven or eight rays (five or six branched). Caudal fin forked or emarginate. Lateral line present. Scales on head absent. Air-bladder partly enclosed in a bony capsule.

Distribution.—India : Gangetic basin, along the base of Himalayas, Meghalaya. Nepal. Pakistan. Bangladesh, Burma. Malaya.

Species.—Three subgenera are known ; only one *Botia* (*Botia*) is relevant to this work.

1. *B.* (*Botia*) *almorhae* Gray—India : Almora, U. P. Nepal.

2. *B.* (*Botia*) *birdi* Chaudhuri—India : Kashmir, Punjab. Pakistan : Sind.
3. *B.* (*Botia*) *dario* (Hamilton)—India : Bihar, U. P., N. Bengal, Cachar, Meghalaya, Punjab. Bangladesh.
4. *B.* (*Botia*) *histrionica* (Blyth)—India : U. P., Manipur, Assam. Burma.
5. *B.* (*Botia*) *hymenophysa* (Bleeker)—India : Manipur. Burma. Thailand, Indo-Australian Archipelago.
6. *B.* (*Botia*) *lohachata* Chaudhuri—India : Gandak river, Saran Dist., Bihar, Rajasthan, Delhi, Punjab. Pakistan : Sind. Nepal. Bangladesh.
7. *B.* (*Botia*) *rostrata** Günther** India : W. Bengal, Meghalaya, Bangladesh.
8. *B.* (*Botia*) *striata* Rao—India : R. Tunga, Karnataka, S. India and Maharashtra, Satara dist.

KEY TO SPECIES †

1.	Three pairs of "barbels" present. (Four rostral, united at their bases ; two maxillary). ...	*B. hymenophysa*	
—	Four pairs of "barbels" present. (Four rostral, united at their bases, two maxillary and two mental lobes) ...	...	2
2.	Snout long, its length considerably more than the post-orbital distance. ...	*B. rostrata*	
—	Snout not very long, its length equal to less than post-orbital distance. ...	...	3
3.	Eyes almost in posterior half of head. ...	...	4
—	Eyes not situated wholly in posterior half of head. ...	...	7
4.	Head and body marked with a number of narrow oblique vertical bands. ...	*B. striata*	
—	Head and body marked with a few broad vertical bands or reticulations. ...	...	5

*B. (*Botia*) *geto* Hamilton is a juvenile of this species (Hora, S. L. *Rec. Indian Mus.*, **34**, p. 573).

**B. *dayi* which Hora proposed for specimens of *Botia geto* tincluded by Day in his *Fish India*, 1878 and *Fauna*, 1889 is a synonym of *B. rostrata* according to Menon, 1974.

Babu Rao and Yazdani (1977) have recorded *B. dayi* = *B. rostrata* Günther from West Mahabaleshwar, Maharashtra which is the first record of this species from Peninsular India.

†After Hora, S. L. 1922. *Rec. Indian Mus*, **24** pp. 316—317.

5.	Dorsal fin inserted slightly behind insertion of pelvic fin, and not at equidistance from tip of snout and caudal fin base. ...		*B. histrionica*
—	Dorsal fin inserted opposite pelvic fins, and at equidistance from tip of snout and caudal fin base. ...	...	6
6.	Eye diameter 4.0 to 4.5 in snout length. ...		*B. birdi*
—	Eye diameter 3.0 in snout length. ...		*B. dario*
7.	Head and body marked with reticulations. ...		*B. almorhae*
—	Head and body marked with vertical bands. ...		*B. lohachata*

Subfamily COBITINAE

Body oblong to cylindrical. A spine under or before the eye. Anterior nostrils tubular or simple. No ridge on upper part of caudal peduncle. Dorsal fin long with 8-30 rays.

KEY TO GENERA

1.	Barbels absent. Lower lip in continuation with the snout and not with the upper lip. ...		*Neoeucirrhichthys* Banarescu & Nalbant
	Barbels present. Lower lip generally continuous with upper lip and definitely not with skin of snout. ...	...	2
2.	Dorsal fin long with 30 rays. ...		*Enobarbichthys* Whitley =*Jerdonia* Day
	Dorsal fin short with 8-15 rays. ...	...	3
3.	Dorsal fin inserted in the posterior half of body near midway between anal and pelvic fins. ...		*Acanthopthalmus* van Hasselt
	Dorsal fin inserted in middle of body, nearer to pelvic fin than to anal fin origin. ...	...	4
4.	Eyes large, bulging, ventral surface flattened. A transversely oval shallow depression over occiput. ...		*Somileptes* Swainson
	Eyes small, not bulging. Ventral surface not flattened, cylindrical. No depression over occiput. ...	...	5
5.	Lateral line very short, not exceeding length of pectoral. Scales do not cover sides of head. ...		*Misgurnus* Lacépède
	Lateral line absent. Scales cover sides and vertex of head. ...		*Lepidocephalus* Bleeker

Genus **Neoeucirrhichthys** Banarescu & Nalbant

Neoeucirrhichthys Banarescu & Nalbant, 1968, *Mitt. Hamburg Zool. Mus. Inst.*, **65**, p. 349 (type-species, *Neoeucirrhichthys maydelli* Banarescu & Nalbant).

Diagnosis.—Body elongated, slightly compressed. Abdomen rounded. Head conical, compressed. Snout pointed. Mouth inferior, horse-shoe shaped. Eyes superior, moderate, in anterior part of head, not visible from below ventral surface. Upper lip thick, slightly furrowed, not interrupted in middle. *Skin in front of upper lip thickened, forming like a parallel duplicate of upper lip.* Lower lip strongly fringed with a round median papilla at angle of mouth. *Lower lip continuous with snout* not with upper lip. A strong suborbital spine, bifid in front and under first half of eyes. Jaws and palate without teeth. *No trace of rostral or maxillary barbel*; *rudiments of mandibular barbel at corner of mouth.* Dorsal fin inserted above base of pelvic fins, with ten rays (seven branched) and no spine. Anal fin short with seven rays (five branched). *Scales well developed, present on sides and dorsal face of head. Lateral line very short, incomplete.*

Distribution.—India : Janali River at Raimona, Goalpara dt., Brahmaputra drainage, Assam.

Species.—*Neoeucirrhichthys maydelli* Banarescu & Nalbant is the single species known.

Genus **Enobarbichthys** Whitley

Jerdonia Day, 1870, *Proc. zool. Soc. London*, p. 700 (type-species, *Platacanthus maculatus* Day, preoccupied in Mollusca and Aves).

Enobarbichthys Whitley, 1931, *Rec. Aust. Mus., Sydney*, **18**, pp. 107. —Banarescu & Nalbant, 1968, *Mitt. Hamburg zool. Mus. Inst.* **65**, p. 343 (review).

Madrassia Nalbant, 1963, *Trav. Mus. Hist. Inst.*, **4** : 360.

Diagnosis.—Body elongate and moderately compressed Abdomen rounded. Head short, conical. Snout acute. Mouth small, subinferior, transverse. Eyes small superior, not visible from below ventral surface. Lips thick, fleshy, continuous at angle of mouth. A free erectile bifid, suborbital spine present. Jaws and palate without teeth. Eight barbels, two mandibular, two maxillary, four rostral. *Dorsal fin inserted ahead of pelvics, over posterior half of pectoral fins, long with* 30 *rays* (28 *branched*), *pectoral fin with a flat osseous spine.* Anal fin with eight rays (five branched). Caudal fin slightly emarginate, nearly rounded. Scales small, but distinct. Lateral line complete.

Distribution.—S. India : Madras.

Species.—*Enobarbichthys maculata* (Day)—S. India : Madras.

Remarks.—When at rest this fish usually remains on sand or rock supported by its two pectoral and anal fins, its abdomen not touching the ground. When frightened it burrows under sand with great rapidity. It consumes animal or vegetable food indifferently and grows considerably while in confinement. (After Day, 1867, p. 942 ; Silas, 1960, p. 93).

This species is known only by its Holotype preserved in the British Museum, (Natural History) London.

Genus **Acanthophthalmus** van Hasselt

Acanthophthalmus van Hasselt, 1823, *Alg. Konst. Letterbode*, **2**, p. 132 (type-species, *Acanthophthalmus fasciatus* van Hasselt).—Banarescu & Nalbant, 1968, *Mitt. Hamburg Zool. Mus. Inst.*, **65**, p. 343 (review).

Diagnosis.—Body elongate and strongly compressed. Abdomen rounded. Head short, cylindrical. Mouth small, narrow, inferior. Snout short, bluntly rounded. Eyes minute, covered by skin, superior. in middle of head, not visible from below ventral surface. Nostrils close together, anterior tubulate. Lips thick, the lower with two contiguous prolongations, or bilobate, continuous at angle of mouth with upper lip. A suborbital spine present. Jaws and palate without teeth. Six barbels, a pair of rostral and two of maxillary. Dorsal fin short inserted in posterior half of body, nearer caudal base than tip of snout and with eight rays (six branched). Anal fin short with seven rays (five branched). Caudal fin truncate, rounded or slightly emarginate. Scales minute or scarcely visible or absent on head. Lateral line complete.

Distribution.—India : N. E. Bengal. Bangladesh. Burma.

Species.—*Acanthophthalmus pangia* (Hamilton).—distribution as of genus.

Genus **Somileptes** Swainson

Somileptes Swainson, 1839, *Natural History of Fishes* 2, p. 311 (type-species, *S. bispinosa* Swainson = *Cobitis gongota* Hamilton).—Mukerji, 1932, *Rec. Indian Mus.*, **34**, pp. 125-129.—Banarescu & Nalbant, 1968, *Mitt. Hamburg Zool. Mus. Inst.*, **65**, p. 343 (review).

Diagnosis.—Body cylindrical, stout, elongated. Abdomen rounded. Head swollen, wider than deep. Nostrils placed close together and open outside through short tubule. *Snout long, straight, broad anteriorly with soft warty tubercles.* Mouth small, inferior, horse-shoe shaped. *Eyes bulging, fairly large, superior,* situated in middle of head, not

visible from below ventral surface. Lips fleshy, continuous, upper lip thickly papillated protruding over lower lip. Lower lip granulated in middle and globular at sides. *A transversely oval shallow depression on the occiput. A suborbital bifid spine below eyes present.* Jaws and palate without teeth. Six barbels, one pair each of rostral and two maxillary. *Dorsal fin inserted behind origin of pelvic fins*, with 11 rays (eight



Fig. 73. Lateral view of *Somileptes gongota* (Hamilton).

branched) and without a spine. Anal fin short with seven rays (five branched). Caudal fin entire, subtruncate or irregularly rounded. *Scales large, entire body except the head covered.* Lateral line complete, slightly curved anteriorly, very distinct.

Distribution.—India : N. Bengal, Meghalaya. Bangladesh.

Species.—*S. gongota* (Hamilton) is the only species known so far.

Genus **Lepidocephalus** Bleeker

Lepidocephalus Bleeker, 1858, *Nat. Tijdschr. Ned. Inde.* **16**, p. 303 (type-species, *Cobitis macrochir* Bleeker).

Diagnosis.—Body elongate and moderately compressed. Abdomen rounded. Head short, conical. Snout blunt. Mouth inferior, narrow, slightly arched. Eyes small, superior, in anterior part of head, not visible from below ventral surface of head. Lips thick, fleshy, continuous at angle of mouth ; lower lip interrupted in middle. Jaws and palate without teeth. Six barbels, one pair rostral, one or two maxillary, two pairs of barbel-like mental lobes. A large erectile, bifid suborbital spine below or in front of eyes. Dorsal fin inserted slightly ahead of pelvic fins, with eight or nine rays (six or seven branched) without any spine. Inner ray of *pectoral fin in males ossified as a flat osseous vertical plate-like structure.* Anal fin short, with seven or eight rays (five branched). Caudal fin truncate or slightly emarginate or forked (in one species). Scales small, covering the lateral and ventral sides of head besides body. Lateral line absent.

Distribution.—Throughout India, Pakistan. Nepal. Bangladesh. Viet-Nam.

KEY TO SUBGENERA†

1. Dorsal and pelvic fins inserted in second half of body. Scales present on head. ... *Lepidocephalus*

— Dorsal and pelvic fins inserted in first half of body. Scales absent on head. ... *Lepidocephalichthys*

Subgenus **Lepidocephalichthys**

Species.—

1. *L.* (*Lepidocephalichthys*) *annandalei* Chaudhuri*—India : Teesta river system, N. Bengal ; Garo hills, Meghalaya.
2. *L.* (*Lepidocephalichthys*) *berdmorei* (Blyth)—India : Manipur. Not recorded from the Brahmaputra drainage. Burma.
3. *L.* (*Lepidocephalichthys*) *caudofurcatus* Tilak and Hussain—India : Doon Valley, Saharanpur, Moradabad, U. P., Brahamputra drainage, Assam.
4. *L.* (*Lepidocephalichthys*) *dibruensis* Sen, 1979—India : Dibru river, Guijan, Dibrugarh, Assam.
5. *L.* (*Lepidocephalichthys*) *goalparensis* Pillai and Yazdani—India : Goalpara, Assam.
6. *L.* (*Lepidocephalichthys*) *guntea* (Hamilton)**—India : Throughout except Karnataka, Kerala and south of Krishna. Nepal. Bangladesh. Pakistan. Burma.
7. *L.* (*Lepidocephalichthys*) *thermalis* (Valenciennes)—India : S. India south of Krishna, Karnataka, Kerala. Sri Lanka.

Subgenus : *Lepidocephalus*

8. *L.* (*Lepidocephalus*) *irrorata* Hora—India : Kaziranga, Mikir hills, Meghalaya.

KEY TO SPECIES††

1. Scales present on vertex or top of head. Dorsal and pelvic fins inserted in second half of body. ... *L.* (*Lepidocephalus*) *irrorata*
— Scales absent on vertex or top of head. Dorsal and pelvic fins inserted in first half of body. 2

†After Nalbant, T. 1963.

**L. menoni* Pillai & Yazdani. 1976 is a synonym of this species (Tilak & Hussain, 1981. *Zool. Surv. India, Occ. Papers* No. 32).

***L.* (*Lepidocephalichthys*) *birmanicus* Rendahl is a synonym of this species.

††After Tilak & Hussain, 1981.

2.	Caudal fin forked or deeply emarginate. ...	*L. (Lepidocephalichthys) caudofurcatus*
—	Caudal fin truncate, lanceolate, rounded but not forked. ...	... 3
3.	16 scales present between back of body and anal fin base. ...	*L. (Lepidocephalichthys) goalparensis*
—	More than 25 scales present between back of body and anal fin base. ...	... 4
4.	40 scales present between anal fin base and back of body. Pectoral fin with 10 rays. ...	*L. (Lepidocephalichthys) berdmorei*
—	20-30 scales present between back and anal fin base. Pectoral fin with seven or eight rays. ...	... 5
5.	Caudal fin lanceolate. Suborbital spine with two convex side curves or elevations on the anterior side. ...	*L. (Lepidocephalichthys) dibruensis*
—	Caudal fin truncate or rounded. Suborbital spine without convex side elevations or curves on the anterior side. ...	... 6
6.	Two intensely dark spots encircled in white rings present on caudal fin. ...	*L. (Lepidocephalichthys) annandalei*
—	Only one dark spot present on caudal fin base. ...	... 7
7.	Head length 5.75-6.00. Body depth 8.17-9.71 in total length. ...	*L. (Lepidocephalichthys) thermalis*
—	Head length 6.00-6.75. Body depth 5.75-6.80 in total length. ...	*L. (Lepidocephalichthys) guntea*

Genus **Misgurnus** Lacépède

Misgurnus Lacépède, 1803, *Hist. Nat. Poissons*, **5**, p. 16 (type-species *Cobitis fossilis* Linnaeus by monotypy)

Diagnosis.—Body elongated, compressed. Abdomen rounded. Head relatively small. Snout conical. Mouth small, narrow, subinferior. Eyes small, superior, in anterior part of head, not visible from below ventral surface of head. Lips thick, fleshy, continuous at angle of mouth. Suborbital spine bifid, non-functional, situated under a layer of muscles. Jaws and palate without teeth. Six barbels, two rostral, two maxillary and two maxillo-mandibular. Two pairs of mental lobes very well developed. Dorsal fin inserted above pelvic fin, usually situated in second half of body, rarely in the middle, with nine branched rays, and without any spine. Anal fin short with seven or eight rays.

Caudal fin rounded. Scales visibly oval or rounded, imbricated, with small eccentric focal area ; they *do not cover sides of head. Lateral line very short not exceeding length of pectoral.*

Distribution.—Europe, Asia.

Species.—M. anguillicaudatus (Cantor)—N. E. Burma.

Order SILURIFORMES

Skin naked or with bony scutes or plates, never with true scales. Mouth not protractile, superiorly bordered by premaxillaries and dentaries, which are generally toothed ; maxillaries much reduced, toothless serving as bases of maxillary barbels. *Nearly always one to four pairs of barbels.* Adipose fin generally present. Symplectic, suboperculum, parietals, first and second pharyngobranchials, epipleural and epineural bones absent. Prevomer and or palatines may be toothed. Pharyngeal bones with small conical or villiform teeth. Branchiostegals 4 to 17. No pseudobranchiae. *Anterior vertebrae, second, third, fourth coossified to form "complex vertebra"* ; additional posterior vertebral centra may be frequently fused to or united by exceedingly tight joints with complex vertebra. Ribs attached to lower surface of long parapophyses. Supracleithrum complicated ; lower part deeply forked for reception of upper limb of cleithrum. Mesocoracoid may be present or absent. First pectoral, and dorsal rays modified as hard pungent spines or thick rays. Lateral line may be ramified, with or without short tubular ossicles enclosing the line. Pelvic fins abdominal in position. Air-bladder subdivided, reduced in many species.

An unusually well defined order, comprising approximately 30 families and about 2,000 species found in its entire range. Most are confined to freshwater, but some are marine.

Thirteen families and 48 genera are dealt with here.

KEY TO FAMILIES

1.	Adipose dorsal fin absent.	2
—	Adipose dorsal fin present as a smooth, short or long, high or low fin (exception *Clupisoma garua* (Hamilton), Schilbeidae) where it may be absent in adult.	6
2.	Head squarish in outline, much depressed, head and body with many dermal papillae. Anal fin short with 7—10 rays. ...	CHACIDAE
—	Head and body without any dermal papillae. Head obtuse, compressed. Anal fin long, with more than 40 rays.	3

3. Dorsal fin with a spine. Pelvic fin with 15 or 16 rays. ... PLOTOSIDAE
— Dorsal fin without any spine. Pelvic fin with six rays. 4

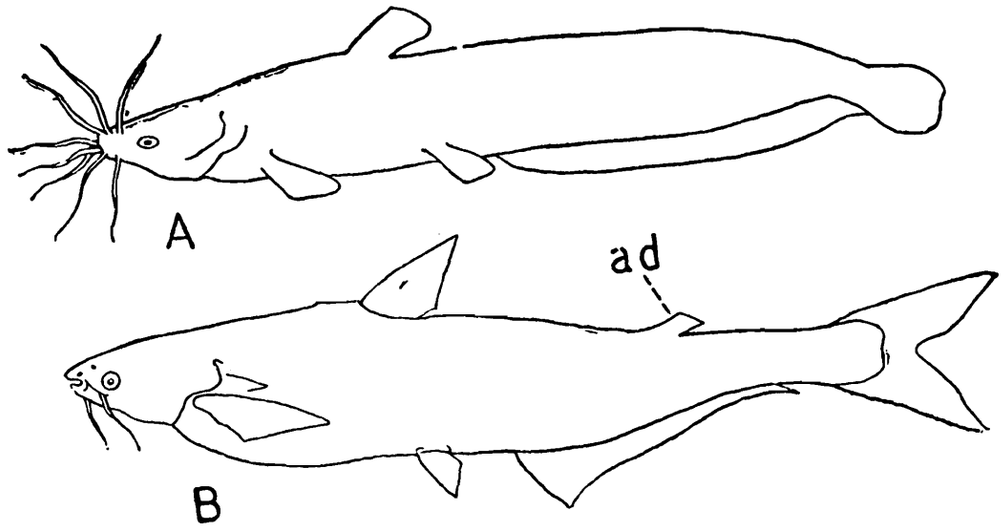


Fig. 74. Outline sketches of *Plotosus* and *Pangasius* to show presence or absence of adipose dorsal fin. (After Jayaram, K. C. 1977, fig. 2, p. 4).

4. Nasal barbels absent. No accessory respiratory organs present. ... SILURIDAE
— Nasal barbels present. Accessory respiratory organs present on gills or in the body cavity. 5

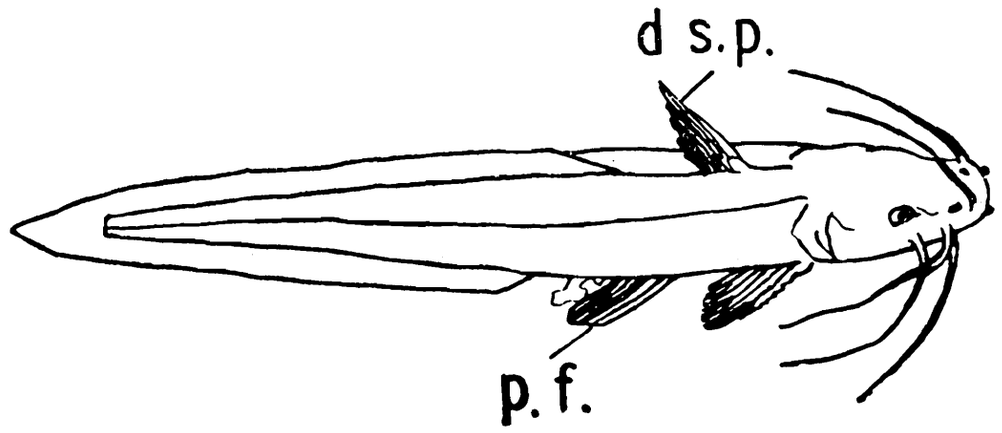


Fig. 75. Outline drawing of Plotosidae to show dorsal spine and pelvic fin. (After Jayaram, K. C. 1977, fig. 4, p. 5).

5. Dorsal fin long, with 23 to 76 rays. Accessory respiratory organs on gills present. ... CLARIIDAE
— Dorsal fin short, with 6 or 7 rays. Accessory respiratory organs as tubular air sacs in body cavity. ... HETEROPNEUSTIDAE

6. Nostrils close together, with very little interspace between the two. 7
— Nostrils wide apart, separated by some interspace. 9

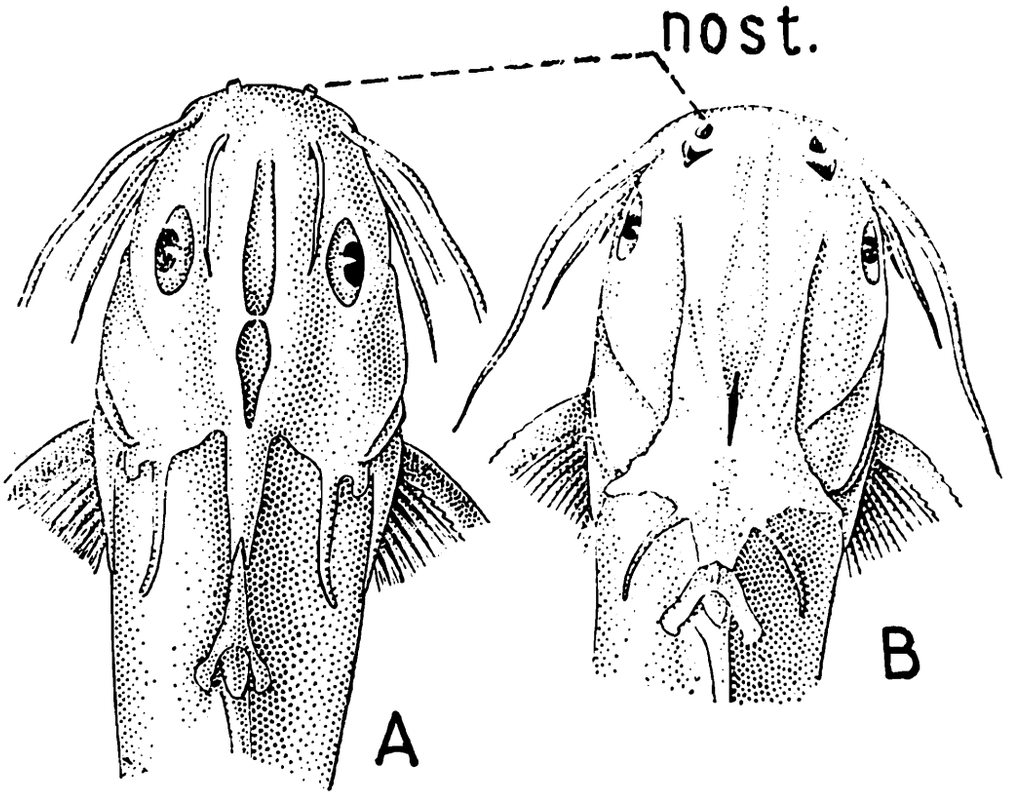


Fig. 76. Dorsal view of head and anterior part of body of A, *Mystus* and B, *Tachysurus* to show position of nostrils (After Jayaram, K. C. 1977. fig. 7, p. 7).

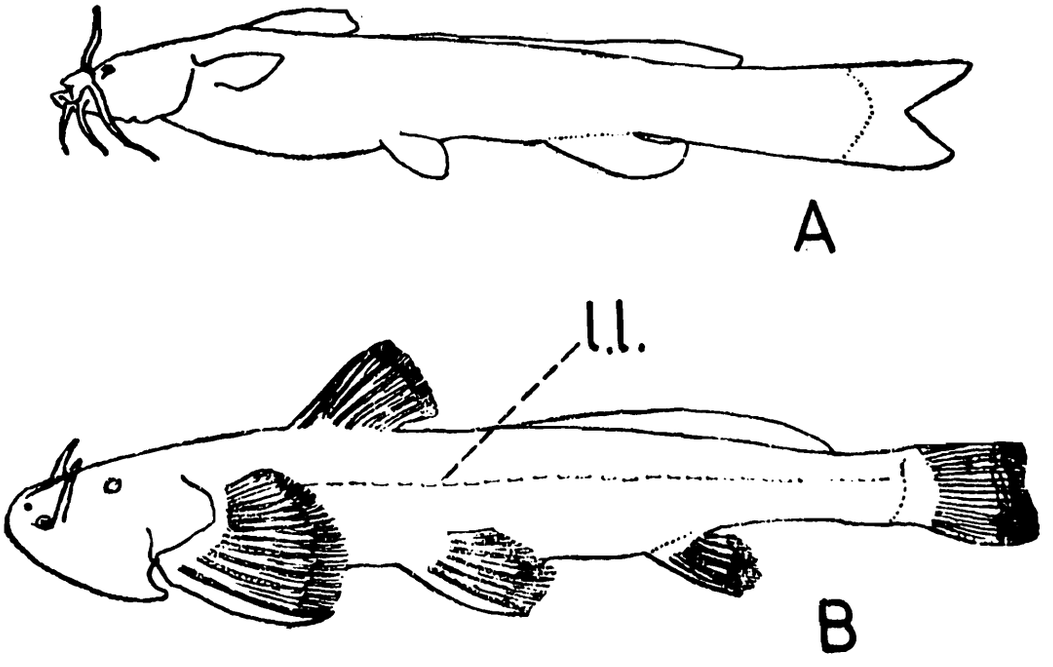


Fig. 77. Outline drawing of A, *Amblyceps mangois* and B, *Euchiloglanis sinensis* to show presence or absence of lateral line. (After Jayaram, K. C. 1977. fig. 8, p. 7).

7.	No nasal barbels present. Barbels two to six. Nostrils separated by a valve. ...	ARIIDAE
—	A pair of distinct nasal barbels present. Nostrils separated by a barbel. Barbels eight. ...	... 8
8.	Lateral line entirely absent. Gill membranes free from isthmus. ...	AMBLYCIPITIDAE
—	Lateral line always present. Gill membranes united with isthmus (exception *Bagarius* Hamilton). ...	SISORIDAE
9.	Dorsal spine absent (exception *Ailia* Swainson, Schilbeidae where dorsal fin itself is absent.) ...	OLYRIDAE
—	Dorsal spine present. ...	... 10
10.	Gill membranes united with each other and also with isthmus. ...	AKYSIDAE
—	Gill membranes free from each other and also from isthmus. ...	... 11

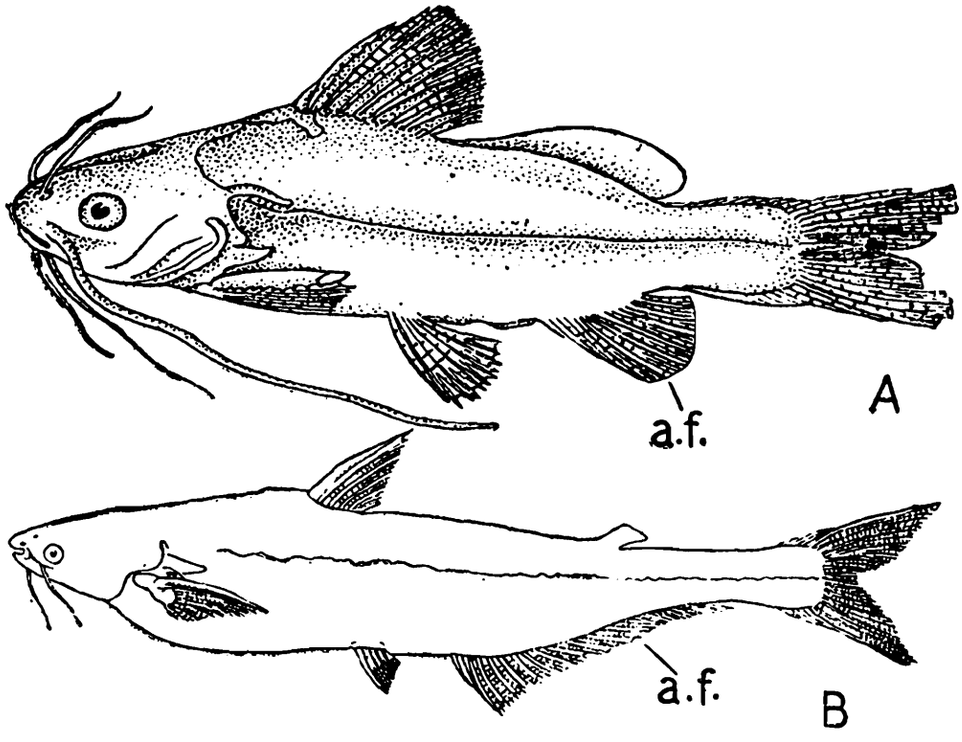


Fig. 78. Outline drawings of A, *Mystus blekeeri* (Day) and B, *Pangasius pangasius* (Ham.) to show relatlve lengths of anal fin. (After Jayaram, K. C. 1977, fig. 10, p. 8).

11.	Anal fin short with less than 20 rays (8-16) ; (exception *Horabagrus* Jayaram, from Kerala with 23-28 rays). ...	BAGRIDAE
—	Anal fin long with more than 20 rays (24-90). ...	... 12

12.	Nasal barbels always present ; (exception *Silonia* Swainson, with 40-46 rays and caniniform teeth on jaws). ...	SCHILBEIDAE
—	Nasal barbels absent. (Anal fin with 30-34 rays and villiform teeth on jaws). ...	PANGASIIDAE

Family BAGRIDAE

Generally large sized, more or less elongate fishes, with a compressed body. Teeth on premaxillaries, mandible and prevomer. Nostrils widely separated, above angle of mouth, anterior tubular on tip of snout, posterior nearer eye than tip of snout and with the nasal barbel. Barbels eight or six, generally well developed. Gill openings wide, extending to above base of pectoral fin, membranes free from each other and also from isthmus. Rayed dorsal fin short with six to eight rays and a spine. Adipose dorsal fin smooth; not confluent with either rayed dorsal or with caudal. Paired fins inserted horizontally. Pectoral fins with a strong spine, generally serrated. Anal fin short or moderately long, not confluent with caudal. Caudal fin forked or deeply emarginate. Lateral line present, generally complete.

Air-bladder large, free in the abdominal cavity, moderately thick-walled.

Lateral ethmoid facet for articulation of palatines more ventral than lateral, usually visible from underside of skull. Palatines rod-like. Endopterygoid absent. Ecto-metapterygoids present, variously developed. Metapterygoid may not be directly connected to hyomandibular. Prevomer large or small, dentigerous. Autopterotics and autosphenotics provide ventrally, articular facet for hyomandibular, but variable. Post-temporals present, united to skull by ligament. Mesocoracoid in pectoral girdle present.

Vertebrae 34 to 57.

Distribution.—Freshwaters of Asia, Africa, ranging from Africa through West Asia, Pakistan, India, Bangladesh, Sri Lanka, Burma, Thailand, Malaya, East Indies, Cambodia, Laos, Viet-Nam, China, Formosa, Japan, Korea and Manchuria.

Six genera are dealt with here.

KEY TO GENERA

1.	Anal fin short with less than 16 rays. Eyes superior, above angle of mouth, not visible from below.	2
—	Anal fin long, with 23 to 28 rays. Eyes inferior, along angle of mouth visible from below. ...	*Horabagrus* Jayaram

2. Pelvic fin with 6 rays. Teeth on palate entirely villiform, in bands. Four pairs of barbels. 3

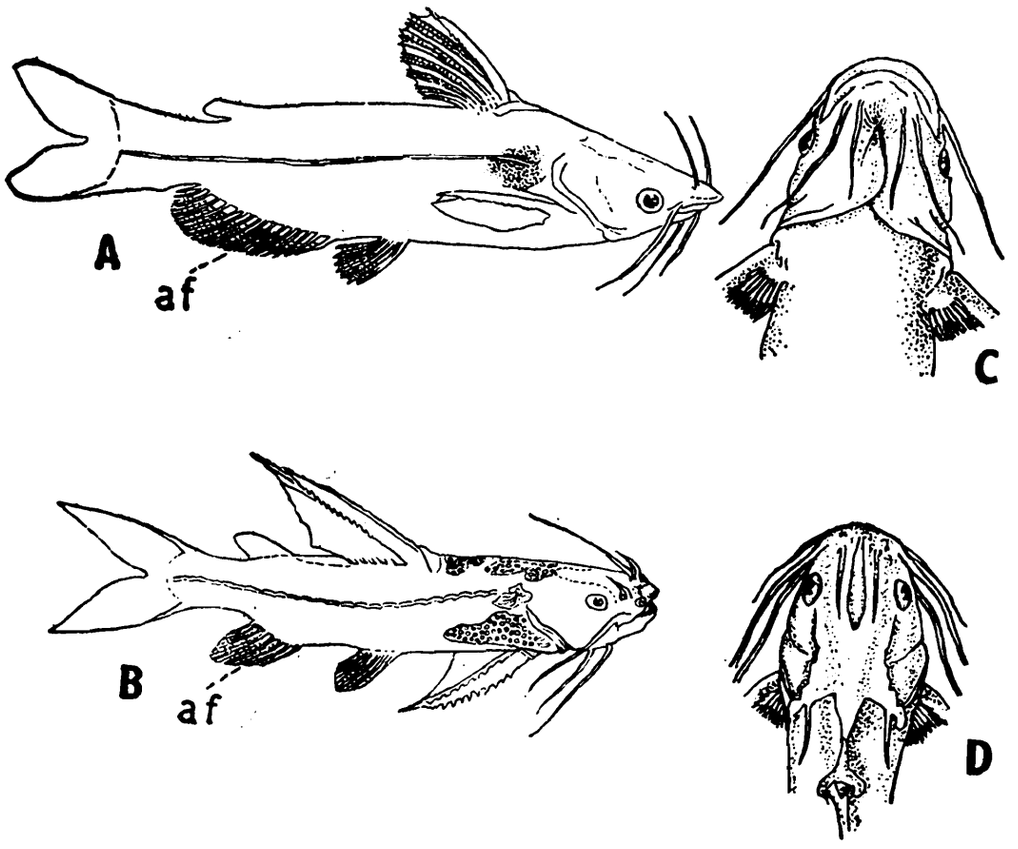


Fig. 79. Outline drawing of A, *Horabagrus brachysoma* (Günther) and B, *Rita rita* (Ham.) to show relative lengths of anal fin. C, D. to show position of eyes. (After Jayaram, K. C. 1977, fig. 11, p, 10).

— Pelvic fin with 7 or 8 rays. Teeth on palate mixed, villiform and molariform in patches. Three pairs of barbels. ... *Rita* Bleeker

3. Maxillary barbels reach beyond dorsal fin. No pores on ventral surface and sides of head. Teeth on lower jaw in a laterally prolonged, deeply curved band, separated in middle. 4

— Maxillary barbels reaching not beyond pectoral fin base. Pores on ventral surface and sides of head. Teeth on lower jaw laterally prolonged, but only slightly, band not separated in middle. 5

4. Interneural shield in between basal bone of dorsal fin and occipital process absent. ... *Mystus* Scopoli

— Interneural shield in between basal bone of dorsal fin and occipital process present. ... *Aorichthys* Wu

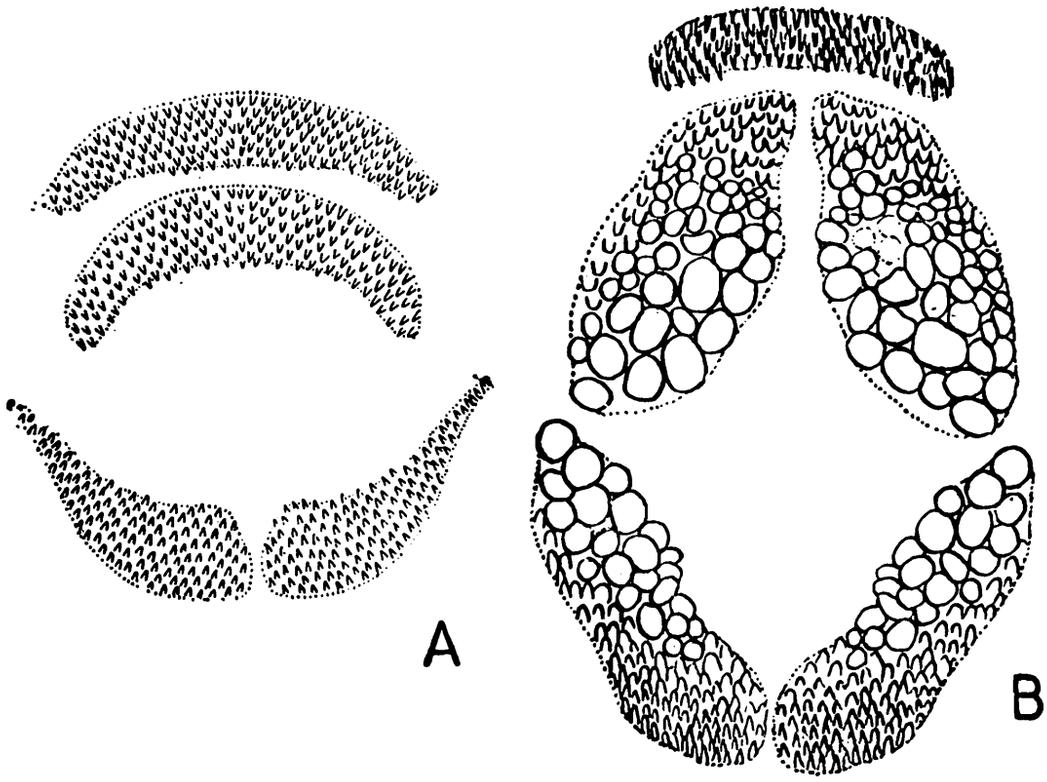


Fig. 80. Dentition of A, *Mystus leucophasis* (Blyth) B, *Rita rita* (Ham.) to show teeth pattern. (After Jayaram, K. C. 1977, fig. 12. p. 10).

5. Pectoral fins reach pelvic base. Eyes inferior, along angle of mouth, visible from below. ... *Chandramara* Jayaram

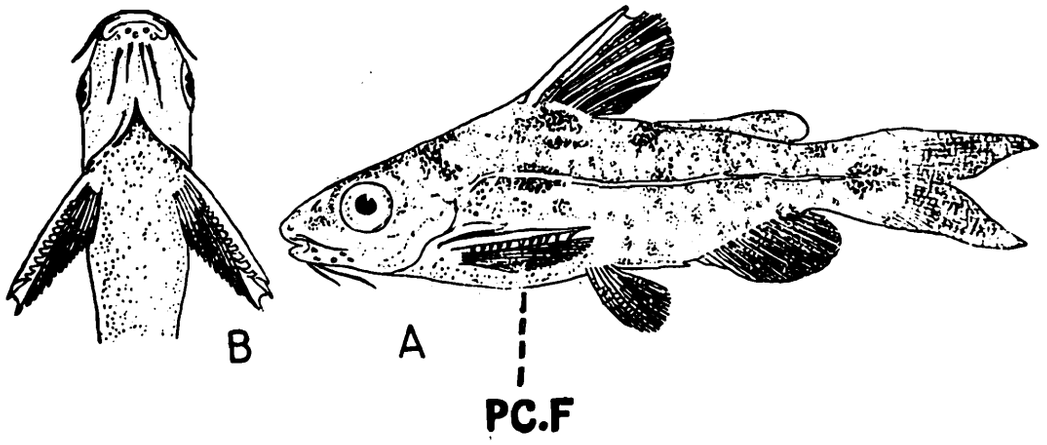


Fig. 81. *Chandramara chandramara* (Hamilton). A, lateral view to show long pectoral fin ; B, Ventral view of head to show low position of eyes. (After Jayaram, K. C. 1977, fig. 14, p. 11).

— Pectoral fins do not reach pelvic base. Eyes superior above angle of mouth, generally not visible from below. ... *Batasio* Blyth

Genus **Rita** Bleeker

Rita Bleeker, 1859, *Acta Soc. Sc. Indo-Neerl.*, **4**, p. 60 (type-species, *Pimelodus rita* Hamilton, by tautonymy).—Jayaram, 1966, *Int. Rev. ges Hydrobiol.*, **51**, (3), p. 434 (revision of genus).

Gogra Day, 1867, *Proc. zool. Soc. Lond.*, p. 563 (type-species, *Gogrius sykesi* Day, by monotypy).

Diagnosis.—Body short, compressed. Abdomen rounded. Head large, depressed. Snout obtuse. Mouth subterminal, transverse, moderately wide. Eyes moderate, dorsolateral, not visible from below ventral surface. Lips thin, occasionally fimbriate ; jaws subequal. Teeth villiform. *Three pairs of barbels, one pair each of maxillary, nasal and only one of mandibular : nasal barbels minute or small with a valve-like base.* Rayed dorsal fin inserted above half of pectoral fin with six

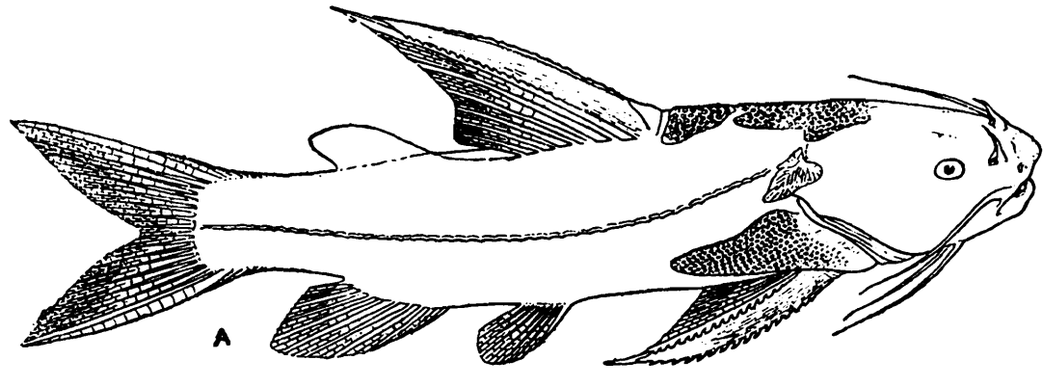


Fig. 82. Lateral view of *Rita rita* (Hamilton).

or seven rays and a spine. Adipose dorsal fin low, short. Pectoral fins with seven to ten rays, and a spine serrated along both the edges. *Pelvic fins with seven or eight rays.* Anal fin short, with 8 to 13 rays. Caudal fin forked. *Lateral line with well developed scutes along anterior quarters*, rather uniformly distinguishable in all species.

Distribution.—India. Pakistan. Nepal. Bangladesh. Burma and Yunnan. The southern limit in India is the Krishna river system.

Species.—

1. *R. chrysea* (Day)—India : Mahanadi river system, Orissa.
2. *R. gogra* (Sykes)—India : rivers of Deccan up to Krishna river system.
3. *R. kuturnee* (Sykes)—India : Krishna, Godavary river systems. Burma : Irrawaddy river.
4. *R. rita* (Hamilton)—India : most rivers of north India. Pakistan. Nepal. Bangladesh. Burma. Yunnan.

KEY TO SPECIES

1. Teeth on palate in one patch. 2
— Teeth on palate in two patches. 3
2. Teeth on prevomer uniformly molariform (mol. in fig). Premaxillary band of teeth 1.0 to 1.5 times as long as broad. ... *R. chrysea*
— Teeth on prevomer mixed with molariform and villiform (Vli. in fig.). Premaxillary band of teeth 3.5 to 4.0 times as long as broad. ... *R. gogra*

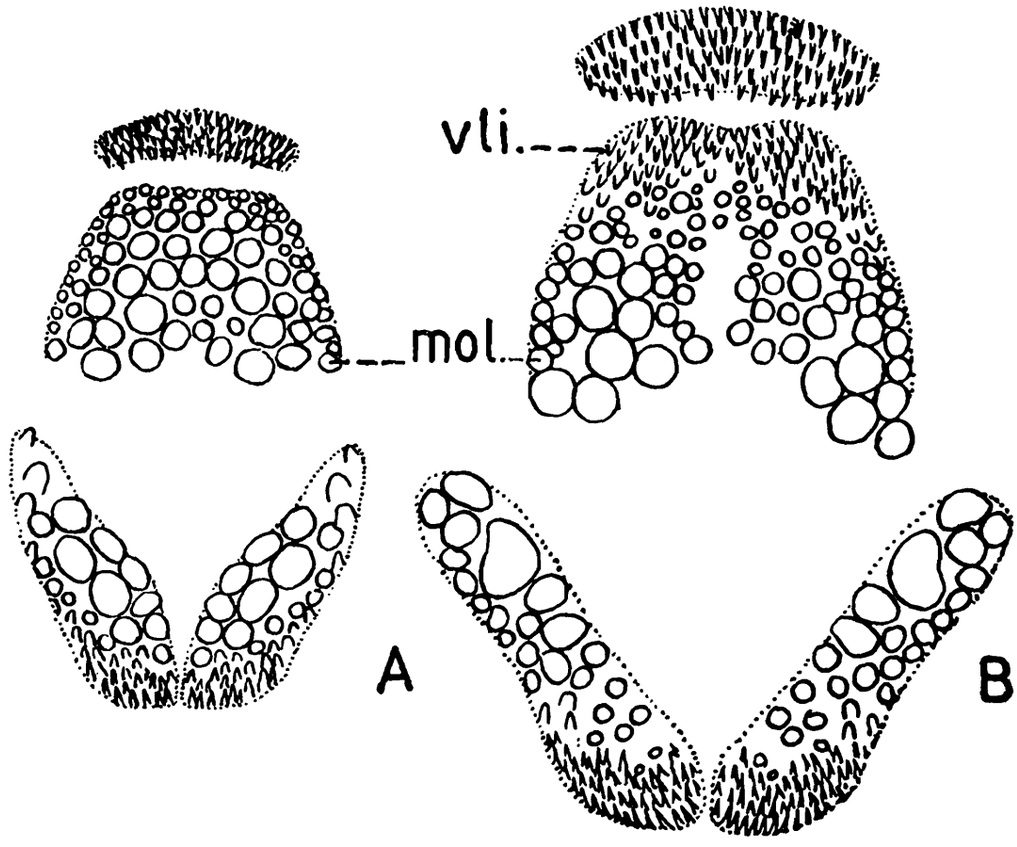


Fig. 83. Dentition in A, *Rita chrysea* Day ; B, *Rita gogra* (Sykes). (After Jayaram, K. C. 1977, fig. 16, p. 13).

3. Teeth on palate in two pear-shaped patches. ... *R. kuturnee*
— Teeth on palate in two elliptical patches. ... *R. rita*

Genus **Batasio** Blyth

Batasio Blyth, 1860, *J. Asiat. Soc. Bengal*, **29**, p. 149 (type-species, *Pimelodus batasio* Hamilton, by original designation).—Hora & Law 1941, *Rec. Indian Mus.*, **43**, p. 28 (see for synonymy, revision).

Rama Bleeker, 1862, *Atlas Ichthyol. Indici prodr.* **2**, Siluri, p. 8 (type-species, *Pimelodus rama* Hamilton, by original designation ; genus proposed provisionally).

macronoides Hora, 1921, *Rec. Indian Mus.*, 22, p. 179 (type-species, *Macronoides affinis* (Blyth), as a subgenus).

Description.—Body short, high and compressed. Abdomen rounded. Head small, compressed, conical, *with pores ventrally and on sides.* Snout

rounded or slightly pointed. Mouth inferior, crescentic, horizontal, not wide. Eyes moderate, dorso-lateral, in middle part of head, not

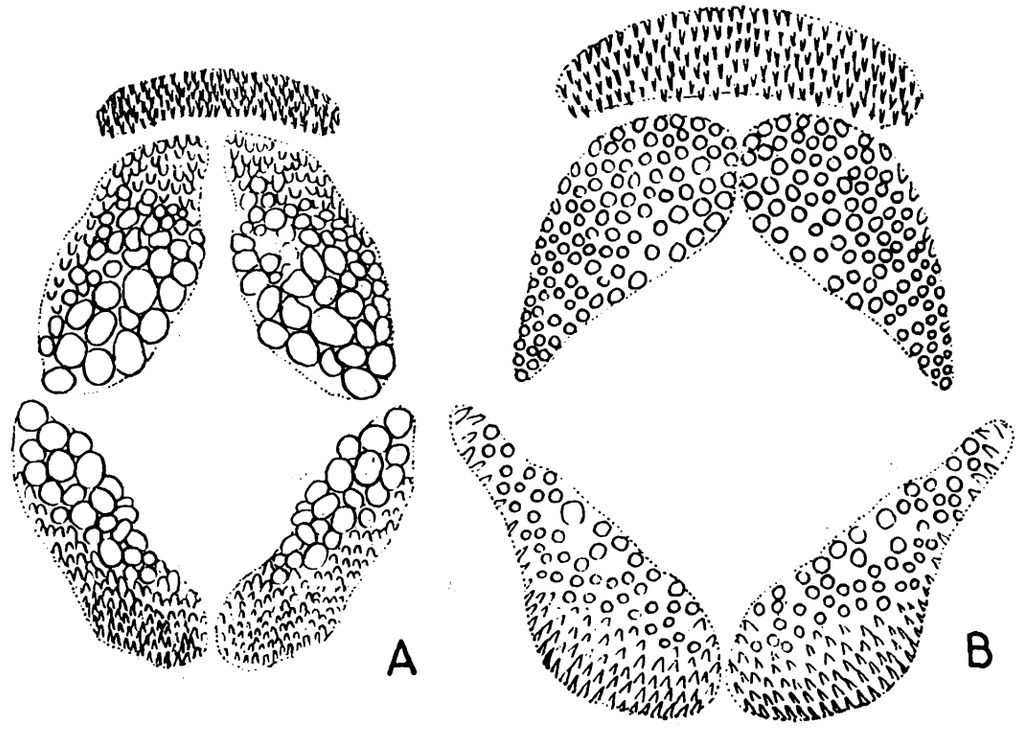


Fig. 84. Dentition in A, *Rita rita* (Hamilton) ; B, *Rita kuturnee* (Sykes). (After Jayaram, K. C. 1977, fig. 17, p. 13).

visible from below ventral surface. Lips fleshy, fimbriated. Jaws subequal or slightly overhanging. Teeth uniformly villiform in bands

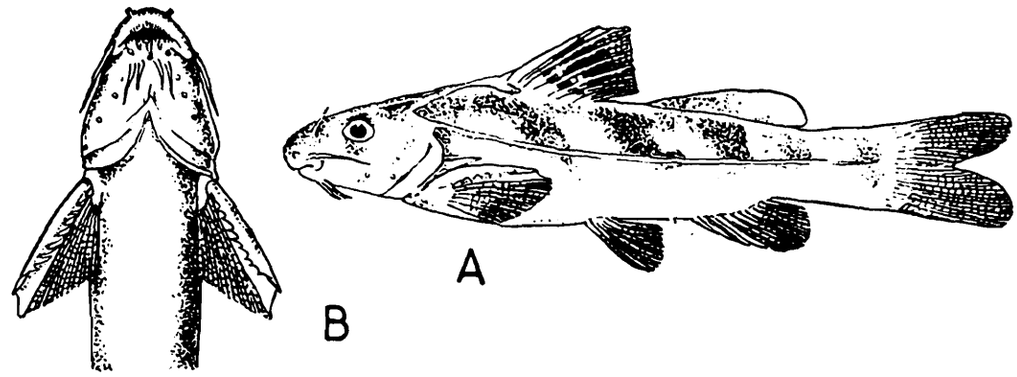


Fig. 85. *Batasio tengana* (Hamilton). A, Lateral view ; B, Ventral view. (After Jayaram, K. C., 1977, fig. 15, p. 12).

on jaws and palate ; *band on lower jaw continuous*. Four pairs of barbels ; one each of maxillary, nasal and two of mandibular, *all generally not extending beyond head*.

Rayed dorsal fin inserted above three-fourth of pectoral fin anteriorly, with seven or eight rays and a spine. Adipose dorsal fin low, of varying length. Pectoral fins with five to nine rays, and a spine serrated along inner edge with antrorse teeth. Pelvic fins with six rays. Anal fin short, with 12 to 15 rays. Caudal fin forked or deeply emarginate. Lateral line complete, with some sensory pores anteriorly.

Distribution.—India : Assam, North Bengal, Kerala. Bangladesh : northern parts. Thailand and Malaysia.

Species.—

1. *B. batasio* (Hamilton)—India : Teesta river system, North Bengal. Bangladesh.
2. *B. tengana* (Hamilton)—India : North Bengal. Bangladesh : northern part. Burma. Thailand. Malaysia.
3. *B. travancoria* Hora & Law—India : Pamba, Kallada, Chittar rivers in the Anaimalai hill range, Kerala.

KEY TO SPECIES

1. Occipital process reaching basal bone of dorsal fin. 2

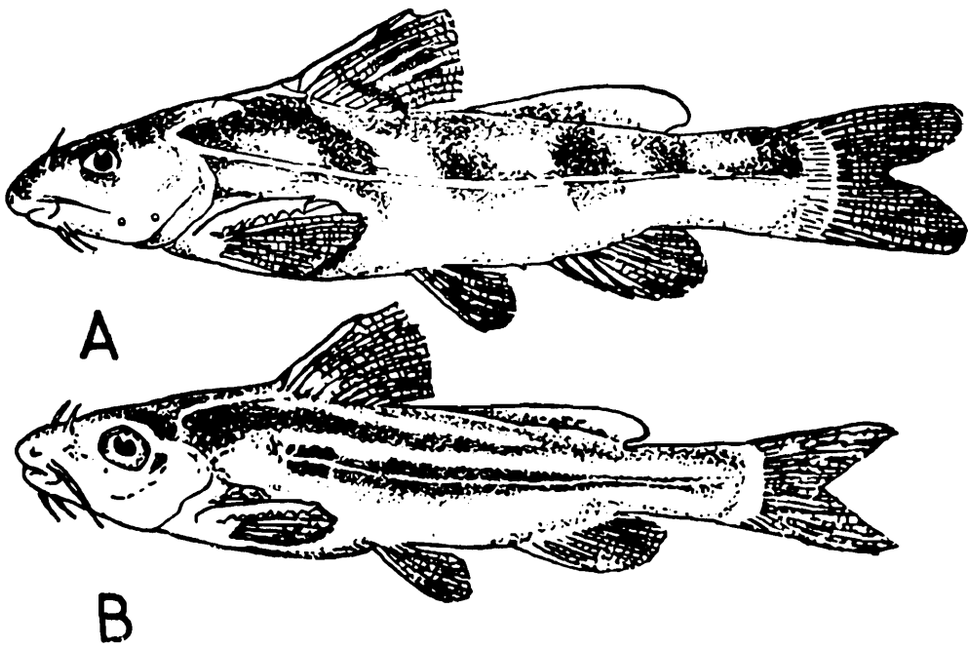


Fig. 86. Lateral view of A, *Batasio tengana* (Hamilton) ; B, *Batasio batasio* (Hamilton). (After Jayaram, K. C. 1977, fig, 18, p. 16).

— Occipital process not reaching basal bone of dorsal fin. ... *B. travancoria*

2. Body with longitudinal bands on either side of lateral line as in *Mystus vittatus* (Bloch). A black spot on shoulder. ... *B. batasio*

— Body with oblique, saddle shaped bands. A black spot on nape. ... *B. tengana*

Genus **Chandramara** Jayaram

Chandramara Jayaram, 1972, *Int. Revue ges. Hydrobiol.*, **57** (5), p. 816 (type-species, *Pimelodus chandramara* Hamiltion, by original designation).

Diagnosis.—Body short, compressed, *speckled with dots.* Abdomen rounded. Head small, compressed, pores on ventral surface and also along sides. Snout obtusely rounded. Mouth subterminal moderately wide. *Eyes large, inferior, visible from below ventral surface of head.* Four pairs of barbels ; one each of maxillary, nasal and two of mandibular, all shorter than head.

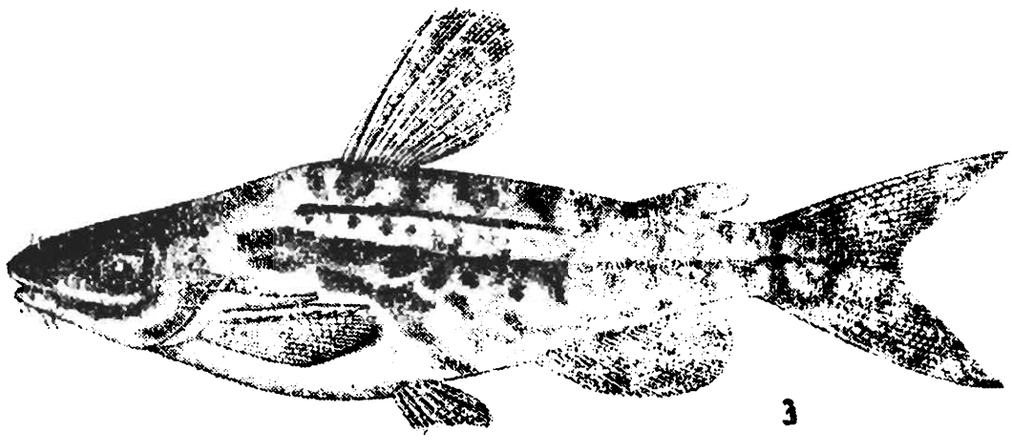


Fig. 87. Lateral view of *Chandramara chandramara* (Hamilton). (After Jayaram, K. C. 1971. *Rec. zool. Surv. India*, **65** (1-4), pl. 1. fig. 3).

Rayed dorsal fin inserted above termination of cleithral process, with seven rays and a spine. Adipose dorsal fin short smooth, posteriorly free. *Pectoral fins with five or six rays, with outermost ray long, reaching pelvic fin base, occasionally with a prolongation,* pectoral fin rays very slender, often damaged. Pectoral spine strong, serrated along inner edge with antrorse teeth. Pelvic fins with six rays. *Anal fin short, with 13 to 17 rays.* Caudal fin forked, lobes equal. Lateral line complete, with a few pores above pectoral fin base.

Distribution.—India : North Bengal, Assam. Known so far only by its type-species.

Species.—Chandramara chandramara (Hamilton) is the only species so far known.

Genus **Horabagrus** Jayaram

Horabagrus Jayaram, 1955, *Bull nat. Inst. Sci. India*, No. 7, p. 261 (type-species, *Pseudobagrus brachysoma* Günther, by original designation).—Jayaram, 1966, *Int. Revue ges. Hydrobiol.*, **51** (3), p. 447 (description).

Diagnosis.—Body moderately elongated, compreased. Abdomen rounded. Head large, anteriorly depressed. Snout obtusely rounded. Mouth subterminal, transverse, wide. *Eyes large, inferior, along angle of mouth, visible when viewed from below.* Lips thin, plain. Teeth uniformly villiform on jaws and palate. Four pairs of barbels, one each of maxillary, nasal, and two of mandibular.

Rayed dorsal fin inserted above half of pectoral fin, with five to seven rays and a spine. Adipose dorsal fin low, short. Pectoral fins

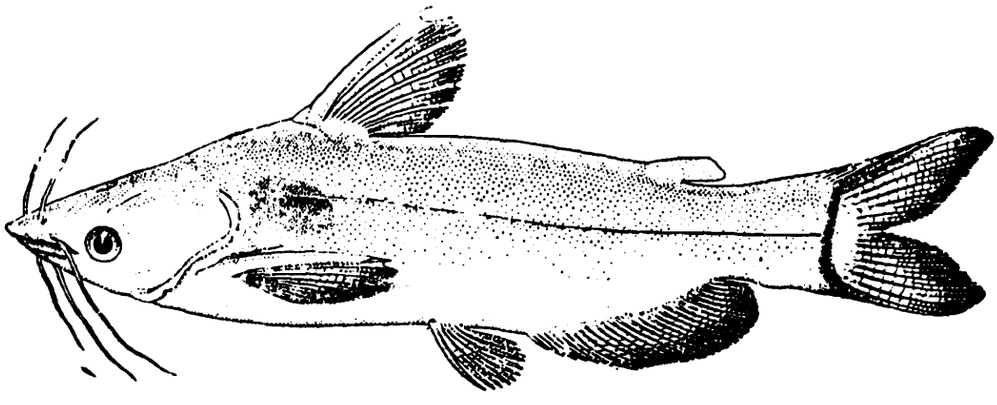


Fig. 88. Lateral view of *Horabagrus brachysoma* Günther.

with eight or nine rays, and a spine serrated along inner edge with antrorse teeth. Pelvic fins with six rays. *Anal fin long, with 23 to 28 rays.* Caudal fin forked or deeply emarginate. Lateral line complete, simple.

Distribution.—India : backwaters of Kerala State. The northern limit is Kanara and the southern limit is Neyyatinkara near Trivandrum.

Species.—*Horabagrus brachysoma* Günther—distribution as of genus.

Genus **Mystus** Scopoli

Mystus Scopoli, 1777, *Introductio ad historiam naturalem*, p. 451 (type-species, *Bagrus halepensis* Valenciennes = *Mystus pelusius* (Solander), by subsequent selection).—Jayaram, 1959, *Proc. First All India Congr. Zool.* part 2, p. 633 (see for synonymy, nomenclature).—Jayaram, 1966, *Int. Revue ges. Hydrobiol.*, **51** (3), p. 444 (list of valid species, generic composition).

Description.—Body short, or moderately elongated, compressed. Abdomen rounded. Head of moderate size, compressed. Snout rounded or obtuse. Mouth terminal, transverse, moderately wide. Eyes moderately large, supralateral, in anterior part of head not visible from

below ventral surface. Lips thin. Jaws subequal. Teeth uniformly villiform in bands on jaws and palate ; that on latter always uninterrupted (exception *M. horai*). Four pairs of barbels, one each of maxillary, nasal and two of mandibular, generally longer than head.

Rayed dorsal fin inserted above last quarter of pectoral fin, with seven rays and a spine. Adipose dorsal fin low, of varying length. Pectoral fins with 6 to 10 rays, and a spine serrated along inner edge with antrorse teeth. Pelvic fins with six rays. *Anal fin short, with 9 to 16 rays.* Caudal fin forked. Lateral line complete, simple. An axillary pore generally present.

Distribution.—Syria in West Asia through India, Nepal, Pakistan to Sri Lanka in south, through Bangladesh, Burma, Thailand, Indo-China, Malaysia to East Indies and China in the east. A few species enter the seas and estuaries.

Species.—

1. *M. armatus* (Day)—India : Wynaad range of hills, Western Ghats. Burma
2. *M. bleekeri* (Day)—India : generally confined to north India : the southernmost limit being the Mahanadi headwaters, recorded by Hora (1940) where it is rare. Commonly found up to West Bengal only. Pakistan. Nepal. Bangladesh. Burma.
3. *M. cavasius* (Hamilton)—India. Pakistan. Bangladesh. Burma. Thailand. Malaysia. Java. Sumatra. Borneo.
4. *M. gulio* (Hamilton)—India. Pakistan. Bangladesh. Burma. Thailand. Sri Lanka. Malaysia. Java. Sumatra. Borneo. Found in the seas, estuaries and tidal waters.
5. *M. horai* (Jayaram)—West Pakistan : River Indus, Kalabagh. Not recorded from elsewhere.
6. *M. keletius* (Valenciennes)—India : Tamil Nadu, Kerala, Karnataka, Western Ghats. Sri Lanka.
7. *M. leucophasis* (Blyth).—Burma : Sittang and other rivers.
8. *M. malabaricus* (Jerdon)—India : Western Ghats from Kerala, Karnataka, Maharashtra.
9. *M. menoda menoda* (Hamilton)—India : Orissa, W. Bengal, Assam. Bangladesh. Burma.

9. 1. *M. menoda trachacanthus* (Valenciennes)—India : W. Bengal, Bombay.

10. *M. microphthalmus* (Day)—Burma : along the valley of Irrawaddy river.
11. *M. montanus* (Jerdon)—India : Kerala State, Wynaad range of hills ; Madhya pradesh, Hoshangabad dist., Assam.
12. *M. oculatus* (Valenciennes)—India : Kerala, Tamil Nadu, Coimbatore district.
13. *M. peguensis* (Boulenger)—Burma : Sittang river near Toungoo.
14. *M. pulcher* (Chaudhuri)—Burma : Bhamo close to Yunnan border ; small muddy streams along Kaminng Jade Mines Road, Myitkyina dist.
15. *M. punctatus* (Jerdon)—India : Bhavani river at base of Nilgiri hills, Karnataka and Kerala States.

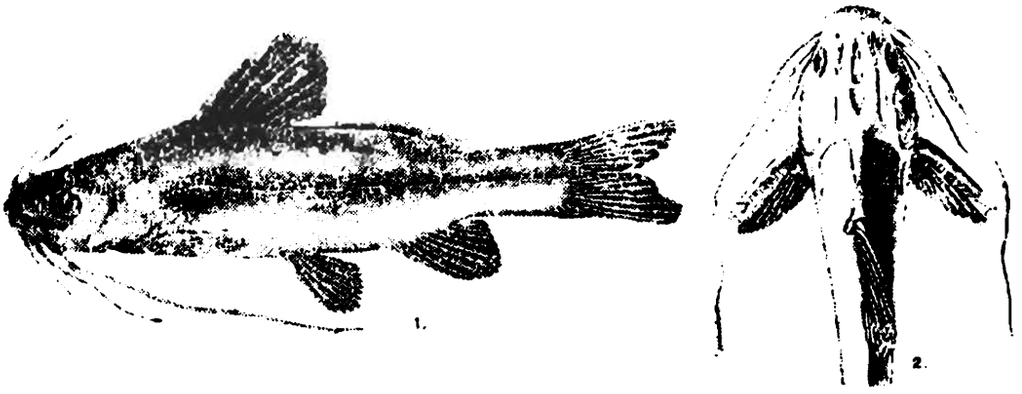


Fig. 89. *Mystus horai* Jayaram. A, Lateral view ; B, Dorsal view of head and body. (After Jayaram, K. C. 1955. *Rec. Indian Mus.*, 51 (4), pl. 19).

16. *M. rufescens* (Vinciguerra)—Burma : Meetan.
17. *M. tengara* (Hamilton)—India : mainly all through north India. Bangladesh. Pakistan.
18. *M. vittatus* (Bloch)—Throughout India, Pakistan, Nepal, Burma, Malaya, Thailand, Sri Lanka. A widely distributed species occurring within tidal influence also.

KEY TO SPECIES

1.	Occipital process reaching basal bone of dorsal fin. ...	...	2
—	Occipital process not reaching basal bone of dorsal fin. ...	...	10
2.	Adipose dorsal fin commencing almost after rayed dorsal fin. ...	...	3
—	Adipose dorsal fin short, commencing after an interspace from rayed dorsal fin. ...	...	6

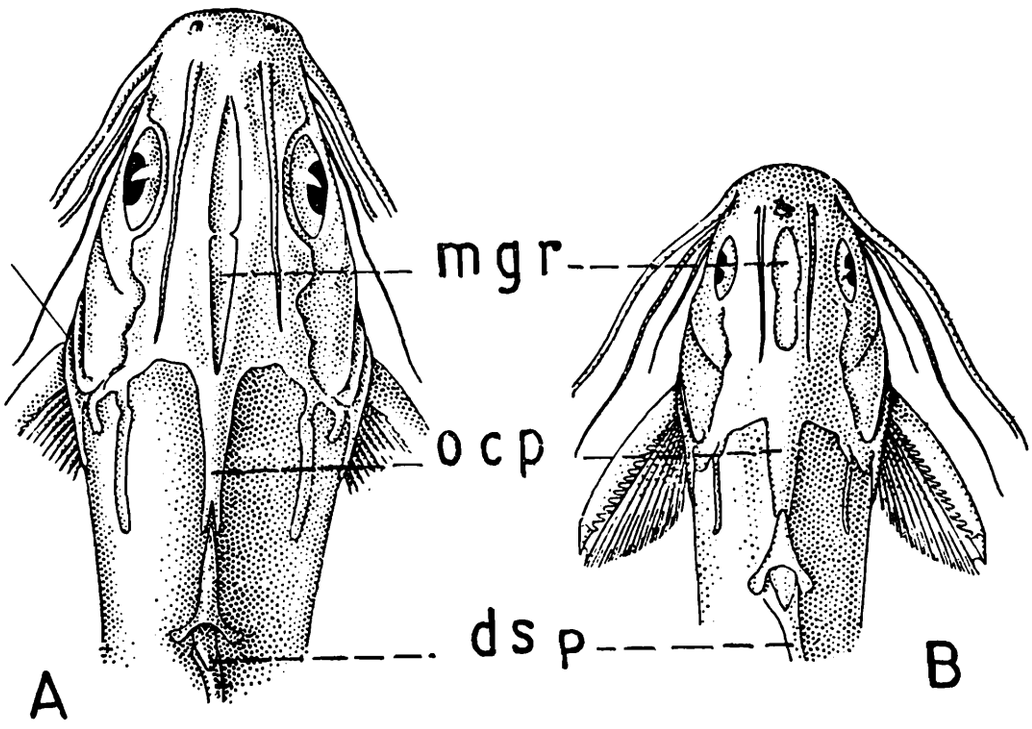


Fig. 90. Dorsal view of head and body of *Mystus* species to show A, Occipital process reaching basal bone of dorsal fin ; B, Occipital process not reaching basal lone of dorsal fin. (After Jayaram, K. C. 1977, fig. 19, p. 22).

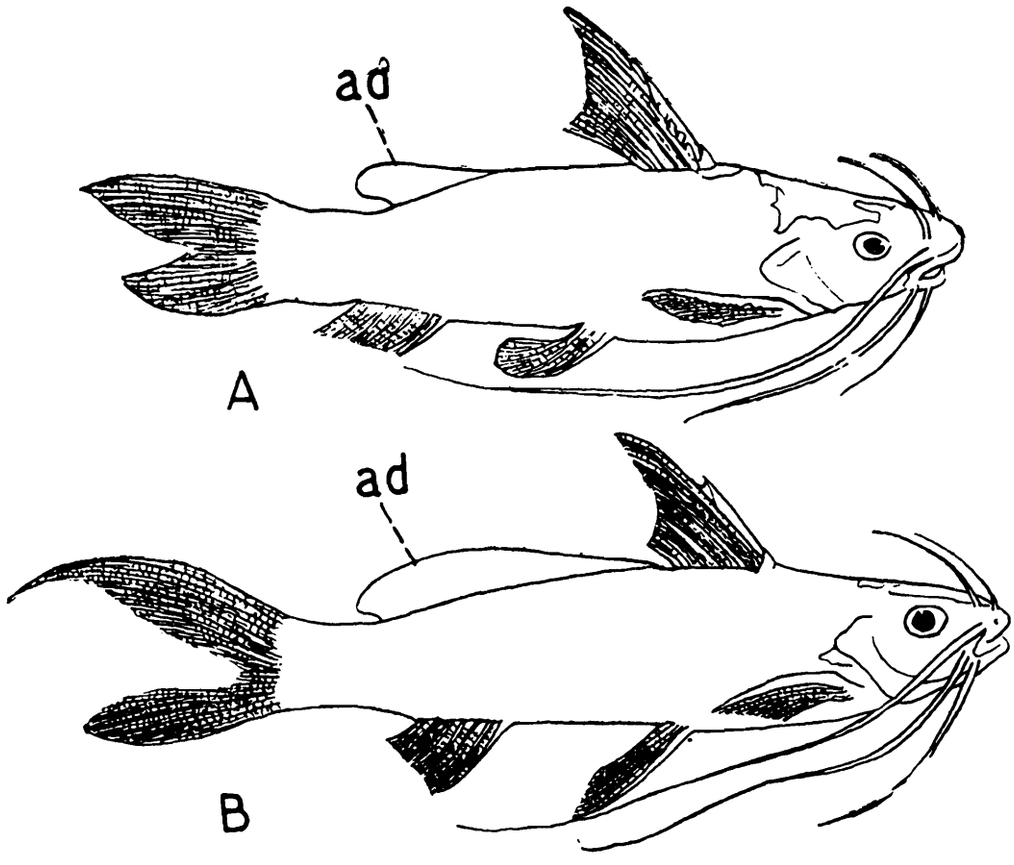


Fig. 91. Outline diagrams of *Mystus* species to show relative lengths of adipose dorsal fin. (After Jayaram, K. C. 1977, fig. 20, p. 22).

3. Caudal peduncle constricted, its least height about 3 times in its length. ... *M. horai*

— Caudal peduncle not constricted, its least height about 2 times in its length. 4

4. Maxillary barbels reach base of pelvic fins. Head length not more than 4 times in total length. ... *M. tengara*

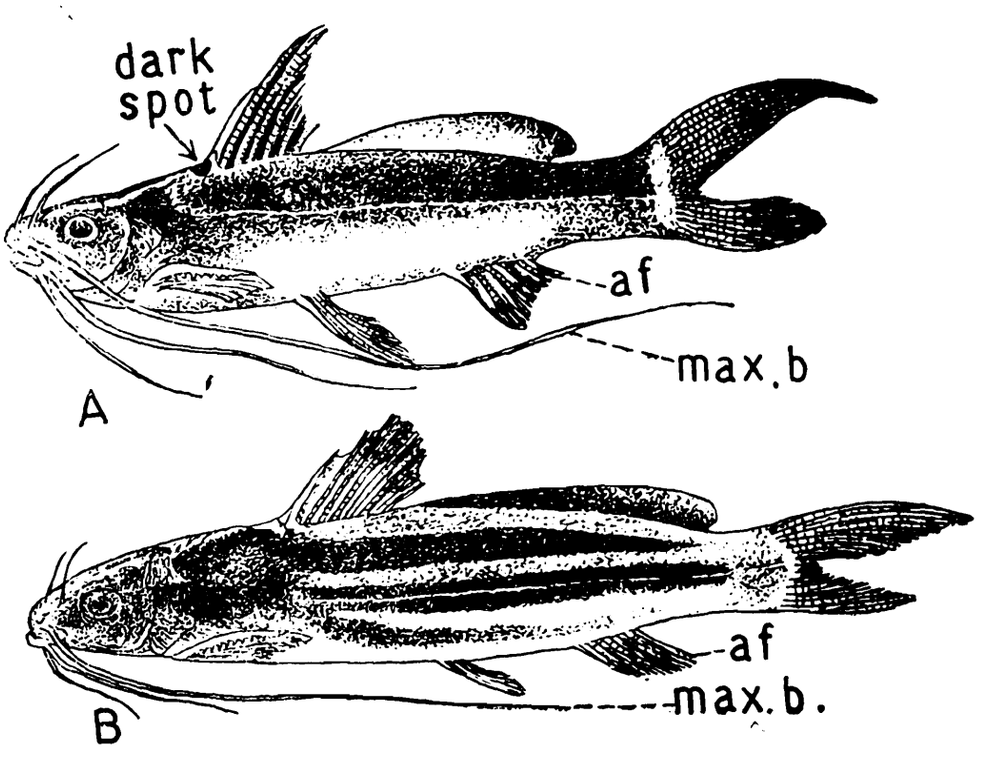


Fig. 92. Lateral view of A, *Mystus oculatus* (Hamilton) ; *Mystus bleekeri* (Day) to show colour spots, and bands. (After Jayaram, K. C. 1977, fig. 21, p. 23).

— Maxillary barbels reach anal fin or beyond. Head length more than 5 times in total length. 5

5. Maxillary barbels reach anal fin. Interorbital width less than 3.0 (2.0 to 3.0) in head length. No dark spot at base of dorsal fin. ... *M. bleekeri*

– Maxillary barbels reach caudal fin base or beyond. Interorbital width more than 3.0 (3.0 to 4.0) in head length. A dark spot at base of dorsal fin. ... *M. carasius*

6. Median longitudinal groove on head short, as two fontanelles, reaching base of occipital process. Adipose dorsal fin base longer than anal fin base. ... *M. oculatus*

— Median longitudinal groove on head short, or long, as one or two fontanelles, not reaching base of occipital process. Adipose dorsal fin base shorter than anal fin base. 7

7. Body plain, without any colour bands. 8

— Body with one or two longitudinal colour bands on either side of the lateral line. 9

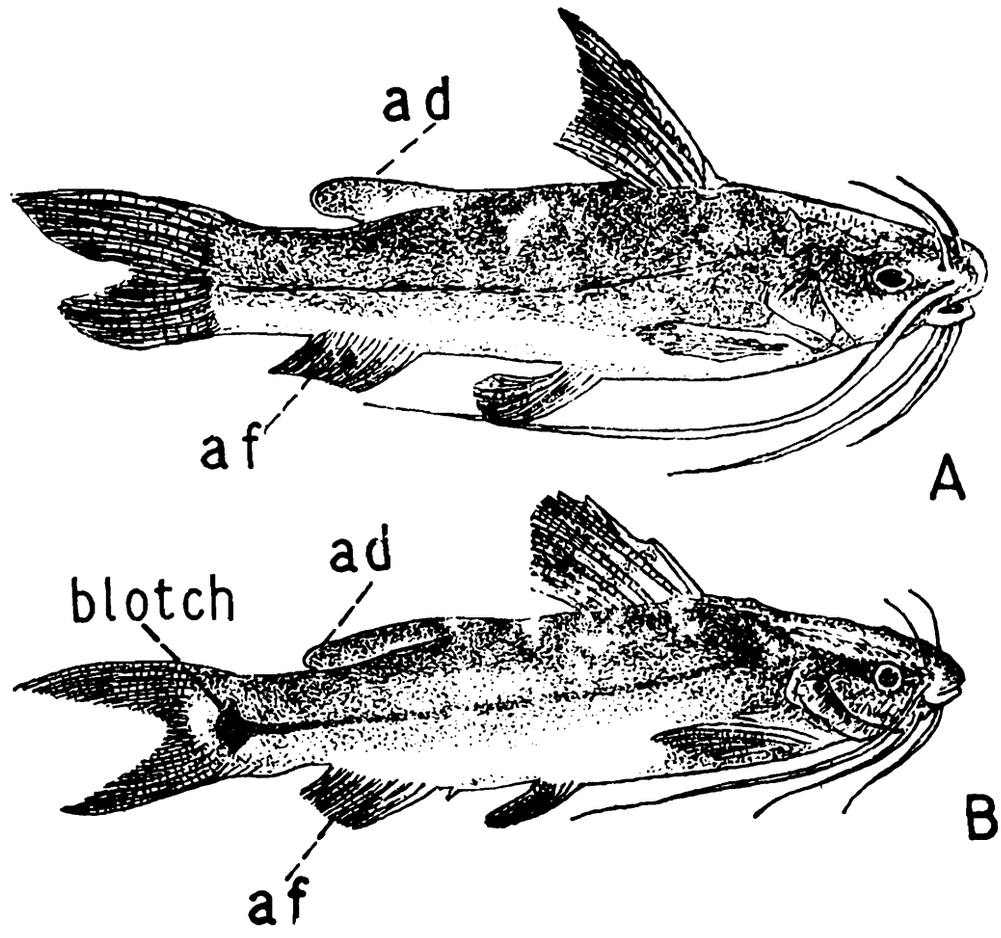


Fig. 93. Lateral views of A, *Mystus gulio* (Hamilton), and B, *Mystus armatus* (Day) to show extent of adipose fin, colour spot. (After Jayaram, K. C. 1977, fig. 23, p. 25).

8. Body plain. Occipital crest rugose. No blotch at base of caudal fin. Adipose dorsal fin base shorter than or equal to anal fin base. Median longitudinal groove short, extending slightly beyond posterior border of orbit. ... *M. gulio*

— Body plain. Occipital crest smooth. A dark blotch at base of caudal fin. Adipose dorsal fin base longer than anal fin base. Median longitudinal groove extending beyond posterior border of orbit, and nearly reaching base of occipital process. ... *M. armatus*

9. Eye diameter 3.5 to 4.0 in head length. Pectoral fin with six rays. Body with a bluish shoulder spot, and a silvery line along the side ending in a dark spot at base of caudal ; one or two light bands along sides above lateral line. ... *M. montanus*

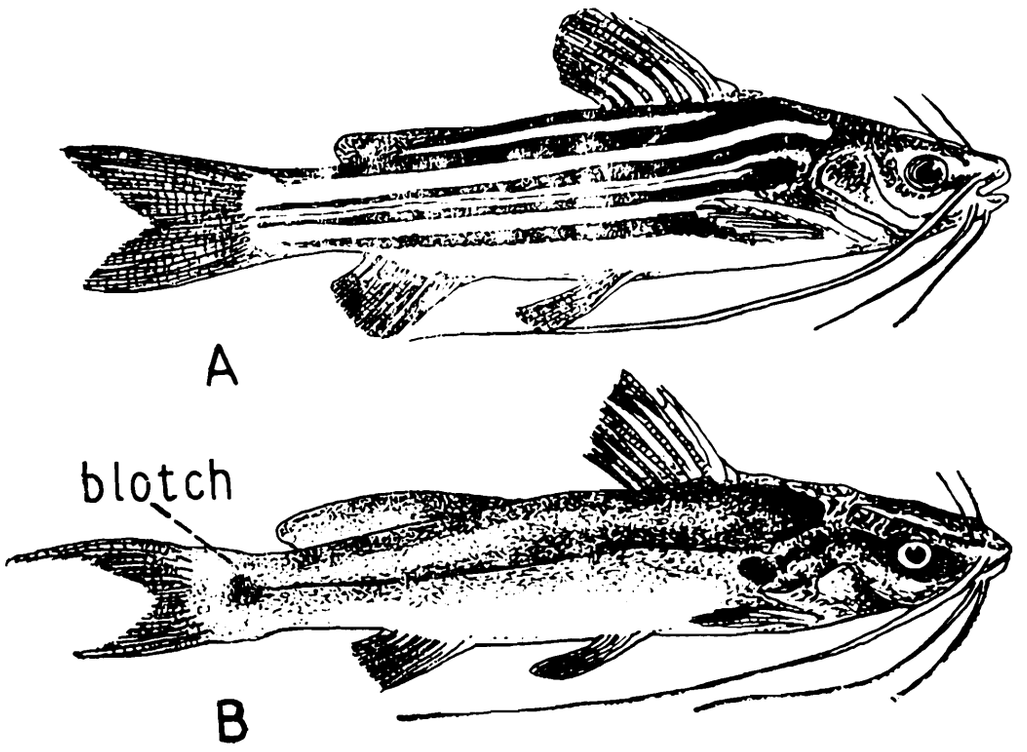


Fig. 94. Lateral view of A, *Mystus vittatus* (Bloch) and B, *Mystus montanus* (Jerdon) to show colour pattern. (After, Jayaram, K. C. 1977, fig. 24, p. 25).

— Eye diameter 4.5 to 5.0 in head length. Pectoral fin with nine rays. Body with 3 or 4 longitudinal colour bands above and below lateral line. A dark shoulder spot. No spot at base of caudal fin. ... *M. vittatus*

10. Median longitudinal groove on head reaching base of occipital process. 11

— Median longitudinal groove on head not reaching base of occipital 'process. 12

11. Ten black rounded solid spots along lateral line. Body depth 7.8. to 8.4 in standard length. *M. punctatus*

— Several clusters of small vertical spots along anterior half of lateral line. Body depth 4.4 to 5.0 in standard length. ... *M. menoda menoda*

12. Similar to *M. menoda menoda*, but with lower lobe of caudal fin prolonged into a filament. ... *M. menoda trachacanthus*

— Unlike *M. menoda menoda* and with lower lobe of caudal fin not prolonged, ... 18

13. Occipital process long, 5.0 times longer than wide at base. Body depth about 4.0 times in standard length. A light band above and below lateral line. No spot at base of caudal fin. ... *M. keletius*

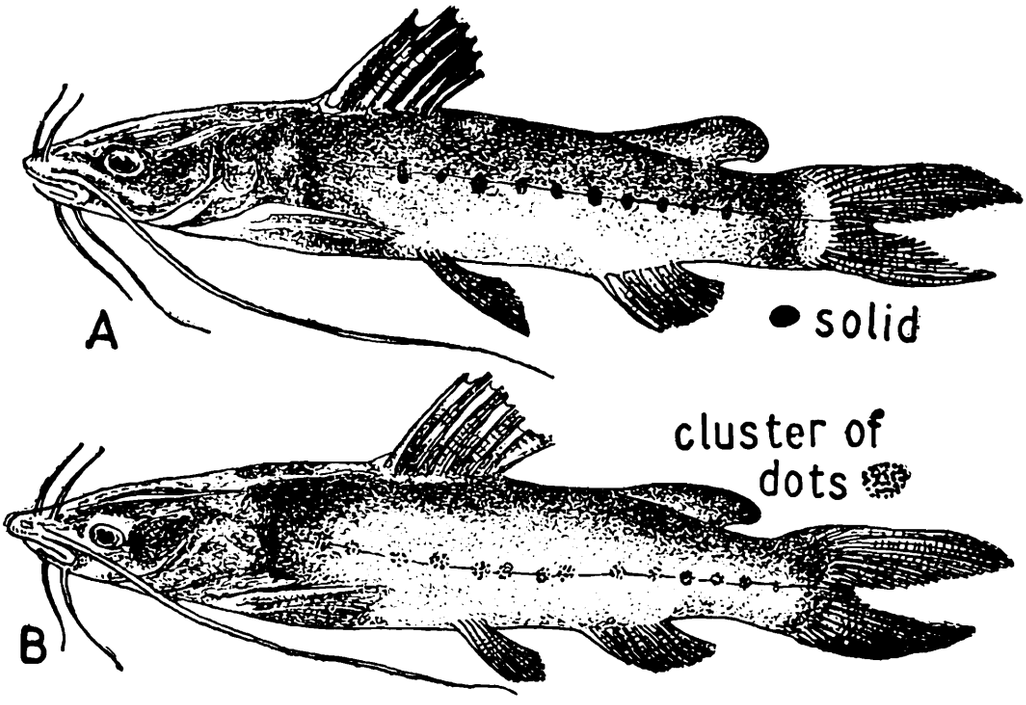


Fig. 95. Lateral view of A, *Mystus punctatus* (Jerdon), and B, *Mystus menoda menoda* (Hamilton) to show colour patterns. (After Jayaram, K. C. 1977, fig. 25, p. 26).

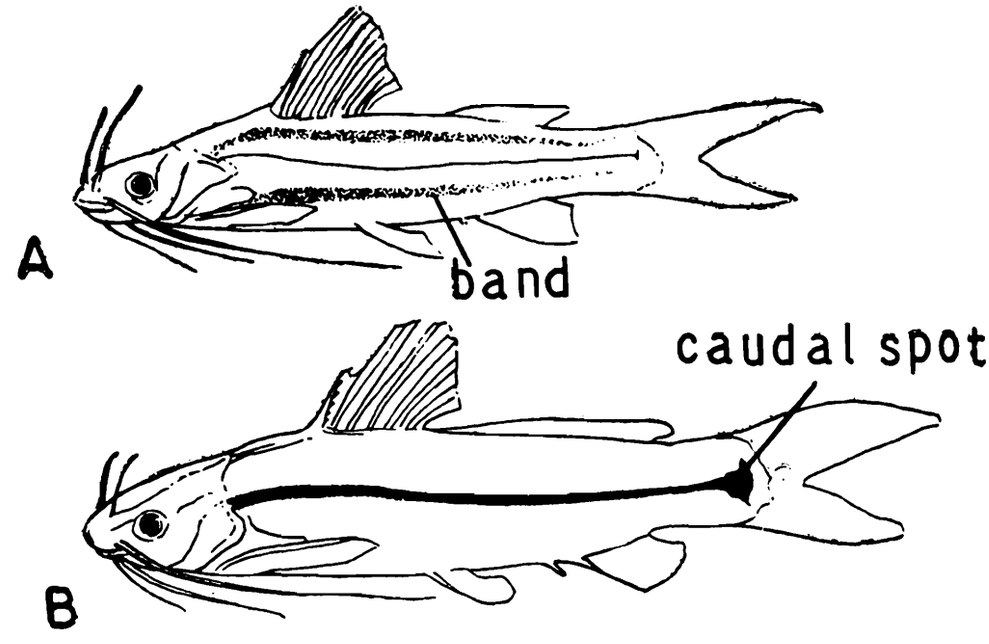


Fig. 96. Outline diagrams of A, *Mystus keletius* (Valenciennes) and B, *Mystus malabaricus* (Jerdon) to show colour spots. (After Jayaram, K. C. 1977, fig. 26, p. 27).

— Occipital process short, 1.0 to 2.0 times longer than wide at base. Body depth 4.5 to 6.0 times in standard length. A dark band only along lateral line ending with a dark blotch at base of caudal fin. ... *M. malabaricus*

KEY TO SPECIES FROM BURMA

1. Maxillary barbels reach middle of pectoral fins. ... *M. peguensis*

— Maxillary barbels reach pelvic fin or beyond. 2

2. Median longitudinal groove on head reaching base of occipital process. 3

— Median longitudinal groove on head not reaching base of occipital process. 4

3. Caudal fin with 24 rays. A black spot at base of caudal fin. Adipose dorsal long and low. ... *M. rufescens*

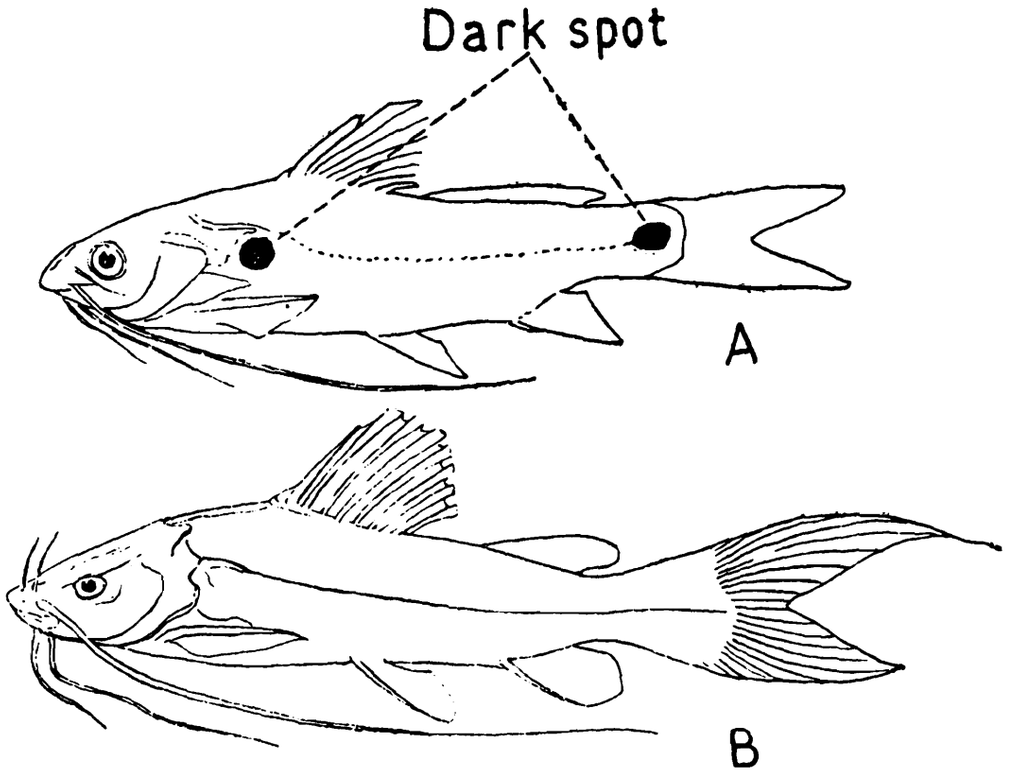


Fig. 97. Outline diagrams of A, *Mystus pulcher* (Chaudhuri) and B, *Mystus microphthalmus* (Day) to show colour spots. (After Jayaram, K. C. 1977, fig. 28. p. 28).

— Caudal fin with less than 20 rays. No black spot at base of caudal fin. Adipose dorsal long and high. ... *M. leucophasis*

4. Occipital process reaching basal bone of dorsal fin. Eye diameter 3.8 to 4.3 in head length. A black shoulder spot and another at base of caudal fin. ... *M. pulcher*

— Occipital process not reaching basal bone of dorsal fin. Eye diameter 6.0 to 8.0 in head length. No spot at base of caudal fin. ... *M. microphthalmus*

Genus **Aorichthys** Wu

Aorichthys Wu, 1939, *Sinensia*, **10**, p. 131 (proposed originally as substitute name for *Aoria* Jordan, 1919 preoccupied in Insecta = *Macrones* Duméril, 1856 preoccupied in Insecta, type species *Pimelodus aor* Hamilton, by subsequent designation.—Jayaram, 1971, *Proc. zool. Soc. Calcutta*, **24**, p. 149 (replaces *Osteobagrus* Jayaram elevated to a generic rank).

Description.—Body elongate, compressed. Abdomen rounded. Head large, slightly depressed. *Snout spatulate or rounded.* Mouth subterminal, transverse, moderately wide. Eyes large, supralateral, in middle of head, not visible from below ventral surface. Lips thin. Jaws subequal. Teeth uniformly villiform on jaws and palate in bands. *A distinct interneural shield in between basal bone of dorsal fin and occipital process present.* Four pairs of barbels, one each of maxillary, nasal and two of mandibular.

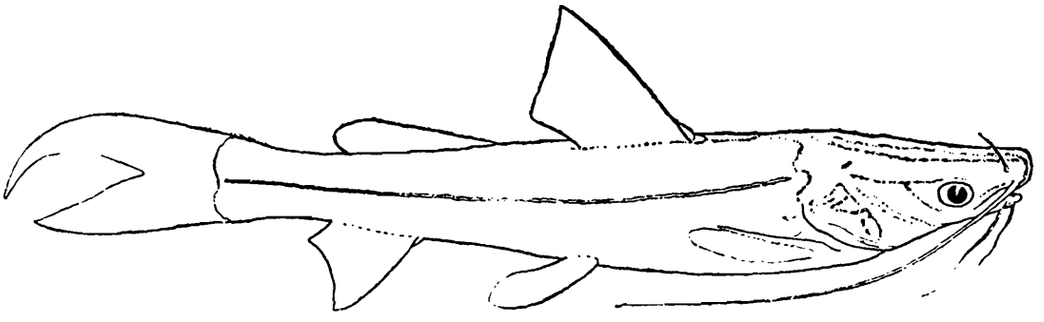


Fig. 98. Lateral view of *Aorichthys aor* (Hamilton). (After Hora, S. L. 1951. *J. Asiat. Soc. Bengal*, **17**, pl. 18, fig. 7).

Rayed dorsal fin inserted above last quarter of pectoral fin with seven rays and a spine. Adipose dorsal fin low, long. Pectoral fins with 9 or 10 rays, and a spine serrated along inner edge with antrorse teeth. Pelvic fins with six rays. Anal fin short with 11 to 13 rays. Caudal fin forked. Lateral line complete, simple.

Distribution.—India up to Krishna river system in the south. Pakistan. Bangladesh. Burma. China.

Species.—

1. *A. aor* (Hamilton)—India : Ganga, Yamuna, Brahmaputra, Mahanadi, Narbada, Tapi, Cauvery river systems. Pakistan. Bangladesh. Burma.
2. *A. seenghala* (Sykes)—India : Ganga, Yamuna, Krishna, Godavari and Cauvery river systems. Pakistan. Bangladesh.

KEY TO SPECIES

1. Snout spatulate. Width of gape of mouth 1/3rd head length. Caudal fin with 19-21 rays. ... *A. seenghala*

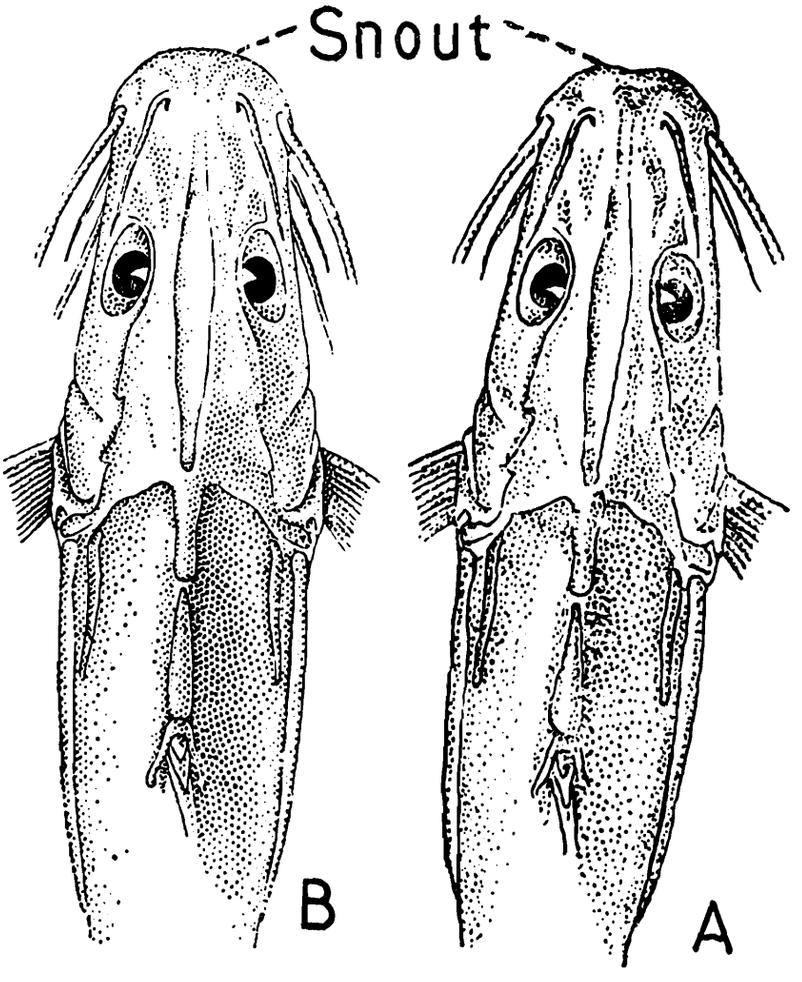


Fig. 99. Dorsal view of head and anterior part of A, *Aorichthys seenghala* (Sykes), and B, *Aorichthys aor* (Hamilton) to show the shape of snout. (After Jayaram, K. C. 1977, fig. 29, p. 39).

— Snout rounded. Width of gape of mouth less than ½ head length. Caudal fin with 17 rays.... *A. aor*

Family SILURIDAE

Sheat fishes

Large sized, elongate fishes with a compressed body. Depressible, teeth on premaxillaries, mandible and prevomer. Nostrils separated from each other by a short distance, anterior tubular on tip of snout, posterior valved and situated before anterior border of eyes. Barbels four or six, generally well developed. Gill openings very wide, extending up to lateral line, membranes free from each other and isthmus.

Rayed dorsal fin short with four or five rays and *without a spine. Adipose dorsal fin absent.* Paired fins laterally inserted. Pectoral fins with a strong spine, occasionally serrated. *Anal fin very long*, extending from just posterior to anal opening to caudal or confluent with it. Caudal fin rounded to weakly emarginate, with bluntly rounded lobes, or forked. Lateral line straight, complete, and with short ventral branches, dendritic or not, but no dorsal branches.

Air-bladder large, attached to second to fourth vertebrae.

Lateral ethmoid facet for articulation of palatines antero-lateral, palatines short, broad, ecto—, metapterygoids present, variously developed. Endopterygoid absent. Prevomer small, dentigerous. Autopterotics and autosphenotics alone provide ventrally articular facet for hyomandibular. Post-temporals absent. Mesocoracoid in pectoral girdle present.

Vertebrae 52 to 74.

Distribution.—India. Pakistan. Sri Lanka. Bangladesh. Burma. Thailand. Viet-Nam. Malaya. Indonesia.

Three genera are dealt with here.

KEY TO GENERA

1.	Gape of mouth very wide, extending beyond eyes posteriorly. ...	*Wallago* Bleeker
—	Gape of mouth not wide, not extending beyond eyes posteriorly.	2
2.	Caudal fin rounded, truncate or weakly emarginate, medially with bluntly rounded lobes. Mandibular barbels one or two pairs. ...	*Silurus* Linnaeus
—	Caudal fin forked. Mandibular barbels one pair, may be rudimentary. ...	*Ompok* Lacépède

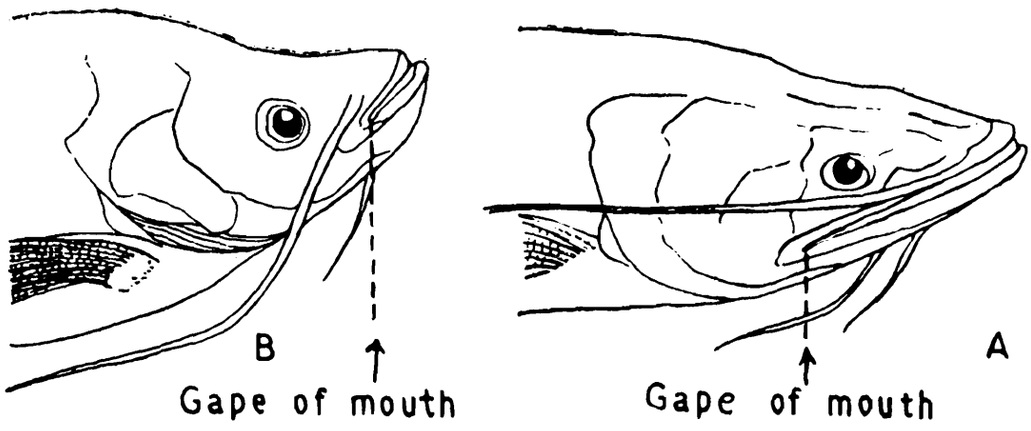


Fig. 100. Diagrams of head and anterior part of body to show extent of gape of mouth in A, *Wallago attu* (Bloch & Schneider) and B, *Ompok bimaculatus* (Bloch). (After Jayaram K. C. 1977c, text fig. 1, p. 2).

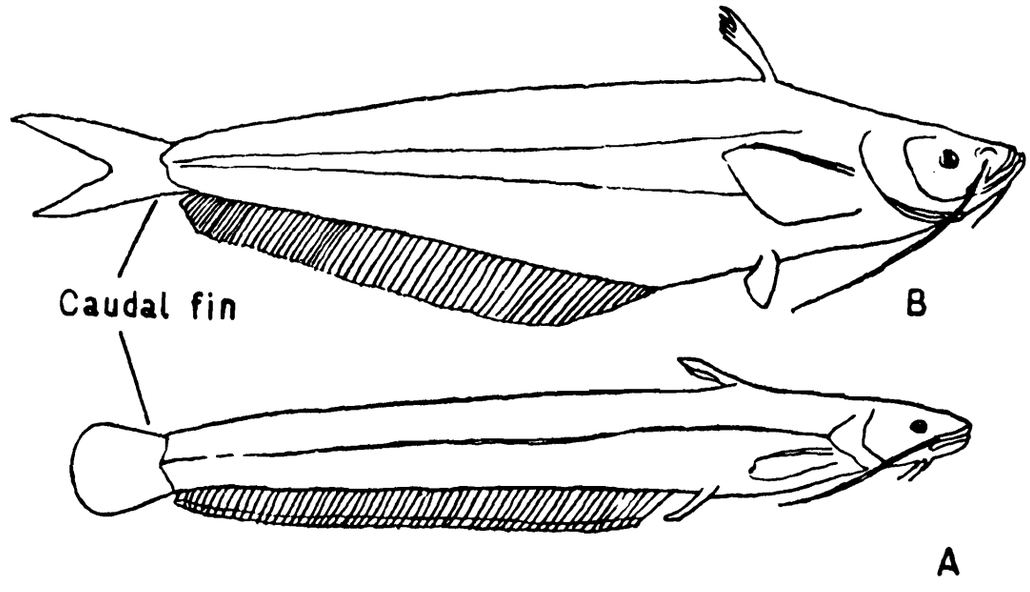


Fig. 101. Outline drawings to show shape of caudal fin in A, *Silurus* and B, *Ompok*.

Genus **Ompok** Lacépède

Butter Catfish

Ompok Lacépède, 1803, *Hist. Nat. Poiss.*, **5**, p. 49 (type-species, *Ompok siluroides* Lacépède, by monotypy).—Haig, 1950, *Rec. Indian Mus.*, **48**, p. 103 (see for synonymy, review).

Diagnosis.—Body elongated, compressed. Abdomen rounded. Head small, broad, depressed. Snout bluntly rounded, depressed. *Mouth superior*, moderately wide, *its cleft oblique*, *not extending to front border of* eyes. *Eyes* small, their *ventral border on level with corner of mouth*,

visible from underside of head. Lips thin. Jaws subequal, lower jaw prominent, more or less elevated at symphysis. Teeth uniformly villiform, depressible in bands on jaws, in two separate patches on palate. Two pairs of barbels, one pair each of maxillary and mandibular ; latter occasionally rudimentary or small.

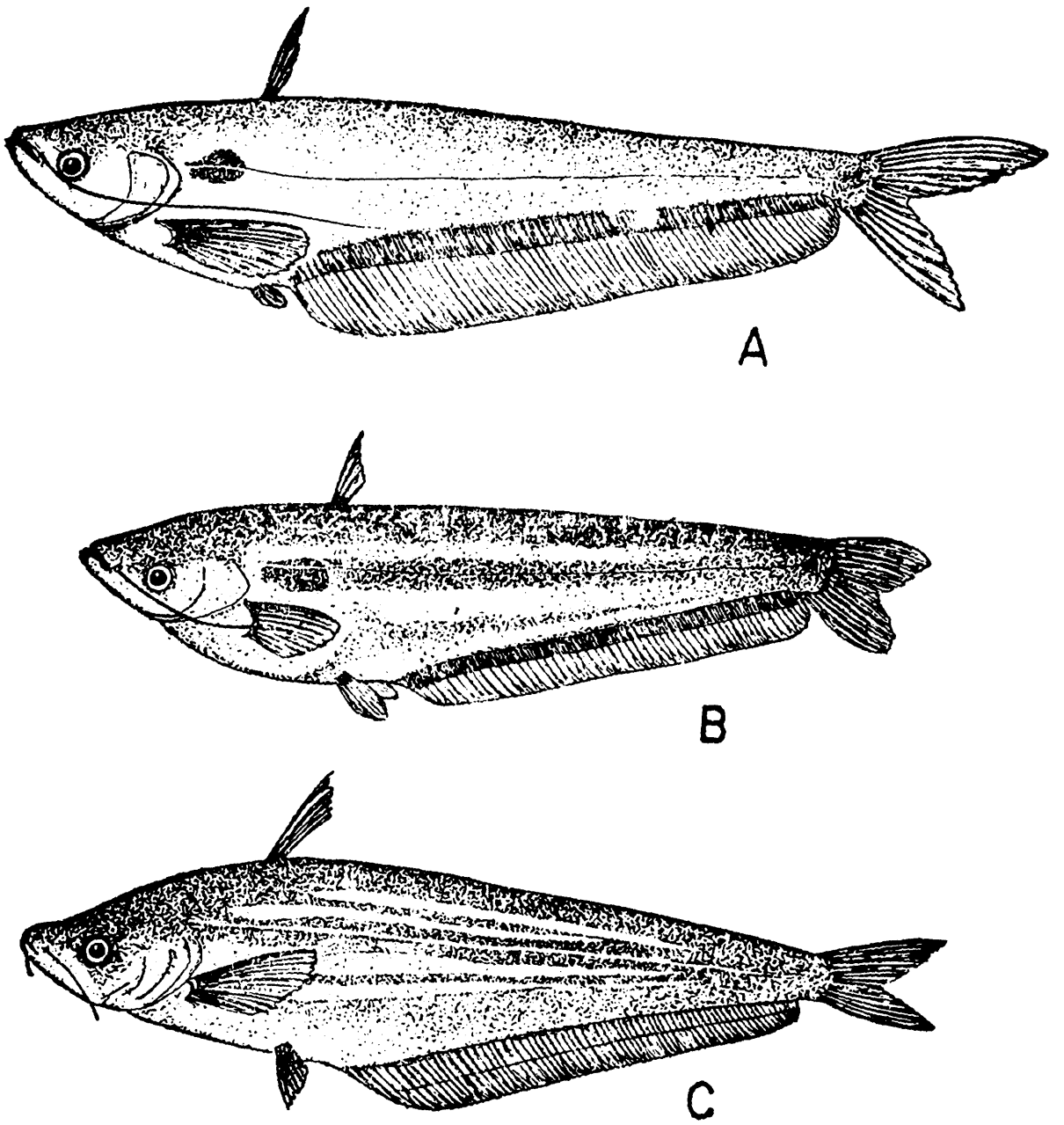


Fig. 102. Lateral view of A, *Ompok bimaculatus* (Bloch); B, *O. pabda* (Hamilton) C, *O. pabo* (Hamilton). (After Jayaram, K. C. 1977 c, text-fig. 3, p. 4).

Rayed dorsal fin inserted above last half of pectoral fin, with four or five rays *and without any spine. Adipose dorsal fin absent. Pectoral fins* with 11 to 14 rays and a feebly serrated or smooth spine ; its length *surpassing pelvic fins*, pelvic fins with 7 to 10 rays. *Anal fin very long, with 52 to 75 rays, close to caudal fin, free from it or narrowly connected to it.* Caudal fin forked. Lateral line complete, simple.

Distribution.—India. Nepal. Sri Lanka. Bangaldesh. Burma. Thailand. Sumatra. Java. Borneo.

A total of eight species are known, of which three are dealt with here.

Species.—

1. *O. bimaculatus* (Bloch)—Throughout India. Pakistan. Nepal. Bangladesh. Sri Lanka. Thailand. Malaya. Viet-Nam. East Indies. Yunnan.

2. *O. pabda* (Hamilton)—India : Ganga and Brahmaputra river systems. Pakistan. Bangladesh. Burma : Indawgyi Lake.

3. *O. pabo* (Hamilton)—India : Ganga. Yamuna. Brahmaputra river systems. Bangladesh. Burma. Pakistan.

KEY TO SPECIES

1.	Maxillary barbels longer than head, extending up to or beyond anal fin. ...	*O. bimaculatus*
—	Maxillary barbels shorter than head, not extending up to anal fin. ...	... 2
2.	Anal fin with 22 to 56 rays. ...	*O. pabda*
—	Anal fin with 66 to 71 rays. ...	*O. pabo*

Genus **Wallago** Bleeker

Freshwater shark

Wallago Bleeker, 1851, *Nat. Tijdschr. Nederl. Inde*, 2, p. 202 (type-species, *Wallago dinema* Bleeker, by original designation).—Haig., 1950, *Rec. Indian Mus.*, 48, p. 101 (review, see for synonymy).

Diagnosis.—Body elongated, compressed. Abdomen rounded. Head large, depressed. Snout spatulate, somewhat protruded. *Mouth* subterminal, oblique, *gape wide, reaching to or beyond anterior border of eyes.* Eyes small, *above level of corner of mouth, not visible from below* ventral surface. Lips thin. Jaws subequal, lower jaw longer, prominent. Teeth villiform in bands on jaws and in patches on palate. Two pairs of barbels, one pair each of maxillary and mandibular.

Rayed dorsal fin inserted above half of pectoral fin, with five rays and without a spine. Adipose dorsal fin absent. Pectoral fins with 13 to 15 rays and a feeble, smooth spine. Pelvic fins with 8 to 10 rays. *Anal fin long with 86 to 89 rays free from caudal fin.* Caudal fin forked, with rounded lobes. Lateral line complete, well marked, simple,

Distribution.—India. Pakistan. Bangladesh. Burma. Thailand. Sri Lanka. Java. Sumatra. Borneo.

A total of five species are known of which only one is listed here.

Species.—*Wallago attu* (Schneider)*—distribution as of the genus.

Genus **Silurus** Linnaeus

Silurus Linnaeus, 1758, *Syst. Nat.* Ed. **10**, p. 304 (type-species, *Silurus glanis* Linnaeus, by subsequent designation by Bleeker, 1862, p. 393).—Haig, 1950, *Rec. Indian Mus.*, **48**, p. 97 (see for synonymy, review).

Diagnosis.—Body elongated, compressed. Abdomen rounded. Head small, broad, rounded, depressed. Snout obtusely rounded. Mouth terminal, horizontal to somewhat oblique, wide, *gape of mouth reaching to below eyes. Eyes small, above level of angle of mouth not visible from below ventral surface.* Lips thin. Jaws equal. Teeth uniformly villiform in bands on jaws and in one or two patches on palate. Two or three pairs of barbels, one pair maxillary, rather heavy, flattened, one or two pairs mandibular.



Fig. 103. Lateral view of *Silurus cochinchinensis* (Valenciennes). (After Misra, K. S. 1962, text-fig. 97).

Rayed dorsal fin inserted above tip of pectoral fin, with four or five rays and without a spine. Adipose dorsal fin absent. Pectoral fins with 10 to 15 rays and a spine serrated along inner edge with antrorse teeth or smooth. Pelvic fins with 7 to 10 rays. *Anal fin very long with 58 to 68 rays***, free from caudal or narrowly to rather broadly joined with it ; *anal rays covered by integument for most of their length.* Caudal fin rounded to weakly emarginate, with bluntly rounded lobes. Lateral line complete, simple.

Distribution.—Freshwaters of the temperate parts of Palaearctic region, Eastern Himalaya, Assam, Western ghats in peninsular India, Burma. Laos (Cochin-China). Usually found on or near the hills.

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*Silas (1952) considers the Sri Lanka form as a separate subspecies *W. attu valeya* (Deraniyagala).

**Applicable to species dealt here only.

A total of 12 species are known the World over, of which three are dealt with here.

Species.—

1. *S. berdmorei wynaadensis* (Day)—India : Wynaad, Bhavani river system, Kerala.
2. *S. cochinchinensis* (Valenciennes)—India : Mysore, Karnataka, N. Bengal. Burma. Thailand. Malaya. Viet-Nam. Hainan. Fukien. Hong Kong.
3. *S. goae* Haig—India : Goa.

KEY TO SPECIES

1.	Teeth on upper jaw in two separate, mesially separated broad bands. ...	*S. goae*
—	Teeth on upper jaw in a single continuous narrow band.	2
2.	Teeth on premover continuous. Two mandibular barbels. ...	*S. cochinchinensis*
—	Teeth on prevomer discontinuous. Four mandibular barbels. ...	*S. berdmorei wynaadensis*

Family SCHILBEIDAE

Medium to large sized fishes with a compressed body. Teeth on premaxillaries, mandible and prevomer. Nostrils widely separated, anterior wide, along front border of snout ; posterior slit-like or with a lip or simple, nearer eye than tip of snout. Barbels two, four or eight, fairly well developed. Gill openings very wide, extending up to lateral line, membranes free from each other and also from isthmus.

Rayed dorsal fin when present short, with five to seven rays and a spine, may be absent also. Adipose dorsal fin generally present, may be absent. Paired fins inserted laterally. Pectoral fins with a strong spine, usually serrated. Anal fin very long, not confluent with caudal. Caudal fin forked. Lateral line generally complete, simple.

Air-bladder of varying types and shapes as described under genera.

Lateral ethmoid facet for articulation of palatines more lateral than ventral. Palatines rod-like, broad. Endopterygoid occasionally present (*Clupisoma, Silonia*). Ectopterygoid toothed. Metapterygoid may have sutural contact with hyomandibular (exception *Pseudeutropius, Neotropius*). Autopterotics and autosphenotics provide ventrally articular facet for hyomandibular, but variable ; temporals present, connected

to skull by sutures. Lower limb of post-temporal moderate to well developed.

Vertebrae 47 to 58.

Distribution.—Africa. India. Pakistan. Bangladesh. Burma. Thailand. Malaya.

Seven genera are dealt with here.

KEY TO SUBFAMILIES

1.	Dorsal fin absent.	...	Ailinae
—	Dorsal fin present.	...	Schilbeinae

Subfamily AILINAE

Dorsal fin and spine absent. Adipose dorsal very small. Teeth on vomer minute. Anal fin very long.

Five vertebrae form the pars sustentaculum. Central limits of vertebrae not clear. Dorsal lamina modified to form a longitudinal ridge of bone. Cardinal grooves changed into canals. Lateral processes of supraethmoid cover whole of premaxilla on dorsal side. Inferior limb of post-temporal absent. Sphenotic excluded from the foramen for the 7th cranial nerve. (After Tilak, 1964).

Genus **Ailia** Gray

Ailia Gray 1831, *Zool. Miscellany*, p. 8 (type-species, *Malapterus* (*sic*) (*Ailia*) *bengalensis* Gray = *Malapterurus coila* Hamilton).—Hora, 1941, *Rec. Indian Mus.*, **43**, p. 10 (review).

Ailichthys Day, 1871, *Proc. Zool. Soc. Lond.*, p. 712 (type-species, *Ailichthys punctata* Day, by monotypy).—Jayaram, 1962, *J. zool. Soc. India*, **14**, (2), pp. 244—248 (systematic position).

Diagnosis.—Body short, compressed. Abdomen rounded. Head short, greatly compressed. Snout overhanging. Mouth terminal, crescentic, moderately wide. Eyes small, lateral, nearly or quite behind angle of mouth, visible from below ventral surface. Lips thin. Jaws subequal.

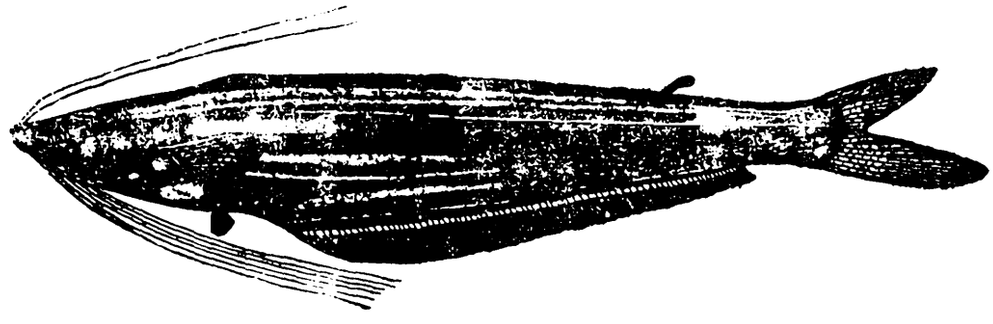


Fig. 104. Lateral view of *Ailia coila* (Hamilton). (After Misra, K. S. 1962, text-fig. 99).

Teeth villiform on jaws and in two small patches on palate. *Four pairs of barbels*, one each of maxillary, nasal, and two of mandibular, all more or less of uniform length, and longer than head.

Rayed dorsal fin absent. Adipose dorsal fin small, short, posteriorly free. Pectoral fins with 13 to 16 rays and a spine, smooth or serrated along inner edge with antrorse teeth. Pelvic fins with six rays may be vestigial or absent occasionally. *Anal fin long, with 58 to 90 rays, not confluent with caudal.* Caudal fin forked. Lateral line complete, simple.

Air-bladder tubular, transverse, horse-shoe shaped, curved forwards and upwards on each side, the lateral horns lying in recesses behind, formed by parapophyses of the IVth and Vth vertebrae.

Distribution.—India. Pakistan. Nepal. Bangladesh. In India confined to the larger rivers of northern peninsula and extending up to Krishna river system in the south.

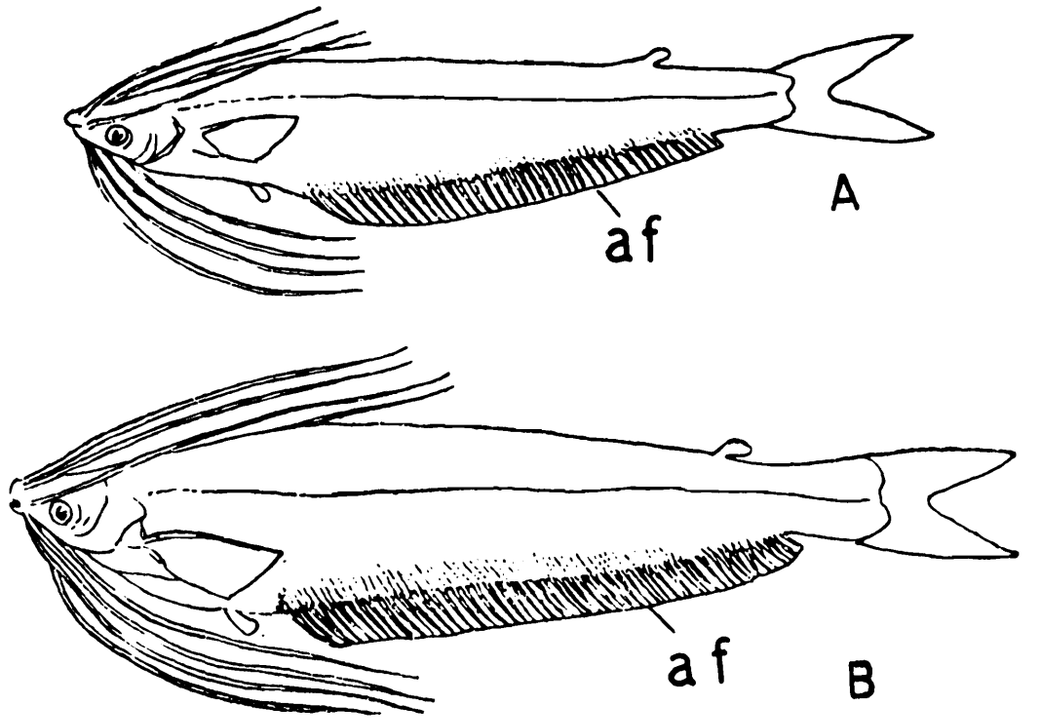


Fig. 105. Outline sketches of A, *Ailia coila* (Hamilton) and B, *A. punctata* (Hamilton) to show relative length of anal fin. (After Jayaram, K. C. 1977c, text-fig. 9, p. 13).

Species.—

1. *A. coila* (Hamilton)—India : up to Krishna river system. Pakistan. Nepal. Bangladesh.
2. *A. punctata* (Day)—India : Ganga, Yamuna and Indus river systems. Bangladesh. Pakistan.

KEY TO SPECIES

1. Anal fin rays 58 to 71. Ventral profile not pronouncedly arched. Body colour silvery to dull brown without any black blotch on caudal fin base or along side of body. (Rivers of North India and Deccan). ... *A. coila*

— Anal fin rays 70 to 90. Ventral profile arched. Body colour pale or dull whitish with a black blotch on caudal fin base and along upper third of body. (Rivers of North India only). ... *A. punctata*

Subfamily SCHILBEINAE

Dorsal fin and spine present. Adipose dorsal fin vestigial, small, may be absent. Teeth on vomer large. Anal fin moderate.

Six vertebra form the pars sustenaculum. Central limits of vertebra clear. Dorsal lamina when present does not form an oblique ridge

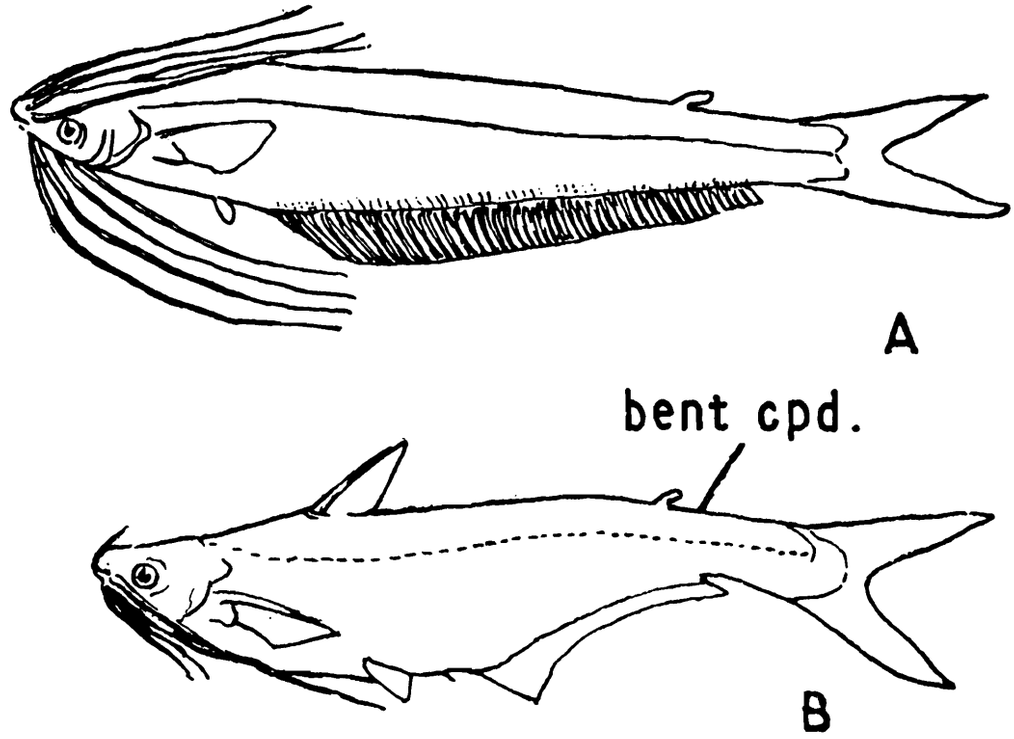


Fig. 106. Outline sketches to show A, normal caudal peduncle in *Ailia* and B, bent caudal peduncle in *Proeutropiichthys*. (After Jayaram, K. C. 1977c, text-fig. 5, p. 10).

of bone. Cardinal groove may be present or absent. Lateral process of supraethmoid extends over half of each premaxilla. Inferior limb of post-temporal present. Sphenotic forms nerve foramen for the 7th cranial nerve. (After Tilak, 1964).

KEY TO GENERA

1. Two or four barbels ; nasal and one pair of mandibular barbels absent. ... *Silonia* Swainson

— Eight barbels. 2

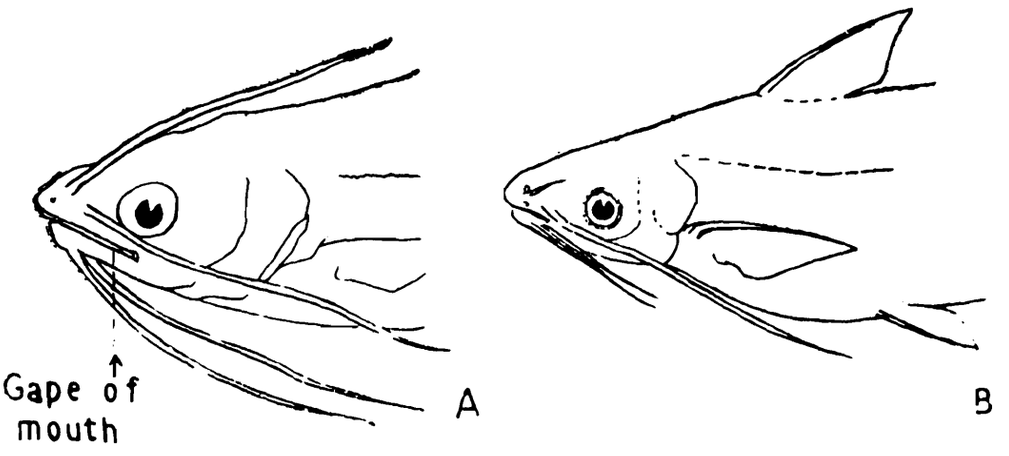


Fig. 107. Outline diagrams to show extent of gape of mouth in A, *Eutropiichthys* and B, *Clupisoma*. (After Jayaram, K. C. 1977c, text-fig. 6, p. 11).

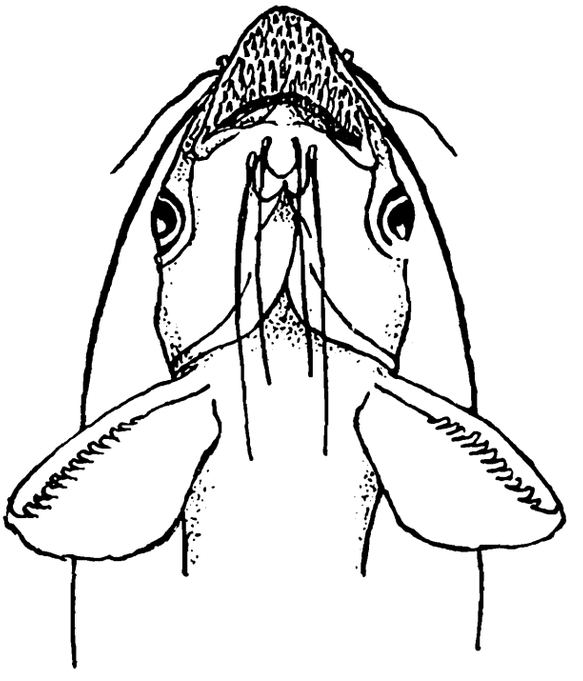


Fig. 108. Ventral view of head in *Neotropius khavalchor* Kulkarni to show exposed teeth. (After Jayaram, K. C. 1977c, text-fig. 7, p. 11).

2. Caudal fin bent downwards from caudal peduncle onwards. Teeth on palate in four small distinct patches. ... *Proeutropiichthys* Hora

— Caudal fin normal, not bent downwards. Teeth on palate in two extensive patches. 3

3.	Cleft of mouth oblique, extending up to middle of eye. ...	*Eutropiichthys* Bleeker
—	Cleft of mouth not oblique, extending only to front edge of eye or even shorter. ...	... 4
4.	Teeth on upper jaw exposed. Jaws wide. ...	*Neotropius* Kulkarni
—	Teeth on upper jaw not exposed. Jaws not wide. ...	... 5
5.	Teeth on palate in bands, not separated in middle. Posterior nostrils wide. ...	*Clupisoma* Swainson
—	Teeth on palate in two separate patches, which may be connected by a linear series. Posterior nostrils narrow. ...	*Pseudeutropius* Bleeker

Genus **Pseudeutropius** Bleeker

Pseudeutropius Bleeker, 1862, *Versl. Akad. Amsterdam*, **14**, p. 398 (type-species, *Eutropius brachyopterus* Bleeker).—Hora, 1941, *Rec. Indian Mus.*, **43**, p. 100 (systematic position clarified).

Diagnosis.—Body elongate, compressed, herring-shaped. *Part of abdomen more or less keeled.* Head short, compressed. Snout sharp, conical, not pointed. Mouth subinferior, transverse, overhung by snout, moderately wide. *Eyes large, ventro-lateral, partly below and behind level of cleft of mouth* with broad circular adipose lids, visible from below ventral surface. Lips thin. Jaws subequal, upper jaw longer. Teeth

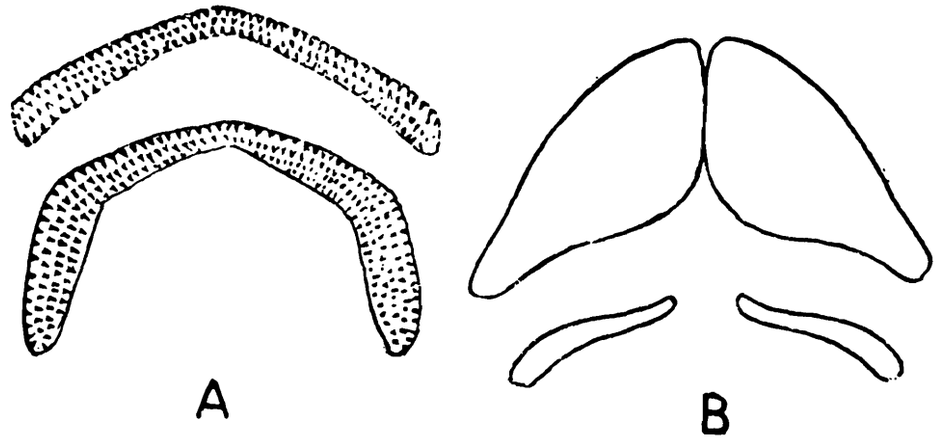


Fig. 109. Dentition in A, *Clupisoma* and B, *Pseudeutropius* (After Jayaram, K. C. 1977c, text-fig. 8. p. 11).

small, villiform, in narrow bands on jaws and *palate* ; *those on latter in two small widely separated patches, occasionally connected by a linear series.* Four pairs of barbels : one each of maxillary, nasal and two of mandibular.

Rayed dorsal fin inserted above half of pectoral fin with five or six rays and a spine. Adipose dorsal fin short, posteriorly free. Pectoral fins with seven to nine rays and a spine serrated along both margins. Pelvic fins with six rays. Anal fin long, with 33 to 46 rays, not confluent with caudal. Caudal fin forked. Lateral line complete, simple.

Air-bladder oval, slightly longer than broad, lying free in abdominal cavity, supported anteriorly by bony vertebral elements.

Distribution.—Throughout India. Pakistan. Nepal. Bangladesh. Burma.

Species.—

1. *P. atherinoides* (Bloch)—India : throughout except Kerala and Assam. Pakistan. Nepal. Bangladesh.
2. *P. mitchelli* Günther—India : Madras.

KEY TO SPECIES

1. Eye diameter 2.5 to 3.0 in head length. Nape well elevated. Maxillary barbels reach anal fin baae. Teeth on palate in two narrow, separate crescentic bands. ... *P. atherinoides*

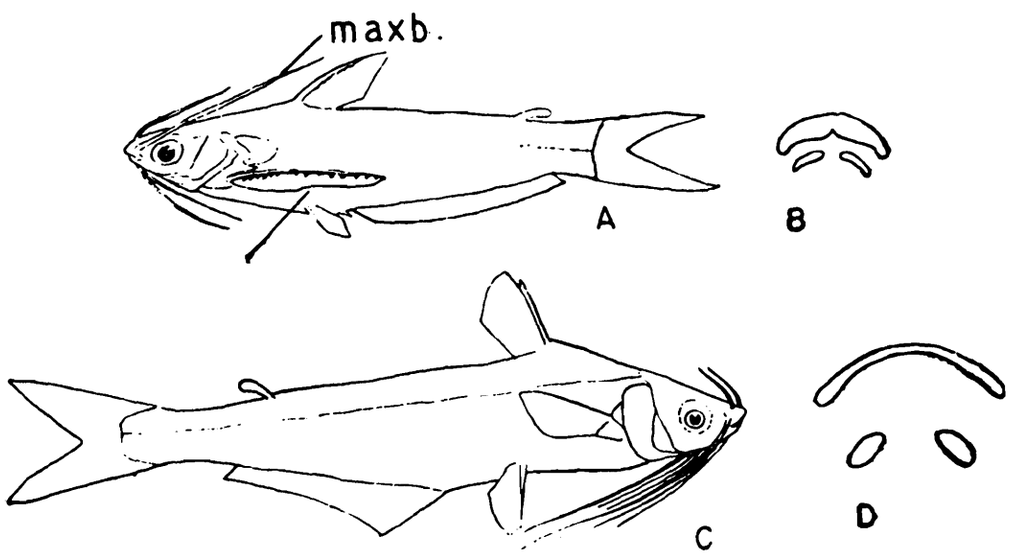


Fig. 110. Diagrams to show extent of maxillary barbels and dentition in A, B, *Pseudeutropius atherinoides* (Bloch) and C, D, *Pseudeutropius mitchelli* Günther. (After Jayaram, K. C. 1977c, text-fig. 10, p. 14).

— Eye diameter 4.8 to 5.0 in head length. Nape slightly elevated. Maxillary barbels reach pectoral or middle pelvics. Teeth on palate in two small oval patches. ... *P. mitchelli*

Genus **Proeutropiichthys** Hora

Proeutropiichthys Hora, 1937, *Curr. Sci.*, **5**, 353 (type-species, *Eutropius macrophthalmus* Blyth, by original designation).—Hora, 1941, *Rec. Indian Mus.*, **43**, p. 105 (description, systematic position discussed).

Diagnosis.—Body elongate, compressed ; herring-shaped, part of abdomen more or less keeled. Head short, oval, compressed. Snout broad, rounded, nearly on a line with level of back. Mouth subterminal, small, crescentic, cleft slightly ascending. Eyes large, ventro-lateral, in anterior half of head visible from below ventral surface. Lips thin. Jaws subequal, lower jaw broadly pointed in middle. Teeth small, villiform in bands on jaws and *in four oval patches forming a semilunar band on palate.* Four pairs of barbels, one each of maxillary, nasal, and two of mandibular.

Rayed dorsal fin inserted above last quarter of pectoral fin, with six or seven rays and a spine. Adipose dorsal fin short, posteriorly free. Pectoral fins with 10 or 11 rays and a spine serrated along both margins. Pelvic fins with six rays. Anal fin long with 43 to 52 rays, not confluent with caudal. Caudal fin deeply forked, *bent downwards from caudal peduncle.* Lateral line complete, simple.

Air-bladder not extensive, moderate sized, lying free in abdominal cavity.

Distribution.—India : Deccan. Burma.

Species.—*P. taakree* (Sykes)—India : Western ghats, Kerala, Maharashtra. Burma.

Genus **Neotropius** Kulkarni

Neotropius Kulkarni, 1952, *Rec. Indian Mus.*, **49** (3 & 4), p. 231 (type-species, *Neotropius khavalchor* Kulkarni, by monotypy).

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head small, depressed. Snout tapering, but not produced. Mouth ventral, semilunar, wide. *Eyes large, inferior, visible from below ventral surface.* Lips thin. *Jaws unequal, upper jaw extending over the entire under surface of snout, excepting lips.* Teeth small, sharp, villiform on jaws and palate in bands ; *exposed on upper jaw.* Four pairs of barbels ; one pair each of maxillary, nasal and two of mandibular.

Rayed dorsal fin inserted above half of pectoral fin with six or seven rays and a spine. Adipose dorsal fin short, posteriorly free. Pectoral fins with seven rays and a spine serrated along inner margin, but with a blunt tip. Pelvic fins with six rays. Anal fin with 24 to 36 rays. Caudal fin forked. Lateral line complete, simple. Air-bladder large, free.

Distribution.—India : Krishna river system, Maharashtra and Andhra Pradesh.

Species.—*N. khavalchor* Kulkarni is the single species so far known.

Genus **Clupisoma** Swainson

Clupisoma Swainson, 1839, *Nat. Hist. Fish. Animal.*, **2**, p. 306 (type-species, *Silurus garua* Hamilton, by monotypy).—Hora, 1937, *J. Bombay nat. Hist. Soc.*, **39** (4), pp. 659-678 (review).

Diagnosis.—Body elongate, compressed, almost herring-shaped ; *whole of abdominal edge with the part between pelvic fins and vent keeled.* Head moderate sized, oval, blunt. Snout rounded. Mouth subterminal, transverse, of moderate width, *cleft extending to front edge of eye.* Lips thin. Jaws equal. Teeth uniformly villiform in bands on jaws and palate. Four pairs of barbels ; one pair each of maxillary, nasal and two of mandibular.

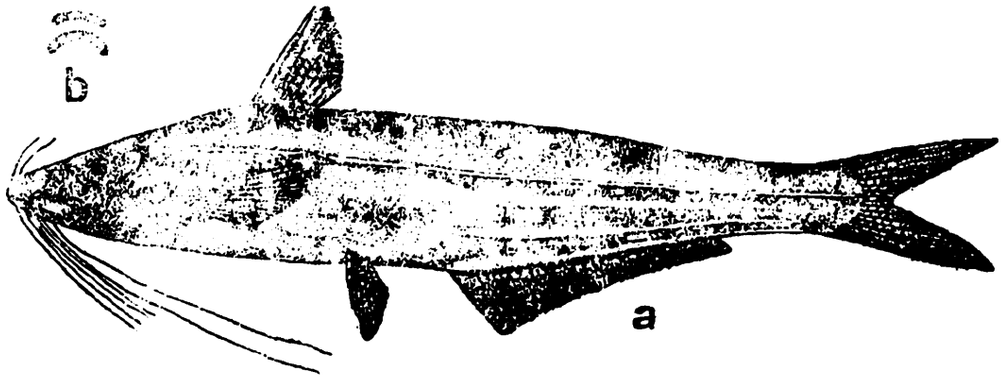


Fig. 111. a. Lateral view of *Clupisoma garua* (Hamilton). b. dentition. (After Misra, K. S. 1962, text-fig. 100).

Rayed dorsal fin inserted above near base of pectoral fin, with seven rays and a spine. A small adipose dorsal fin may be present or absent. Pectoral fins with 11 or 12 rays and a spine serrated along inner edge with antrorse teeth or smooth. Pelvic fins with six rays. Anal fin moderately long with 29 to 44 rays. Caudal fin deeply forked. Lateral line complete, simple.

Air-bladder greatly reduced, thick-walled, flat ; closely applied to the ventral surface of anterior vertebrae.

Distribution.—India. Pakistan. Nepal. Bangladesh. Burma.

Species.—

1. *C. bastari* Datta & Karmakar—India : Indravati river, Bastar dist., Madhya pradesh.
2. *C. garua* (Hamilton)—India : throughout North India, not recorded from south of Mahanadi. Pakistan. Nepal. Bangladesh.

3. *C. montana* Hora—India : Teesta river below Darjeeling, N. Bengal, Yamuna and Sone river, U. P. Nepal.

4. *C. naziri* Mirza & Iqbal Awan*—Pakistan : Punjab : Jinnah barrage near Kalabagh, R. Indus ; Kabul river near Khatki village, N. W. F. P.

5. *C. prateri* Hora—India : Teesta river, N. Bengal. Sone river, Bihar, Allahabad, U. P. Bangladesh. Burma.

KEY TO SPECIES

1. Abdominal edge rounded. 2

— Abdominal edge keeled throughout or partly. 3

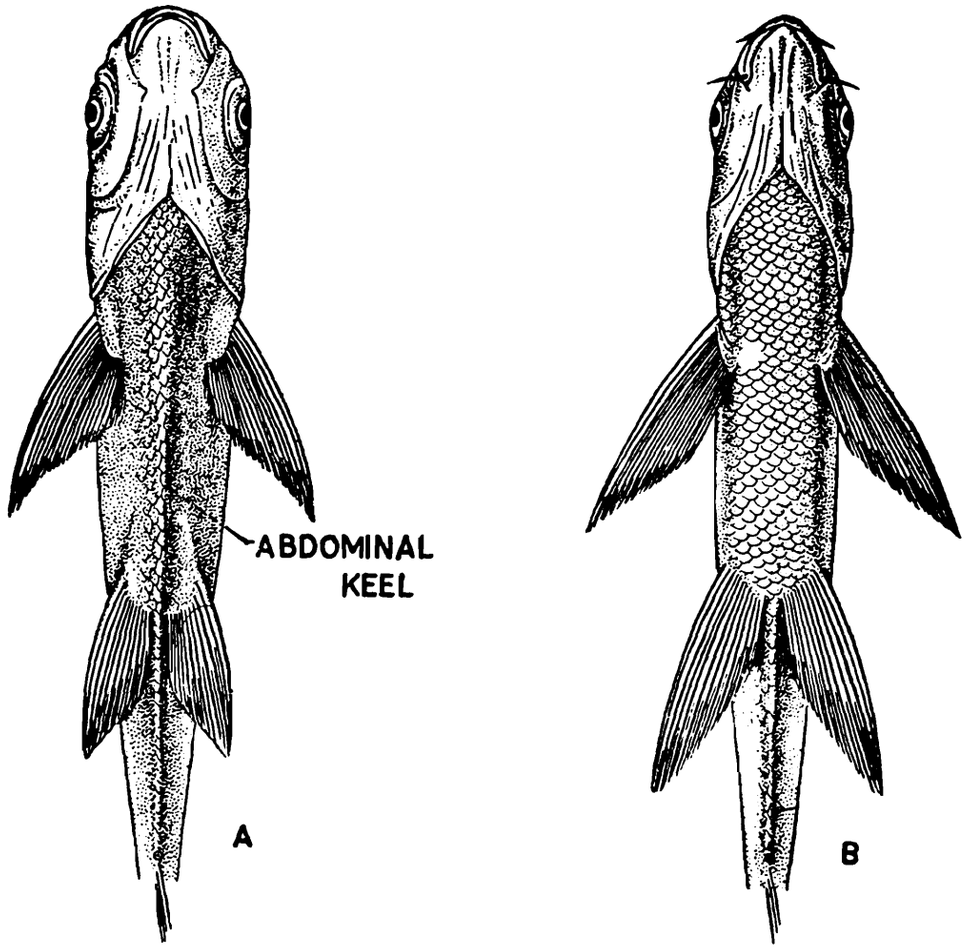


Fig. 112. Ventral view of *Clupisoma* species to show extent of abdominal keel.

2. Maxillary barbels not extending beyond base of pectoral fin. Pectorals reaching pelvic fin. Anal fin with 41-43 rays. ... *C. montana*

— Maxillary barbels extending up to or behind base of pelvic fin. Pectorals may or may not reach pelvics. Anal fin with 40-47 rays. ... *naziri**

*Mirza, M. R. & Awan, M. I. 1973. *Biologia*, 19 (1 & 2), pp. 152-158.

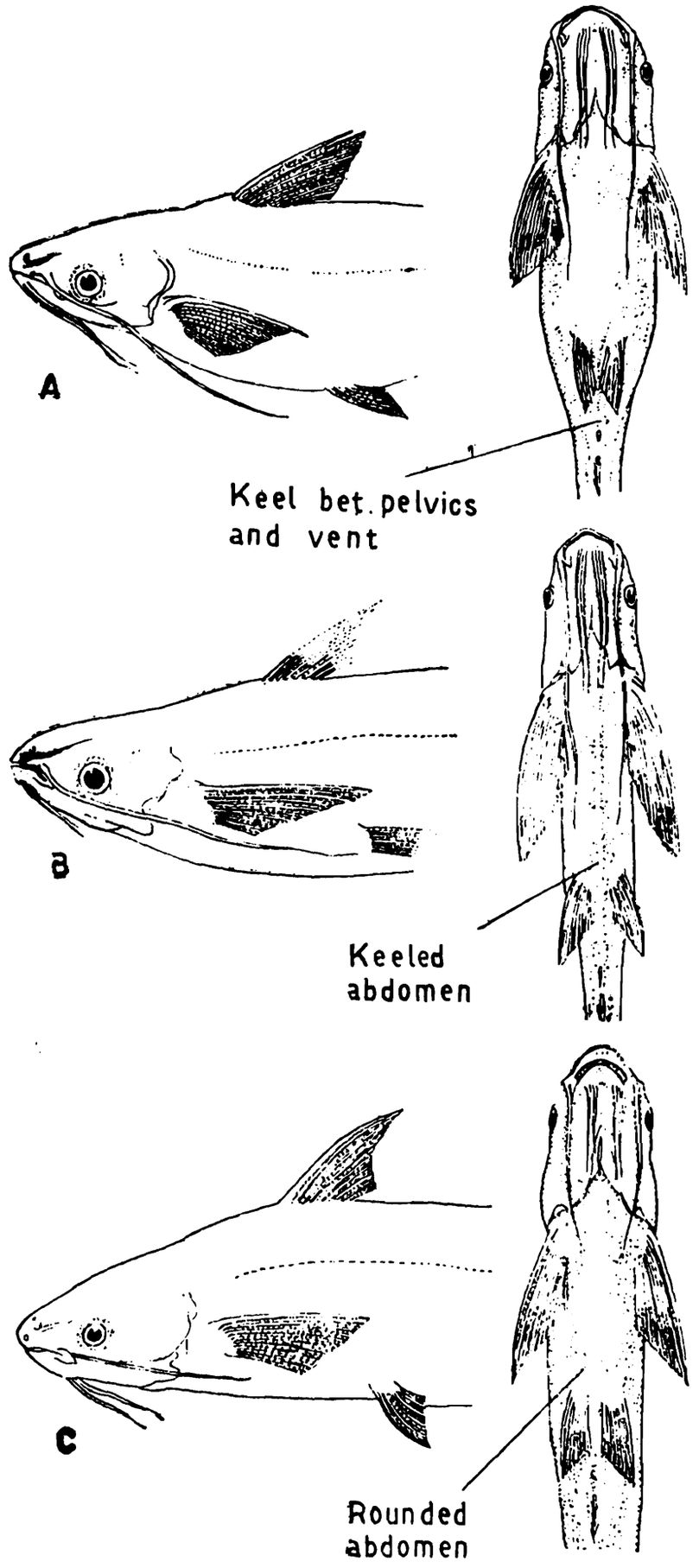


Fig. 113. Diagrams to show extent of maxillary barbels and keel in A, *Clupisoma garua* (Hamilton). B, *C. prateri* Hora and C. *C. montana* Hora. (After Jayaram, K. C. 1977c, text-fig. 11, p. 19).

3.	Abdominal edge keeled throughout. Maxillary barbels not reaching pelvics. Anal fin with 40-44 rays. ...	*C. prateri*
—	Abdominal edge keeled partly. ...	... 4
4.	Abdominal edge keeled from vent to thorax. Pectorals not reaching pelvics. Maxillary barbels reaching anal fin base. Anal fin with 52-54 rays. ...	*C. bastari**
—	Abdominal edge keeled between pelvic and vent. Pectorals not reaching pelvics. Maxillary barbels reaching pelvic fin. Anal fin with 29-36 rays. ...	*C. garua*

Genus **Eutropiichthys** Bleeker

Eutropiichthys Bleeker, 1862, *Versl. Akad. Amsterdam*, **14**, p. 398 (type-species, *Pimelodus vacha* Hamilton).—Hora, 1937, *J. Bombay nat. Hist. Soc.*, 39, p. 431—446 (review).

Diagnosis.—Body elongate, compressed, almost Indian-trout shaped. Abdomen rounded. Head of moderate size, conical. Snout pointed, sharp but may be blunt occasionally. Mouth subterminal, transverse, *ascending wide, its cleft reaching below orbit or slightly beyond.* Eyes moderately large, lateral, visible from below ventral surface. Lips thin. Jaws subequal. Teeth small, uniformly villiform on jaws and palate,

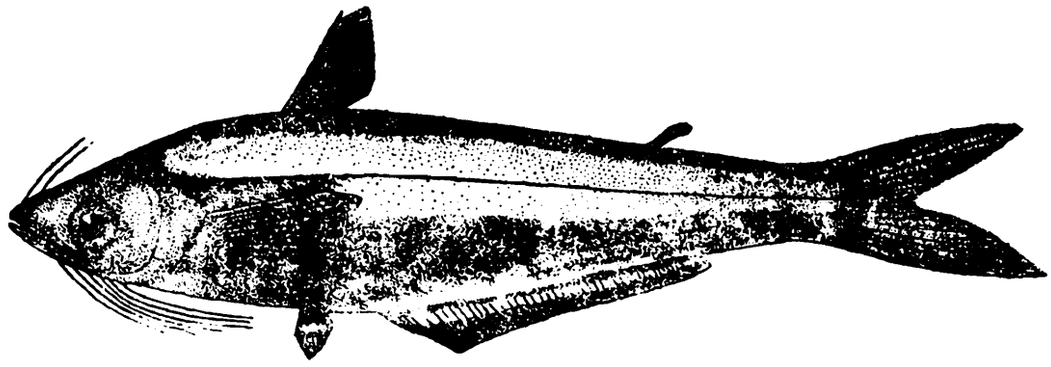


Fig. 114. Lateral view of *Eutropiichthys vacha* (Hamilton). (After Misra, K. S. 1962, text-fig. 101).

teeth bands very closely set, bands on jaws laterally produced. Four pairs of barbels ; one pair each of maxillary, nasal and two of madibular.

Rayed dorsal fin inserted above half of pectoral fin with seven rays and spine. Adipose dorsal fin short, posteriorly free. Pectoral fins with 10 to 16 rays and a smooth spine. Pelvic fins with six rays. *Anal fin long with* 38 to 54 rays. Caudal fin deeply forked. Lateral line complete, simple.

*Datta, A. K. & Karmakar, A. 1980. *Bull. zool. Surv. India*, **2** (2 & 3) pp. 193-196.

Air-bladder greatly reduced, transverse, closely applied to ventral surface of anterior vertebrae forming a circular loop, incomplete

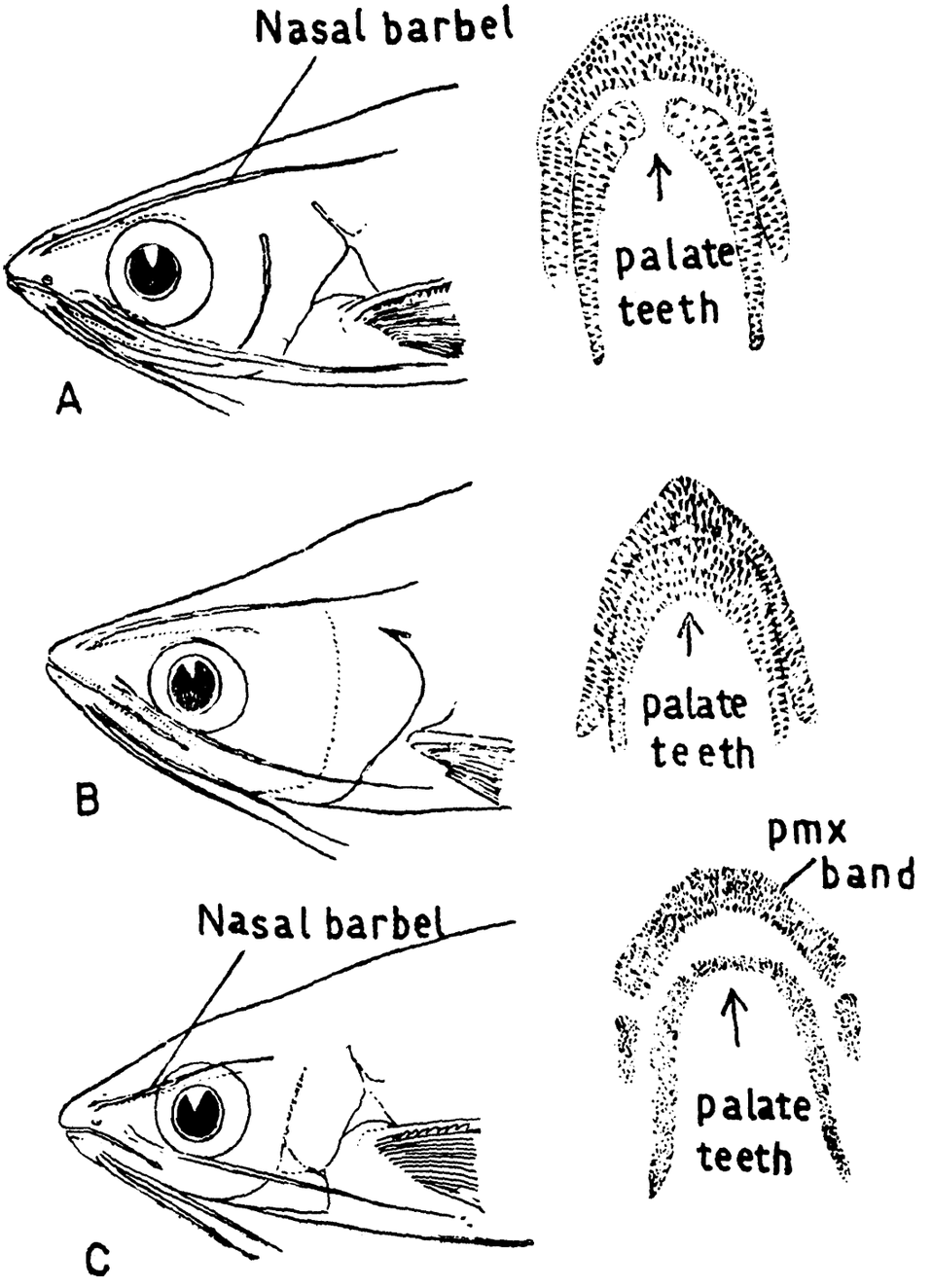


Fig. 115. Diagrams to show extent of nasal barbel and palate dentition in A, *Eutropiichthys goongwaree* (Sykes). B, *E. vacha* (Hamilton) and C, *E. murius* (Hamilton), (After Jayaram, K. C. 1977c, text-fig. 12, p. 22)

anteriorly ; not enclosed by bone, but supported on dorsal surface by bony extensions of transverse processes of anterior vertebrae.

Distribution.—India. Pakistan. Nepal. Bangladesh. Burma. Thailand. In India the southern limit is the Krishna river system.

Species.—

1. *E. goongwaree* (Sykes)—India : South India, Andhra Pradesh, Maharashtra.
2. *E. murius* (Hamilton)—India : North India, Yamuna river, W. Bengal, Orissa, Assam. Pakistan : Sind. Bangladesh.
3. *E. vacha* (Hamilton)—India : North India, up to Mahanadi. Pakistan. Nepal. Bangladesh. Burma. Thailand.

KEY TO SPECIES

1.	Teeth on palate continuous. Nasal barbels shorter than or equal to head length. ...	... 2
—	Teeth on palate interrupted in the middle. Nasal barbels longer than head length, reaching dorsal fin base. ...	*E. goongwaree*
2.	Teeth on palate in a band wider than premaxillary band. Nasal barbels reach hind border of head or slightly beyond. ...	*E. vacha*
—	Teeth on palate in a band narrower than premaxillary band or just equal to it. Nasal barbels reach a short distance behind posterior edge of eyes. ...	*E. murius*

Genus **Silonia** Swainson

Silonia Swainson, 1839, *Nat. Hist. Fish. Animal.*, 2, p. 305 (type-species, *Pimelodus silondia* Hamilton, by subsequent designation).—Hora, 1938, *J. Bombay nat. Hist. Soc.*, **40** (2), pp. 137-147 (review).—Silas, 1952, *Proc. nat. Inst. Sci. India*, **18** (5), p. 433 (*Silonopangasius* synonymised).

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head moderate sized, compressed, anteriorly rounded. Snout obtusely

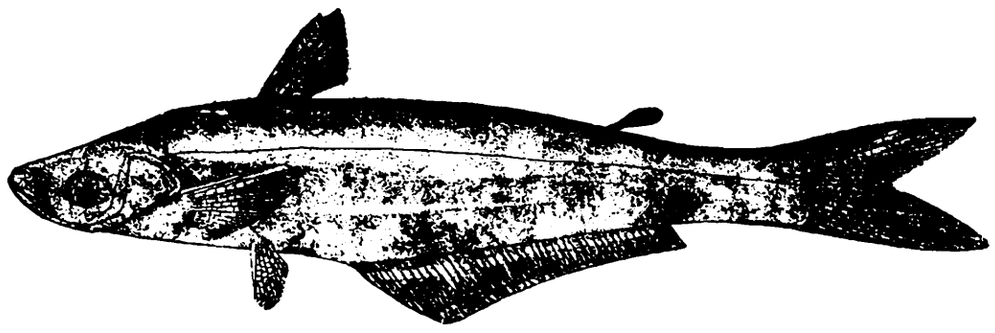


Fig. 116. Lateral view of *Silonia silondia* (Hamilton). (After Misra, K. S. 1962, text-fig. 103).

rounded. Mouth anterior, wide, obliquely directed upwards. Eyes moderate sized, situated laterally behind angle of mouth, visible from

below ventral surface. Lips thin. Jaws equal. *Teeth large, caniniform on jaws, villiform on palate ; jaw teeth project outside mouth opening. Two pairs of barbels ; one of maxillary, small, in a groove ; one of mandibular ; either of the pair may become vestigial or absent.*

Rayed dorsal fin inserted above half of pectoral fin with seven rays and a spine. Adipose dorsal fin short, posteriorly free. Pectoral fins with 11 to 13 rays and a strong spine serrated along both edges. Pelvic fins with six rays. Anal fin long with 40 to 46 rays. Caudal fin deeply forked. Lateral line complete, indistinct.

Air-bladder generally reduced, thick-walled, not enclosed in bone.

Distribution.—India. Pakistan. Nepal. Bangladesh. Burma. Inhabits estuaries, also ascending large rivers.

Species.—

1. *S. childreni* (Sykes)—India : Krishna, Godavary and Cauvery river systems.
2. *S. silondia* (Hamilton)—India : N. India. Bangladesh. Nepal. Pakistan.

KEY TO SPECIES

1.	Air-bladder greatly reduced. (North India, Burma, Pakistan). ...	*S. silondia*
—	Air-bladder large, longer axis transversely disposed (Deccan). ...	*S. childreni*

Family PANGASIIDAE

Large sized fishes with a compressed body. Teeth on premaxillaries, mandible and prevomer. Nostrils widely separated, anterior ones wide, situated along front border of snout, posterior with a lip situated at some distance behind anterior nostrils. Barbels four, moderately developed. Gill openings wide, extending to above base of pectoral fin ; membranes united with each other, but free from isthmus.

Rayed dorsal fin short with a pungent spine. Adipose dorsal fin smooth, not confluent either with rayed dorsal or with caudal. Paired fins inserted laterally. Pectoral fins with a strong, serrated spine. Anal fin long, not confluent with caudal. Caudal fin forked. Lateral line complete, simple.

Air-bladder large, free in the abdominal cavity ; consists of two parts, a large anterior portion, broad in front, oval behind, a small tubular part extending into kidney.

Lateral ethmoid facet for articulation of palatines more ventral than lateral. Palatines rod-like, edentate. Endopterygoid present. Ectopterygoid edentate. Metapterygoid suturally articulating with hyomandibular. Autosphenotics alone provide whole of articular facet ventrally for hyomandibular. Post-temporals present, connected to skull by sutures. Inferior limb of post-temporal moderately developed. *An elastic spring apparatus formed by anterior part of 4th parapophyses present.*

Distribution.—India. Pakistan. Bangladesh. Burma. Thailand. Laos. Viet-Nam. Malaya. Java. Sumatra. Borneo.

A single genus is dealt with here.

Genus **Pangasius** Valenciennes

Pangasius Valenciennes, 1840, In : Cuvier & Valenciennes, *Hist. Nat. Poiss.*, **15.** p. 45 (type-species, *Pimelodus pangasius* Hamilton, by original designation).—Hora, 1938, *J. Bombay nat. Hist. Soc.*, **40** (3) pp. 355-466 (review).

Diagnosis.—Body elongate, compressed. Abdomen rounded. *Head moderate sized, exceptionally granulated, blunt.* Snout more or less prominent, rounded or bluntly pointed. Mouth subterminal, horizontal or slightly ascending. Eyes large, behind corner of mouth, a part of eye being below horizontal through corner of mouth, visible from below ventral surface. Lips thin. Jaws subterminal, upper jaw slightly longer.

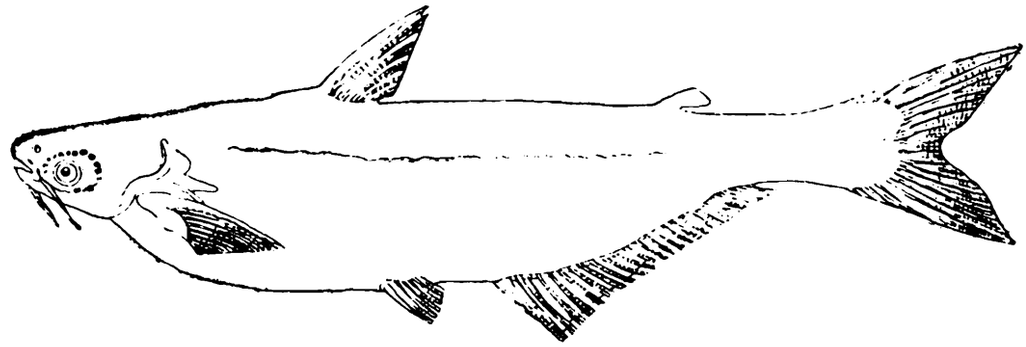


Fig. 117. Lateral view of *Pangasius pangasius pangasius* (Hamilton). (After Jayaram, K. C. 1977c, text-fig. 14, p. 27).

Teeth small, villiform in bands on jaws *in four patches on palate,* separate or variously united, occasionally dentition poorly developed. *Two pairs of barbels, one each of maxillary and mandibular.*

Rayed dorsal fin inserted above last quarter of pectoral fin with six or seven rays and a spine. Adipose dorsal fin short, posteriorly free. Pectoral fins with 9 to 12 rays and a strongly serrated spine. Pelvic fins with six rays. Anal fin long, with 30 to 34 rays. Caudal fin forked. Lateral line complete, simple.

Distribution.—India. Pakistan. Bangladesh. Burma. Thailand. Malaya. Viet-Nam. Indonesia.

One species and two subspecies. The two subspecies are mere geographical local populations.

Species & sub-species.—

1. *Pangasius pangasius pangasius* (Hamilton) distribution as of the genus.

1. 1. *P. pangasius godavarii* David—India : Godavary river, Andhra Pradesh.

1. 2. *P. pangasius upiensis* Srivastava—India : Rivers Rohini and Rapti, U. P.

Family AMBLYCIPITIDAE

Dimunitive loach-like fishes with body depressed anteriorly up to pelvic fins, strongly compressed and rectangular behind. Teeth on premaxillaries and mandible, palate edentate. Nostrils close together separated by nasal barbel. Barbels eight, moderately developed. Gill openings very wide, extending far forward on ventral surface, membranes united with each other, but free from isthmus.

Rayed dorsal fin enveloped in thick skin. Adipose dorsal fin smooth, not confluent with either rayed dorsal or caudal. Paired fins inserted horizontally, enveloped in skin, not confluent with caudal. Caudal fin subrounded, truncate or slightly emarginate. Lateral line entirely absent.

Air-bladder greatly reduced, divided into two lateral chambers, partially enclosed in bone.

Palatines rod-like. Endopterygoid absent. Mesopterygoid elongate, extending from palatines to hyomandibular. Metapterygoid reduced. Post-temporals absent. Parapophyses of fourth vertebra form on each side a semicylinder, incomplete below in the form of an inverted cup.

Vertebrae 36 to 45.

Distribution.—Freshwaters of Asia.

A single genus is dealt with here.

Genus **Amblyceps** Blyth

Amblyceps Blyth, 1858, *Proc. Asiat. Soc. Bengal*, **27**, p. 282 (type-species, *Pimelodus mangois* Hamilton).—Hora, 1933, *Rec. Indian Mus.*, **35**, pp. 607-621 (synonymy, revision).

Diagnosis.—Body elongate, subcylindrical, compressed. Abdomen rounded. Head small, broad, depressed, covered with thick skin.

Snout broadly rounded, or subtruncate. Mouth anterior, wide, transverse. Eyes small, superior, not visible from below ventral surface. Lips fleshy. Jaws subequal, either upper or lower jaw being slightly longer. Teeth small, villiform in bands on jaws ; *palate edentate.* Four pairs of barbels ; one pair each of maxillary, nasal, two of mandibular ; maxillary barbels with broad bases. *A fold of skin above and anterior to pectoral fin base, and immediately behind gill opening present.* Gill membranes rest on this skin fold when gill opening is closed.

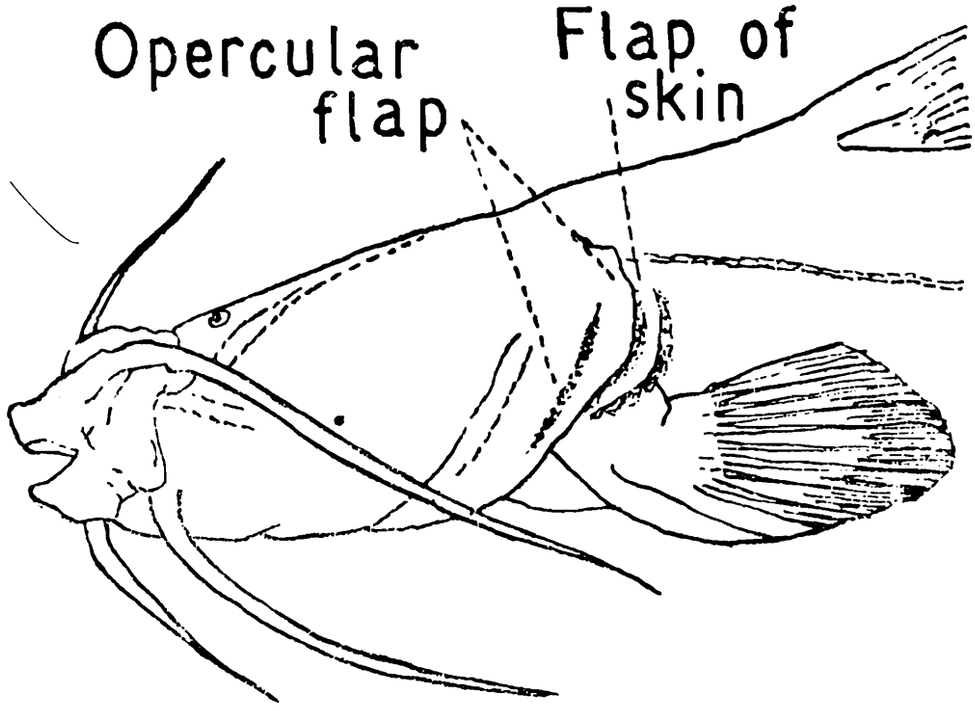


Fig. 118. Diagram of head portion of *Amblyceps mangois* (Hamilton) to show flap of skin near operculum. (After Jayaram, K. C. 1977 c., text-fig. 15, p. 29).

Rayed dorsal fin inserted above half or first quarter of pectoral fin with five or six rays and a weak spine. Adipose dorsal fin of variable length, smooth, usually low. *Pectoral fins with* seven rays and *a smooth, weak spine.* Pelvic fins with six rays. Anal fin with 8 to 11 rays. *Caudal fin truncate or emarginate.* Lateral line absent.

Distribution.—India : along the foot-hills of the Himalaya from Kangra valley in Punjab to Assam, Krishna river system, S. India. Pakistan. Nepal. Bangladesh. Burma. Thailand. Laos.

Species.—*A. mangois* (Hamilton) is the only species known so far.

Family Akysidae

Small, more or less elongate fishes with head, and anterior part of body depressed. Teeth on premaxillaries, and mandible ; palate edentate. Nostrils widely separated, anterior tubular on front border of snout, posterior with a circular rim, the front border of which

carries the nasal barbel. Barbels eight, well developed. *Gill openings narrow of moderate width, extending to base of pectoral fin or above* ; *membranes* united with each other and isthmus.

Rayed dorsal fin short with a pungent spine. Adipose dorsal fin present or absent, when present smooth, not confluent either with rayed dorsal or caudal. Paired fins inserted horizontally. Pectoral fins with a strong spine. Anal fin short, not confluent with caudal. Caudal fin truncate or deeply emarginate. Lateral line present, complete or incomplete.

Air-bladder much reduced, not free in abdominal cavity, in the form of two ovoid thin-walled sacs, laterally situated.

Osteology not known.

Distribution.—Burma. Thailand. Malaya. Java. Sumatra. Borneo.

A single genus is dealt with here.

Genus **Akysis** Bleeker

Akysis Bleeker, 1858, *Ichth. Arch. Indici*, **I**, Siluri, p. 234 (type-species, *Pimelodus variegatus* Bleeker, by original designation).—Hora, 1936, *Rec. Indian Mus.*, **38**, pp. 199-209 (revision).

Diagnosis.—Body elongate, depressed up to pelvic base. Abdomen rounded. Head small, anteriorly depressed with or without prominent ridges. *Skin covered with roundish granules or tubercles which are sometimes*

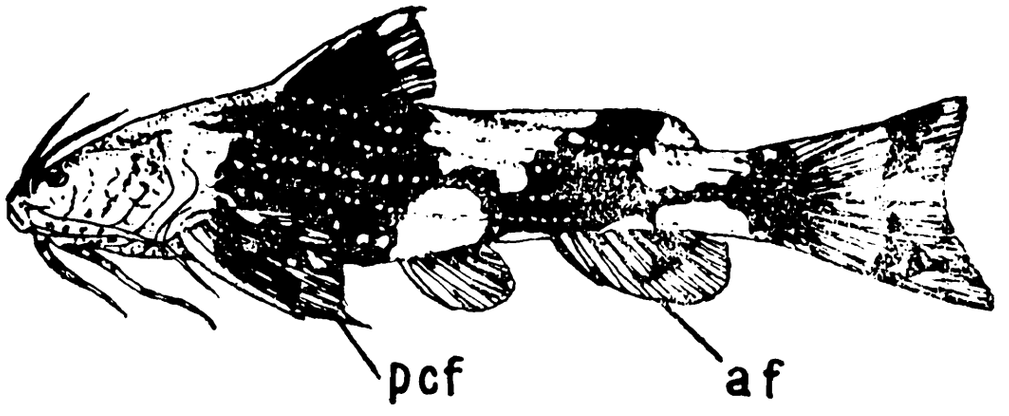


Fig. 119. Lateral view of *Akysis prashadi* Hora. (After Jayaram, K. C. 1977c, text-fig. 16, p. 32).

arranged in longitudinal rows. Snout broadly rounded. Mouth subinferior, transverse of moderate width, overhung by upper jaw. Eyes small, dorsal, looking upwards, not visible from below ventral surface. Lips fleshy, papillated. Jaws equal. Teeth small, villiform in bands on jaws, *palate edentate.* Four pairs of barbels, one pair each of maxillary, nasal and two of mandibular.

Rayed dorsal fin inserted above base of pectoral fin with five to eight rays and a *strong spine*. Adipose dorsal fin short, posteriorly free. *Pectoral fins* with five to eight rays *and a spine strongly serrated along inner edge with antrose teeth, longitudinally furrowed, covered with thick skin, with a cartilaginous filament*. Pelvic fins with six rays. Anal fin with 8 to 11 rays. Caudal fin emarginate with lower lobe better developed. Lateral line complete, simple. Air-bladder with thin walls.

Distribution.—Burma. Thailand. Sumatra. Java. Borneo.

A total of six species are known of which two are dealt here.

Species.—

1. *A. pictus* Günther—Burma : Tenasserim.
2. *A. prashadi* Hora—Burma : Indawgyi Lake.

KEY TO SPECIES

1.	Anal fin with 11 rays. Pectoral fins with 8 rays. ...	*A. prashadi*
—	Anal fin with 9 rays. Pectoral fins with 7 rays. ...	*A. pictus*

Family SISORIDAE

Sucker catfishes

Generally small to medium sized fishes with head and anterior part of body depressed, and tail compressed or entire body compressed. An adhesive apparatus on thorax may be present or absent. Teeth on premaxillaries and mandible ; palate edentate. Nostrils close together, slit-like, separated by nasal barbel of varying length. Barbels eight, generally well developed, in some genera thick, fleshy with broad bases. Gill openings wide or narrow, restricted to sides ; free or confluent with isthmus.

Rayed dorsal fin short, with or without a spine. Adipose dorsal fin smooth, generally free, but in some genera confluent with caudal, in some rudimentary, represented by a small short spine (*Sisor*). Paired fins inserted horizontally, may or may not be plaited below. Pectoral fins with or without a spine, denticulated either on inner or outer margin, or on both ; in some genera (*Euchiloglanis*) outermost ray pinnate, cartilaginous, a spine in typical sense being absent ; outermost ray of pelvic fins thick, pinnate. Anal fin short, not confluent with caudal. Caudal fin deeply forked, emarginate, truncate or rounded. Lateral line present, complete.

Air-bladder small, partly enclosed in a bony capsule.

Lateral ethmoid facet for articulation of palatines more lateral than ventral. Palatines very well developed, broad. Endopterygoid absent,

ecto-and mesopterygoid present, variously developed. Metapterygoid connected to hyomandibular. Prevomer small, edentate. Autosphenotics alone provide ventrally the articular facet for hyomandibular. Post-temporals present, united to skull with sutures, with inferior limb weak, fused to basioccipital.

Vertebrae 34 to 40.

Distribution.—Freshwaters of Asia : India. Pakistan. Bangladesh. Burma. Thailand. Viet-Nam. Malaya. China. Not known so far from Sri Lanka.

18 genera are dealt with here.

KEY TO GENERA

1. An adhesive apparatus on ventral surface of body present, distinct and well developed. 2

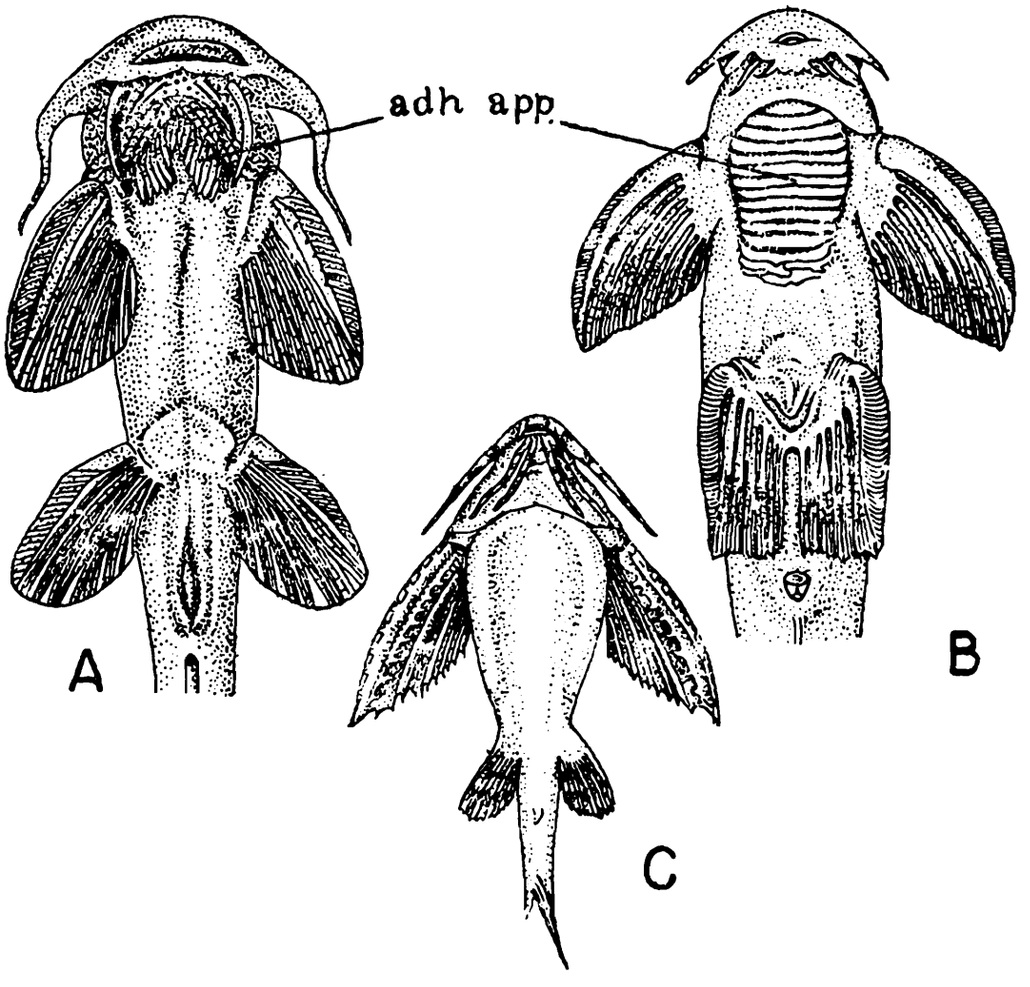


Fig. 120. A. Ventral view of *Glyptothorax pectinopterus* to show adhesive apparatus. (After Hora, S. L. 1952. *J. Asiat. Soc.*, **18** (2), p. 125, text-fig. 2, fig. a.).

B. Ventral view of *Pseudecheneis sulcatus* to show adhesive apparatus. (After Hora, S. L. 1952. *J. Asiat. Soc.* **18** (2), p. 124, text-fig. 1, fig. C.)

C. Ventral view of *Erethistes pussilus* to show absence of adhesive apparatus. (After Hora, S. L. 1949. *Rec. Indian Mus.*, **47** (1), pl. 1, fig. 3.)

— An adhesive apparatus on ventral surface of body absent, if present faintly developed, indistinct. 5

2. Adhesive apparatus in the form of prominent, well developed transverse folds. ... *Pseudecheneis* Blyth

— Adhesive apparatus in the form of longitudinal folds. 3

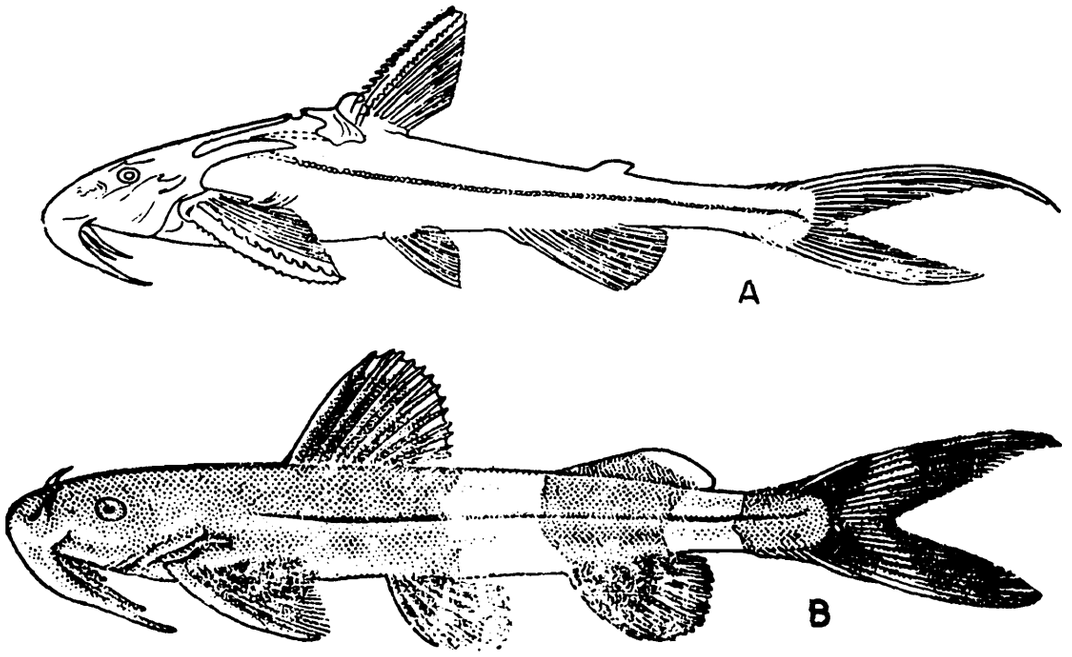


Fig. 121. A. Lateral view of *Conta conta* to show prolonged caudal fin ray, oval shaped compessed head. (After Hora, S. L. 1949. *Rec. Indian Mus.*, **47**, p. 197, fig. 4C).

B. Lateral view of *Glyptothorax anamaliensis* Silas to show caudal fin without any prolongation, flat and depressed head. (After Silas, E. G. 1951. *J. Bombay nat. Hist. Soc.*, **49**, fig. 1).

3. Gill membranes separated by broad isthmus. Caudal fin rays prolonged. Head oval shaped, compressed. ... *Conta* Hora

— Gill membranes united with isthmus. Caudal fin rays not prolonged. Head flat, depressed. 4

4. Cubito-humeral process inconspicuous, hidden by skin. ... *Glyptothorax* Blyth

— Cubito-humeral process conspicuous, exposed, prominently seen. ... *Pseudolaguvia* Misra

5. Dorsal spine present, well developed. 6

— Dorsal spine absent, anteriormost ray thick, but not bony. 12

6. Serrations along outer margin of pectoral spine divergent or a combination of retrorse and antrorse teeth. 7

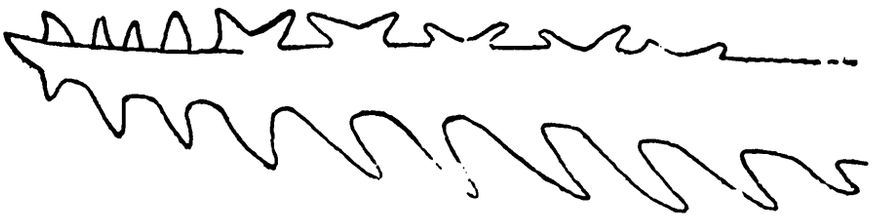


Fig. 122. Left pectoral spine of *Erethistes pussilus* to show divergent serrations. (After Hora, S. L. 1949. *Rec. Indian Mus.*, **47**, p. 185, fig. 2).

— Serrations along outer margin of pectoral spine either absent or when present weak, in one direction only. 8

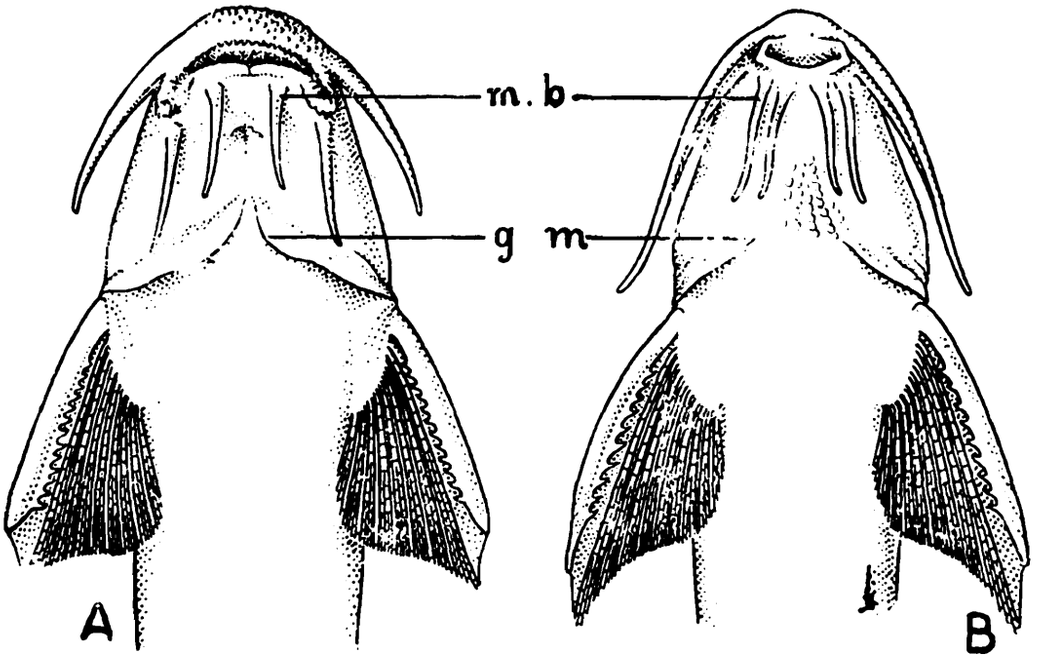


Fig. 123. A. Ventral view of head of *Nangra viridescens* to show insertion of mandibular barbels at different levels, gill membranes free from isthmus and ventral surface of head flat and broad.

B. Ventral view of head of *Gagata gagata* to show insertion of mandibular barbels at same levels, gill membranes broadly united with isthmus and ventral surface of head compressed and narrow. (After Jayaram, K. C. 1979, p. 5, fig. 4 A, B).

7. Serrations along outer margin of pectoral spine divergent. ... *Erethistes* Müller & Troschel

— Serrations along outer margin of pectoral spine directed towards base in proximal half (antrorse), while along distal half directed towards tip (retrorse). ... *Erethistoides* Hora

8. Caudal fin rays not prolonged. Body smooth, without bony plates. 9

— Caudal fin rays prolonged. Body with bony plates. 11

9. Maxillary barbels with stiff base, lying in a groove anteriorly. 10

— Maxillary barbels without any stiff base and groove anteriorly. 12

10. Mandibular pair of barbels inserted on a transverse line at different levels. Gill membranes free from isthmus or only slightly adherent to it. Ventral surface of head flat and broad. (Fig. 123A) ... *Nangra* Day

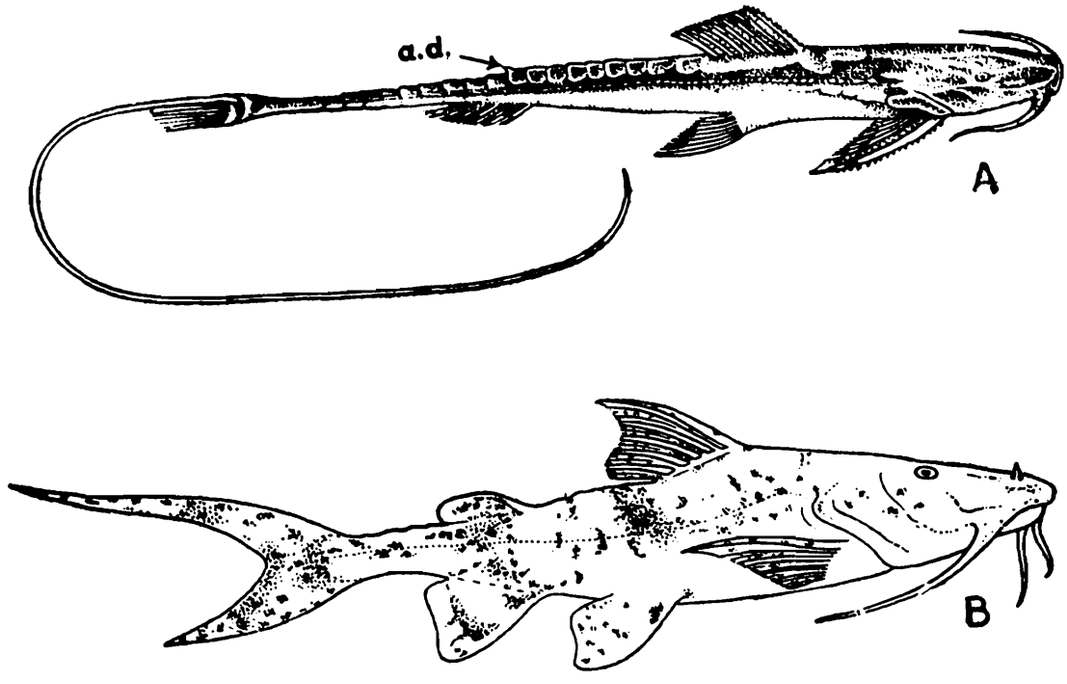


Fig. 124. A. Lateral view of *Sisor rhabdophorus* to show prolonged caudal fin ray, body with bony plates, small gill openings, adipose fin in the form of spine. (Drawn from a specimen).

B. Lateral view of *Bagarius bagarius* to show prolonged caudal fin rays, wide gill openings, smooth long adipose fin. (After Hora, S. L. 1939. *J. Bombay nat. Hist. Soc.*, **40** (4), p. 587, fig. 1).

— Mandibular pair of barbels inserted on a transverse line at the same level. Gill membranes broadly united with isthmus. Ventral surface of head compressed and narrow. (Fig. 123B) ... *Gagata* Bleeker

11. Gill openings small. Adipose dorsal fin in the form of a spine. Upper ray of caudal fin much prolonged. (Fig. 124A) ... *Sisor* Hamilton

— Gill openings wide. Adipose dorsal fin long, smooth. Both lobes of caudal fin may be prolonged, but not very long. (Fig. 124B) ... *Bagarius* Hamilton

12. Caudal fin emarginate, semicircular. 13

— Caudal fin deeply forked. 14

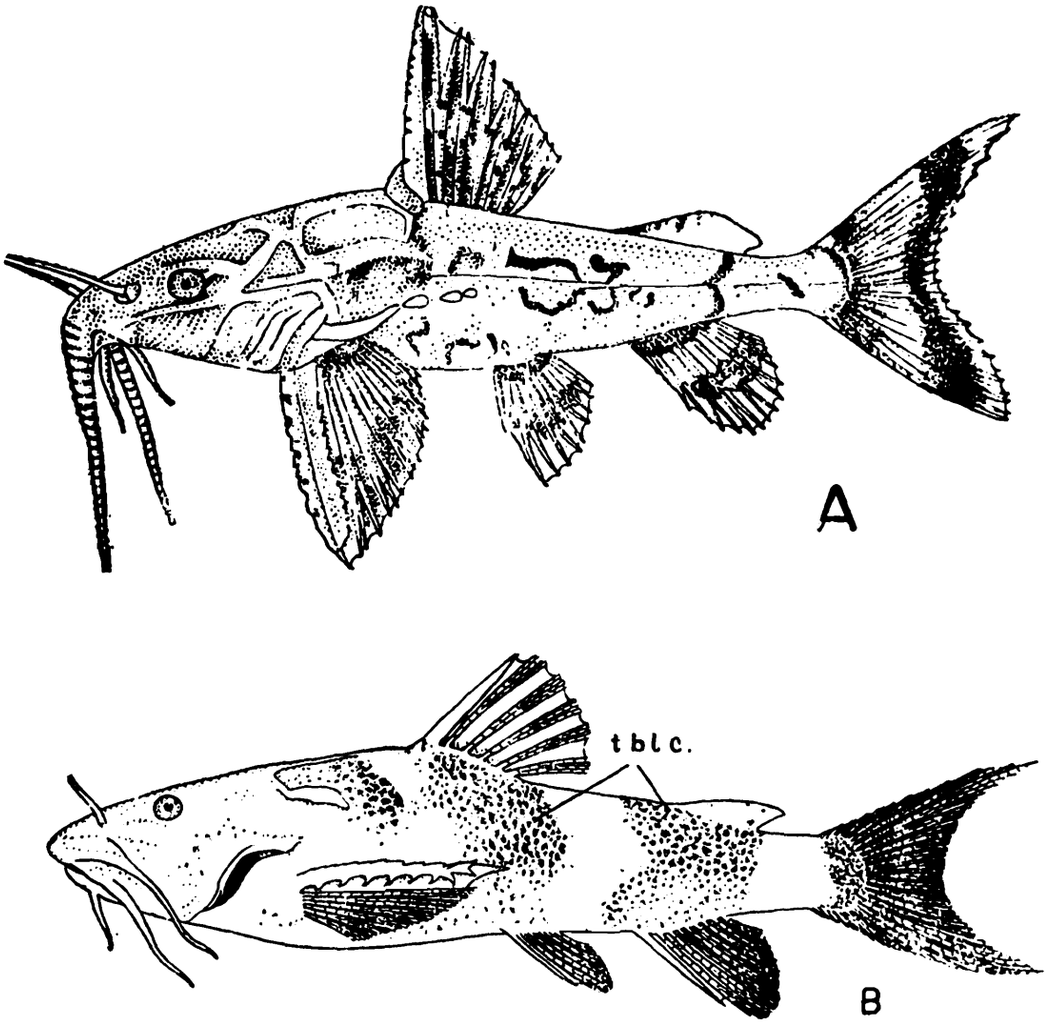


Fig. 125. A. Lateral view of *Hara hara* to show annulated barbels, (After Hora, S. L. 1949. *Rec. Indian Mus.*, 47, p. 200).
B. Lateral view of *Laguvia shawi* to show emarginate caudal fin, barbels without annulations and tubercles on body (Drawn from a specimen).

13. Barbels annulated. Body plain. ... *Hara* Blyth

— Barbels not annulated. Body with tubercles along sides of body. ... *Laguvia* Hora

14. Post-labial groove interrupted. (Fig. 126A) 15

— Post-labial groove continuous. (Fig. 126B) 17

15. Gill openings extending to ventral surface of body. ... *Glyptosternum* McClelland

— Gill openings restricted to dorsal surface of body. 16

16. Teeth on upper jaw in a continuous band extending backwards at sides. ... *Coraglanis* Hora & Silas

— Teeth on upper jaw in a discontinuous or continuous band not extending backwards at sides. ... *Euchiloglanis* Regan

17. Pectoral fins with 10 to 12 branched rays. Teeth on upper jaw in two well separated patches, oar-shaped. (Fig. 127A) ... *Exostoma* Blyth

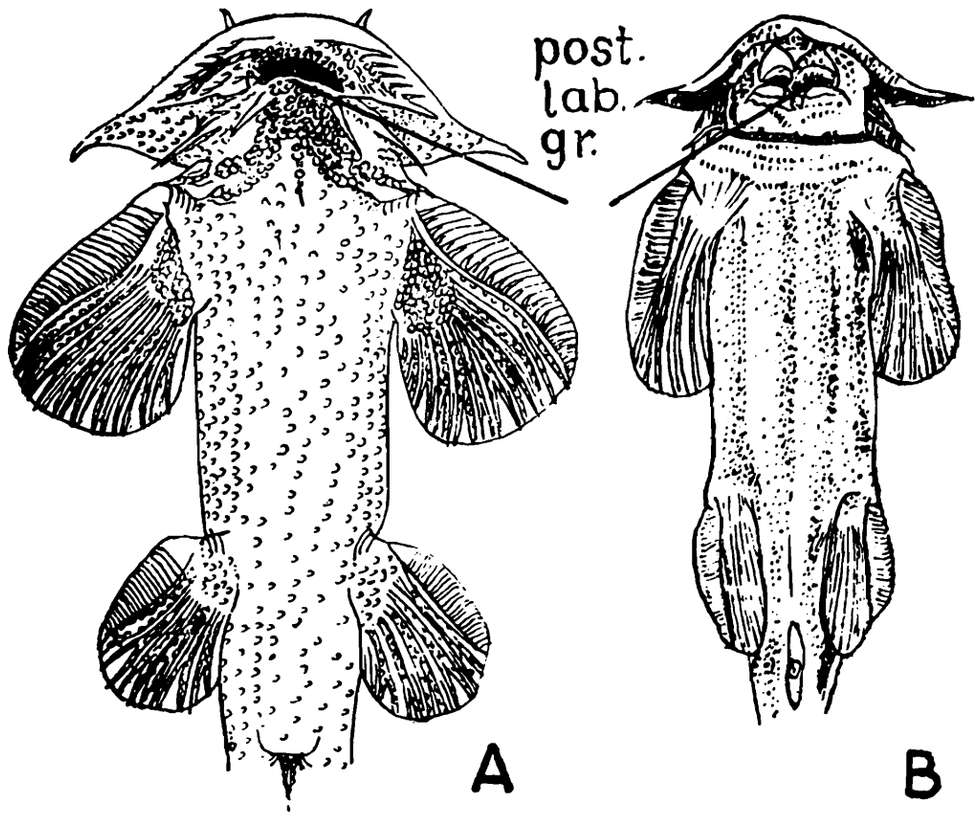


Fig. 126. A. Ventral view of head and anterior part of body of *Glyptosternum reticulatum* to show post-labial groove interrupted. B. Ventral view of head and anterior part of body of *Exostoma labiatum* to show post-labial groove continuous. (After Hora, S. L. & Silas, E. G. 1952. *Proc. nat. Inst. Sci. India*, p. 311, text-fig. 20).

— Pectoral fins with 16 to 19 rays. Teeth on upper jaw in a bilobed band not produced at sides, villiform. 18

18. All teeth in both jaws conical and pointed. (Fig. 127B) ... *Myersglanis* Hora & Silas

— All teeth in both jaws not conical and pointed. ... *Oreoglanis* Smith

Genus **Bagarius** Bleeker

The Goonch

Bagarius Bleeker, 1853, *Verh. Bat. Gen.*, **25**, p. 121 (type-species, *Pimelodus bagarius* Hamilton).—Hora, 1939, *J. Bombay nat. Hist. Soc.*, **40** (4) pp. 585-593 (review).

Diagnosis.—Body and abdomen elongate, flattenned up to pelvics. Head large, naked, osseous, rugose in regular bands and lines, greatly depressed. Snout sharply conical, not pointed. Mouth ventral, wide,

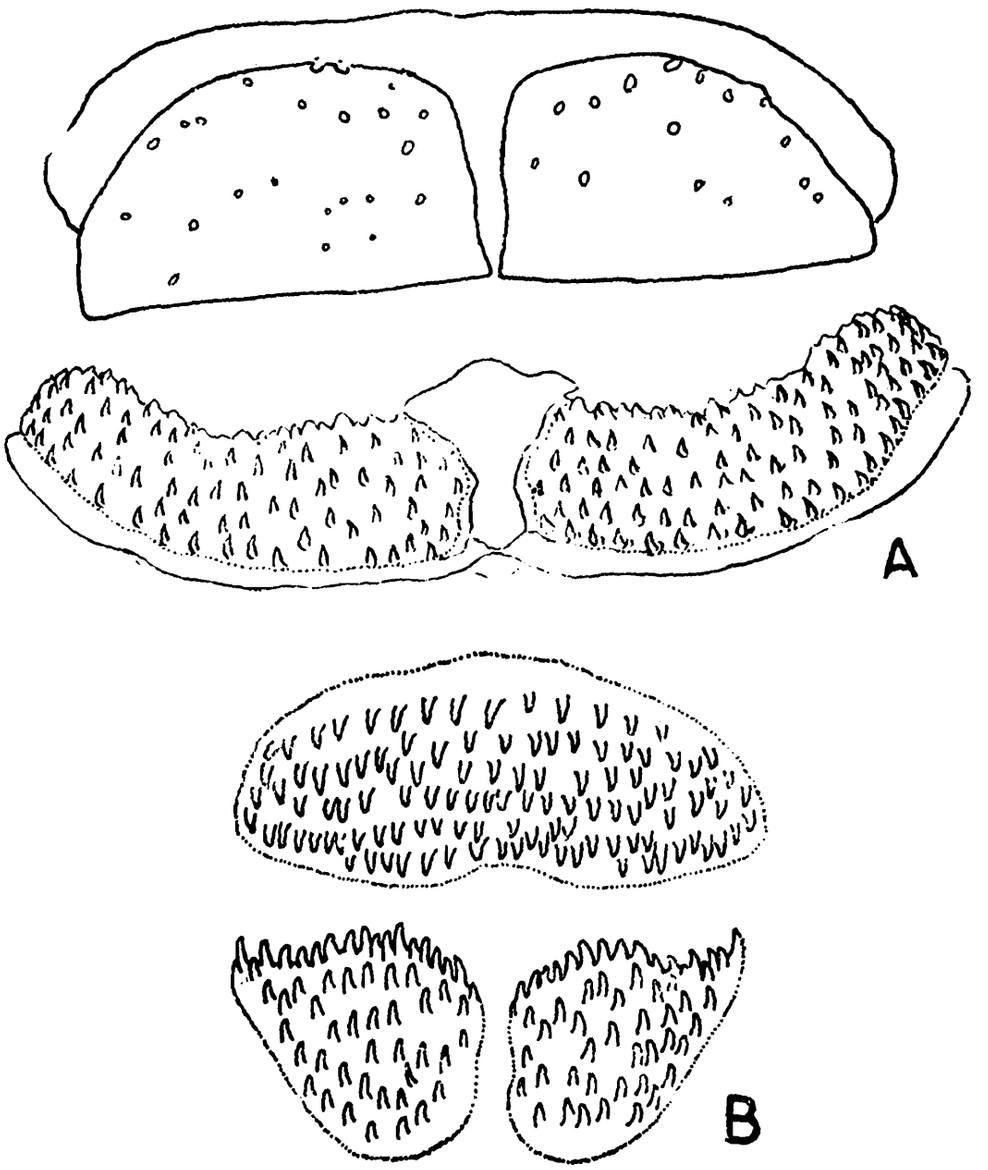


Fig. 127. A. Drawing of dentition of *Exostoma labiatum* to show upper jaw teeth in two well separated oar-shaped patches. (Drawn from a specimen No. F. 11819/1).

B. Drawing of dentition of *Myersglanis blythii* to show all teeth in both jaws conical and pointed. (Drawn from Cat. 599 ASB, Type).

crescentic. Eyes small, subcutaneous, dorsally placed at posterior half of head, not visible from below ventral surface. Lips thick. Teeth sharp, unequal in size in bands on jaws ; palate edentate. Four pairs of

barbels ; one pair each of maxillary, nasal, and two of mandibular ; *maxillary barbels with broad bases*. Gill membranes free from each other up to base of isthmus and overlapping, free from isthmus.

Rayed dorsal fin inserted above base of pectoral fin with six rays and a smooth spine with *an elongated soft termination of varying length*. Adipose dorsal moderately long, posteriorly free. Pectoral fins with 13 rays and

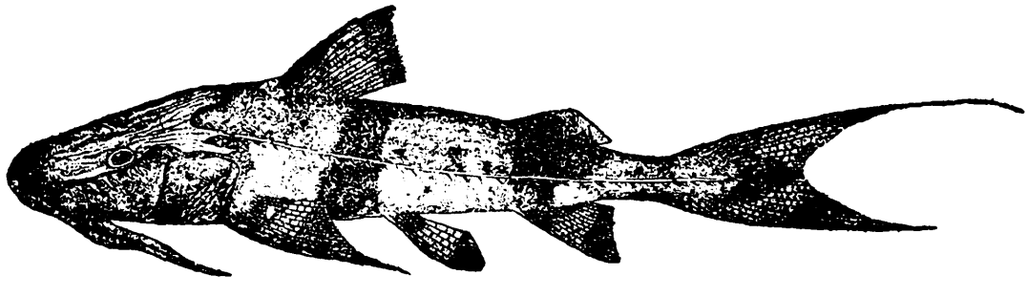


Fig. 128. Lateral view of *Bagarius bagarius* (Hamilton). (After Misra, K. S. 1962, text-fig. 113).

a spine serrated along inner edge and also with a soft prolongation. Pelvic fins with six rays. Anal fin short, with 12 to 15 rays. *Caudal fin deeply forked, upper lobe longer and both lobes produced into soft filamentous prolongations.*

Lateral line complete, simple.

Air-bladder small, enclosed in two bony capsules.

Distribution.—India. Pakistan. Nepal. Bangladesh. Burma. Thailand. Malaya. East Indies. Tonkin.

Species.—*Bagarius bagarius* (Hamilton) is the only species known so far from this area.

Genus **Gagata** Bleeker

Gagata Bleeker, 1858, *Ichthyol. Archipel. Ind. Prodr.*, **I**, p. 204 (type-species, *Gagata typus* Bleeker, *Pimelodus gagata* Hamilton).— Hora & Law, 1941, *Rec. Indian Mus.*, **43** (1), p. 9 (revision, synonym).

Diagnosis.—Body short, compressed. Abdomen rounded. Head short, snubnosed though globular, somewhat elevated, *compressed and narrow*. Snout obtusely rounded. Mouth ventral, transverse, narrow. Eyes large, dorso-lateral. Lips thick, fimbriated. Jaws subequal. Teeth uniformly villiform on jaws in bands ; palate edentate. Four pairs of barbels ; *mandibular pair of barbels inserted on a transverse line at the same level*, nasal pair with broad flaps at base separated by two nostrils. Gill membranes free from each other postero-laterally, but *broadly united* with isthmus.

Rayed dorsal fin inserted above half of pectoral fin, with not more than six rays and a spine. Adipose dorsal short, posteriorly free. Pectoral fins with seven to nine rays and a spine serrated along inner edge. Pelvic fins with six rays. Anal fin short, with 11 to 16 rays. Caudal fin deeply forked. Lateral line complete, may be with pores in anterior half.

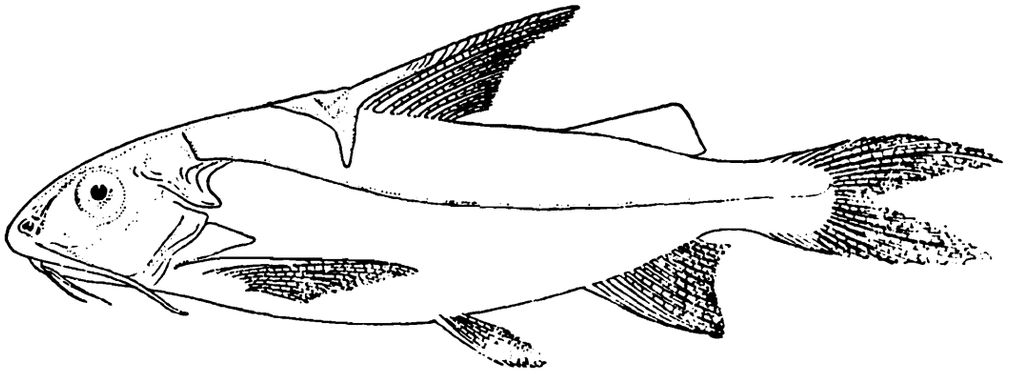


Fig. 129. Lateral view of *Gagata cenia* (Hamilton). (After Day, F. 1878, pl. 115, fig. 4).

Air-bladder divided into two rounded portions, partly enclosed in bone.

Distribution.—India. Pakistan. Bangladesh. Burma. Thailand. Sumatra. The southern limit in India is Orissa.

Species.—

1. *G. cenia* (Hamilton)—India : Punjab, Delhi, U. P., Bihar, W. Bengal, Assam, Orissa. Bangladesh. Burma. Pakistan. Nepal.
2. *G. gagata* (Hamilton)—India : U. P., West Bengal. Bangladesh. Burma.
3. *G. sexualis* Tilak—India : Yamuna river system, Chota Nagpur, Bihar.
4. *G. youssoufi* Rahman—Bangladesh. Old Brahamputra river near Mymensingh ; Meghna river, Chandpur.

KEY TO SPECIES

1. Median longitudinal groove on head extends to end of supraoccipital process. Distal portions of all fins except caudal coloured black.... *G. gagata*

— Median longitudinal groove does not extend to full length of supraoccipital process, but only up to base. 2

2. Maxillary barbels longer than head length. Pectoral fin with a filamentous prolongation... *G. sexualis*

— Maxillary barbels shorter than head length 3

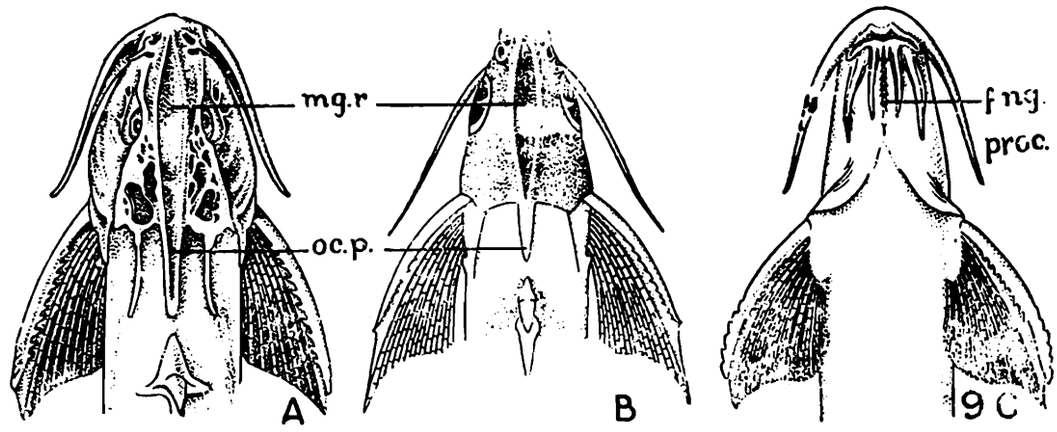


Fig. 130. A. Dorsal view of head and anterior part of body of *Gagata gagata* to show median longitudinal groove extending to end of occipital procces. Tip of pectoral fin tinged black. (After Hora, S. L. & Law, N. C. 1941. *Rec. Indian Mus.*, **43** (1), pl. 1, fig. 2.).

B. Dorsal view of head and anterior part of body of *Gagata sexualis* Tilak to show maxillary barbels longer than head, median longitudinal groove not extending to end of occipital process. (After Raj Tilak, 1970. *Zool. Meded.* **44** (4), p. 207, fig. 1).

C. Ventral view of *Gagata cenia* to show presence of finger like processess between mandibular barbel, and the tip of pectoral fin plain. (After Hora, S. L. & Law, N. C. 1941. *Rec. Indian Mus.*, **43** (1) pl. 1, fig. 5).

3. Snout much longer than eye. Head 3.6-4.0 in standard length. Anal fin with 13-15 rays. *G. cenia*

— Snout equal to or shorter than eye. Head 4.2-4.5 in standard length. Anal fin with 15-18 rays. ... *G. youssouft**

Genus **Nangra** Day

Nangra Day, 1877, *Fish India*, p. 493 (type-species, *Pimelodus nangra* Hamilton, by original designation).—Hora & Law, 1941, *Rec. Indian Mus.*, **43**, p. 9 (as a synonym of *Gagata* Bleeker).—Jayaram, 1972, *J. zool. Soc. India*, **23** (2) : 171 (genus resurrected from synonymy of *Gagata*).

Diagnosis.—Body short, compressed. Abdomen rounded. Head short, compressed. Snout obtusely rounded. Mouth ventral, transverse, narrow. Eyes large, dorso-lateral, not visible from below ventral surface of head. Lips thick, fimbriated. Jaws subequal. Teeth uniformly villiform in bands on jaws, palate edentate. Four pairs of barbels ; one pair each of maxillary, nasal and two of mandibular ; maxillary pair with stiff bases, may be very long ; *mandibular pair of barbels*

*Rahman, A. K. A. 1976. *Bangladesh J. Biol. Sci.*, **5** (1), pp. 1-8.

inserted on a transverse line at different levels. A pair of finger-like processes in between inner mandibular pair may be present. *Gill membranes confluent with each other, and also with isthmus.*

Rayed dorsal fin inserted above tip or last quarter of pectoral fin with 6 to 10 rays and a spine. Adipose dorsal short, posteriorly free. Pectoral fins with eight or nine rays and a spine serrated either along inner edge only or along both edges. Pelvic fins with six rays. Anal fin short, with 11 to 13 rays. Caudal fin deeply forked. Lateral line complete, may be with pores on anterior half.

Air-bladder divided into rounded portions, partly enclosed in bone.

Distribution.—India. Pakistan. Nepal. Bangladesh.

Species.—

1. *N. itchkeea* (Sykes)—India : Deolali, Poona, Satara, Maharashtra ; Cauvery river, Karnataka. Burma.
2. *N. nangra* (Hamilton)—India : Yamuna, Ganga, Kosi and the Hooghly river systems. Pakistan : Indus river system. Bangladesh. Nepal.
3. *N. viridescens* (Hamilton)—India : Yamuna at Delhi, W Bengal, Bihar, Assam. Bangladesh. Nepal.
4. *N. robusta* Mirza & Awan—Pakistan : Indus river near Kalabagh, Punjab.

KEY TO SPECIES

1.	Outer mandibular barbels extend beyond pectoral fin. Nasal pair longer than head. Dorsal fin with 9 or 10 rays. ...	*N. nangra*
—	Outer mandibular barbels do not extend beyond pectoral fin. Nasal barbels shorter than head. Dorsal fin with six or seven rays. ...	... 2
2.	A pair of finger-like processes in between bases of inner mandibular barbles present. Maxillary barbels with stiff bases, lying in a groovs. ...	*N. viridescens*
—	No finger-like processes in between bases of inner mandibular barbels. ...	... 3
3.	Median longitudinal groove on head extending to base of occipital process and beyond. Maxillary barbels arising from a groove ...	*N. robusta*
—	Median longitudinal groove as two short fontanelles, not reaching base of occipital process. Maxillary barbels without any groove.	*N. itchkeea*

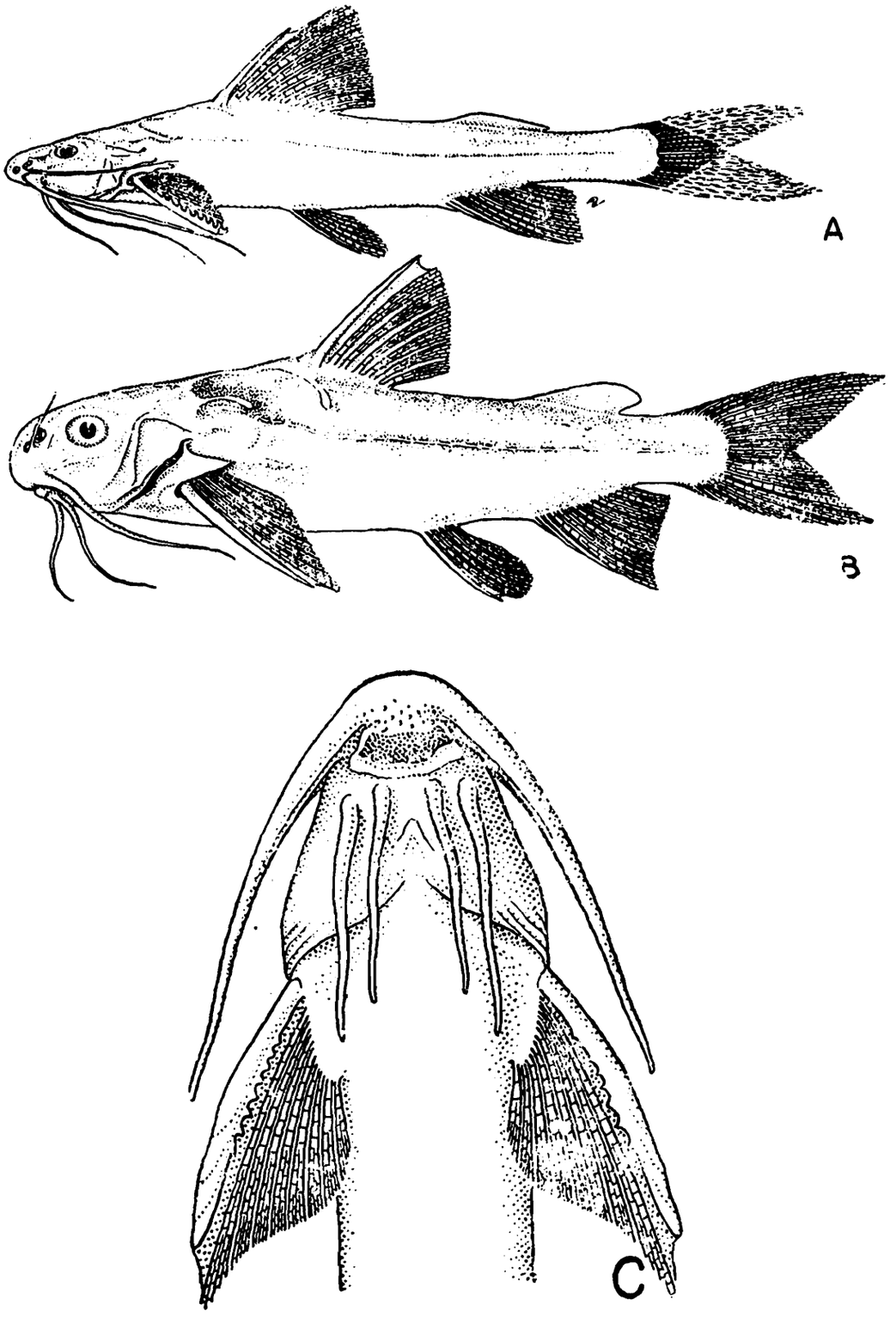


Fig. 131. A. Lateral view of *Nangra nangra* to show outer mandibular barbels extending beyond pectoral fin, nasal barbels longer than head, and dorsal fin with nine or ten rays. Drawn from specimen No. F. 13501/1, Nawabgunge, W. Bengal.

B. Lateral view of *Nangra viridescens* to show maxillary barbels with stiff bases. (Drawn from specimen No. F. 1052/2, Bombay).

C. Ventral view of *Nangra itchkeea* to show absence of finger-like process between bases of mandibular barbels. (After Hora S. L. & Law, N. C. 1941. *Rec. Indian Mus.*, **43** (1), pl. 1, fig. 3).

Genus **Erethistes** Müller & Troschel

Erethistes Müller & Troschel, 1845, *Horae Ichthyol.*, 3, p. 12, pl. 1, fig. 3 (type-species, *Erethistes pussilus* Müller & Troschel, by monotypy).—Hora, 1950, *Rec. Indian Mus.*, **47**, p. 183 (synonymy, revision).

Diagnosis.—Body short, compressed. Abdomen flattened up to pelvic base. *Head* small, naked, granulated, dorsal surface covered *with very short, backwardly directed spines.* Snout conical. Mouth ventral, crescentic, narrow Eyes minute, dorsal, situated in middle of head, not visible from below ventral surface. Lips thin. Jaws subequal. Teeth sharp, unequal in size in bands on jaws ; palate edentate. Four pairs of barbels, one pair each of maxillary, nasal and two of mandibular. Gill membranes fused with each other and also with isthmus.

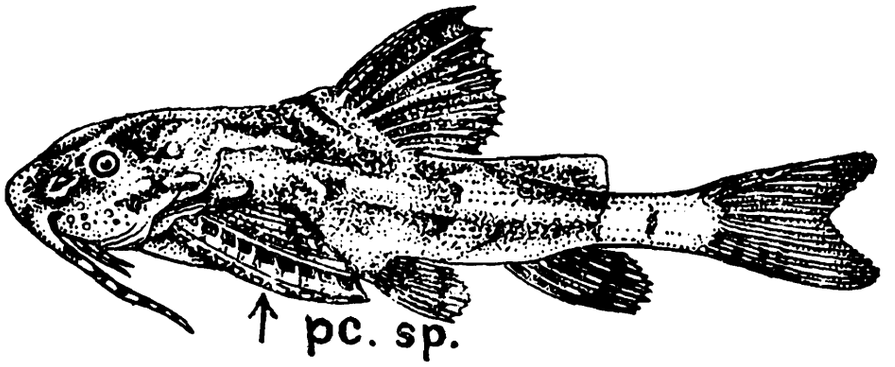


Fig. 182. Lateral view of *Erethistes pussilus* Müller & Troschel. (After Hora, S. L. 1949. *Rec. Indian Mus.*, **47**, pl. 12, fig. 1).

Rayed dorsal fin inserted above half of pectoral fin with six rays and a spine. Adipose dorsal very low, small, short. *Pectoral fins with five rays and a spine serrated along both edges ; serrations along outer edge arranged in the form of divergent spines.* Pelvic fins with six rays. Anal fin short, with 11 rays. Caudal fin truncate. *Lateral line complete, may be with tubercles.*

Air-bladder divided into two globular lateral lobes but free.

Distribution.—India : W. Bengal, Assam, Bihar, Orissa. Bangladesh. Burma. Its distribution in Orissa needs confirmation.

Species.—*E. pussilus* Müller & Troschel is the only species known so far.

Genus **Erethistoides** Hora

Erethistoides Hora, 1950, *Rec. Indian Mus.*, **47**, p. 190 (type-species, *Erethistoides montana* Hora, by original designation).

Diagnosis.—Body elongate, greatly depressed, *covered with small backwardly directed spines on dorsal surface.* Abdomen flat and horizontal.

Head small, depressed, broadly pointed in front, covered. *Snout projecting like a broad hood in front of mouth.* Mouth inferior, of moderate width, more or less transverse. Eyes small, dorso-laterally situated in posterior half of head, not visible from below ventral surface. Lips thin. Jaws subequal. Teeth uniformly villiform in bands on jaws ; palate edentate. Four pairs of barbels ; one pair each of maxillary, nasal and two of mandibular. Gill membranes fused with each other, and also with isthmus ; *portion of gill opening in front and somewhat inner to base of pectoral spine modified into a spoutlike formation.*

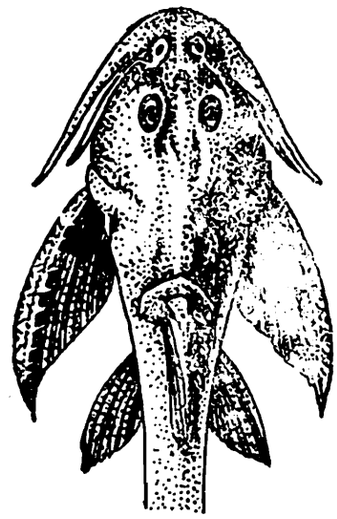


Fig. 133. Dorsal view of head and anterior part of body of *Erethistoides montana pipri* Hora. (After Hora, S. L. 1949. *Rec. Indian Mus.*, **47**, pl. 12, fig. 8)

Rayed dorsal fin inserted above half of pectoral fin with five rays and a spine. Adipose dorsal short, low. *Pectoral* fins with six rays and a *spine strongly serrated along outer edge with teeth directed towards tip of spine in distal half ; spine tips produced into a filiform process,* along with similar structure of some outer rays. Pelvic fins with six rays. Anal fin short, with nine rays. *Caudal fin emarginate, lower portion greatly produced, but not filiform.* Lateral line complete, simple.

Air-bladder as in *Erethistes.*

Distribution.—India : Uttar Pradesh, Assam.

Species.—

1. *E. montana montana* Hora—India : Tangla, Darrang dist., Assam.

1.1 *E. montana pipri* Hora—Rihand river, Pipri, Mirzapur dist., U. P.

Genus **Hara** Blyth

Hara Blyth, 1860, *J. Asiat. Soc. Beng.*, **29**, p. 151 (type-species, *Pimelodus hara* Hamilton, by original designation).—Hora, 1950, *Rec. Indian Mus.*, **47**, p. 199 (synonymy, revision).—Tilak, 1978, *Bull zool. Surv. India*, **1** (3) : 295-301 (redescription).

Diagnosis.—Body moderately elongate, compressed. Abdomen flat. Head small, conical, exposed, not covered with skin. Snout obtusely sharp, not pointed. Mouth ventral, transverse, narrow. Eyes small dorso-lateral, situated in posterior half of head not visible from below ventral surface. Lips thick, fleshy, papillated. Jaws subequal, lower jaw slightly prolonged. Teeth minute, uniformly villiform on jaws ; palate edentate. *Occipital process, cleithral process, scapular process all prominent and naked. Humeral process prominent on ventral side. Four pairs of barbels, all annulated,* one pair each of maxillary, nasal and two of mandibular ; *maxillary pair with broad cutaneous flaps at their bases.* Gill membranes free from each other but united broadly with isthmus. Gill openings extend to ventral surface for a short distance.

Rayed dorsal fin inserted above near base of pectoral fin with five or six rays and a spine. Adipose dorsal short, high, posteriorly free. *Pectoral* fins with five or six rays and a *spine serrated along both edges, serrations along outer edge retrorse, along inner edge antrorse.* Pelvic fin with six rays. Anal fin short, with 8 to 10 rays. *Caudal fin emarginate, semicircular,* with lower lobe slightly longer. Lateral line complete, simple.

Air-bladder structure not known.

Distribution.—India : U. P., Bihar, W. Bengal, Assam, Orissa. Bangladesh. Burma.

Species.—

1. *H. filamentosus* Blyth—Burma : Indawgyi Lake, Bassein, Mandalay, Tenasserim.
2. *H. hara* (Hamilton)—India : U. P., Terai, Duars, N. Bengal, Sadiya, Assam, Orissa. Nepal. Bangladesh.
3. *H. horai* Misra—India : Terai Duars, N. Bengal.
4. *H. jerdoni* (Day)—India : Siripur, Saran, Bihar, Teesta river, Jalpaiguri, N. Bengal, Assam. Bangladesh.

KEY TO SPECIES

1. Pelvic fin inserted just below last ray of dorsal fin. Upper lobe of caudal fin with a long filamentous prolongation. ... *H. filamentosus*

— Pelvic fin inserted below, anterior to last ray of dorsal fin. Upper lobe of caudal fin simple. ... 2

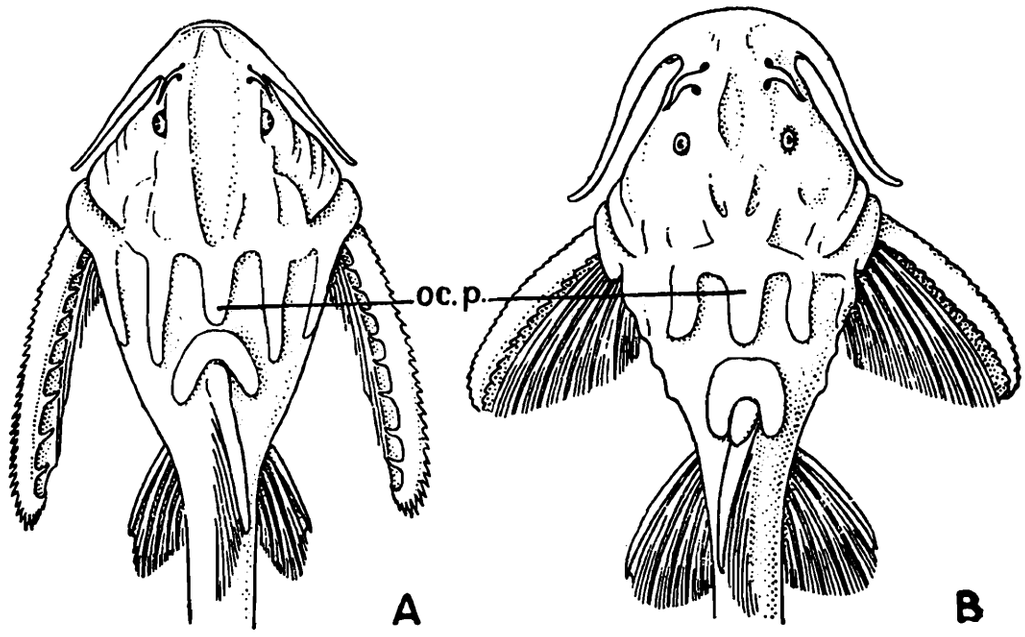


Fig. 134. A. Dorsal view of head of *Hara jerdoni* to show occipital process reaching basal bone of dorsal fin.

B. Dorsal view of head of *Hara hara* to show occipital process not reaching basal bone of dorsal fin and pectoral spine shorter than head length. (Both figures after Hora, S. L. 1949. *Rec. Indian Mus.* **47**, Plate II, figs. 7 & 2 respectively)

2. Occipital process reaching basal bone of dorsal fin. ... *H. jerdoni*

— Occipital process not reaching basal bone of dorsal fin. 3

3. Pectoral spine just equal to head length. ... *H. horai*

— Pectoral spine shorter (1.05-1.08) than head length. ... *H. hara*

Genus **Conta** Hora

Conta Hora, 1950, *Rec. Indian Mus.*, **47**, p. 194 (type-species, *Pimelodus conta* Hamilton, by original designation).

Diagnosis.—Body short, compressed. Abdomen moderately flat. Head small, oval. Snout obtuse. Mouth ventral, transverse. *An adhesive pad similar to that found* in Glyptothorax *formed by plaited skin folds present on abdomen.* Eyes small, dorsolateral, situated in posterior half of head, not visible from below ventral surface lips thick. Jaws

subequal. Teeth uniformly villiform in bands on jaws ; palate edentate. Four pairs of barbels ; one pair each of maxillary, nasal and two of mandibular ; *maxillary pair with broad cutaneous flaps at their bases.* Gill membranes united with each other and also with isthmus. *Gill openings* restricted up to pectoral base, *provided with spout-like structures in front of pectoral spine base.*

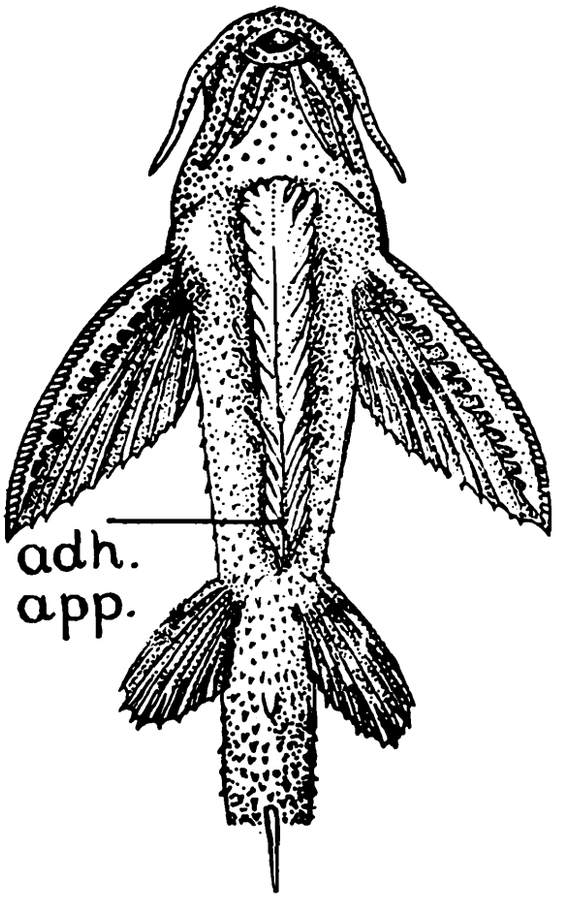


Fig. 135. Ventral view of head and part of body of *Conta conta* (Ham.) to show well developed adhesive apparatus. (After Hora, S. L. 1951. *Rec. Indian Mus.*, 47, pl. 13, fig. 5).

Rayed dorsal fin inserted above last quarter of pectoral fin with five rays and spine serrated along both edges. Adipose dorsal short, posteriorly free. Pectoral fins with six rays and a spine serrated along both edges. Pelvic fins with six rays. *Paired fins not plaited* below. Anal fin short, with 9 or 10 rays. *Caudal fin deeply furcate, with both lobes greatly produced. Lateral line* straight, *high on sides, marked by prominent tubercles.*

Distribution.—India : N. Bengal, Assam. Bangladesh.

Species.—

1. *C. conta* (Hamilton)—India : Mahananda river, N. Bengal. Bangladesh.
2. *C. elongata* (Day)—India : Garo hills, Meghalaya, Siliguri, N. Bengal.

KEY TO SPECIES

1. Least height of caudal peduncle 5.0 to 8.0 in its length. Pelvic origin below middle of rayed dorsal fin. ... *C. conta*

— Least height of caudal peduncle 2.2 in its length. Pelvic origin below last dorsal fin ray. ... *C. elongata*

Genus **Glyptosternum** McClelland

Glyptosternon McClelland, 1842, *Calcutta J. nat. Hist.*, 2, p. 584 (type-species, *Glyptosternum reticulatum* McClelland).—Hora, 1934, *Rec. Indian Mus.*, **36**, p. 285 (synonymy, characterisation of the genus).—Hora & Silas, 1952, *Rec. Indian Mus.*, **49**, p. 8 (key to species).

Diagnosis.—Body elongate, compressed. Abdomen flat up to pelvic base. Head small, flattened, covered with thick skin. Snout broadly rounded. Mouth inferior, transverse. Eyes minute, superior, in middle or anterior part of head, not visible from below ventral surface. Lips thick, fleshy, *papillated, labial groove broadly interrupted.* Jaws subequal, upper jaw overhanging lower. Teeth small, villiform in bands on jaws ; palate edentate. Four pairs of barbels, one pair each of maxillary, nasal and two of mandibular ; *mandibular barbels provided with very broad bases on ventral surface, and bear striated pads of adhesive skin on outer halves.* Gill membranes free from each other, not overlapping, united with isthmus.

Rayed dorsal fin inserted above tip of pectoral fin with six or seven rays and without any spine. Adipose dorsal long, low, posteriorly free. *Pectoral fins with 11 branched rays and without any spine.* Pelvic fins with six rays. *Paired* fins horizontally inserted, *their first ray soft, skin on ventral surface corrugated in pinnate folds for adhesion.* Anal fin short, with five or six rays. Caudal fin truncate, obliquely truncate or somewhat rounded. Lateral line complete, simple.

Air-bladder small, enclosed in bone.

Distribution.—Afghanistan. E. Turkestan. West Pakistan. India : Leh, Ladak, Sikkim. Tibet.

Species.—

1. *G. maculatum* (Regan)—India : Sikkim. China : Tibet.

*2. *G. reticulatum* McClelland—India : Leh, Ladak, Kashmir. Afghanistan. Pakistan : Chitral. China.

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* *G. stoliczkae* (Day) is a synonym of this species.

KEY TO SPECIES

1. Body 3.6 to 5.1 in standard length. Adipose dorsal not continuous with caudal fin. ... *G. maculatum*

— Body 7.5 to 8.0 in standard length. Adipose dorsal continuous with caudal fin. ... *G. reticulatum*

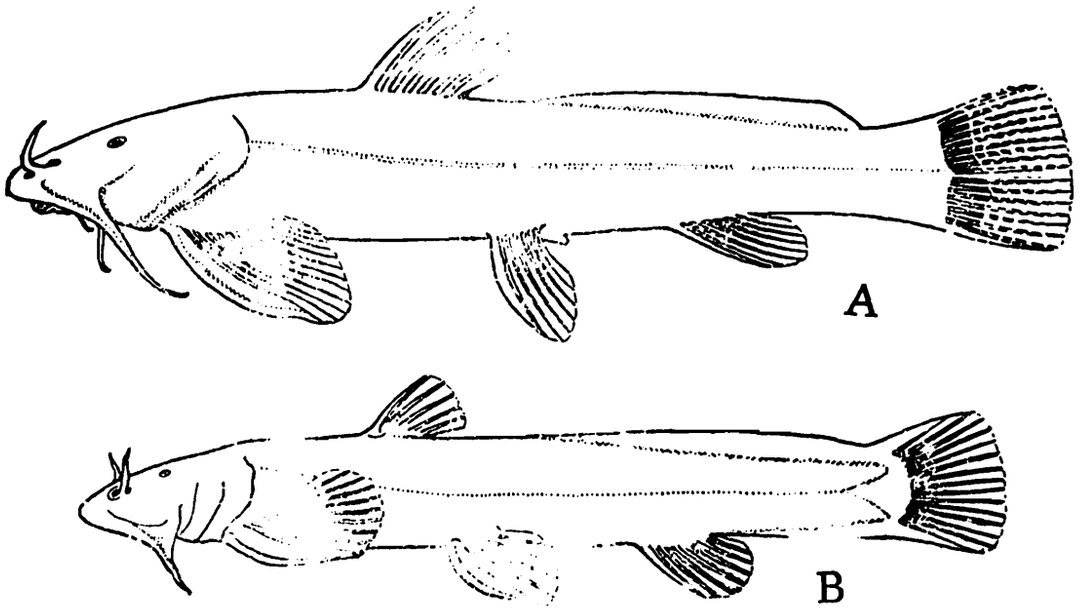


Fig. 136. A. Lateral view of *Glyptosternum maculatum* to show adipose dorsal fin free from caudal fin. (Drawn from a specimen No. ZSI F. 2144/1, Gyantse, Sikkim).

B. Lateral view of *Glyptosternum reticulatum* to show adipose dorsal fin continuous with caudal fin. (Drawn from a specimen No. F. ZSI F. 2386/2, Tehsil stream, Kashmir).

Genus **Laguvia** Hora

Laguvia Hora, 1921, *Rec. Indian Mus.*, **22**, p. 739 (type-species, *Pimelodus asperus* McClelland, by original designation).—Menon, M.A.S. 1954, *Rec. Indian Mus.*, **52**, p. 27 (as a synonym of *Glyptothorax*).—Jayaram, 1973, *Rec. zool. Surv. India.*, **67**, pp. 385-389 (genus resurrected).

Diagnosis.—Body short, compressed. Abdomen subcylindrical. Head small, slightly depressed, covered with skin. Snout semicircular, broad. Mouth subterminal, transverse, wide. Eyes minute, dorsal, in middle of head not visible from below ventral surface of head. Lips thick, fleshy. Jaws subequal. Teeth villiform in bands on jaws ; palate edentate. *Ventral surface of body corrugated or with faint V-shaped groove forming an inconspicuous adhesive apparatus, but not so well developed or prominent as in* Glyptothorax. Four pairs of barbels, one each of maxillary, nasal and two of mandibular ; maxillary barbels with broad bases ; barbels may be annulated. Gill membranes free from each other, but united narrowly with isthmus.

Rayed dorsal fin inserted above last quarter of pectoral fin with five or six rays and a strong spine. Adipose dorsal short, posteriorly free. Pectoral fins with six to eight rays and a spine serrated along inner edge with antrorse teeth. Pelvic fins with six rays. Anal fin short, with nine or ten rays. Paired fins not plaited. Caudal fin truncate, or slightly emarginate, its free portion of posterior border semicircular, Lateral line complete, simple.

Air-bladder small, in the form of two capsules enclosed by bone.

Distribution.—India : North Bengal. Mahananda and Teesta river systems at the base of Eastern Himalaya. Nepal. Bangladesh.

Species.—

1. *L. asperus* (McClelland)—Burma : Northern parts.
2. *L. ribeiroi ribeiroi* Hora—India : Hoshangabad dist., M. P., U. P., Rihand river, Bihar, W. Bengal. Nepal. Bangladesh.

2. 1. *L. ribeiroi kapuri* Tilak & Hussain* India : Padhoi and Dhamola rivers, Saharanpur dist., U. P.

3. *L. shawi* (Hora)—India : N. Bengal. Bangladesh.

KEY TO SPECIES

1. Origin of pelvic fin distinctly nearer base of caudal than tip of snout. Dorsal spine smooth. 2

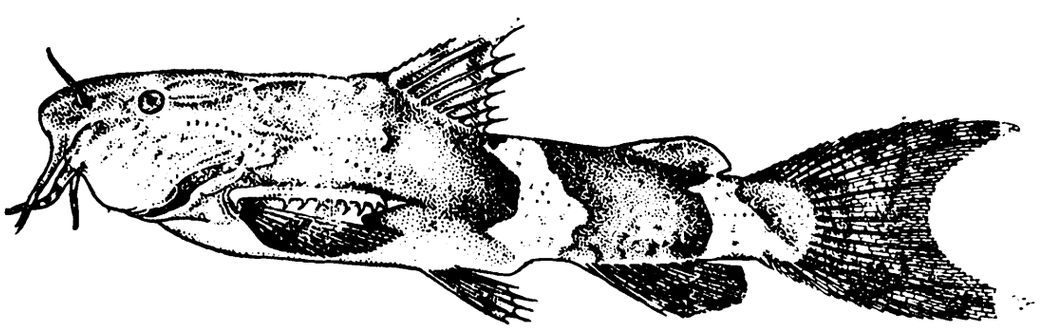


Fig. 137. Dorso-lateral view of *Laguvia ribeiroi ribeiroi* to show color bands on body, serratad nature of spine. (After Hora, S. L. 1921, *Rec. Indian Mus.* **22**, p. 741, pl. 29, fig. 3).

— Origin of pelvic fin equidistant from tip of snout and caudal base. Dorsal spine finely serrated along whole of anterior margin and also along upper one third of posterior margin. ... *L. ribeiroi ribeiroi*

*This subspecies differs from *L. ribeiroi ribeiroi* in having 10 rays in both the pelvic and anal fins (*vs.* six and nine respectively and the eye situated in the middle of the head (*vs.* in posterior half of head).

2. Body depth 4.5 to 5.0 in standard length. Interorbital width 3.2 to 3.5, snout length 2.0 to 2.2 in head length. Body with two bands, posterior band below entire width of adipose dorsal. ... *L. shawi*

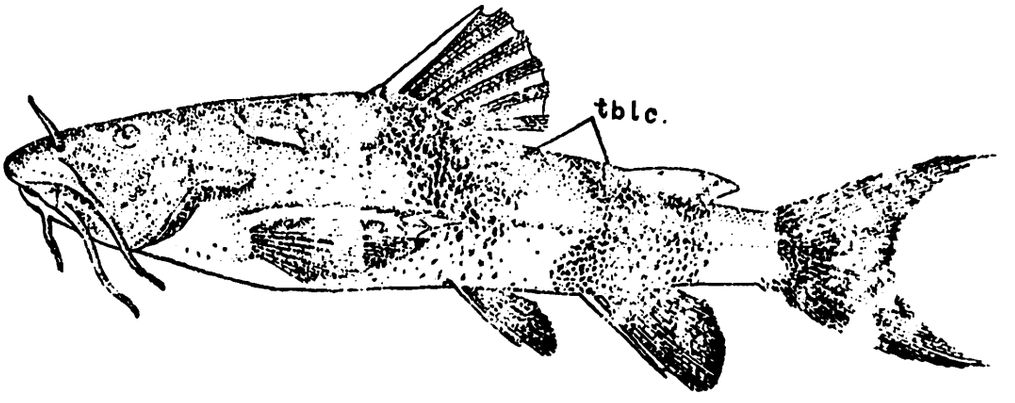


Fig. 138. Lateral view of *Laguvia shawi* to show colour bands on body and tuberculated skin. (After Hora, S. L. 1921. *Rec. Indian Mus.*, **22**, p. 740 (5), pl. 29, fig. 2).

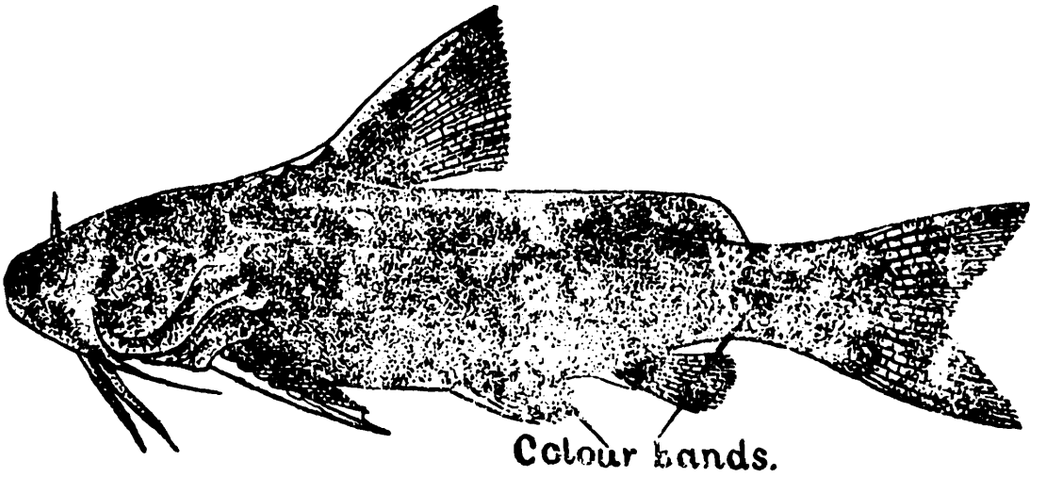


Fig. 139. Lateral view of *Laguvia asperus* to show colour pattern, smooth dorsal spine, and position of pelvic fin. (After Chaudhuri, B. L. 1919. *Rec. Indian Mus.*, **16**, p. 276, pl. 22, fig. 2).

— Body depth 3.3 to 3.4 in standard length. Interorbital width 2.5 to 2.85, snout length 1.66 to 1.82 in head length. Body with two bands, posterior band at base of adipose fin. ... *L. asperus*

Genus **Pseudolaguvia** Misra

Pseudolaguvia Misra, 1976, *Fauna of India*, Pisces, Ed. 2, 2 : 253 (type-species, *Glyptothorax tuberculatus* Prashad & Mukerji).

Diagnosis.—All characters similar to *Glyptothorax*, except that the cubito-humeral process is conspicuous and all barbels are annulated as compared to in all other species of *Glyptothorax*.

Distribution.—Burma : Sankha, Myitkyina dt.

Species.—*Pseudolaguvia tuberculatus* (Prashad & Mukerji) is the single species known so far.

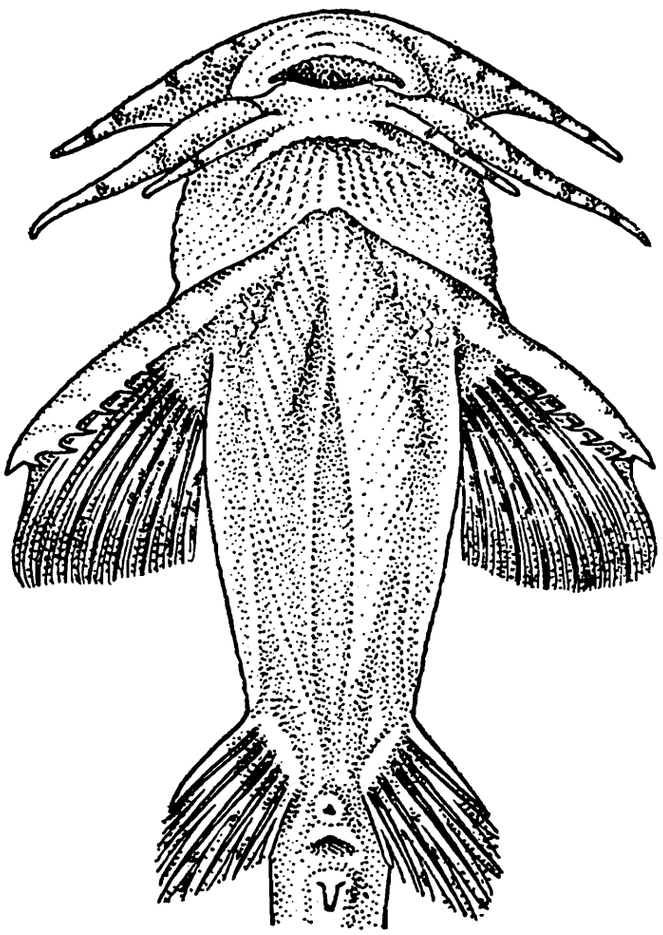


Fig. 140. Ventral view of *Pseudologuvia tuberculatus* (Prashad & Mukerji). (After Prashad, B & Mukerji, D. D. 1929. *Rec. Indian Mus.*, **31** (2), p. 182).

Genus **Glyptothorax** Blyth

Glyptothorax Blyth, 1860, *J. Asiat. Soc. Bengal*, **29**, p. 154 (type-species, *Glyptothorax trilineatus* Blyth, by original designation).—Hora, 1923, *Rec. Indian Mus.*, **25**, p. 8 (synonymy, description, taxonomy of species).—Menon, M.A.S. 1954, *Rec. Indian Mus.*, **52**, pp. 27-54 (key, revision).

Diagnosis.—Body elongate, moderately or greatly depressed. Body smooth or rough with granules or tubercles. Abdomen slightly flat to rounded. Head small, covered with thick skin, depressed. Snout conical, not pointed. Mouth inferior, transverse, narrow. Eyes dorsal, small, not visible from below ventral surface. Lips thick, fleshy, papillate. Jaws subequal, upper jaw the longer. Teeth villiform in jaws ; palate edentate. *Ventral surface of body provided with an adhesive apparatus with or without a central pit or depression on thorax.* Four pairs of barbels ; one pair each of maxillary, nasal and two of mandibular ;

maxillary pair with broad bases. Gill membranes united with each other and also with isthmus.

Rayed dorsal fin inserted above half of pectoral fin with five to seven rays *and a spine.* Adipose dorsal short, high, posteriorly free. Pectoral fins with 6 to 11 rays and *a spine, strong, broad, serrated with antrorse teeth along inner edge.* Fins may be enveloped in skin. Pelvic fins with six rays. Paired fins may be plaited below. Anal fin short, with 7 to 14 rays. Caudal fin deeply forked. Lateral line complete, simple.

Air-bladder enclosed in bone.

Distribution.—Iraq. Pakistan. India. Nepal. Bangladesh. Burma. Thailand. East Indies.

Species.—

1. *G. anamaliensis* Silas—India : Anamalai hills, Kerala state.
2. *G. annandalei* Hora—India : Bhavani river at base of Nilgiri hills, S. India. ? Nepal.
3. *G. brevipinnis brevipinnis* Hora—Not known.

3. 1. *G. brevipinnis alaknandi* Tilak—India : Alaknanda river, near Srinagar, Pauri Garhwal dist., U. P.

4. *G. cavia* (Hamilton)—India : North Bengal, Assam. Bangladesh. Nepal. Burma. Pakistan : Punjab, N. W. F. P.
5. *G. coheni* Ganguly, Datta & Sen—India : Subarnarekha river, Chotanagpur plateau, Bihar.
6. *G. conirostrae conirostrae* (Steindachner)—India : Kangra Valley, Punjab, Mahananda river, Siliguri, N. Bengal. China.

6. 1. *G. conirostrae poonaensis* Hora—India : Mula Mutha river, Poona.

7. *G. garhwali* Tilak—India : Alaknanda river, Pauri Garhwal, Sarada river, Tanahpur, Nainital dist., U. P.
8. *G. gracilis* (Günther)—India : Sikkim. Nepal.
9. *G. horai* Shaw & Shebbeare—India : Kosi river, Rihand river, streams in the Vindhya range of mountains, Terai, E. Himalaya. Nepal.
10. *G. housei* Herre—India : Puthuthottam estate, Kerala.
11. *G. kashmirensis* Hora—India : Kashmir valley. Pakistan : Azad Kashmir.

12. *G. lonah* (Sykes)—India : Deccan, Godavari and Krishna river systems.

13. *G. madraspatanum* (Day)—India : W. ghats, Anamalai hills, Nilgiri hills.

14. *G. naziri* Mirza & Naik—Pakistan : Zhob river, Baluchistan.

15. *G. nelsoni* Ganguly, Datta & Sen—India : Subaranarekha river, Chotanagpur plateau, Bihar.

16. *G. pectinopterus* (McClelland)—India : Kangra valley, Simla hills, Punjab. Pakistan : Azad Kashmir. Nepal.

17. *G. platypogonoides* (Bleeker)—India : Nagaland, Assam. Burma. Thailand. Sumatra. Pakistan : Punjab, N. W. F. P., Azad Kashmir.

18. *G. prashadi* Mukerji—Burma. Thailand.

19. *G. punjabensis* Mirza & Kashmiri—Pakistan : River Soan, Jhelum Canal, Punjab ; Kabul river, Siran river near Ghazi, N. W. F. P. and Kotli, Azad Kashmir.

20. *G. saisii* (Jenkins)—India : Parashnath Hills, Bihar.

21. *G. sinense sinense* (Regan)—Burma : Mali Hka river. China : Tungting.

21. 1. *G. sinense manipurensis* Menon—India : Manipur valley, Barak river, Karong.

22. *G. stocki* Mirza & Nijseen—Pakistan : Swat river, tributary of Kabul river, near Abazai, Peshawar division, N. W. F. P.

23. *G. stoliczkae* (Steindachner)—India : Western Himalaya, Simla.

24. *G. striatus* (McClelland)—India : Kashi and Garo hills, Meghalaya, E. Himalaya.

25. *G. telchitta telchitta* (Hamilton)—India : Vindhya range of mountains, U. P., Bihar, N. Bengal. Nepal. Bangladesh. Pakistan : D. G. Khan, Punjan Sehwan, Sind (Mirza & Hameed, 1974, p. 90).

25. 1. *G. telchitta sufii* Bashir & Mirza—Pakistan : R. Sutlej, Kanganpur, Punjab ; Sind.

26. *G. trewavasae* Hora—India : Krishna river system ; Yenna, Koyna, Tunga rivers, W. ghats. S. India.

27. *G. trilineatus* Blyth—India : Manipur. Burma. Thailand.

A. KEY TO SPECIES FROM SOUTH INDIA, DECCAN PLATEAU, W. GHATS

1. Adhesive apparatus on thorax as long as broad or broader than long. 2

   Adhesive apparatus on thorax longer than broad. 3

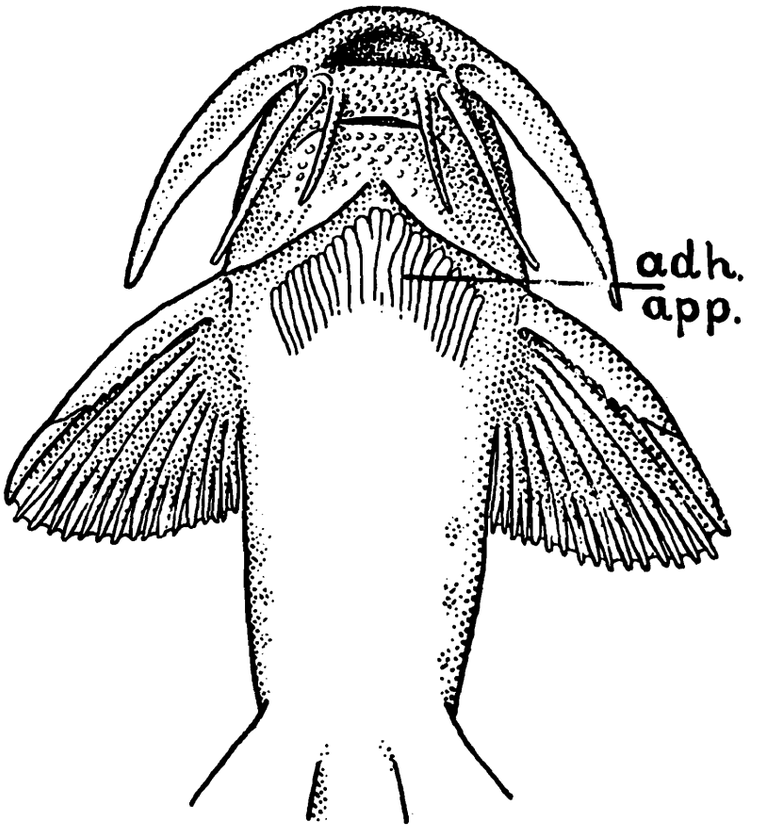


Fig. 141. Ventral view of *Glyptothorax anamaliensis* to show feebly developed adhesive apparatus. (After Jayaram, K. C. 1979, p. 33, fig. 24A).

2. Adhesive apparatus feebly developed. Body with three broad white vertical bands. ... *G. anamaliensis*

   Adhesive apparatus well developed extending forwards to a point in between union of gill membranes to isthmus. ... *G. trewavasae*

3. Occipital process not reaching basal bone of dorsal fin. 4

   Occipital process reaching basal bone of dorsal fin. 5

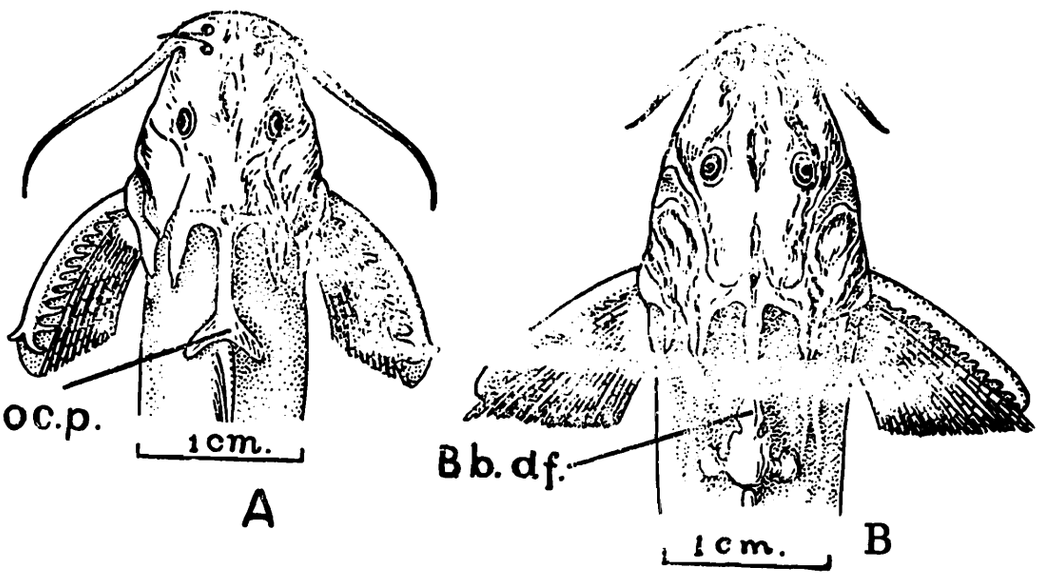


Fig. 142. Dorsal side of *Glyptothorax prashadi* to show occipital process reaching basal bone of dorsal fin. (Drawn from specimen No. ZSI F. 10848/1). B. Dorsal view of *Glyptothorx telchitta* to show occipital process not reaching basal bone of dorsal fin. (Drawn from specimen No. ZSI 1488 labelled *G. botia*).

4. Paired fins plaited ventrally. Adhesive apparatus well developed. Mandibular and nasal barbels long. ... *G. housei*

   Paired fins not plaited ventrally. Adhesive apparatus poorly developed. Mandibular and nasal barbels short. ... *G. conirostrae poonaensis*

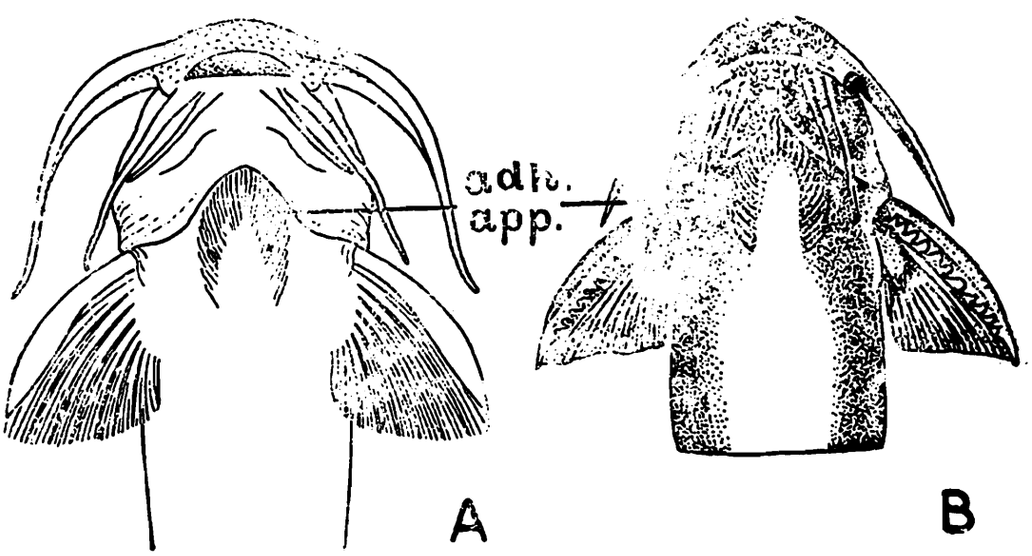


Fig. 143. A. Ventral view of *Glyptothorax housei to* show well developed adhesive apparatus and long mandibular barbels. (After Herre, A. W. C. T. 1942. *Stanford Ichthyol. Bull.*, 2, p. 118). B. Ventral view of *Glyptothorax conirostrae poonaensis* to show poorly developed adhesive apparatus and short mandibular barbels. (After Hora, S. L. 1938. *Rec. Indian Mus.*. **40**, p. 368, pl. 7. fig. 6).

5. Least height of caudal peduncle 1.5-2.0 in its length. Body without bands. 6

   Least height of caudal peduncle 2.6-2.7 in its length. Body with two light longitudinal bands. ... *G. annandalei*

6. Paired fins plaited. Skin granulated. Rayed dorsal $\frac{1}{2}$ depth of body. ... *G. lonah*

   Paired fins not plaited. Skin smooth or occasionally tuberculated. Rayed dorsal 1.0-1.3 times depth of body. ... *G. madraspatanum*

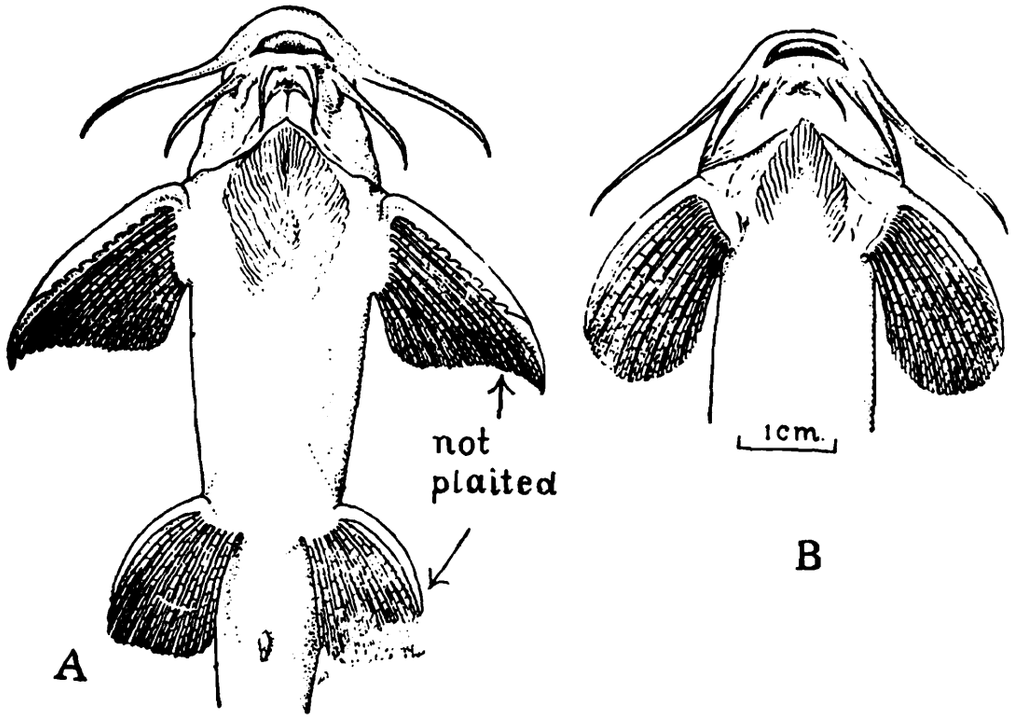


Fig. 144. A. Ventral view of *Glyptothorax madraspatanum* to show non-plaited paired fins. B. *Glyptothorax stoliczkae* to show plaited pectoral fins. (After Jayaram, K. C. 1979, p. 30, fig. 19A & 19B).

B. KEY TO SPECIES FROM NORTH INDIA, EASTERN HIMALAYA, BURMA, BANGLADESH AND PAKISTAN.

1. Adhesive apparatus on thorax as long as broad or broader than long. 2

   Adhesive apparatus on thorax longer than broad. 8

2. Occipital process not reaching basal bone of dorsal fin. 3

   Occipital process reaching basal bone of dorsal fin. 5

3. Ventral surface of paired fins plaited. Adhesive apparatus as long as broad. ... *G. striatus*

   Ventral surface of paired fins not plaited. Adhesive apparatus broader than long. ... ...

4. Adhesive apparatus rhomboidal in shape, very extensive from tip of pectoral fin base traversing through gill membranes. ... *G. horai*

   Adhesive apparatus small, inverted V-shaped.... *G. punjabensis*

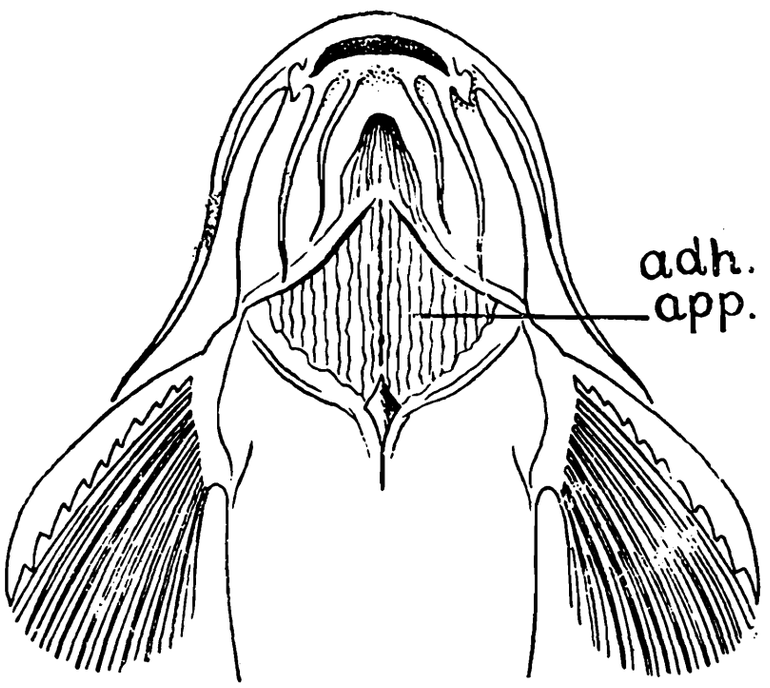


Fig. 145. Ventral view of *Glyptothorax horai* to show pectoral fins not plaited, adhesive apparatus broader than long. (After Jayaram, K. C. 1979, p. 31, fig. 22).

5. Origin of rayed dorsal fin considerably nearer to tip of snout than to origin of adipose dorsal fin. ... *G. brevipinnis brevipinnis*

   Origin of rayed dorsal fin equidistant or nearer adipose origin than tip of snout. 6

6. Maxillary barbels shorter than head length. ... *G. brevipinnis alaknandi*

   Maxillary barbels longer than head length. 7

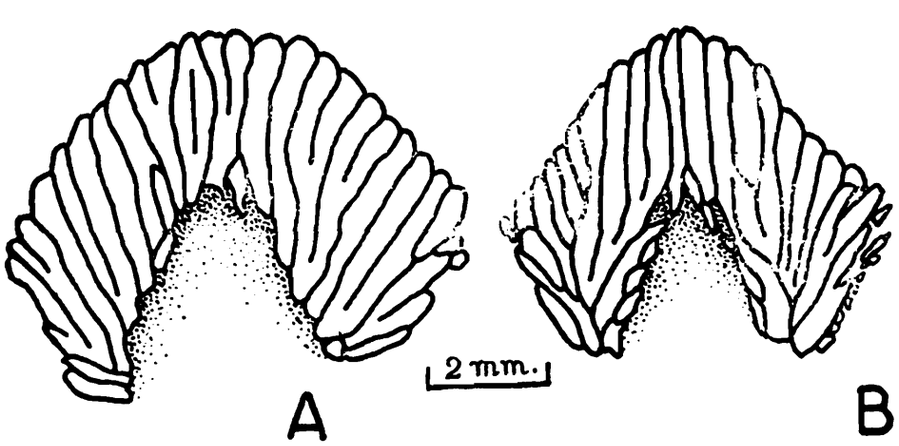


Fig. 146. Drawing of adhesive apparatuses of A. *Glyptothorax brevipinnis alaknandi* and B. *G. brevipinnis brevipinnis* to show relative length/width. (After Tilak, R. 1969. *J. Inland Fish. Soc. India*, **1**, p. 43, figs. 11 & 12).

7. Rayed dorsal fin higher than body depth. Dorsal spine serrated. Adhesive apparatus broader than long. Ventral profile peculiar. ... *G. naziri*

Rayed dorsal fin shorter or equal to body depth. Dorsal spine smooth. Adhesive apparatus as long as broad. Ventral profile normal.... *G. pectinopterus*

8. Adhesive apparatus with a distinct central pit. 9

Adhesive apparatus without a central pit. 11

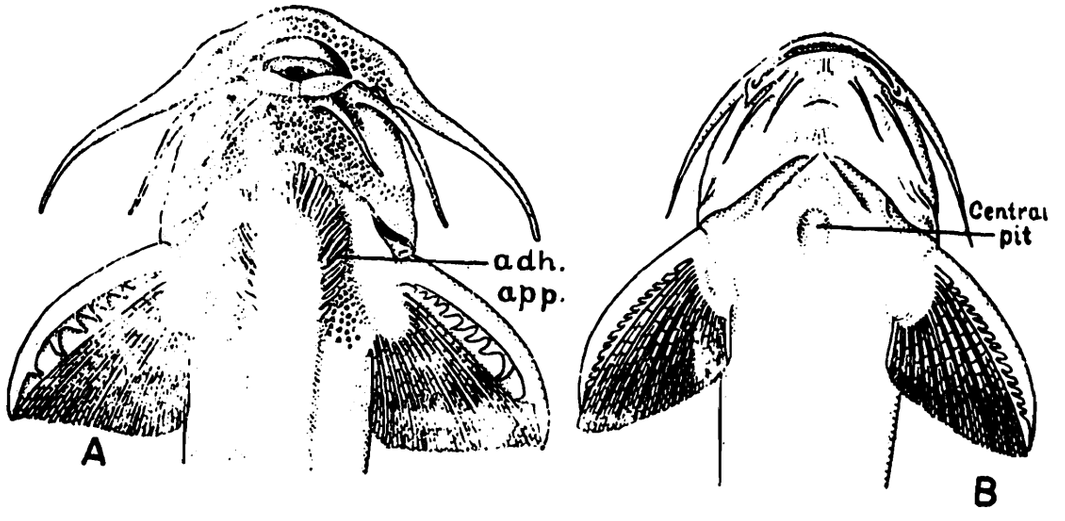


Fig. 147. A. Ventral view of *Glyptothorax sinense manipurensis* to show adhesive apparatus on thorax without a central pit. B. *G. housei* with a central pit. (After Jayaram, K. C. 1979, p. 30, fig. 20 A & B).

9. Skin profusely granulated. Adhesive apparatus triangular in shape. ... *G. kashmirensis*

Skin smooth. Adhesive apparatus conical in shape. 10

10. Adhesive apparatus on thorax complete posteriorly. Least height of caudal peduncle 2.5 in its length. ... *G. cavia*

Adhesive apparatus on thorax incomplete posteriorly. Least height of caudal peduncle 1.24 to 1.77 in its length. ... *G. garhwali*

11. Occipital process not reaching basal bone of dorsal fin. 12

Occipital process reaching basal bone of dorsal fin. 18

12. Origin of rayed dorsal fin nearer tip of snout than origin of adipose dorsal fin. 13

Origin of rayed dorsal fin midway or nearer origin of adipose dorsal fin than tip of snout.... ... 14

13. Height of rayed dorsal fin equal to body depth. Origin of adipose dorsal anterior to anal origin. Body with three longitudinal bands. ... *G. nelsoni*

Height of rayed dorsal fin greater than body depth. Origin of adipose dorsal opposite to anal origin. Body without any bands. ... *G. coheni*

14. Body rough with granulations or tubercles. ... 15

Body smooth. 16

15. Nostrils separated from the snout by a distance equal to eye diameter. Caudal peduncle height 3.0-3.8 times in length. ... *G. telchitta telchitta*

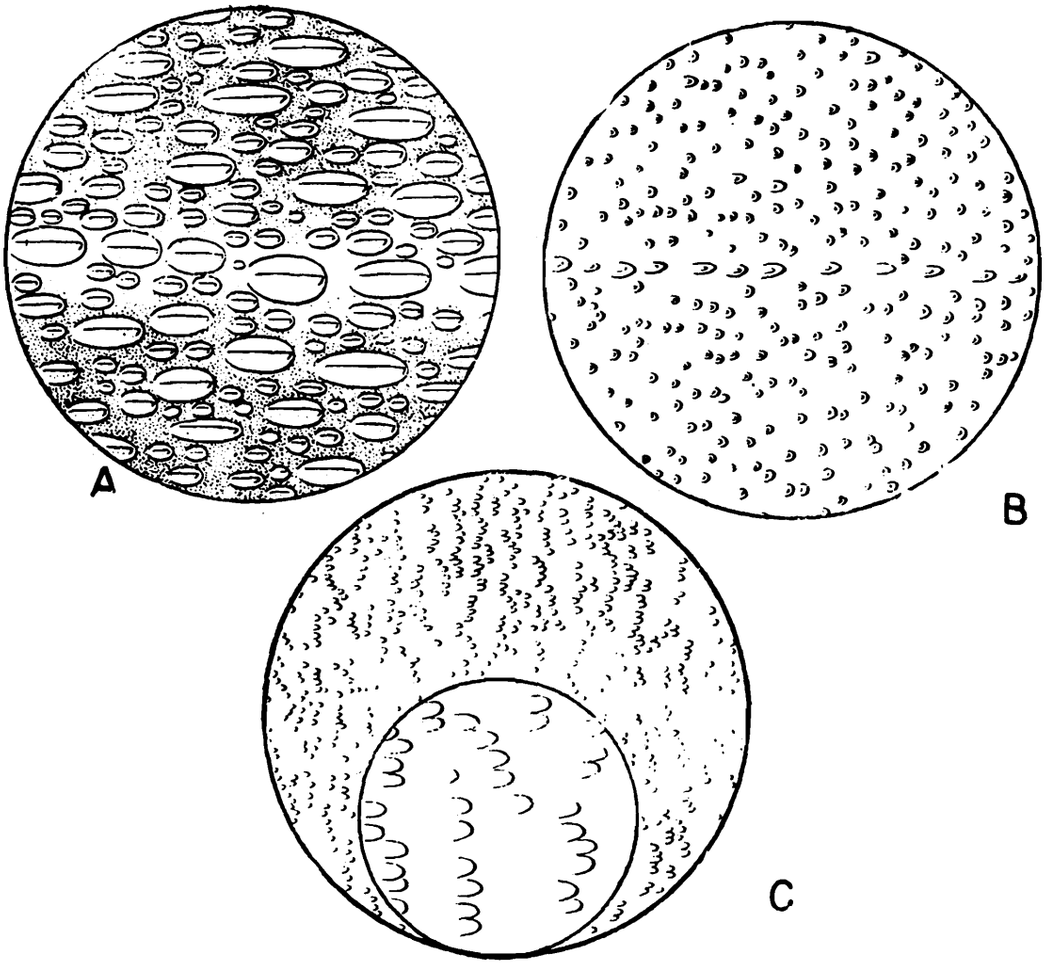


Fig. 148. A. Magnified portion of skin of *Glyptothorax telchitta* to show tuberculated skin ; B. *G. prashadi* to show denticulated skin ; C. *G. kashmirensis* to show granulated skin. (After Jayaram, K. C. 1979, p. 29, fig. 23 A, B & C).

Nostrils separated from snout by a distance greater than eye diameter. Caudal peduncle height 1.60—2.50 times in its length. ... *G. telchitta sufii*

16. Rayed dorsal fin higher than body depth. Body depth 4.5 in standard length. ... *G. conirostrae conirostrae*

Rayed dorsal fin equal to or shorter than body depth. Body depth 5.1 to 5.0 in standard length. 17

17. Dorsal spine strong. Dark patches at base of rayed dorsal, adipose and caudal fins conspicuous. ... *G. sinense manipurensis*

Dorsal spine weak. Two dark brownish bands one below rayed dorsal and other below adipose dorsal fin alone present. ... *G. sinense sinense*

18. Ventral surface of paired fins plaited. 19

Ventral surface of paired fins not plaited. 20

19. Body smooth. Adipose dorsal base 1.4 times rayed dorsal fin base. ... *G. stoliczkae*

Body granulated. Adipose dorsal base equal to rayed dorsal fin base. ... *G. saisii*

20. Origin of rayed dorsal fin nearer snout than origin of adipose dorsal or midway between. 21

Origin of rayed dorsal fin nearer adipose dorsal fin than tip of snout. 22

21. Origin of rayed dorsal fin midway between tip of snout and origin of adipose dorsal fin. Body depth 4.5 in standard length. Body with three longitudinal stripes. ... *G. trilineatus*

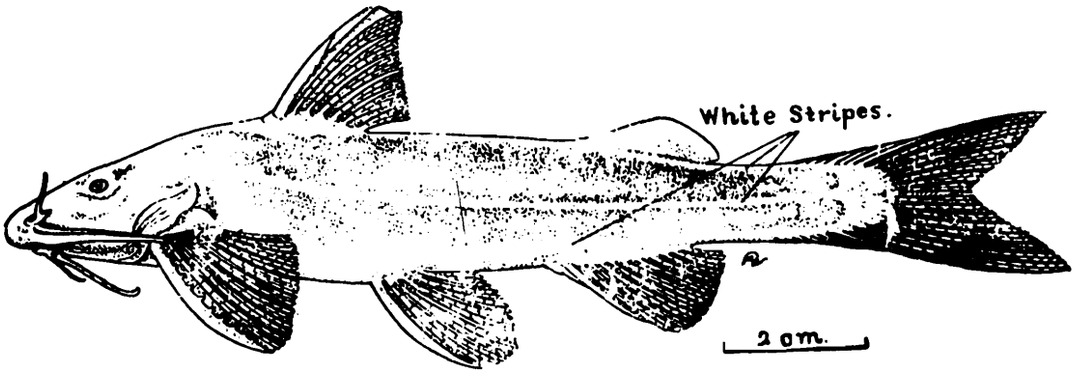


Fig. 149. Lateral view of *Glyptothorax trilineatus* to show three white stripes. (Drawn from specimen ZSI F. 238/2).

Origin of rayed dorsal fin nearer tip of snout than origin of adipose dorsal fin. Body depth 5.6 to 6.5 in standard length. ... *G. stocki*

22. Rayed dorsal fin higher than body depth. Pectoral fins longer than head length and almost reaching pelvics. ... *G. gracilis*

Rayed dorsal fin shorter than body depth. Pectoral fins equal or shorter than head length. ... 23

23. Body depth 5.0 to 5.5 in standard length. Skin with prominent tubercles arranged in regular longitudinal lines. ... *G. platypogonoides*

Body depth 4.3 in standard length. Skin with cone-shaped sharp prickles arranged regularly and directed backwards. ... *G. prashadi*

Genus **Euchiloglanis** Regan

Chimarrhichthys Sauvage, 1874, *Rev. et. Mag. Zool.*, **25**, p. 332 (name preoccupied ; type-species, *C. davidi* Sauv.).

Euchiloglanis Regan, 1907, *Rec. Indian Mus.*, **1**, p. 158 (substitute name for *Chimarrhichthys*).—Hora & Silas, 1952, *Rec. Indian Mus,*, **49**, p. 14 (revision).

Diagnosis.—Body elongate. Abdomen flattened up to pelvic base. Head small, depressed. Snout broadly rounded. Mouth ventral, transverse. Eyes small, subcutaneous in anterior or posterior half of head, not visible from below ventral surface. Lips thick, fleshy, papillated, fold of lower lip broadly interrupted. Jaws subequal, upper jaw overhanging lower. Teeth small, pointed, in bands on jaws ; palate edentate. Four pairs of barbels, one pair each of maxillary, nasal and two of mandibular, *maxillary with broad bases, their ventral surface of outer halves with striated pads of adhesive skin.* Gill membranes united with each other and also with isthmus. *Gill openings as an aperture above pectoral* base.

Rayed dorsal fin inserted above half of pectoral fin, with seven rays and without any spine. Adipose dorsal long, low, posteriorly free. *Pectoral*

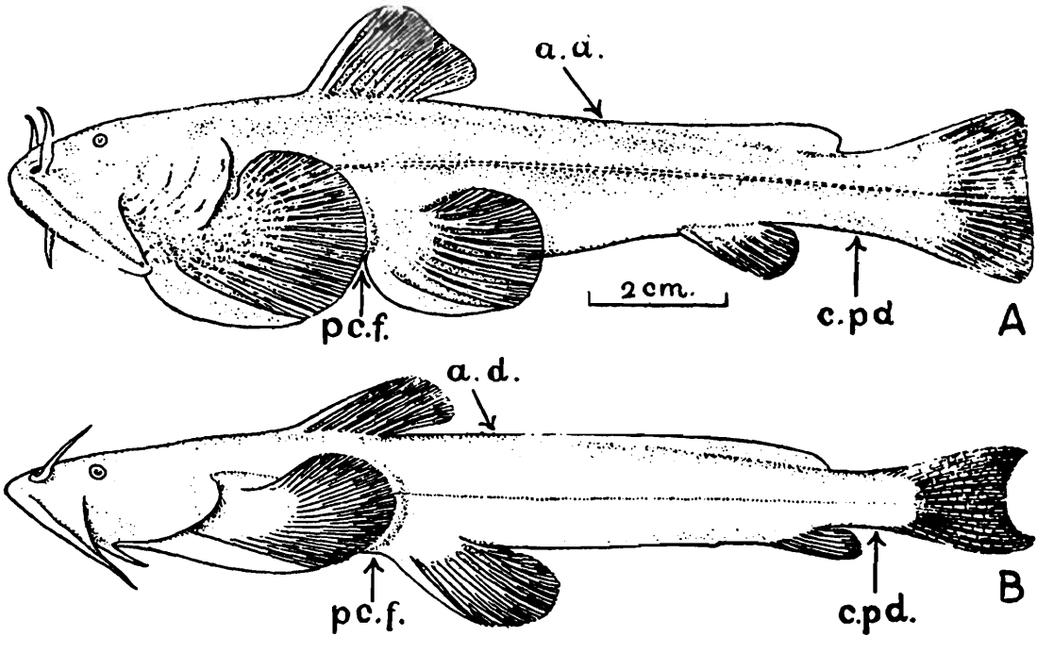


Fig. 150. A. Lateral view of *Euchiloglanis kamengensis* to show extent of pectoral fin, adipose fin and shape of caudal peduncle. (Drawn from a specimen in the type series).

B. Lateral view of *Euchiloglanis hodgarti* to show extent of pectoral fin, adipose fin and shape of caudal fin. (Drawn from a specimen).

fins with 13 to 17 rays and *without any spine.* Pelvic fins with six rays. *Outer rays of paired fins soft, pinnate, their inner halves vertical, outer halves horizontal ; skin on ventral surface of outer rays corrugated in pinnate folds for adhesion.* Anal fin short, with five to seven rays. *Caudal* fin

obliquely *truncate or somewhat rounded.* Lateral line straight, complete, simple.

Air-bladder small, enclosed in bone.

Distribution.—India : North Bengal, Assam, Nepal. Burma. China : E. Tibet, Yunnan.

Species.—

1. *E. feae* (Vinciguerra)—Burma : Karen hills.
2. *E. hodgarti* (Hora)—India : Teesta valley, Kurseong, Darjeeling, Abor hills, Meghalaya. Nepal. Bangladesh.
3. *E. kamengensis* Jayaram—India : Arunachal Pradesh, Kameng frontier division, Dupla-Ko, Norgum Chu.

KEY TO SPECIES

1.	Pectoral fins extending scarcely 2/3 of distance from its base to base of pelvics. ...	*E. feae*
—	Pectoral fins extending $\frac{3}{4}$ or more of distance from its base to base of pelvics. ...	... 2
2.	Caudal peduncle 2.01 to 2.66 as long as deep. Adipose fin 2.3 to 3.2 times dorsal fin base. ...	*E. kamengensis*
—	Caudal peduncle 1.0 to 1.2 as long as deep. Adipose dorsal fin 3.25 to 4.20 times dorsal fin base. ...	*E. hodgarti*

Genus **Coraglanis** Hora & Silas

Coraglanis Hora & Silas, 1952, *Rec. Indian Mus.*, **49**, p. 12 (type-species, *Euchiloglanis kishinouyei* Kimura, by original designation).

Diagnosis.—Similar to *Euchiloglanis* in all features, except that the *teeth bands on the upper jaw* are continuous and *extend backwards at sides* ; lower band of teeth interrupted in the middle.

Distribution.—Essentially a Chinese genus, which has been recently recorded from Nepal in the Eastern Himalaya.

Species.—*C. kishinouyei* (Kimura)—Nepal, E. Himalaya (recorded by Datta, 1962). Also known from China.

Genus **Myersglanis** Hora & Silas

Myersglanis Hora & Silas, 1952, *Rec. Indian Mus.*, **49**, p. 19 (type-species, *Myersglanis blythii* (Day), by original designation).

Diagnosis.—Body elongate. Abdomen flat up to pelvic base. Head small, depressed. Snout broadly rounded. Mouth ventral, crescentic.

Eyes minute ; subcutaneous, dorsal, not visible from below ventral surface. Lips thick, fleshy, fold of lower lip continuous. Jaws subequal, upper jaw overhanging. *Teeth conical in bands on jaws only ; palate edentate.* Four pairs of barbels ; one pair each of maxillary, nasal and two of mandibular ; maxillary pair with broad bases. Gill membranes united with isthmus and also with each other. *Gill opening restricted to dorsal surface above pectoral fin base as an aperture.*

Rayed dorsal fin inserted above last quarter of pectoral fin with seven rays, and without any spine. Adipose dorsal long, posteriorly free. Pectoral fins with 16 rays and without any spine. Pelvic fins with six rays ; paired fins rounded, flat, horizontal, vertical in inner, and horizontal in outer halves. *Skin on ventral surface of outer rays corrugated in pinnate folds for adhesive purpose.* Anal fin short, with eight rays. *Caudal fin lunate, with outer* rays slightly produced. Lateral line complete, simple.

Air-bladder small, enclosed in bone.

Distribution.—Nepal.

Species.—*M. blythi* (Day)—Nepal : Pharping.

Genus **Oreoglanis** Smith

Oreoglanis Smith, 1933, *J. Siam Soc. nat. Hist. Suppl.*, **9**, p. 70 (type-species, *Oreoglanis siamensis* Smith, by monotypy).—Smith, 1945, *Bull. U. S. nat. Mus.*, **188**, p. 395.

Diagnosis.—Body elongate. Abdomen flat up to pelvic base. Head moderate sized, covered with skin. Snout flatly rounded. Mouth ventral, narrow, transverse. Eyes minute, dorsal, not visible from below ventral surface. Lips thick, *lower lip with a continuous fold.* Jaws subequal. *Teeth conical or pointed* in bands on jaws ; palate edentate. Four pairs of barbels ; one pair each of maxillary, nasal and two of mandibular ; maxillary barbels with broad bases. Gill membranes fused with each other and also with isthmus ; *gill openings extend to pectoral base.*

Rayed dorsal inserted above half of pectoral fin with five rays and without any spine. Adipose dorsal short, posteriorly free. *Pectoral fins with 19 rays, overlapping pelvic fins and without any spine.* Pelvic fins with six rays. Outer rays of pectoral fins thick, pinnate. Anal fin short with five rays. Caudal fin truncate. Lateral line complete, simple.

Distribution.—Thailand. Burma.

Species.—*O. macropterum* (Vinciguerra) is the only species occurring in this area—Burma : Mt. Catein.

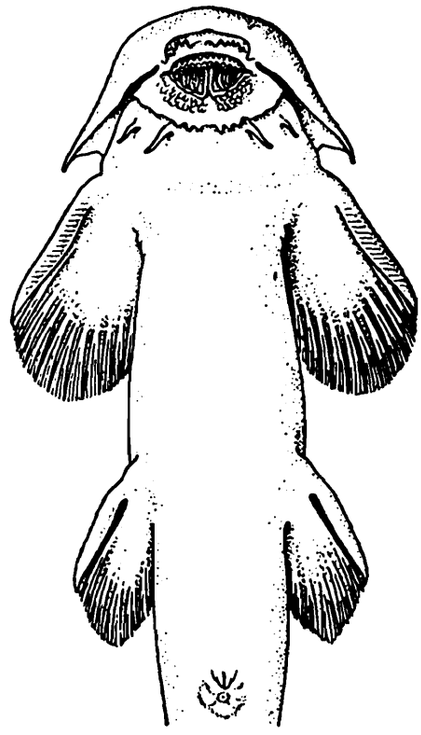


Fig. 151. Ventral view of head and anterior part of body of *Oreoglanis siamensis* Smith.

Genus **Exostoma** Blyth

Exostoma Blyth, 1860, *J. Asiat. Soc. Beng.*, **29**, p. 154 (type-species, *Exostoma berdmorei* Blyth, by original designation)—Hora & Silas, 1952, *Rec. Indian Mus.*, **49**, p. 23 (revision).

Diagnosis.—Body elongate. Abdomen flattened up to pelvic base. Head small, depressed. Snout broadly rounded. Mouth ventral, more or less crescentic, narrow. Eyes minute, subcutaneous, dorsal not visible from below ventral surface. Lips thick, fleshy, papillated, forming a continuous labial fold around mouth. Jaws subequal, upper jaw overhanging lower. *Teeth large, movable, oar-shaped, flattened distally and directed backwards in patches on jaws only* ; palate edentate. Four pairs of barbels, one each of maxillary, nasal and two of mandibular, maxillary pair with broad bases, their ventral surface of outer halves with striated pads of adhesive skin. Gill membranes united with isthmus. *Gill opening restricted to dorsal surface above pectoral base.*

Rayed dorsal fin inserted behind pectoral fin with six or seven rays and without any spine. Adipose dorsal long, may be confluent with caudal fin. Pectoral fins with 10 to 13 rays and *without a spine* ; outer

ray of paired fins with soft, pinnate folds for purposes of adhesion and giving off soft pointed cartilaginous rays along anterior margin which are enveloped in membrane of fin. Pelvic fins with six rays.

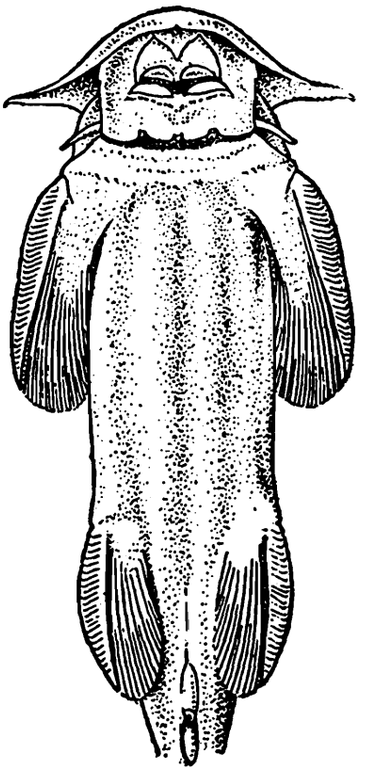


Fig. 152. Ventral view of head and anterior part of body of *Exostoma labiatum*.

Anal fin rays five to eight. Caudal fin truncate, forked, slightly or deeply emarginate. Lateral line straight, complete, simple.

Air-bladder small, enclosed in bone.

Distribution.—India : Abor and Naga hills, Meghalaya. Burma.

Species.—

1. *E. berdmorei* Blyth.—Burma : Tenasserim.
2. *E. labiatum* (McClelland)—India : Mishmee hills, Meghalaya.
3. *E. stuarti* (Hora)—Burma : Namyak river, at Tanjor in N. Burma.
4. *E. vinciguerrae* (Regan)—Burma : N. shan states, Putao plains.

KEY TO SPECIES

1.	Caudal fin truncate or slightly emarginate. ...	...	2
—	Caudal fin forked or deeply emarginate. ...	...	3
2.	Adipose dorsal confluent with caudal. Caudal peduncle 3.0 to 3.25 as long as deep. ...		*E. vinciguerrae*
—	Adipose dorsal free from caudal. Caudal peduncle 2.0 to 2.5 as long as deep. ...		*E. stuarti*

3. Pectoral fins with 10 branched rays. Gill openings greatly restricted, extending to above base of pectorals. ... *E. berdmorei*

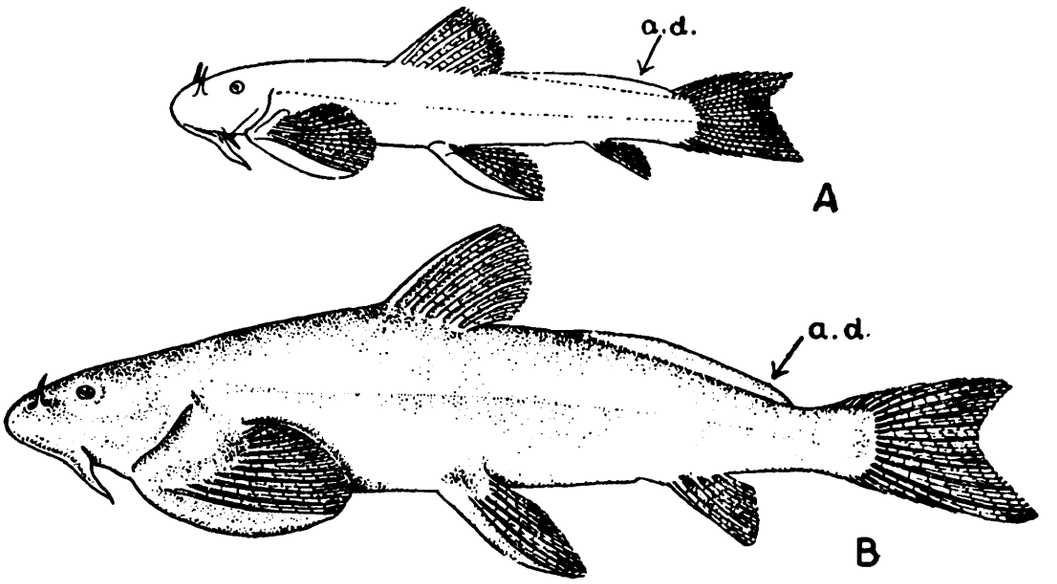


Fig. 153. A. Lateral view of *Exostoma vinciguerrae* to show adipose fin confluent with caudal fin. (After Hora, S. L. 1923. *Rec. Indian Mus.*, **25**, (1) pl. 3, fig. 1).

B. Lateral view of *Exostoma stuarti* to show adipose fin free from caudal fin. (After Hora, S. L. 1923. *Rec. Indian Mus.*, **25** (1) pl. 2, fig. 4).

— Pectoral fins with 12 branched rays. Gill opening wide, extending to opposite base of pectoral spine. ... *E. labiatum*

Genus **Pseudecheneis** Blyth

Pseudecheneis Blyth, 1860, *J. Asiat. Soc. Beng.*, **29**, p. 154 (type-species, *P. sulcatus* (McClelland), by original designation).—Hora, 1923, *Rec. Indian Mus.*, **25**, p. 43 (definition of genus).

Diagnosis.—Body elongate. Abdomen flat up to pelvics. Head short, anteriorly depressed, provided *with a broad, oval adhesive apparatus ventrally composed of a series of transverse plates.* Snout sharp, not pointed. Mouth inferior, transverse, small. Eyes subcutaneous, dorsal, not visible from below ventral surface. Lips thick, fleshy, papillated, continuous around mouth. Jaws subequal. Teeth somewhat flattened with truncate apices in small patches on jaws ; palate edentate. Four pairs of barbels, one pair each of maxillary, nasal and two of mandibular. Gill membranes united with each other and also with isthmus.

Rayed dorsal fin inserted above last quarter of pectoral fin with six rays and a spine. Adipose dorsal fin short, high, well developed,

posteriorly free. Pectoral fins with 13 rays and a spine, enveloped in skin, feebly serrated along inner edge with antrorse teeth. Pectoral fin's inner third vertical, outer two-thirds horizontal, with a striated skin ventrally. *Pelvic fins* with six rays, outer pelvic fin rays with striated skin ventrally, *with large number of pointed cartilaginous rays along outer border.* Anal fin short, with 9 to 13 rays. Caudal fin emarginate. Lateral line complete, simple.

Air-bladder with rounded lateral portions, enclosed in bone.

Distribution.—India : North Bengal, Khasi hills, Meghalaya. Nepal. Bangladesh.

Species.—*P. sulcatus* (McClelland) is the only species so far known.

Genus **Sisor** Hamilton

Sisor Hamilton, 1822, *Fish. Ganges*, pp. 208, 379 (type-species, *Sisor rhabdophorus* Hamilton, by monotypy).

Diagnosis.—Body elongate, whip-like. Abdomen flat up to pelvic base. *Head* moderate, anteriorly depressed, *with numerous rough ridges, covered by very thin skin.* Snout pointed but not sharp. Mouth inferior, small, transverse. Eyes small, nearer gill opening than end of snout, not visible from below ventral surface. Lips thick, fleshy, papillated. Teeth absent. *Six pairs of barbels* ; one pair maxillary, *five short mandibular pairs arising from lower labial fold.* Maxillary pair dilated at base. Gill membranes united with each other and also with isthmus.

Rayed dorsal fin inserted behind pectoral fin half, ahead of pelvic fin, with six rays and a weak spine serrated anteriorly. *Five plates on either side of dorsal fin present* ; *six elevated scale-like plates* along median line behind dorsal fin, *last plate in the form* of a *spine. Adipose* dorsal fin present *in the form of a spine.* Pectoral fins with eight rays and a spine, compressed, serrated along both edges, but strongly along outer edge. Pelvic fins with seven rays. Anal fin short with six rays. *Caudal fin truncate, upper caudal ray prolonged into a very long filament.* Lateral line with a series of small rough bony plates.

Air-bladder reduced, enclosed in a bony capsule, An axillary pore present.

Distribution.—India : confined to Indus, Ganga, Jamuna rivers of Northern India. Pakistan. Bangladesh.

Species.—*S. rhabdophorus* Hamilton is the single species known so far.

Family CLARIIDAE

Air breathing Catfishes

Large sized elongate fishes with a compressed body. Teeth on premaxillaries, mandible and prevomer. Nostrils widely separated, anterior tubular, situated near tip of snout, posterior slit-like and with nasal barbel. Barbels eight, well developed. Gill openings wide, extending to above base of pectoral fin.

Rayed dorsal fin very long, separate or continuous with caudal fin. No adipose dorsal fin. Paired fins inserted horizontally. Pectoral fins with a strong spine, may be serrated ; in some genera fin vestigial. Anal fin long, not confluent with caudal. Caudal fin rounded. Lateral line present, complete.

Air-bladder reduced, consisting of two thin-walled sacs united by a transverse tube ; two lateral chambers covered by incomplete bony capsule.

Distribution.—Freshwaters of Asia, Africa. Vastly represented in Africa.

Two genera are dealt with here.

KEY TO GENERA

1. Eyes absent. Pectoral fins rudimentary. Accessory dendritic apparatus in gill cavity not well developed. ... ***Horaglanis*** Menon

— Eyes present. Pectoral fins well developed. Accessory dendritic apparatus in gill cavity well developed. ... *Clarias* Scopoli

Genus **Clarias** Scopoli

Clarias Scopoli, 1777, *Introductio ad historiam Naturalam*, p. 445 (type-species, *Clarias orontis* Günther).—Hora, 1936, *Rec. Indian Mus.*, **38**, pp. 347-351 (review, key to species).—Silas, 1952, *Proc. nat. Inst. Sci. India*, **18**, p. 434 (species composition discussed).—Jayaram, 1980, *Occ. Papers ZSI*, No. **23**, p. 3.

Diagnosis.—Body elongated, compressed. Abdomen rounded. *Head moderate sized, greatly depressed, covered with osseous plates* dorsally and laterally *forming a cask covering a diverticulum of the gill cavity.* Snout broadly rounded or pointed. Mouth terminal, fairly wide, transverse. Eyes small, dorso-lateral with free orbital margins, not visible from ventral surface. Lips fleshy, papillated. Jaws subequal ; upper jaw longer. Teeth villiform in broad bands or patches on jaws and palate. Four pairs of barbels, one pair each of maxillary, nasal and two of mandibular. Gill membranes deeply notched, partly united with each

other, free from isthmus. An accessory respiratory dendritic branchial organ attached to second to fourth branchial arches present.

Rayed dorsal fin long, with 62 to 77 rays and without any spine, commencing from near occiput and extending to and not continuous

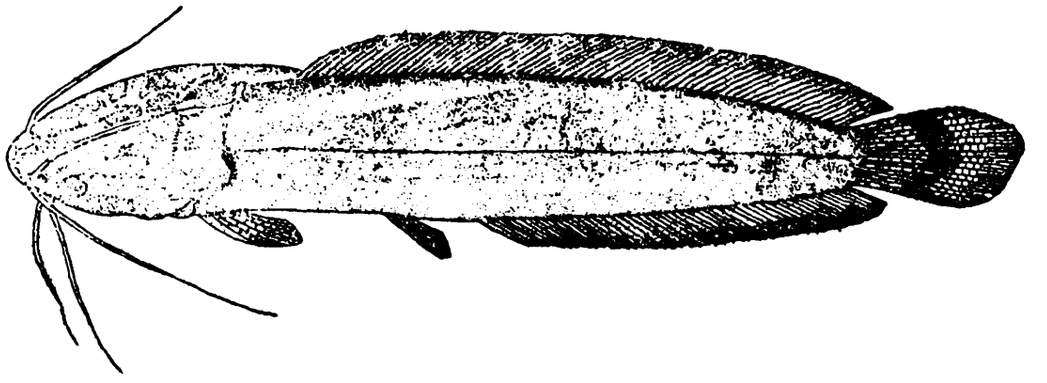


Fig. 154. Lateral view of *Clarias batrachus* (Linnaeus). (After Misra, K. S. 1962, taxt-fig. 105).

with caudal. Adipose dorsal absent. Pectoral fins with 7 to 11 rays and a strongly serrated spine ; spine enveloped in skin. Pelvic fins with six rays. Anal fin long with 45 to 63 rays. Caudal fin almost rounded. Lateral line complete, simple.

Air-bladder reduced, consisting of two thin walled sacs united by a transverse tube ; the lateral chambers covered by incomplete horny capsule.

Distribution.—Freshwater of Africa and South Asia.

Species.—

1. *Clarias batrachus* (Linnaeus)—India. Pakistan. Nepal. Sri Lanka. Bangladesh. Burma. Thailand. Malaya. Malacca. Philippines. Java. Bali. Lombok. Sumatra. Singapore. Borneo.
2. *Clarias dussumieri brachysoma* Günther—Sri Lanka.

2. 1. *Clarias dussumieri dayi* Hora—India : Wynaad, Kerala State ; Pondicherry.

2. 2. *Clarias dussumieri dussumieri* Valenciennes—India : Kerala State.

KEY TO SPECIES

1. Distance from dorsal fin base to base of occipital process 4.0 to 5.0 times in head length measured along upper median line from tip of snout to base of occipital process. ...	*C. batrachus*
Distance from dorsal fin base to base of occipital process less than 4.0 times in head length as measured above. ...	*C. dussumieri*

KEY TO SUBSPECIES OF *C. DUSSUMIERI*

1. Dorsal fin with 66-70 rays. Pectoral spine strongly serrated externally. 2

   Dorsal fin with 70-77 rays. Pectoral spine rough externally (Sri Lanka). ... *C. dussumieri brachysoma*

2. Snout pointed. Nasal barbels more than two times in head length measured from tip of snout to base of occipital process. ... *C. dussumieri dayi*

   Snout broad. Nasal barbels not more than two times in head length measured as above. ... *C. dussumieri dussumieri*

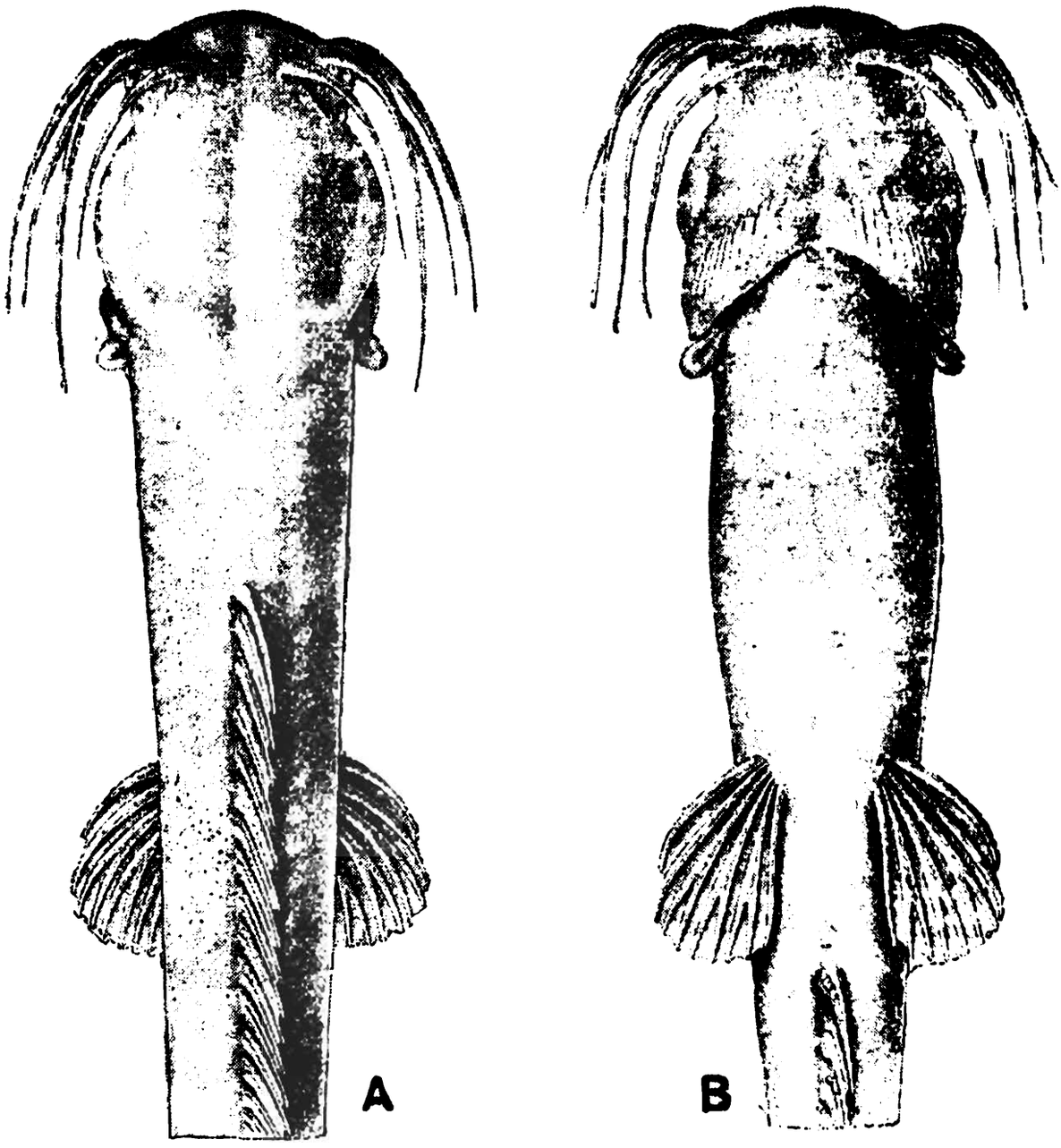


Fig. 155. *Horaglanis krishnai* Menon. A. Dorsal view of head and anterior part of body ; B. Ventral view. (After Menon, A. G. K. 1951).

Genus **Horaglanis** Menon

Horaglanis Menon, 1951, *Rec. Indian Mus.*, **48**, p. 60 (type-species, *Horaglanis krishnai* Menon, by monotypy).—Jayaram, 1980, *Occ. Papers ZSI*, No. **23**, p. 9.

Diagnosis.—Body elongated. Abdomen rounded. Head short, globular. Snout truncated. Mouth subvertical, fairly wide, crescentic. *Eyes absent.* Lips thick, fleshy. Jaws subequal. Teeth villiform, closely set in broad bands or patches in jaws and palate. Four pairs of barbels, one pair each of maxillary, nasal and two of mandibular. Gill membranes united with each other and also with isthmus. *Two small bony structures corresponding to the 2nd and 4th arch represent the dendritic apparatus.*

Rayed dorsal fin long, with 23 rays, commencing in the beginning of the third of the distance between the tip of snout and caudal base, and extending to caudal but free from it. Adipose dorsal absent. *Pectoral fins vestigial*, with a central axial ray which bears six small rays distally and nine smaller rays on the sides. Pelvic fins with six rays. Anal fin long with 17 rays, free from caudal. Caudal fin rounded. Lateral line faint.

Air-bladder bag-like, laterally broader than long, slightly notched at the anterior end, completely free.

Distribution.—India : Kottayam, Kerala State.

Species.—*Horaglanis krishnai* Menon is the only species known so far.

Family Heteropneustidae

Stinging Catfishes

Moderate sized elongate fishes with a compressed body. Teeth on premaxillaries, mandible and prevomer. Nostrils widely separated, anterior produced into a short tube, on tip of snout, posterior slit-like behind nasal barbels. Barbels eight, well developed. Gill openings wide, extending to above base of pectoral fins.

Rayed dorsal fin short and without any spine. Paired fins inserted horizontally. *Adipose dorsal fin absent or represented by a low ridge.* Pectoral fin with a strong spine, serrated. Anal fin long, just reaching or united with caudal. Caudal fin almost rounded. Lateral line present, complete.

Distribution.—India. Pakistan. Sri Lanka. Bangladesh. Burma. Thailand and Viet-Nam. Absent from Malaya and East Indies.

A single genus is dealt with here.

Genus **Heteropneustes** Müller

Heteropneustes Müller, 1840, *Arch. Anat. physiol.*, p. 115 (type-species, *Silurus fossilis* Bloch, by original designation).—Hora, 1936, *Rec. Indian Mus.*, **38**, pp. 208-209 (review).—Jayaram, 1980, *Occ. Papers ZSI*, No. 23, p. 11.

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head moderate sized, greatly depressed, covered with thin skin. Snout flat. Mouth terminal, transverse, narrow. Eyes small, lateral, in anterior part of head, not visible from below ventral surface. Lips fleshy, papillated. Jaws subequal. Teeth villiform in broad bands on jaws and in two oval patches on palate. Four pairs of barbels ; one pair each

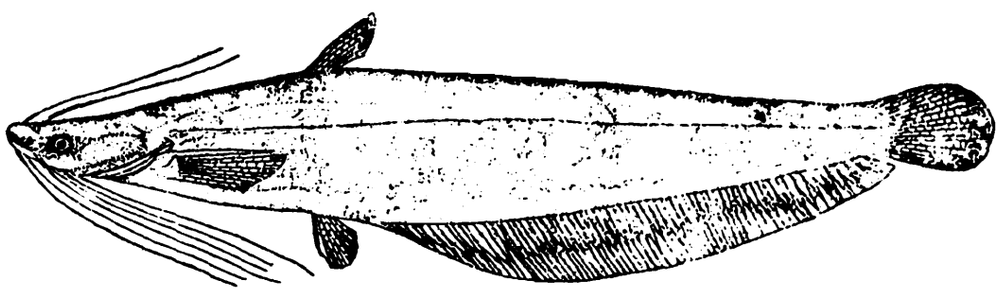


Fig. 156. Lateral view of *Heteropneustes fossilis* (Bloch). (After Misra, K. S. 1962, text-fig. 104).

of maxillary, nasal and two of mandibular. Gill membranes separated by a deep notch, not united with isthmus. *Gill chambers with accessory air-sacs extending backwards into caudal region.*

Rayed dorsal fin short, inserted above tip of pectoral fin with six to eight rays and *without any spine. Adipose dorsal absent or represented by a low adipose ridge, along posterior third of caudal region.* Pectoral fins with seven or eight rays and a strong spine serrated along inner edge. Pelvic fins with six rays. Anal fin long with 60 to 79 rays, just reaching caudal fin. Caudal fin almost rounded. Lateral line complete, simple.

Air-bladder greatly reduced, consisting of two thin walled pyriform sacs enclosed in incomplete bony capsules. Sacs united by a transverse tube which is connected with oesophagus through a slender tube.

Distribution.—India. Pakistan. Nepal. Sri Lanka. Bangladesh. Thailand. Laos.

Species.—

1. *H. fossilis* (Bloch)—India. Pakistan. Nepal. Sri Lanka. Bangladesh. Thailand. Laos.
2. *H. microps* (Günther)—Sri Lanka : Dikkanda, Dambuva near Yakvala (U. P.)

KEY TO SPECIES

1.	Anal fin separated from the caudal by a deep notch. ...	*H. fossilis*
—	Anal fin confluent with caudal. ...	*H. microps*

Family CHACIDAE

Robust large sized ugly fishes with head and body ahead of anal fin depressed. Teeth villiform on premaxillaries, mandible ; palate edentate. Nostrils widely separated, anterior pair tubular, situated along front border of snout, posterior pair with or without a short tentacle. Barbels six (eight if posterior nostril is provided with tentacles), feebly developed. Gill openings mainly lateral, somewhat contracted.

Rayed dorsal fin short with 3-4 rays and with a pungent spine. *Adipose dorsal fin smooth, confluent with caudal fin.* Paired fins horizontally inserted. Pectoral fins with a strong, serrated spine. Anal fin short, with 7-10 rays, not confluent with caudal. *Caudal fin rounded with a long procurrent dorsal and a shorter ventral part. Lateral line complete, marked by a prominent papillated and tuberculated ridge.*

Distribution.—India. Pakistan. Burma. Bangladesh. Malaya. East Indies.

A single genus is dealt with here.

Genus **Chaca** Gray

Chaca Gray, 1831, *Zool. Misc.*, p. 9 (type-species, *Platystacus chaca* Hamilton, by monotypy).—Jayaram & Majumdar, 1964, *Proc. zool. Soc. Calcutta*, **17** (2), p. 178 (review).—Jayaram, 1980, *Occ. Papers ZSI*, No. 23, p. 15.

Diagnosis.—Body short, depressed, ahead of anal fin, but strongly compressed and sharply tapering behind. Abdomen flat. *Head very large, strongly depressed.* Mouth subterminal, arcuate, very wide. Eyes small, superior, in anterior quarter of head, not visible from below ventral surface. Lips thick, fleshy. Jaws subequal, lower jaw prominent. Teeth small, villiform on jaws ; palate edentate. Barbels three pairs (four pairs if posterior nostrils provided with tentacles) ; one pair maxillary, two pairs mandibular. Gill membranes free up to pectoral base and united with isthmus.

Rayed dorsal fin short, with three or four rays and a strong spine. *Adipose dorsal confluent with caudal fin.* Pectoral fins with four to five rays and a short, strong spine. Pelvic fins with six rays. Anal fin short with seven to ten rays. *Caudal fin rounded with a long procurrent dorsal and a shorter ventral part. Lateral line complete, marked by a prominent papillated and tuberculated ridge.*

Air-bladder rather large, somewhat cardiform in shape, concave anteriorly, lying across the bodies of the anterior vertebrae and not enclosed in bone.

Distribution.—India up to W Bengal. Bangladesh. Burma. Banka. Borneo. Sumatra.

Species.—*C. chaca* (Hamilton)—India : Bihar, West Bengal, Assam. Bangladesh. Burma. Banka. Malacca. Borneo. Sumatra. Record from Bombay (Day, 1889, p. 112) doubtful.

Family OLYRIDAE

Loach-like, elongate, small sized fishes with body flattened in front of pelvics and compressed behind. Teeth on premaxillaries, mandible and prevomer. Nostrils widely separated, anterior tubular, nearer snout than eye, posterior with nasal barbel. Barbels eight, generally well developed. Gill openings very wide, extending to far forwards ; *functional part greatly restricted by flaps of skin along lower edges.*

Rayed dorsal fin short and without a spine. Adipose dorsal fin long, low, smooth, not confluent with either rayed dorsal or caudal. Paired fins inserted horizontally. Pectoral fins with a sharp, serrated spine. Anal fin of moderate length, ensheathed in skin, not confluent with caudal. *Caudal fin long, lanceolate or forked, filiform, upper part better developed than lower.* Lateral line present, may be indistinct.

Distribution.—India. Burma.

A single genus is dealt with here.

Genus **Olyra** McClelland

Olyra McClelland, 1842, *Calcutta J. nat. Hist.*, 2, p. 588 (type-species, *Olyra longicaudata* McClelland).—Hora, 1936, *Rec. Indian Mus.*, 38, pp. 202-207 (family status provided, systematic position (defined).—Jayaram, 1980, *Occ. Papers ZSI*, No. 23, p. 17.

Diagnosis.—Body elongate. Abdomen subcylindrical, behind pelvics. Head small, compressed. Snout obtusely rounded. Mouth anterior, narrow, crescentic. Eyes superior, small, in anterior part of head, not visible from below ventral surface. Lips thin, continuous, not fleshy. Jaws subequal, provided with a number of open pores. Teeth uniformly villiform on jaws and palate in bands. Fours pairs of barbels, one each of maxillary, nasal and two of mandibular. Gill membranes extensive and united with each other across isthmus.

Rayed dorsal fin inserted above pelvic fins with six to eight rays *and without a spine.* Adipose dorsal short, low, posteriorly free. Pectoral fins with four to seven rays and a strong serrated spine. Pelvic fins with six rays. *Anal fin moderately long* with 16 to 23 rays, *fin rays increasing in length posteriorly. Caudal fin long, lanceolate or forked, filiform, upper part better developed than lower.* Lateral line complete.

Air-bladder fairly extensive, free in abdominal cavity, though surrounded dorsally and laterally by thin wing-like extensions of transverse processes of the complex vertebra.

Distribution.—India : Eastern Himalaya. Burma.

Species.—

1. *O. burmanica* Day—Burma : Pegu Yomas.
2. *O. horae* (Prashad & Mukerji)—Burma : Indawgyi Lake, Myitkyina district.
3. *O. kempi* Chaudhuri—India : Mangaldai, Assam.
4. *O. longicaudata* McClelland—India : base of Darjeeling Himalaya, Assam.

KEY TO SPECIES

1.	Caudal fin entire. ...	*O. burmanica*	
—	Caudal fin forked. ...	...	2
2.	Upper lobe of caudal fin not very long than lower lobe. ...	*O. horae*	
—	Upper lobe of caudal fin almost twice as long as lower. ...	...	3
3.	Body depth 9 to 11 in standard length. Anal fin rays 18 to 23. ...	*O. longicaudata*	
—	Body depth 11 to 12 in standard length. Anal fin rays 17 or 18. ...	*O. kempi*	

Family ARIIDAE

Sea catfishes

Robust large sized, more or less elongate fishes with a compressed body. Teeth on premaxillaries, mandible, prevomer and palatines, may be absent on either of latter two or on both. Nostrils close together, posterior with a valve, but without a barbel. Barbels two or six, moderate to well developed. Gill openings wide, extending to base of or above base of pectoral fins.

Rayed dorsal fin short with a pungent spine. Adipose dorsal fin smooth, not confluent with either rayed dorsal or with caudal. Paired fins inserted horizontally and plain. Pectoral fins with a sharp, serrated spine. Anal fin moderately long, not confluent with caudal. Caudal fin forked or bifurcate. Lateral line present, generally complete.

Air-bladder large, with thick walls, in abdominal cavity, not enclosed in bone.

Distribution.—Shores, estuaries and seas of tropical and subtropical regions.

Five genera are dealt with here.

KEY TO GENERA

1.	Maxillary barbels stiff, osseous. ...	*Osteogeniosus* Bleeker	
—	Maxillary barbels soft, not osseous. ...	...	2
2.	Two or four barbels. Lower jaw longer than upper. (Maxillary barbels vestigial) ...	*Batrachocephalus* Bleeker	
—	Six barbels. Lower jaw equal to upper jaw. ...	...	3
3.	Palate with teeth. ...	*Tachysurus* Lacépède	
—	Palate without teeth. ...	...	4
4.	Cleft of mouth extending beyond anterior border of eye. ...	*Ketengus* Bleeker	
—	Cleft of mouth extending much before anterior border of eye. ...	*Hemipimelodus* Bleeker	

Genus **Batrachocephalus** Bleeker

Frog-headed catfish

Batrachocephalus Bleeker, 1846, *Nat. Geneesk. Arch. Ned. Ind.*, (2) **3** pp. 147, 176 (type species, *Batrachocephalus ageniosus* Bleeker).—Smith, 1945, *Bull. U. S. nat. Mus.*, **188**, p. 404.

Diagnosis.—Body elongated, compressed. Abdomen rounded. Head large, broad, depressed, *with head-shields exposed.* Snout bluntly rounded. Mouth terminal, very widely cleft, gape arcuate. Eyes large, dorso-lateral, in anterior half of head and above angle of mouth visible from below ventral surface. Lips thin. Jaws subequal, lower jaw prominent. Teeth conical in bands on jaws and palatines, no teeth on vomer. One pair of small barbels, mandibular only, indications of inner pair seen, but not conspicuous. Gill membranes with a free posterior margin, without a notch, but united with isthmus.

Rayed dorsal fin inserted above half to three-fourth of pectoral fin with seven rays and a strong spine. Adipose dorsal short, posteriorly free. Pectoral fins with seven to nine rays and a strong spine serrated along both margins. Pelvic fins with six rays. Anal fin moderate with 19 to 21 rays. Caudal fin forked. Lateral line complete, simple.

Air-bladder free, not enclosed in bone.

Distribution.—Seas, estuaries and tidal rivers of India, Pakistan, Sri Lanka, Bangladesh, Burma, Thailand, Java, Borneo, Sumatra.

Species visiting freshwater.—*B. mino* (Hamilton) is the only species known so far.

Genus **Osteogeniosus** Bleeker

Soldier Catfish

Osteogeniosus, Bleeker, 1846, *Nat. Geneesk. Arch. Ned. Ind.*, (2) 3, pp. 146-173 (type species, *Osteogeniosus macrocephalus* Bleeker).—Smith, 1945, *Bull. U. S. nat. Mus.*, **188**, p. 405.

Diagnosis.—Body long, compressed. Abdomen rounded. Head large, strongly depressed, covered by smooth skin. Snout obtuse. Mouth subterminal, arcuate, wide. Eyes moderate, lateral, in anterior half of head, above angle of mouth, visible from below ventral surface. Lips thick. Jaws subequal, upper jaw projecting before mouth. Teeth villiform in bands on jaws and conical in patches on palate. Barbels one pair, *a pair of semiosseous stiff maxillary barbels. Gill membranes united with each other* and posteriorly united with isthmus.

Rayed dorsal fin inserted above last quarter of pectoral fin with seven rays and a pungent spine. Adipose dorsal short, posteriorly free. Pectoral fins with 10 or 11 rays and a strong serrated spine. Pelvic fins with six rays. Anal fin moderately long with 19 or 22 rays. Caudal fin forked. Lateral line complete, simple.

Air-bladder free, not enclosed in bone.

Distribution.—Seas, estuaries and tidal rivers of India, Pakistan, Sri Lanka, Burma, Bangladesh, Thailand, Malaya, Java, Sumatra, Borneo, Malacca.

Species visiting freshwater.—*O. militaris* (Linnaeus)—distribution as of the genus.

Remarks.—Day (1889) iucluded his *O. sthenocephalus* from Burma as a second species of this genus. The characters distinguishing this species from *O. militaris* fall within the range of variation of the latter and as such, it is not treated separately.

Genus **Tachysurus** Lacépède

Mouth-breeding catfishes

Tachysurus Lacépède, 1803, *Hist. nat. poiss.*, **5**, p. 150 (type-species, *Tachysurus sinensis* Lecépède).—Chandy, 1954, *Rec. Indian Mus.*, **51** (1), pp. 1—18 (synopsis of species, key).

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head large, subconical, depressed, exposed, with more or less granular or rugose osseous shields on dorsal surface, or covered with thin skin. Snout conical or pointed obtusely. Mouth subterminal, moderate or large, transverse. Eyes lateral or slightly directed upwards with free orbital margin, in middle or anterior part of head, may or may not be visible from below ventral surface. Lips thin. Jaws subequal, upper jaw projecting. Teeth villiform, granular or conical on jaws and palate, in bands or patches. Three pairs of barbels ; one pair maxillary, two mandibular. Gill membranes united, connected with isthmus but with a free posterior margin.

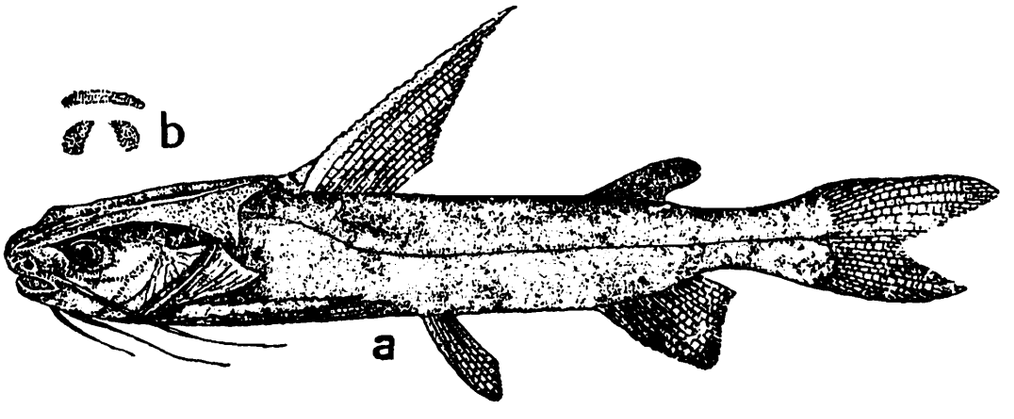


Fig. 157. a. Lateral view of *Tachysurus caelatus* (Val.) b. dentition (After Misra, K. S. 1962, text-fig. 91).

Rayed dorsal fin inserted above middle or last quarter of pectoral fin with six or seven rays and a pungent, strong spine. Adipose dorsal short or of moderate length, posteriorly free. Pectoral fins with nine to twelve rays and a strong serrated spine. Pelvic fins with six rays. Anal fin short with 14 to 24 rays. Caudal fin forked with rounded or acute lobes. Lateral line prominent, complete, simple.

Air-bladder large, heart-shaped, free, not enclosed in bone.

Distribution.—Seas and estuaries of tropical regions ascending to within tidal influence or even entering freshwater.

Species visiting freshwater.—

1. *T. acutirostris* (Day)—Burma : Salween river.
2. *T. arius* (Hamilton)—India : W. Bengal, Orissa, Tamil Nadu, Kerala. Bangladesh. Burma.

3. *T. burmanicus* (Day)—Burma.
4. *T. caelatus* (Valenciennes)—India : W. Bengal, Orissa, Andhra Pradesh, Coromandel and Maharashtra coasts. Burma. Thailand. Java. Sumatra. Borneo.
5. *T. gagora* (Hamilton)—India : West Bengal, Orissa. Bangladesh. Thailand.
6. *T. nenga* (Hamilton)—India : Hooghly river, W. Bengal. Orissa. Bangladesh.

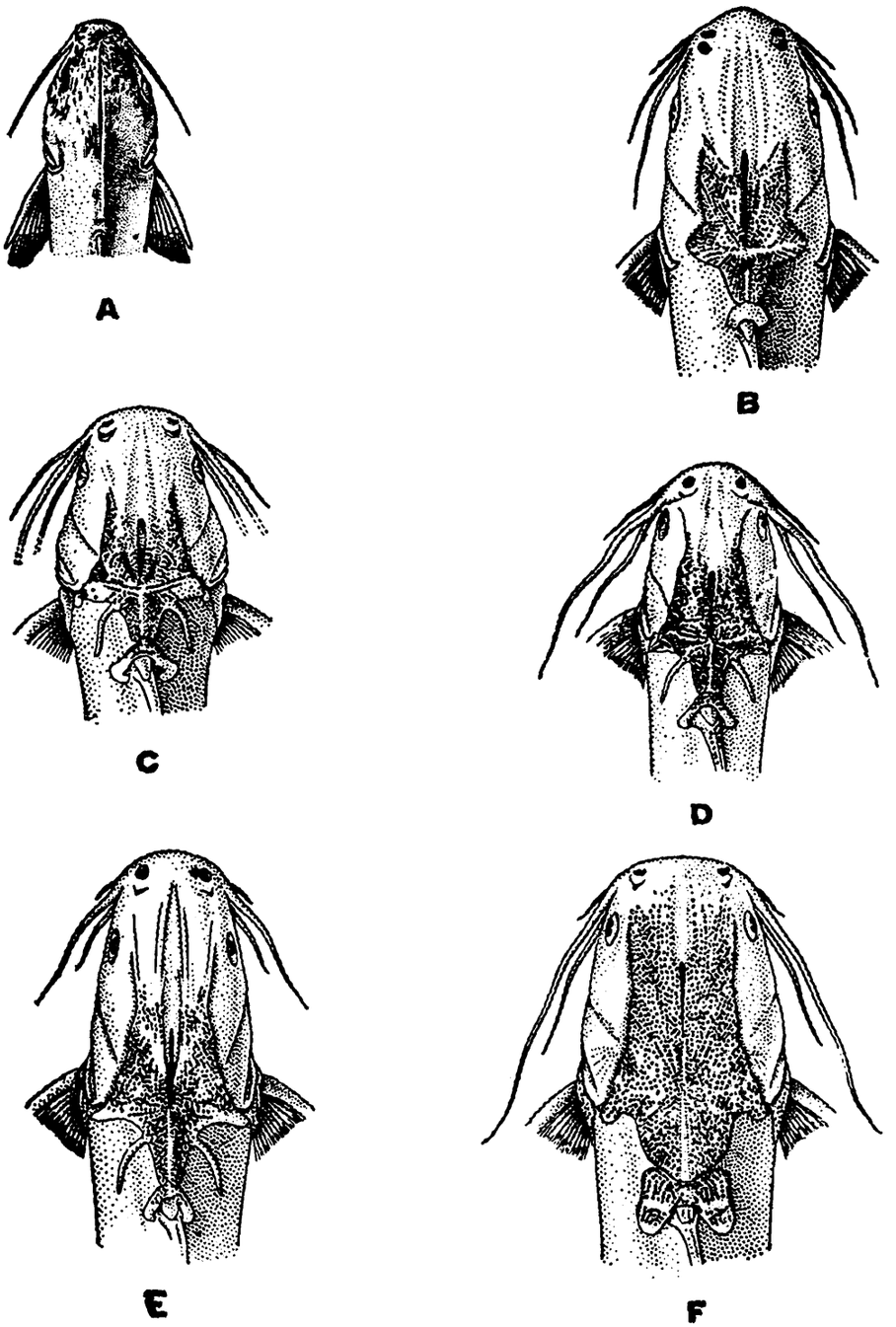


Fig. 158. Dorsal view of head and body of A. *Tachysurus satparanus* Chaudhuri. B. *T. arius* (Hamilton). C. *T. caelatus* (Valenciennes). D. *T. nenga* (Hamilton). E. *T. sagor* (Hamilton). (After Chandy, M. 1954, pls. 1, 2).

7. *T. sagor* (Hamilton)—India : Bombay coast, Bay of Bengal. Bangladesh. Thailand. Malaya. Java. Sumatra.

8. *T. satparanus* (Chaudhuri)—India : Chilka Lake, Orissa.

KEY TO SPECIES

1. Teeth on palate in two distinct transverse series of patches on each side. Basal bone of dorsal fin butterfly shaped. ... *T. sagor*

— Teeth on palate in one group or patch on each side. Basal bone of dorsal fin not butterfly shaped. 2

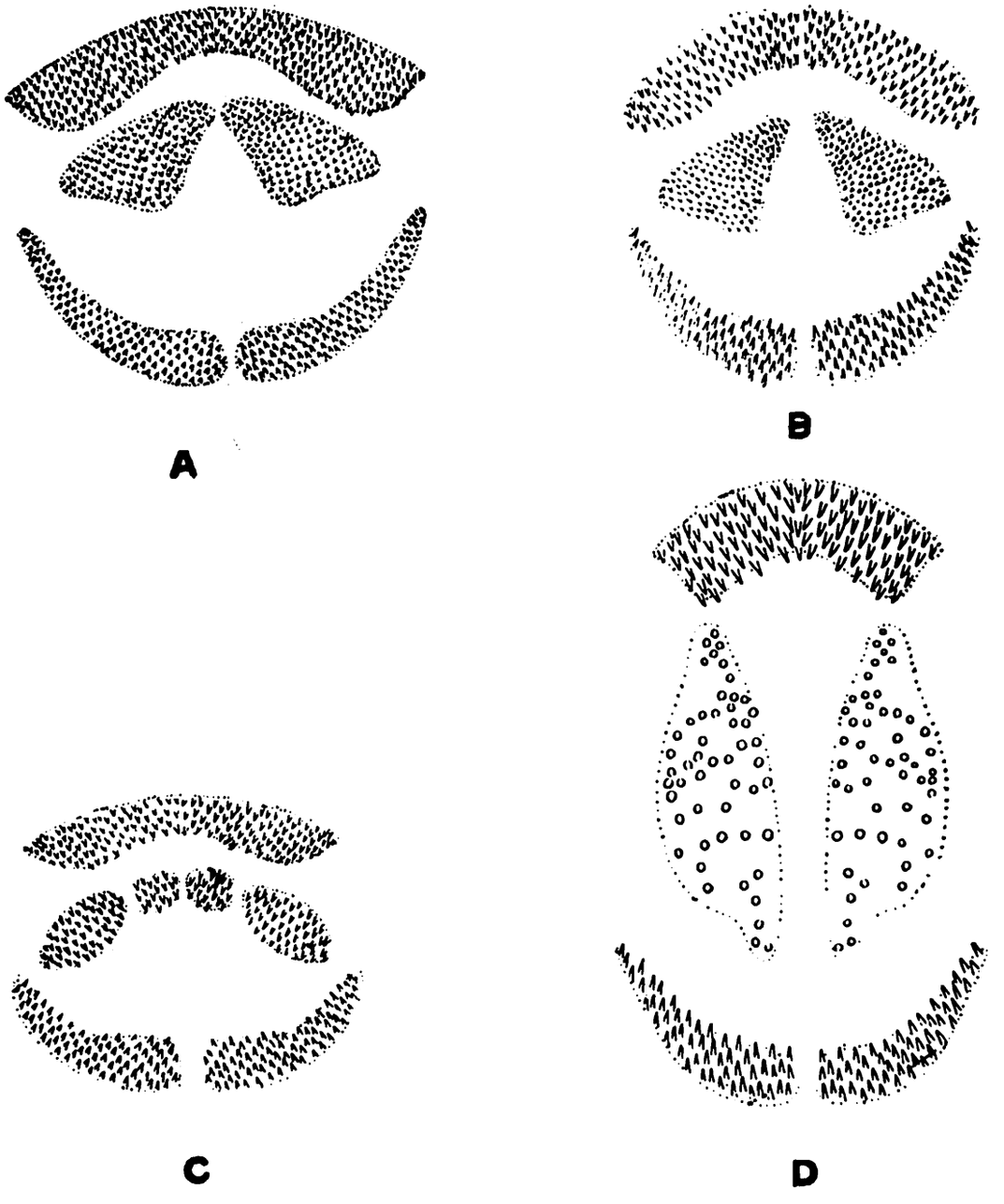


Fig. 159. Dentition in A. *Tachysurus caelatus* (Valenciennes). B. *T. nenga* (Hamilton). C. *T. sagor* (Hamilton). D. *T. gagora* (Hamilton). (After Chandy, M. 1954, pl. 3).

2.	Teeth on palate roughly in triangular patches. ...	...	3
—	Teeth on palate in oval or ovoid or elliptical patches. ...	...	4
3.	Median longitudinal groove narrow reaching base of occipital process. ...		*T. nenga*
—	Median longitudinal groove broad, not reaching base of occipital process. ...		*T. caclatus*
4.	Snout elongated, acute. ...		*T. acutirostris*
—	Snout not elongated, obtuse. ...	...	5
5.	Snout duck-bill shaped. ...		*T. burmanicus*
—	Snout blunt, rounded. ...	...	6
6.	Premaxillary band of teeth short, nearly separated in the middle. ...		*T. satparanus*
—	Premaxillary band of teeth large, not separated in middle. ...	...	7
7.	Teeth on palate villiform. ...		*T. arius*
—	Teeth on palate not villiform, globular. ...		*T. gagora*

Genus **Ketengus** Bleeker

Ketengus Bleeker, 1847, *Nat. Geneesk. Arch. Ned. Ind.*, (4) **2**, p. 167 (type-species, *Ketengus typus* Bleeker, by original indication).—*Ketengus*, Smith, 1945, *Bull. U. S. nat. Mus.*, **188**, p. 414.

Diagnosis.—Body elongated, compressed. Abdomen rounded. Head large, very broad, not depressed with head-shields exposed, rugose. Snout obtuse, slightly overhanging mouth. *Mouth subterminal, wide, arcuate, reaching behind eyes.* Eyes lateral, in anterior half of head, above angle of mouth, moderate sized, not visible from below ventral surface of head. Lips thin. Jaws subequal, upper jaw the longer. *Teeth closely set, small, incisor-like in a single series, obtusely tricuspid or subtruncated on jaws* ; palate edentate. Three pairs of barbels ; one pair maxillary, two of mandibular. Gill membranes posteriorly free with a notch, united with isthmus.

Rayed dorsal fin inserted above half of pectoral fin, short, with seven rays and a spine. Adipose dorsal short, posteriorly free. Pectoral fins with seven or eight rays and with a strong serrated spine. Pelvic fins with six rays. Anal fin moderately long with 19 or 20 rays. Caudal fin forked. Lateral line complete, simple.

Air-bladder free, not enclosed in bone.

Distribution.—Seas, estuaries and tidal rivers of India. Java. Sumatra. Borneo. Malaya. Thailand.

Species visiting freshwater.—*K. typus* Bleeker—India : Andaman Islands. Thailand. Malaya. Java. Borneo.

Genus **Hemipimelodus** Bleeker

Hemipimelodus Bleeker, 1858, *Acta. Soc. Sci. Ind. Neerl.*, **4**, p. 236 (type-species, *Pimelodus borneensis* Bleeker, by original designation)—Smith, 1945, *Bull. U. S. nat. Mus.*, **188**, p. 415 (Thailand).

Diagnosis.—Body elongated, compressed. Abdomen rounded. Head large, more or less depressed, *head-shields exposed or covered by thin skin.* Snout bluntly rounded. *Mouth subterminal, narrow, transverse, not extending to eyes.* Eyes lateral, in anterior half of head above angle of mouth, moderate, not visible from below ventral surface. Lips thin. Jaws subequal, upper jaw slightly longer. Teeth villiform in bands on jaws ; *palate edentate.* Barbels three pairs ; one pair maxillary and two pairs mandibular. Gill membranes united with each other, free only along a narrow posterior margin, and united with isthmus.

Rayed dorsal fin inserted nearer base of pectoral fin, with seven rays and a spine. Adipose long, low, free. Pectoral fins with 10 rays and a strong serrated spine. Pelvic fins with six rays. Anal fin with 18-20 rays. Caudal fin deeply forked. Lateral line complete, simple.

Air-bladder free, not enclosed in bone.

Distribution.—Seas, estuaries, tidal rivers of India, Pakistan, Bangladesh, Burma, Thailand, Malaya, Java, Borneo, Sumatra.

Species visiting freshwater.—*H. jatius* (Hamilton)—India : W. Bengal, Orissa. Bangladesh. Burma. Sri Lanka.

Family PLOTOSIDAE

Eel Catfish

Large sized, elongate fishes with a compressed body and tapering tail. Teeth on premaxillaries, mandible and prevomer. Nostrils widely separated, anterior tubular, in front border of upper lip, posterior slit-like, between eye and upper lip. Barbels eight, well developed ; occasionally labial folds at angle of mouth produced into short barbels. Gill openings wide, extending to above base of pectoral fins.

Two rayed dorsal fins, first small with a serrated spine ; *second very long, confluent with caudal (dorso-caudal fin). No adipose dorsal fin.* Pectoral fins laterally inserted with a strong serrated spine. Pelvics

inserted horizontally. Anal fin many rayed, confluent with caudal fin. A well developed dendritic organ between vent and anal fin present. Caudal fin pointed. Lateral line conspicuous, represented by distant pores.

Air-bladder fairly large in proportion to body size, free, not enclosed in bone.

Palatines rod-like. 3/5th of autosphenotics provide facet for articulation of hyomandibular. Endopterygoid absent. Ectopterygoid

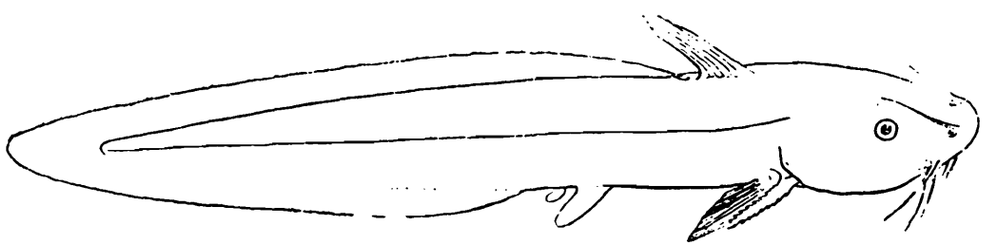


Fig. 160. Outline drawing of *Plotosus lineatus* (Thunberg). (After Hora, S. L. 1951, *J. Asiat. Soc. Beng.*, **17**, pl. 18, fig. 5).

small, toothless, suturally articulated to the long, flat, metapterygoid. Metapterygoid suturally connected with hyomandibular. Post-temporals connected to skull by ligament. Inferior limb of post-temporals well developed, attached to basioccipital. Mesocoracoid in shoulder girdle present.

Distribution.—Indo-Pacific Ocean, mainly marine, entering rivers and with some permanently fluviatile species.

A single genus is dealt with here.

Genus **Plotosus** Lacépède

Plotosus Lacépède, 1803, *Hist. Nat. Poiss.*, **5**, p. 128 (type-species, *Platystacus anguillaris* Bleeker, by original designation).—Jayaram & Majumdar, 1968, *Proc. zool. Soc. Calcutta*, **20**, p. 137 (review).

Diagnosis.—Body elongate, compressed. Abdomen subcylindrical, tail tapering. Head depressed, short. Snout bluntly rounded. Mouth transverse, cleft not extending to orbit. Eyes moderate, in anterior half or middle of head. Lips papillated. Jaws equal, with conical teeth in band in upper jaw ; in lower jaw mixed with molariform teeth in a band of two to five rows ; *palate with molariform or conical teeth. Two dorsal fins* ; first inserted above pectoral fin base, with four or five rays and a pungent spine, *second long, uniformly low, united with caudal. No adipose dorsal fin.* Pelvic fin with 11-14 rays. *Anal*

fin long, confluent with caudal fin. A dendritic post anal apparatus close behind anal fin present. Caudal fin bluntly pointed or rounded. Lateral line complete.

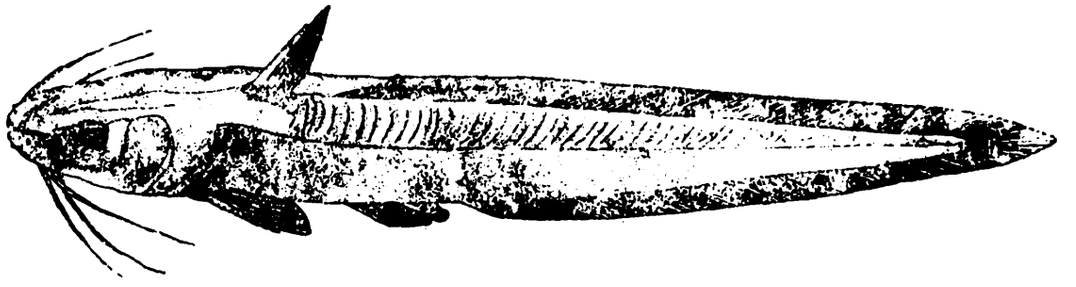


Fig. 161. Lateral view of *Plotosus canius* (Ham.). (After Misra, K. S. 1962, text-fig. 94).

Distribution.—India. Pakistan. Bangladesh. Burma. Sri Lanka. Also Red Sea. Seychelles. Natal. Mauritius. Malaya. Singapore. Thailand. Indonesia. Amoy. Hong Kong. Japan. Philippines. British N. Guinea. Australia. Tahiti.

Species visiting freshwater.—

1. *P. canius* (Hamilton)—India : Kerala, Maharashtra, W. Bengal, Andaman Islands. Bangladesh. Pakistan. Burma. Sri Lanka. Malaya. Thailand.
2. *P. lineatus* (Thunberg)—India : Kerala, Maharashtra, Gujarat, Tamil Nadu. Pakistan : Makran. Burma. Sri Lanka.

KEY TO SPECIES

1. Nasal barbels extending considerably beyond eyes. Mandibular teeth in 3 to 5 rows. Colour generally olive-green without any stripes on body. ... *P. canius*

— Nasal barbels not extending farther than hind border of eyes. Mandibular teeth in 2 or 3 rows. Colour lighter, with 2 or 3 white stripes on body. ... *P. lineatus**

SUPERORDER ATHERINOMORPHA

Upper jaw protractile in many species without true ascending processus and supported by a foundation of loose connective tissue and a complex maxillary process, without palato-premaxillary or ethmo-maxillary ligaments. Upper and lower pharyngeal bones well developed.

**P. anguillaris*, *P. arab* are junior synonyms.

dentigerous. Ceratohyal and epihyal joined together by dorsal lamella. Branchiostegals, four to 15 in number. Mesethmoid usually bilaminar, invariably discoidal or scale like. Infraorbital series reduced to two, rarely three elements. Opercular bones unarmed. Pectoral radials four in number, cuboidal, recessed within excavation in scapulocoracoid margin. Supracleithrum when present discoidal, confined within dorsal tip of cleithrum. Baudelot's ligament to basicranium present. Pelvic girdle abdominal, subabdominal or thoracic. Vertebral number high in most species. Caudal skeleton with two large hypural plates of opposite symmetry on terminal half centrum ; in no instance more than four hypurals, two of which are invariably broad and fan-shaped. Fin spines present or absent. Ctenoid scales in relatively few species (After Greenwood *et al.* 1966).

A single order Atheriniformes is dealt with here.

Order ATHERINIFORMES

Body short, compressed, or elongate, with scales. *Head with scales.* Margin of upper jaw formed solely by premaxillaries. Upper jaw protractile in many species. Teeth in both jaws, also in the superior and inferior pharyngeal bones. Upper and lower pharyngeal bones well developed. Ceratohyal and epihyal joined together by dermal lamella. Branchiostegals 4 to 15 in number. Pseudobranchiae absent. Infraorbital series reduced to two, rarely three elements. Opercular bones unarmed. *A single spineless dorsal fin. Pelvic fins abdominal, subabdominal or thoracic.* Caudal skeleton with two large hypural plates. Lateral line may be absent. Air-bladder simple.

Small to medium sized surface feeding fishes, principally in fresh and brackish waters, some marine. Most freshwater species with pronounced secondary sexual dimorphism in size, color, and in fin shape and function. Both oviparous and viviparous species are found.

Five families and 11 genera are dealt with here.

KEY TO FAMILIES

1.	Jaws produced into long and pointed beak-like structure. ...	...	2
—	Jaws not produced into beak-like structure. ...	...	9
2.	Both jaws produced. ...		BELONIDAE
	Lower jaw alone produced. ...		HEMIRAMPHIDAE
3.	Caudal peduncle longer than head. ...		POECILIDAE (Genus *Gambusia* Poey.)
—	Caudal peduncle shorter than head. ...	...	4

4. Anal fin of the male not modified into a gonopodium. Female without genital pads. Anal finl rays not many. ... CYPRINODONTIDAE

— Anal fin of the male modified into a long gonopodium. Female with genital pads. Anal fin with many rays. ... HORAICHTHYIDAE

Family HEMIRAMPHIDAE

Half Beaks

Body subcylindrical and elongate. Scales on body and head. Margin of upper jaw formed mesially by premaxillaries, laterally by maxillaries. Lower pharyngeals united into a single bone. Branchiostegals numerous. Gill openings wide. *Usually lower jaw elongated.* Barbels absent. Teeth on jaws, palate usually edentate. *A single dorsal fin inserted in the posterior part of body without spines.* Air-bladder large, may be cellular. Lateral line present along ventral surface of body.

Three genera are dealt with here.

KEY TO GENERA

1. Dorsal fin inserted behind anal origin and with fewer rays than anal fin. ... *Dermogenys* van Hasselt

   Dorsal fin inserted above or ahead of anal origin and with equal or more number of rays than anal fin. 2

2. Caudal fin emarginate or moderately forked. ... *Hyporhamphus* Gill

   Caudal fin rounded or truncate. ... *Zenarchopterus* Gill

Genus **Hyporhamphus** Gill

Hyporhamphus Gill, 1859, *Proc. Acad. nat. Sci. Philad.*, p. 131 (type-species, *Hyporhamphus tricuspidatus*, by original designation).

Diagnosis.—Body subcylindrical and elongate. Abdomen rounded. Head and snout pointed. Mouth superior, wide, cleft extending beyond anterior margin of orbit. Eyes small, superior, in anterior part of head, not visible from below ventral surface. A preorbital ridge between nasal fossa and eye present. Lips thin. Jaws not equal. *Upper jaw flat or only slightly arched formed by the premaxillaries, short, more or less triangular, covered with scales. Lower jaw in adult elongated far beyond the upper.* Teeth villiform on jaws. A nasal papilla, paddle-shaped, not fimbriate, not extending out of nasal fossa. Dorsal fin inserted in posterior half, in between pelvic and anal, extending over

latter, with 9-22 rays (16 or 17 branched) and no spine. No finlets posterior to the dorsal fin. Anal fin long, with 13-19 rays. Caudal fin moderately forked or emarginate. Scales moderate or large. Lateral line complete, running within lowermost half of body with 40-62 scales. Air-bladder large, occasionally cellular.

Distribution.—World wide : throughout the seas, estuaries of India, Pakistan, Bangladesh, Burma, Malay Archipelago and beyond. Some species ascend fresh water and live in that habitat.

Species visiting freshwater.—

1. *H. limbatus* (includes *H. gorakhpurensis* Srivastava, 1967)—India : Coromandel coast, Malabar. Bangladesh. Burma.

2. *H. xanthopterus*—India : Lake Vembanad, Kerala.

KEY TO SPECIES

1. Total gill rakers on first arch 41-53, on second arch 39-47. Lower jaw 1.3—1.7 in head length, dorsal 14 or 15 rays, anal 16 or 17. ...	*H. xanthopterus*
Total gill rakers on first arch 19-37, on second arch 16-28. Lower jaw 0.7-1.2 in head length, dorsal 13 or 14 rays, anal 14 or 15. ...	*H. limbatus*

Genus **Dermogenys** van Hasselt

Dermogenys van Hasselt, 1823, *Algem. Konst. en Letterbode*, 2, p. 131 (type-species, *Dermogenys pussilus* van Hasselt).—Herre, 1944, *Stanford Ichthyol. Bull.*, 9 (2), p. 42 (Philippines).

Diagnosis.—Body elongate, moderately compressed, but in old females may be very broad. Abdomen rounded. Head and snout pointed. Mouth superior, wide. Eyes small, superior, in anterior part of head, lateral, not visible from below ventral surface. Lips thin. Jaws not equal. A short nasal barbel may or may not be present. *Dorsal fin inserted behind anal in the last quarter of body, with 10-12 rays (3 simple) and no spine.* Anal fin with 13-16 rays (one simple) ; males have the anterior half or two thirds of anal enveloped by a thick fold of skin, and anterior rays modified. None of the other fins of either sex altered. Caudal fin rounded or truncate or slightly emarginate. Scales more or less irregular. Lateral line scales 45-54, more or less deciduous, often imperfect, not continued beyond anal.

Distribution.—India. Bangladesh. Burma. Thailand. Malaya. Borneo. Sunda islands. Philippines.

Species.—*D. pusillus* van Hasselt—distribution as of genus.

Remarks.—These small sized viviparous fishes are rarely found in the sea. They live near the surface and are larvicidal.

Genus **Zenarchopterus** Gill

Zenarchopterus Gill, 1863, *Proc. Acad. nat. Sci. Philad.*, **15**, p. 273 (type-species *Hemiramphus dispar* Valenciennes)—Herre, 1944, *Stanford Ichth. Bull.*, **9**(2), p. 17 (Philippines).

Diagnosis.—Body very elongate, sub-cylindrical, slender, laterally compressed. Abdomen rounded. Head and snout pointed. Mouth superior, wide, cleft extending to anterior border of orbit. Eyes small, superior, lateral, not visible from below ventral surface. Upper jaw formed by the premaxillaries, triangular. *Lower jaw elongated with a*

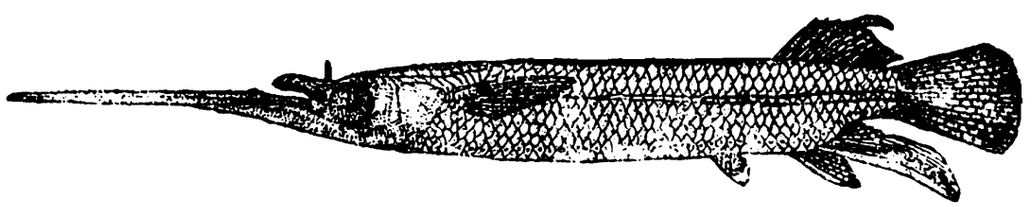


Fig. 162. Lateral ew of *Zenarchopterus dispar* (Valenciennes). (After Misra, K. S. 1962, text-fig. 118).

coloured flap at its tip. Teeth villiform on jaws. Nasal barbels elongate, extending beyond nasal fossa. *Dorsal fin inserted far back, slightly ahead of anal in the last quarter of body*, with 11 to 14 rays and no spine. *Anal fin with 10-12 rays ; males may have the sixth or other rays modified with the stem thick, wide and also greatly lengthened ; the anal fin itself may be separated into one, two or three distinct parts.* Caudal fin rounded, truncate or slightly emarginate, *never forked.* Scales moderate. Lateral line complete with 40-50 scales.

Distribution.—India, Madagascar, East Coast of Africa to Hongkong, Micronesia, Samoa in Polynesia.

Species visiting freshwater.—

1. *Z. brachynotopterus* (Bleeker)—India : Hooghly river, W. Bengal.
2. *Z. buffonis* (Valenciennes)—India : Bombay, Calcutta. Also in New Guinea. Aru Islands, Bismarck Archipelago. Caroline Is.
3. *Z. dispar* (Valenciennes)—Throughout India to Malay Archipelago to Philippines, Sri Lanka.
4. *Z. ectuntio* (Hamilton)—India : Hooghly river, W. Bengal. Burma. Thailand, Malay Archipelago.

KEY TO SPECIES*

1.	Anal fin inserted nearer head than dorsal fin. ...	*Z. brachynotopterus*
	Dorsal fin inserted nearer head than anal fin.	2
2.	Triangular part of upper jaw longer than wide. ...	*Z. ectuntio*†
	Triangular part of upper jaw wider than long.	3
3.	A dark brown line along midline of snout; dorsal and anal rays of male modified but not reaching beyond caudal base. ...	*Z. buffonis*
	Snout of uniformly brown colour, one or two dorsal rays of males thickened and elongate; either the 3rd & 4th or 4th & 5th, 6th and 7th anal rays of males greatly elongated. ...	*Z. dispar*

Family BELONIDAE

Freshwater Gars

Body elongate, slender, with small scales. Head with scales. *Both jaws elongated as a beak.* Teeth on jaws; palate edentate in Indian species. Branchiostegals 12-15. Gill openings wide. Dorsal fin placed far posterior of body without spines; dorsal fin rays varying in elevation, sometimes forming a lobe to the fin. No separate finlets. Lateral line on free portion of tail with or without a keel.

Two genera are dealt with here.

KEY TO GENERA

1.	Dorsal fin inserted behind anal origin. ...	*Strongylura* van Hasselt
	Dorsal fin inserted opposite anal origin. ...	*Xenentodon* Regan

Genue **Strongylura** van Hasselt

Strongylura van Hasselt, 1823, *Alg. Konst. Letterbods*, **2**, p. 130 (type-species, *Strongylura caudimaculata* = *Belone strongylura* van Hasselt).

Diagnosis.—Body elongated, subcylindrical, compressed. Abdomen rounded. Head and snout pointed. Mouth superior, wide, cleft extending to orbit. Eyes moderate, superior, in anterior part of head,

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*After Collette, B. B. 1974. *Rec. Austral. Mus.*, **29** (2) : p. 29.

†*Z. ectuntio* described as *Hemiramphus ectuntio* by Day (*Fish India*, p, 517, pl. 119, fig, 6, 1878) is different from *Esox ectuntio* described by Hamilton (1822, pl. 21, fig. 1) ; the systematic position of the latter species is uncertain.

not visible from below ventral surface. *Both jaws prolonged into a beak.* Teeth villiform on jaws ; palate edentate. *A shallow median groove along head, superciliary region scarcely striated.* Dorsal fin inserted above anal fin ; upper margin concave, posterior rays elongated not extending to root of caudal, with 12—15 rays and no spine, Anal fin with first four rays in advance of dorsal, shaped as dorsal with 15—18 rays. Caudal fin rounded. Scales small. *Lateral line double.*



Fig. 163. Lateral view of *Strongylura strongylura* (van Hasselt) (After Misra, K. S. 1962, text-fig. 115).

Distribution.—World wide.

Species visiting freshwater.—S. strongylura van Hasselt—Persian Gulf. Pakistan. India. Sri Lanka. Thailand. East Indies. Philippines. Australia. S. China.

Genus **Xenentodon** Regan

Xenentodon Regan, 1911, *Ann. Mag. nat. Hist.*, (8) 7, p. 382 (type-species, *Belone cancila* Hamilton, by original designation).

Diagnosis.—Body elongated, subcylindrical, compressed. Abdomen rounded. Head pointed. Snout sharply pointed. Mouth superior,

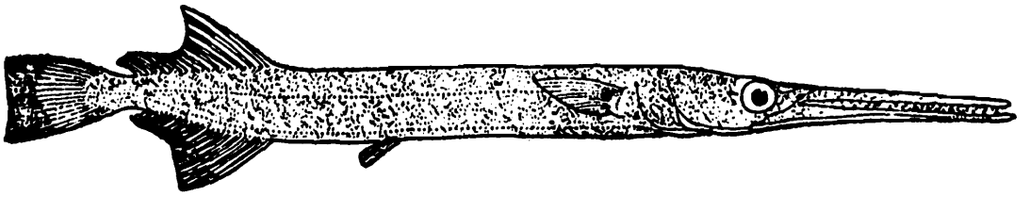


Fig. 164. Lateral view of *Xenentodon cancila* (Ham) (After Misra, K. S. 1962, text-fig. 116).

wide, cleft extending to orbit. Eyes moderate, superior, in anterior part of head, not visible from below ventral surface. *Both jaws prolonged into a beak, with fine rugosities.* In juveniles jaws may not be much prolonged. Teeth villiform on jaws ; palate edentate. *A deep longitudinal groove along upper surface of head present.* Dorsal fin usually inserted above anal fin, with 15—18 rays, and no spine. *Anterior dorsal rays sometimes form a lobe to the fin, without any finlets.* Anal fin with 15—19 rays. Caudal fin truncate. Scales small. *Lateral line on posterior half of body*, without a keel.

Distribution.—Pakistan. India. Nepal. Bangladesh. Sri Lanka. Burma. Thailand. Malay Archipelago. Borneo and Sumatra.

Species visiting freshwater.—*X. cancila* Hamilton (Pl. VI, Fig. C)—Freshwaters of Sind, Punjab (Pakistan), India, Nepal, Sri Lanka, Bangladesh, Burma, Malaya and Thailand.

Family HORAICHTHYIDAE

Body elongate, strongly compressed, translucent, covered with thin cycloid scales. Head with scales. Premaxillaries not protractile. Bones of both upper and lower jaws loosely connected. Jaws with teeth. *Premaxillaries produced below into dentigerous arm lying outside the mouth.* Gill membranes broadly united and free from isthmus. Pectoral fins set high. Anal fin long. *In the males six anterior rays of anal fin separated from rest to form a gonopodium. In the females, the genital opening is asymmetric and the region surrounding it strengthened by development of callosities or genital pads.*

Only a single genus is known.

Genus **Horaichthys** Kulkarni

Horaichthys Kulkarni, 1940, *Rec. Indian Mus.*, **42**, 385 (type-species, *Horaichthys setnai* Kulkarni).

Diagnosis.—Body elongate, narrow, compressed. Abdomen rounded. Head slightly depressed. Snout broad and truncate. Mouth sub-ventral,

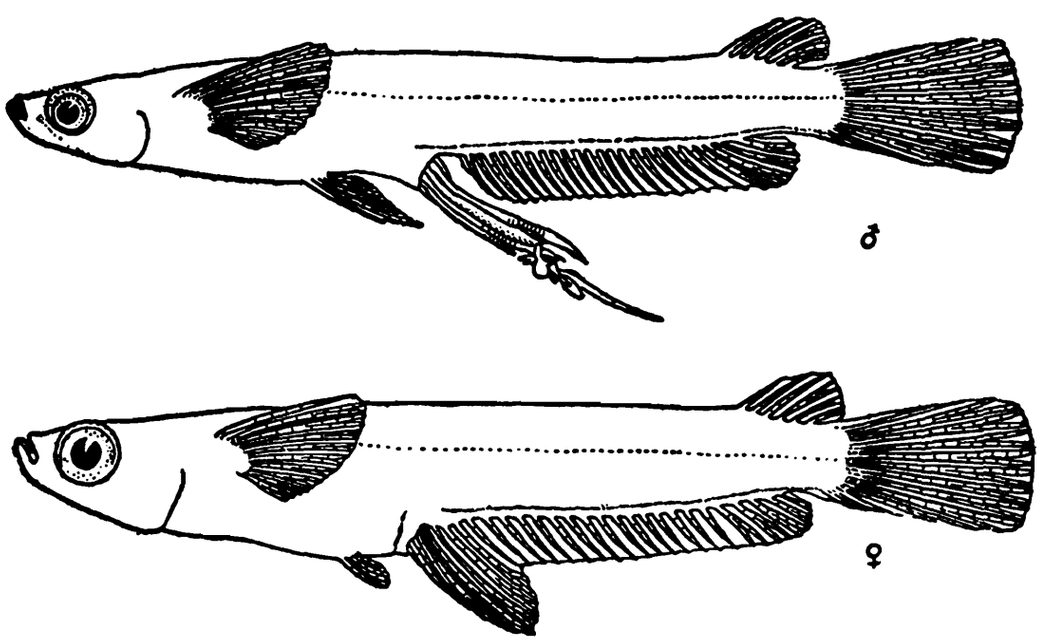


Fig. 165. Lateral views of the male and female of *Horaichthys setnai* Kulkarni. (After Kulkarni, C. V. 1940, text-fig. 2).

upturned, transverse, non-protractile, cleft almost vertical, not extending to orbit. Eyes lateral and large, in anterior part of head, visible from

below ventral surface. Lips thin. Nostrils inconspicuous. Jaws subequal, lower jaw longer. Both jaws with a single row of sharp conical teeth. Palate without teeth. No barbels. Dorsal fin inserted far posterior, near the caudal fin, short with six or seven rays, some of the rays almost reaching base of caudal fin. The anal fin in adults modified into two parts. *In male, the first six rays separated off into an independent gonopodium which remain folded on the right side parallel to the twa anal fins.* In female anal fin rays simple, the second to sixth rays more elongated and somewhat more bent backwards ; the fourth and the fifth rays the longest. Anal fin long with 28—32 rays (seven or eight branched). Pelvic fins paired in male, not paired in female. Pectoral fins large and well developed in both sexes, longer than head, with thick muscular bases. Ventral edge of caudal peduncle not keeled but with a narrow, short, fleshy adipose edge which protrudes gradually to unite with caudal. Caudal fin large and rounded. Scales cycloid, thin, moderately large, 32—34 along longitudinal series between upper margin of gill opening and base of caudal ffn. Lateral line rudimentary.

Distribution.—Backwaters and tanks along the coast about 160 km from Navlakai, Kathiawar coast north and south of Bombay, Maharashtra ; Manad, Kalaba district ; Cochin, Valliathurai, Trivandrum (Job, 1940, Silas, 1959). Also recorded from Jhanor, Nabada river, and Kalhor, Bodhan, Tapi river, Gujarat (Karamchandani & Pandit 1971).

Species.—*H. setnai* Kulkarni—distribution as of the genus.

Remarks.—Most frequently found in puddles of stagnant brackish water pools resulting from artificial enclosures set up by fishermen. Found in swarms near the surface of water and mostly in midst of aquatic plants like *Enteromorpha, Ruppea* etc. Feeds mainly on Copepods, diatoms.

Family CYPRINODONTIDAE

Killifishes

Body moderately elongated and compressed. Head and body with scales. Preorbital very narrow. Premaxillaries may be protractile. Margin of upper jaw formed solely by the premaxillaries. Teeth on jaws. A small patch on vomer. Pharyngeal bones toothed. A small tuft-like or flattenned pseudobranchiae present, may be absent. Gill membranes free from each other and also from isthmus. *A single dorsal fin inserted in posterior half of body. No spines. No barbels. Lateral line absent.* Air-bladder simple without a pneumatic duct.

Three genera are dealt with here.

KEY TO GENERA

1.	Dorsal fin inserted anterior to anal fin origin. ...	*Aphanius* Nardo
—	Dorsal fin inserted posterior to anal fin origin.	2
2.	Upper jaw protractile. Anal fin rays 14—18. Pectoral fins with their upper base below longitudinal axis of body. ...	*Aplocheilus* McClelland
—	Upper jaw not protractile. Anal fin rays 20—24. Pectoral fins with their upper base well above longitudinal axis of body. ...	*Oryzias* Jordan & Snyder

Genus **Aphanius** Nardo

Aphanius Nardo, 1827, *Giorn. Fisica De Pavia*, **1**, p. 17, 23 (type-species, *Cyprinodon calaritanus* Valenciennes).

Diagnosis.—Body short, cylindrical. Abdomen rounded. Head and snout blunt. Mouth terminal, small, cleft not extending to orbit. Eyes small, superior, in middle of head, not visible from below ventral surface. Margin of upper jaw formed solely by premaxillaries. Lips thin. Jaws not elongated. Teeth of moderate size on jaws in a single compressed row, and notched at their summit. Palate edentate. Barbels absent. *Dorsal fin inserted anterior to or just above anal origin, with nine rays and without any spine.* Anal fin with 10 rays. Caudal trilunate. Lateral line indistinct or may be absent. Scales moderate with 25—27 in lateral line series. Colour of sexes different.

Distribution.—India : common in Gujarat. Pakistan. Also in Gulf countries, shores of Red Sea.

Species visiting freshwater.—*A. dispar* (Rüppell)—distribution as of genus.

Genus **Aplocheilus** McClelland

Aplocheilus McClelland, 1839, *Asiat. Res.*, **19**, p. 301 (type-species, *Aplocheilus chrysostigmus* McClelland).

Diagnosis.—Body somewhat elongate and compressed. Upper surface of head and nape broad and depressed. Abdomen rounded. Head conical but not sharp. Snout spatulate. Mouth terminal, moderately wide, its cleft however not extending to front border of orbit. Eyes small, superior, in middle of head, not visible from below ventral surface. Mandibular bones united at symphysis. Lips thin. Jaws not

prolonged. Upper jaw protractile. Teeth villiform on jaws, may be present or absent on palate. Barbels absent. *Dorsal fin inserted above or behind posterior end of anal fin*, with 7—11 rays and no spine. Anal

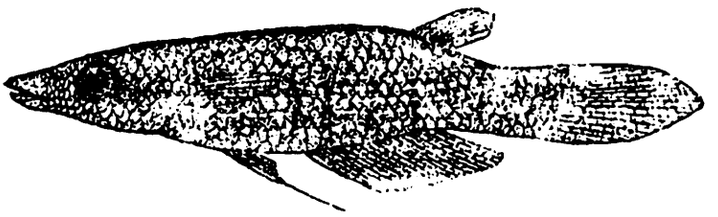


Fig. 166. Lateral view of *Aplocheilus lineatus* (Valenciennes). (After Misra, K. S. 1962, text-fig. 121).

fin with 15—24 rays, with an elongate base. Caudal fin rounded. Scales cycloid of moderate size, 27—34 in lateral series. Lateral line absent.

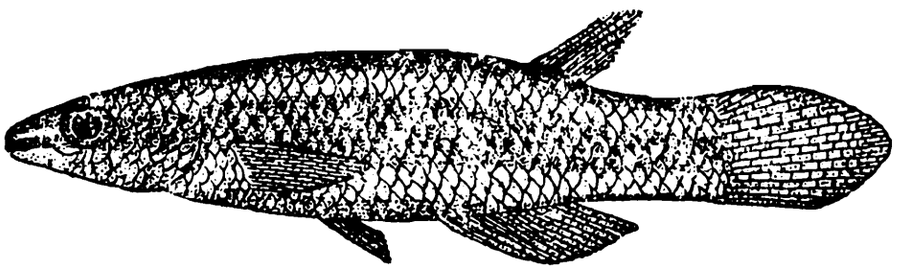


Fig. 167. Lateral view of *Aplocheilus panchax* (Hamilton). (After Misra, K. S. 1962, text-fig. 122).

Distribution.—Tropical Africa. Madagascar. India. Pakistan. Bangladesh. Sri Lanka. Thailand. Malay Archipelago.

Species visiting freshwater.—

1. *A. lineatus* (Valenciennes)—India : Coorg, Wynaad, Kerala Coast. Sri Lanka.
2. *A. panchax* (Hamilton)--India : Orissa, W. Bengal, Andamans. Bangladesh. Pakistan. Burma. Thailand to Malay Archipelago. Sri Lanka.
3. *A. rubrostigma* (Jerdon)—India : Kerala and Coromandel Coast.

KEY TO SPECIES

1.	Pelvic fin without any prolonged ray. ...	*A. panchax*
—	Pelvic fin rays prolonged. ...	... 2
2.	Anal fin with 17 or 18 rays. Each scale spotted red along side. One or two rows of red spots along base of anal fin. ...	*A. rubrostigma*
—	Anal fin with 15—17 rays. A golden green spot in the centre of each scale. Eight to ten vertical black bands along sides. ...	*A. lineatus*

Genus **Oryzias** Jordan and Snyder

Oryzias Jordan and Snyder, 1906, *Proc. U. S. nat. Mus.*. **31**, no. 1486, p. 289 (type-species, *Poecilia latipes* Temminck and Schlegel).

Diagnosis.—Body compressed, head and anterior part of nape depressed and flattened. Abdomen rounded. Head short, depressed. Snout slightly spatulate. Mouth terminal, small, cleft not extending to orbit. Eyes large, in middle of head, visible from below ventral surface. Lips thin. Lower jaw upturned, *upper jaw short, not protractile.* Teeth villiform on jaws, absent on palate. Barbels absent. *Dorsal fin inserted above posterior end of anal fin,* with six or seven rays and without any spine. Anal fin with 20—24 rays, some with filiform rays. Caudal fin rounded. Scales moderate. Lateral line curved above pectoral fin, with about 27 scales.

Distribution.—India : W. Bengal, Orissa, Tamil Nadu, Wynaad. Bangladesh. Burma. Thailand.

Species visiting freshwater.—O. melanostigma (McClelland)—India : Wynaad. Kerala, Tamil Nadu, W. Bengal. Bangladesh.

Family Poecilidae

Top Minnows

Body short, cylindrical, compressed. Head and body with scales. Premaxillaries slightly protractile ; mandible prominent, teeth on jaws ; palate edentate. Gill membranes free from each other and also from isthmus. A single dorsal fin without any spine. Anal fin without any spine. *Males with a moderately long intromittant organ.* Lateral line complete.

Two genera are dealt with here.

KEY TO GENERA

1.	Teeth conical and fixed.	...	*Gambusia* Poey
	Teeth spatuliform and movable.	...	*Lebistes* Filippi

Genus **Gambusia** Poey

Gambusia Poey, 1854, *Memoriæ sobra in historia natural de la isla de Cuba,* **1**, p. 382 (type-species, *Gambusia punctata* Poey).

Diagnosis.—Body cylindrical, compressed. Abdomen rounded. Head short. Snout pointed. Mouth oblique, small, cleft not extending to orbit. Eyes large, in centre of head, visible from below ventral surface.

Lips thin. Lower jaw slightly upturned, upper jaw shorter than lower. Teeth villiform on jaws. No teeth on palate. Dorsal fin inserted in middle of body in males and midway between front margin of eye and tip of caudal in females ; with six to 12 rays and no spine. ***Anal fin*** with eight to ten rays, *with anal processes of male longer than head.*

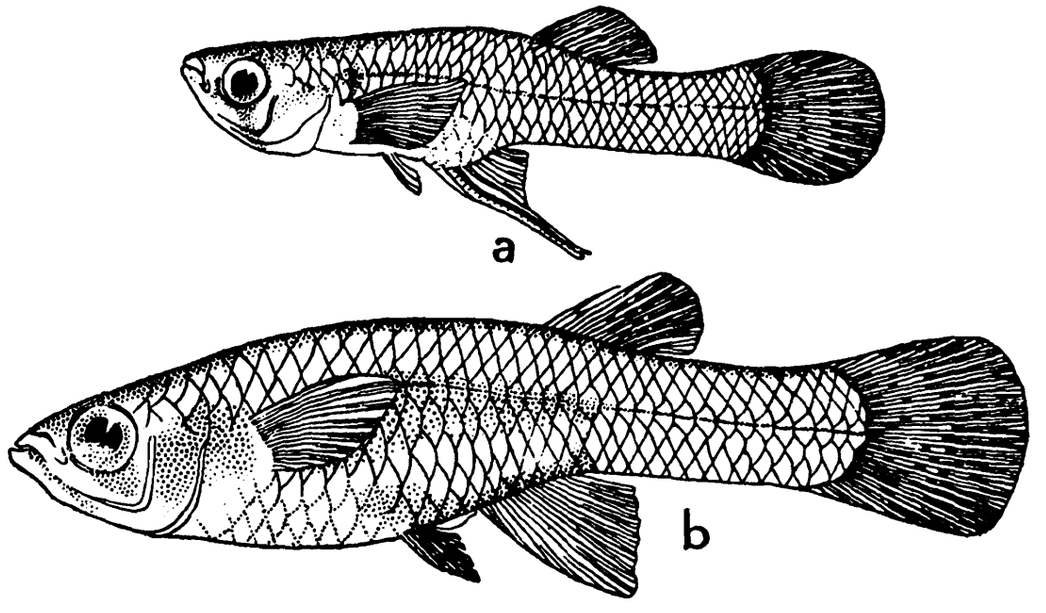


Fig. 168. Lateral views of a. male and b. female of *Gambusia affinis patruelis* (Baird and Girard). (After Misra, K. S. 1962, text-fig. 124).

Caudal fin rounded. Scales moderate. Lateral line complete, with 28-32 scales.

Distribution.—Introduced throughout India, Pakistan, Bangladesh, Sri Lanka, Burma, Thailand, Malaya, Philippines, Hawaii, Formosa. Native of coastal waters of United States from New Jersey southwards.

Species visiting freshwater.—Gambusia affinis patruelis (Baird and Girard)—Throughout India, Pakistan, Bangladesh, Burma, Sri Lanka.

Genus **Lebistes** Filippi

Lebistes Filippi, 1861, *Arch. Zool. Anat. Fisiol.*, **1**, p. 69 (type-species *Lebistes poeciloides* Filippi, by original designation).

Diagnosis.—Very similar to *Gambusia*, but differing chiefly in having *movable spatuliform teeth.* Other differences are : in males the length of anal fin rays is more or less equal to length of gonopodium (*vs.* less than half the length of gonopodium in *Gambusia*) ; eyes bigger and situated on the dorsal profile of head (*vs.* eyes smaller and situated in between dorsal and ventral profiles of head ; caudal fin elongated (*vs.* short and fan shaped) ; generally black spots and other brilliant colouration present (*vs.* no such colouration in males of *Gambusia.* The females of *Gambusia* have black dots on the caudal and dorsal fins).

Distribution.—Originally from Tropical America. Introduced into India, particularly well established in S. India : Rameswaram, Thanjavur, Salem, Madras City, Malabar, Cuddapah and Kurnool. Babu Rao *et al.* (1975) have recorded this species for the first time from Kulbhor river near Loni, Maharashtra.

Species.—*L. reticulatus* (Peters)—distribution as of the genus.

Superorder ACANTHOPTERYGII

Upper jaw protractile in many species, with a premaxilla having ascending, articular and lateral (maxillary) processes. Palato-premaxillary and ethmomaxillary ligaments present, but in some cases modified. Upper and lower pharyngeals well developed and toothed. Hyoid bar with ankylosed ceratohyal and epihyal ; distal depressed section of ceratohyal with a large foramen in many cases ; elevated proximal part of ceratohyal and epihyal with four blade-like branchiostegals, the hair-like anterior branchiostegals when present being on the inner surface of the depressed distal section of ceratohyal. A subocular shelf present on the infraorbital series in numerous species. Infraorbital bones frequently in contact with preoperculum. Bones of head with numerous pungent spines. Opercular apparatus armed in many species. Baudelot's ligament usually attached to basicranium. Supracleithrum strut like extending above cleithral tip in most members of the group. Mesocoracoids absent. Radials not exceeding four in number. Pelvic fins if present thoracic, or jugular in position, pectorals inserted high on the sides. Pelvic fin typically consisting of a spine and five articulated rays. Pleural ribs usually well developed. Vertebrae commonly numbering 24. Hypural bones virtually always emanating from a single centrum, when on two centra, the hypurals no fewer than six in number, in no case formed as two hypural plates. Fin spines present in most species. Ctenoid scales common. Presumably uniformly physoclistic. Otophysic connections rare, in no case involving the intercalation of bony elements. (After Greenwood *et al.* 1966).

Seven orders are dealt with here.

Order INDOSTOMIFORMES Banister, 1970.

Body elongated, with a complete dermal armour of osseous rings. *Head depressed and mobile.* Jaws and palate without teeth. Lower jaw elongated. Pterygoid series of bones reduced in number. Upper jaw not protrusible, lower jaw long. A series of isolated spines present in front of dorsal fin. Dorsal and anal fins short based, opposite

each other. Pelvic fin rays with cartilaginous nodules at their bases. No pelvic fin spine. Branchiostegals six. (After Banister, 1970).

A single family with one genus is dealt with here.

Family INDOSTOMIDAE

Trunk tubular, slightly compressed dorso-ventrally with a long drawn out tail provided with a small, *fan shaped caudal fin.* Head produced into a dorso-ventrally compressed short snout. Vomer, "pterygoids" without teeth. External olfactory organ represented by two pairs of open pits situated near eyes. *Operculum well developed with six conspicuous spines.* Gill openings separate and moderately wide. Four lobate gills present. Two dorsal fins, first in the form of discontinuously inserted spines, second in the form of soft rays. Pectoral and pelvic fins well developed. No lateral line.

Post-temporals overlying the rear margins of epiotic and pterotic. 21 vertebrae without any ribs.

Air-bladder simple, physoclistous. A gas gland present.

Only a single genus is known.

Genus **Indostomus** Prashad & Mukerji

Indostomus Prashad and Mukerji, 1929, *Rec. Indian Mus.*, **31** (3), p. 220 (type-species, *Indostomus paradoxus* Prashad & Mukerji, by original designation and monotypy). —Banister, 1970, *Bull Brit. Mus.* (*N. H.*) *Zoology*, **19** (5), pp. 181-209 (new order proposed, anatomical study).

Diagnosis.—Body elongate, more or less tubular, part of body from posterior end of dorsal fin to base of caudal considerably narrow. Body with 21 dorsal plates. In the abdominal region there is a median row of dorsal plates and two rows of ventro-lateral plates. Three pairs

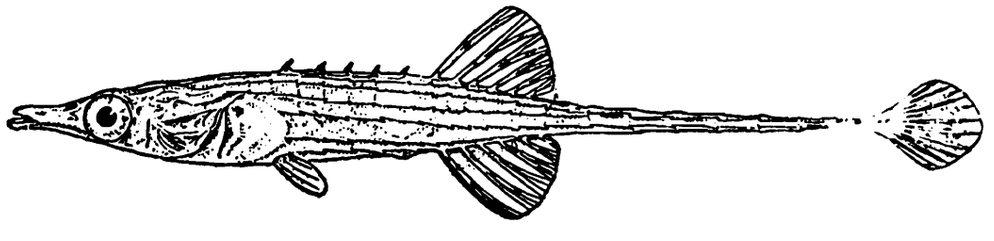


Fig. 169. Lateral view of *Indostomus paradoxus* Prashad & Mukerji.

of cristae on the dorsum running parallel to one another on either side of dorsal fins present. Head and snout moderately compressed, *head mobile.* Mouth small, terminal, cleft not extending to orbit. Eyes large, prominent, in the anterior half of head, visible from below ventral

surface. Lips thin. Jaws produced, beak-like, lower jaw longer. Both jaws without teeth. *Upper jaw non protrusible.* Palate edentate. No barbels. *Dorsal fins two, anterior consisting of five short, slender, sharp spines, not connected by any membrane, second or posterior dorsal higher than body with six soft rays all but the last branched distally.* No spine in second dorsal. Anal fin with six unbranched rays. Pectoral fin rounded, with 23 rays. Pelvic fins with four rays, outermost ray thickened and middle two branched. *Caudal fin fan shaped. Body enveloped by calcareous scutes, forming distinct rings round the body.* Lateral line absent.

Distribution.—Upper Burma : Indawgyi Lake, near Nyaungtin.

Species.—*Indostomus paradoxus* Prashad & Mukerji—distribution as of the genus.

Order GASTEROSTEIFORMES

Body elongate with dermal skeleton, and osseous rings. Jaws and palate edentate. Not much discrepency between the lengths of the upper and lower jaws. Opercular bones reduced as a single plate. Gill openings small, gills consisting of small rounded tufts attached to the branchial arches. Pelvic fins abdominal ; sometimes imperfectly developed. Lateral line absent. Air-bladder simple.

Anterior three or four vertebrae articulating in a complex manner with each other. Ecto-and endopterygoids separate. Branchiostegals not more than three. Symplectic with a dorsal lamina. Pectoral pterygials four.

A single family with four genera are dealt with here.

Family SYNGNATHIDAE

Pipe fishes

Body tubular, with distinct ridges and cristae. Dorsal edge of trunk may or may not be continuous with that of tail. Jaws and palate edentate. Opercular bones reduced to a single plate. Gill openings small, round ; gills in the form of small rounded tufts attached to branchial arches. A single dorsal fin without spines. Pelvic fins absent. Pectoral fins present, may be absent. Tail not prehensile. Caudal fin present. Lateral line absent. Air-bladder without a pneumatic duct. Males with an egg pouch on tail or abdomen.

Four genera are dealt with here.

KEY TO GENERA

1.	Superior cristae of trunk and tail continuous. ...	*Ichthyocampus* Kaup
—	Superior cristae of trunk and tail discontinuous. ...	... 2
2.	Brood pouch in male subcaudal. ...	*Syngnathus* Linnaeus
—	Brood pouch in male abdominal. ...	... 3
3.	Anus behind middle of length. Number of trunk rings equal to or less than that of tail rings. Snout longer than remaining part of head. ...	*Microphis* Kaup
—	Anus generally before middle of length. Number of trunk rings less than that of tail rings. Snout shorter or only slightly longer than remaining part of head. ...	*Doryichthys* Kaup

Genus **Doryichthys** Kaup

Doryichthys Kaup, 1853, *Arch. Naturg.*. **19**, pl. 1, p. 233 (type-species, *Doryichthys bilineatus* Heckel).

Diagnosis.—Body elongated, nearly as high as broad ; covered with transversely striated shields. Abdomen rounded. Trunk region heptagonal, tail tetragonal. Mouth narrow, terminal cleft not extending

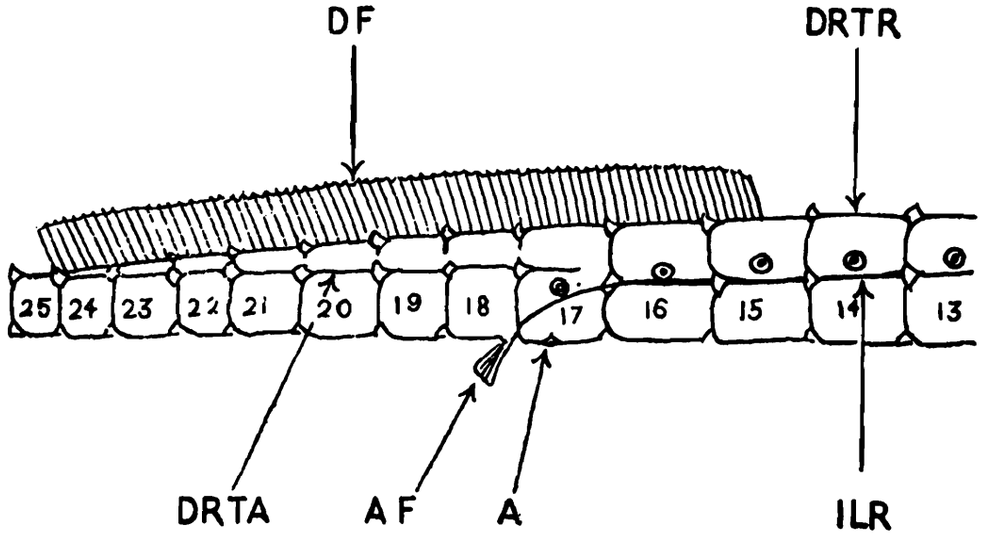


Fig. 170. Illustration of the middle part of body of *Doryichthys chokderi* Rahman showing the trunk, tail rings and ridges. A = Anus, AF = Anal fin. DF = Dorsal fin. DRTA = Dorsal ridge of trunk. ILR = Infero-lateral ridge. (After Rahman, A. 1976. *Bangladesh J. zool.*, **1** (2), pp. 43-50.)

to orbit. Eyes prominent, in middle of head, visible from below ventral surface. Lips thin. Jaws produced in the form of a beak. Jaws and palate without teeth. No barbels. Dorsal fin inserted opposite vent,

of moderate length, with 40-50 rays and no spine. Anal fin minute with two or three rays. Pectoral and caudal fin present, latter lanceolate. Lateral line complete. *Males with egg pouch on abdomen. Ridges on body well developed, one along upper surface of snout to between eyes discontinuous ; an elevated ridge divides gill cover into two halves, each with a spine at its termination.*

Distribution.—Tropical Seas, some entering freshwater.

Species visiting freshwater.—

1. *Doryichthys chokderi* Rahman*—Bangladesh : Dhaleswari, Meghna river near Chandpur.
2. *Doryichthys cuncalus* (Hamilton)—Throughout India, Bangladesh : Meghna river, Chandpur.
3. *Doryichthys deocata* (Hamilton)—India : Rivers of W. Bengal, Bihar. Bangladesh : Chandpur.
4. *Doryichthys dunckeri* Prashad & Mukerji—Burma : Namkwag, Kamaing, Myitkyina dist.
5. *Doryichthys insularis* Hora—India : Corbyn's Cove, North Andamans.
6. *Doryichthys ocellatus* Duncker—Sri Lanka.

KEY TO SPECIES

1.	Inferior cristae of trunk and tail discontinuous. ...	...	1
—	Inferior cristae of trunk and tail continuous. ...	...	2
2.	Dorsal fin with 50 or 51 rays and on 11 rings. ...	...	3
—	Dorsal fin with 30 rays and on 6 rings. ...		*D. deocata*
3.	Tail rings 16-19. Vent situated posteriorly. Post-anal length 2.2-2.6 in total length. ...		*D. chokderi*
—	Tail rings 26-27. Vent situated anteriorly. Post anal length 1.8-2.0 in total length. ...		*D. cuncalus*
4.	Dorsal fin rays 32. ...		*D. dunckeri*
—	Dorsal fin rays 34-40. ...	...	5
5.	Dorsal fin rays 34-35. ...		*D. insularis*
—	Dorsal fin rays 37-40. ...		*D. ocellatus*

*Rahman, A. K. 1976. *Bangladesh J. Sci.* **4** (2), pp. 43-50.

Genus **Microphis** Kaup

Microphis Kaup, 1853, *Arch. Naturg.*, p. 234 (type-species, *Syngnathus deokhata* Hamilton).—Duncker, 1910, *Spolia zeylanica*, 7 (25), p. 26.

Diagnosis.—Body elongated with distinct ridges. Abdomen rounded. Head long, with a spatulate beak. Snout flat, longer than remaining part of head. Mouth narrow, terminal, cleft not extending to orbit. Eyes large, in posterior half of head, visible from below ventral surface. Lips thin. Jaws produced in the form of a beak ; jaws and palate without teeth. No barbels. Dorsal fin long, inserted opposite to vent, with 30 rays, situated above, atleast 7 rings belonging to the largest part of tail. Anal fin behind middle of length with three or four rays. Pectoral fins present. Caudal fin well developed, fan-shaped, middle rays prolonged. Lateral line complete. *Superior cristae of trunk and tail discontinuous* ; inferior cristae of trunk and tail may or may not be continuous ; *Males with brood pouch* on abdomen.

Distribution.—Tropical Seas, found in both fresh and brackish water.

Species visiting freshwater.—M. bleekeri (Day)*—India : Alwaye river, Alwaye, Kerala.

Genus **Syngnathus** Linnaeus

Syngnathus Linnaeus, 1758, *Systema naturae*, ed. 10, p. 336 (type-species, *Syngnathus acus* Linnaeus).

Diagnosis.—Body elongated with distinct ridges. Abdomen rounded. Head short, pointed, compressed. *Snout* cylindrical *with a prominent median spinous keel on dorsal surface.* Mouth narrow, terminal, cleft not extending to orbit. Eyes large, in middle of head, visible from below ventral surface. Lips thin. Jaws produced, in the form of a beak ; jaws and palate without teeth. No barbels. Dorsal fin inserted opposite to vent or nearly so, with 20-32 rays and no spine. Anal fin small, with two to four rays. Pectoral fins well developed. Caudal fin small, square. Lateral line complete. *Dorsal edges or superior cristae of trunk and tail not continuous, but inferior cristae of trunk continuous with tail. Males with an egg pouch on tail.*

Distribution.—Tropical and temperate seas, some entering freshwater.

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* = *Doryichthys bleekeri* Day.

Species visiting freshwater.—

1. *Syngnathus argyrostictus* Kaup*—India : Ennore, Madras ; Marmagao, Goa.
2. *Syngnathus spicifer* Rüppel!—Seas, estuaries and freshwaters of Red Sea, East Coast of Africa, India, Malay Archipelago.

KEY TO SPECIES

1.	Snout longer than remaining part of head. Trunk with seven longitudinal series of pearly ocelli. ...	*S. argyrostictus*
—	Snout longer, but less than twice than post-orbital part of head. Trunk ventrally with 13-15 white cross bars. ...	*S. spicifer*

Genus **Ichthyocampus** Kaup

Ichthyocampus Kaup, 1853, *Arch. Naturg.*, **19** (1) p. 231 (type-species, *Ichthyocampus belcheri* Kaup).

Diagnosis.—Body elongated, anterior part deep, posterior whip-like, tapering ; covered with transversely striated shields. Abdomen rounded. Interorbital space cancave, with a sharp, low, median ridge passing along snout, another in occipital region. A very sharp straight ridge across opercle. Head and snout pointed. Mouth terminal, narrow, cleft not extending to orbit. Eyes large, superior, in middle of head, visible from below ventral surface. Lips thin. Jaws produced as a beak, without teeth. Palate without teeth. Dorsal fin nearly or quite opposite to vent, with 23-26 rays, no spine. Pectoral fins present. Anal fin with two rays. Caudal fin fan-shaped. Lateral line present. *Ridges on body and tail continuous and continued to caudal fin. Males with an egg pouch on tail having a cutaneous covering.*

Distribution.—Throughout India to Australia.

Species visiting freshwater.—Ichthyocampus carce (Hamilton)—Throughout India, Pakistan, Bangladesh, Malay Archipelago.

Order CHANNIFORMES

Body elongate with scales. *Head with plate-like scales.* Gill openings wide. *Suprabranchial accessory respiratory apparatus well developed.* No pseudobranchiae. Branchiostegals five. Teeth on jaws and palate.

*Day (1878, p. 678) synonymised this species with *S. spicifer*. Weber & Beaufort (1922, p. 82) resurrected it which Hora (1925, p. 46) also followed.

A single long dorsal fin, and a similar anal fin, both without spines. Pelvic fins thoracic or absent. Lateral line abruptly curved or almost interrupted. Air-bladder present.

A single family with a single genus is dealt with here.

Family CHANNIDAE

Murrels

Body elongate, subcylindrical anteriorly. Body with large scales ; head with plate-like scales. *Cephalic pits present.* Teeth on jaws, vomer and palate. Branchiostegals five. Pseudobranchiae absent. Gills four. Gill membranes connected beneath isthmus. A suprabranchial organ present. A single long spineless dorsal fin present and a similar anal fin, both free from caudal fin. Lateral line abruptly curved or almost interrupted. Air-bladder present, not bifid posteriorly. Pyloric appendages few, when present.

Basisphenoid roughly Y-shaped. Frontals articulating with the basisphenoid, not with the parasphenoid. Posterior edge of nasal suturally united with frontal. Each epiotic produced into a prominent epiotic process posteriorly. (After Yazdani, 1971).

A single genus is dealt with here.

Genus **Channa** Scopoli

Snake headed fishes

Channa Scopoli, *Introd. Hist. Nat.*, 1777, p. 459 (type-species, *Channa orientalis* Bloch & Schneider).—*Ophicephalus* Bloch, 1793, *Naturg. Ausland. Fische*, 7 p. 137 (type-species, *O. punctatus* Bloch).

Diagnosis.—Body elongated, subcylindrical anteriorly. Abdomen rounded. *Head depressed with plate like scales.* Snout somewhat obtuse. Mouth opening moderate to wide, may extend to below orbit. Eyes

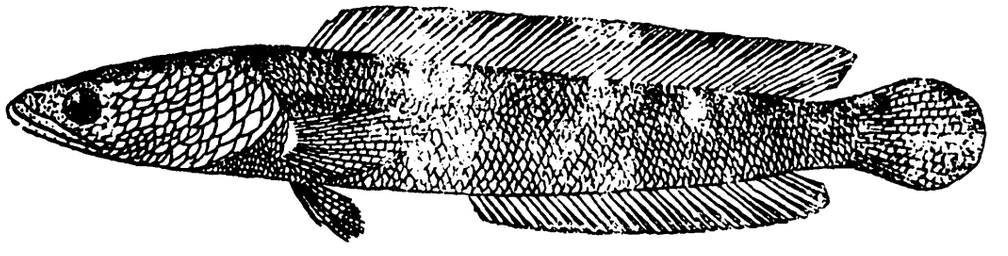


Fig. 171. Lateral view of *Channa marulius* Hamilton. (After Misra, K. S. 1972, text-fig. 132),

lateral, moderate, in anterior part of head, not visible from below ventral surface. Lips moderate. Jaws equal. Teeth on jaws and palate.

Gill openings wide, membranes of two sides connected beneath isthmus. *An accessory respiratory organ in the form of a thin bony laminae present in a cavity in gill chamber.* Dorsal fin long, inserted almost above pectoral with 29-55 rays and no spine. Anal fin long, with 21-36

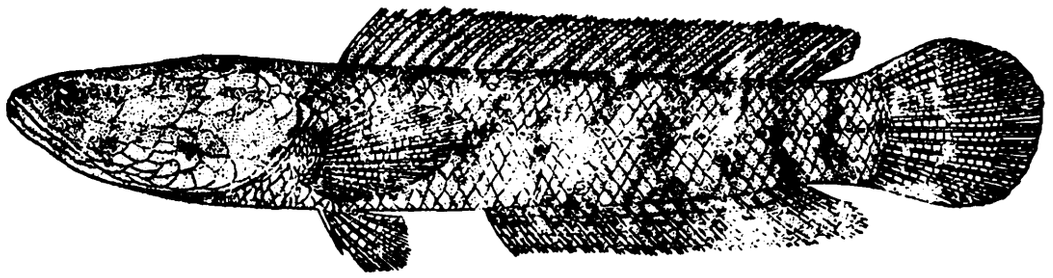


Fig. 172. Lateral view of *Channa punctatus* (Bloch). (After Misra, K. S. 1962, text-fig. 133).

rays. *Both dorsal and anal fin free from caudal.* Caudal fin rounded. Scales small. Lateral line abruptly curved or almost interrupted with 37-110 scales.

Distribution.—Throughout India, Nepal, Pakistan, Afganistan, Bangladesh, Sri Lanka, Burma, Thailand, China and the Malay Archipelago.

Species.—

1. *Channa amphibia* (McClelland)+—India : Bhutan.
2. *Channa barca* (Hamilton)—India : W. Bengal, Meghalaya. Bangladesh. Pakistan.
3. *Channa marulius* Hamilton*—Throughout India, Sri Lanka, Pakistan, Bangladesh. Burma. Thailand. China.
4. *Channa micropeltes* Kuhl & van Hasselt—India : Kerala, Thailand to Malay Archipelago.
5. *Channa orientalis* (Schneider)**—Throughout India. Nepal. Sri Lanka. Bangladesh. Burma. Pakistan.
6. *Channa punctatus* (Bloch) (Pl. V, Fig. B)—Throughout India. Nepal. Sri Lanka. Bangladesh. Pakistan. Burma. Malaya. China. Tahiti. Polynesia.

+*C. amphibia* (McClelland) has been resurrected from the synonymy of *C. barca* (Hamilton) by Reddy, P. B. 1981 (seen in MS).

*Silas (1952) considers the Sri Lanka forms as *C. marulius ara* Deraniyagala. *C. leucopunctatus* (Sykes) and *C. pseudomarulius* (Günther) are synonymous with this species (*vide* Dutt, S. & Reddy, P. B. 1976).

**_Channa gachua_ Hamilton is a synonym of this species (Hora & Mukerji, 1934). Silas (1952) considers the Sri Lanka forms as *C. gachua kelaarti*.

7. *Channu stewartii* (Playfair)—India : Meghalaya, Bihar, W. Bengal, Arunachal Pradesh. Nepal.

8. *Channa striatus* (Bloch)—Throughout India. Sri Lanka. Bangladesh. Pakistan. Burma. China. Philippines. Malaya, Malay Archipelago. Thailand.

KEY TO SPECIES

1.	Four or five scales between orbit and angle of preopercle, 12 or 13 predorsal scales. ...	... 2
—	Nine to 17 scales between orbit and angle of preopercle. 15-22 predorsal scales. ...	... 4
2.	Pelvic fin less than half length of pectoral fin. Pectoral fins spotted in zones, darker and lighter patches. Chin marbled. ...	... 3
—	Pelvic fin more than half length of pectoral fin. Pectoral fins plain. ...	*C. punctatus*
3.	Anal fin with 26 rays. Circular black spots each occupying part of a scale present, base of dorsal iridescent blue in life. Dorsal fin with 39-40 rays. ...	*C. stewartii*
—	Anal fin with 21-23 rays. No black spots on scales. Dorsal fin with 32-37 rays. ...	*C. orientalis*
4.	16 or 17 scales between orbit and angle of preopercle, 22 predorsal scales. ...	*C. micropeltes*
—	9 or 10 scales between orbit and angle of preopercle. ...	... 5
5.	18-20 predorsal scales. Lateral line with peninsula of the darker colour extending into the yellow. ...	*C. striatus*
—	15-16 predorsal scales. No such colour markings on lateral line. ...	... 6
6.	A black white-edged ocellus on basal portion of caudal fin present. ...	*C. marulius*
—	No such ocellus. ...	... 7
7.	Lateral line scales 80. ...	*C. amphibia*
—	Caudal fin rounded. Lateral line scales 60-65. ...	*C. barca*

Order SYNBRANCHIFORMES

Body eel-like, compressed, with small scales if present, arranged in longitudinal rows, or absent. Margin of upper jaw formed by the premaxillaries, the maxillaries being internal and parallel to them. Humeral arch may or may not be attached to skull. Teeth on jaws and palate.

Gill membranes attached to isthmus, *and gill opening in the form of a single transverse opening.* Three or four branchial arches. *Accessory breathing apparatus in the form of air-sac may be present or absent. Vertical fin rudimentary in the form of mere folds of skin. No paired fins.* Air-bladder absent. Lateral line present.

Found in freshwater and the sea.

One family and two genera are dealt with here.

Family SYNBRANCHIDAE Swainson, 1838

Swamp Eels

Body moderate to small. Scales when present small, oval and confined largely to caudal region. Teeth on jaws and palate. Eyes small well forward in skull, near a vertical from the midpoint of upper lip, and covered by dense skin. Anterior and posterior nares present. Gill membranes united and continuous around isthmus. Branchiostegals four to six (rarely seven) in number. Vertical fins, dorsal and anal, in the form of median folds only ; otherwise reduced or absent. Caudal fin reduced or absent. Pectoral fins absent. Pelvic fins or girdles reduced or absent.

Neurocranium elongate. Frontals, pterosphenoid, basisphenoid, vomer and parasphenoid attenuated, last bone much widened and with two prongs posteriorly. Palatines joined firmly to vomer in midline. Vomer a long, thin, strut, dentulous. Frontal turned down and sutured to basisphenoid. Parietals large, meeting in mid line. Intraorbital bones reduced to a single preorbital. Palatoquadrate articulating with a prominence on the basisphenoid, frontal or both, and with the vomer and lateral ethmoids. Maxilla and premaxilla long, strut-like, reduced.

Basihyal edentulous, ankylosed with first basibranchial. Dorsal gill arch skeleton with an ossified interarcual cartilage connecting first epibranchial with median part of second arch. No first pharyngobranchial; second reduced or absant. A small tooth patch below third pharyngobranchial and another in portion of missing fourth. Scapulocoracoid absent. Cleithrum well developed.

Vertebrae 98-188, at least 51 abdominal.

Pan tropical fishes from freshwater at high and low elevations ; individuals of some species reported from brackish water. (After Rosen & Greenwood, 1976).

Two genera are dealt with here.

KEY TO GENERA

1.	Gill openings triangular or crescentic, without lateral folds and internally attached to isthmus. Gills when present reduced to a single row of filaments. ...	*Monopterus* Lacépède includes *Amphipnous* as synonym.
—	Gill openings a simple crescentic transverse fold, free from isthmus. Gill filaments normal.	*Ophisternon* McClelland

Genus **Monopterus** Lacépède

Monopterus Lacépède, 1800, *Hist. Nat. Poiss.*, 2, p. 138 (type-species, *Muraena alta* Zuiew, by subsequent designation).—Rosen & Greenwood, 1976, *Bull. Amer. Mus. Nat. Hist.*, **157**, p. 56 (revision, reclassification). —*Amphipnous* Müller, 1841, *Abh. Akad. Wiss. Berlin*, p. 544 (type-species, *Unibranchipertura cuchia* Hamilton, by monotypy).

Diagnosis.—Body much elongated, eel-like, compressed. Abdomen rounded. Head conspicuous, short, with a dome-shaped muscular occipital region. Snout bluntly rounded. Mouth wide, terminal, cleft just reaching anterior margin of orbit. Eyes superior, in anterior part

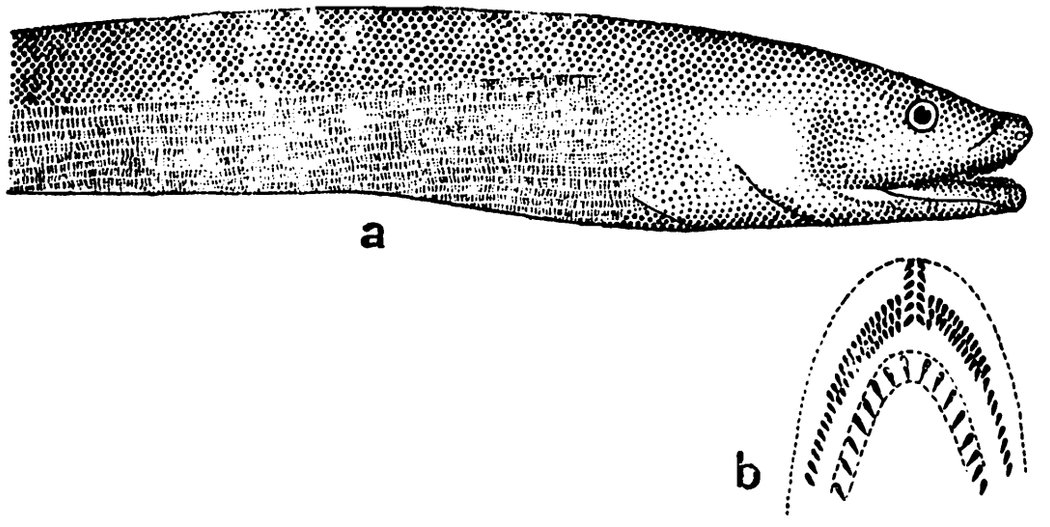


Fig. 173. Lateral view of (a) head and anterior part and (b) dentition of *Monopterus cuchia* (Hamilton). (After Misra, K. S. 1962, text-fig, 135).

of head, greatly reduced, covered by skin, not visible from below ventral surface. Upper lip thick, overlapping part of lower lip. Jaws and palate with bands of villiform teeth ; rows of teeth variable. *Gill openings triangular or crescentic without lateral folds and internally attached to isthmus.* Supra branchial accessory respiratory chamber may be present. Dorsal and anal fin in the form of folds or ridges, varying with age. Dorsal ridge commences behind vent or behind anal fin.

Caudal tip bluntly rounded. Scales small, not uniformly distributed. Lateral line well developed, conspicuous.

Distribution.—Throughout India, Burma, Nepal, Pakistan.

*Species**—

1. *Monopterus albus* (Zuiew)—India : Meghalaya, Arunachal Pradesh, Assam. Indo-Malayan Archipelago. Japan.
2. *Monopterus cuchia* (Hamilton)—India : north and north eastern parts. Pakistan. Nepal. Burma. Bangladesh.
3. *Manopterus fossorius* (Nayar)—India : Karamani river, Trivandrum.
4. *Monopterus indicus* (Silas & Dawson)—India : Robber's cave, Dhobi falls, Mahabaleshwar, Satara dist., Davri river, Krishna giri National Park, Borivili, Kanheri caves, Bombay, Maharashtra.

KEY TO SPECIES**

1.	Gill openings triangular. ...	...	2
—	Gill openings crescentic. ...	...	3
2.	Scales present. Palatine teeth, uniserial. ...		*M. cuchia*
—	Scales absent. Palatine teeth biserial. ...		*M. albus*†
3.	Skin of branchial region of ventral side of head drawn out into longitudinal folds. Teeth on palate anteriorly biserial. ...		*M. fossorius*
—	Skin of branchial region of ventral side of head not drawn into longitudinal folds. Teeth on palate anteriorly tri or quadriserial. ...		*M. indicus*

Genus **Ophisternon** McClelland

Ophisternon McClelland, 1845, *J. nat. Hist. Calcutta*, **5**, p. 197 (type-species, *O. bengalensis* McClelland, by monotypy).—Rosen & Greenwood, 1976, *Bull. Amer. Mus. nat. Hist.*, **157**, p. 50 (revision. reclassification).

Diagnosis.—Body much elongated, eel-like, compressed. Abdomen rounded. Head short, compressed. Snout anteriorly rounded. Mouth wide, terminal, cleft extending to some distance behind orbit. Eyes small, antero-lateral, not visible from below ventral surface. Lips fleshy.

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*A fifth species "*M. indicus*" has been described by Eapen (1963, *Bull. Dept. Marine Biol. Oceanogr. Univ. Kerala*, **1**, pp. 130-132) whose taxonomic position is uncertain.

**Partly after Rosen & Greenwood, 1976.

†*M. javanensis* Lacépède is a synonym of this species.

Upper jaw longer. Villiform teeth on jaws and palate. *Gill membranes a simple crescentic transverse fold, free from isthmus. Four branchial arches with well developed gills.* No accessory respiratory organ. Dorsal fin low, situated ahead of anal. Anal fin low, situated in the posteriormost

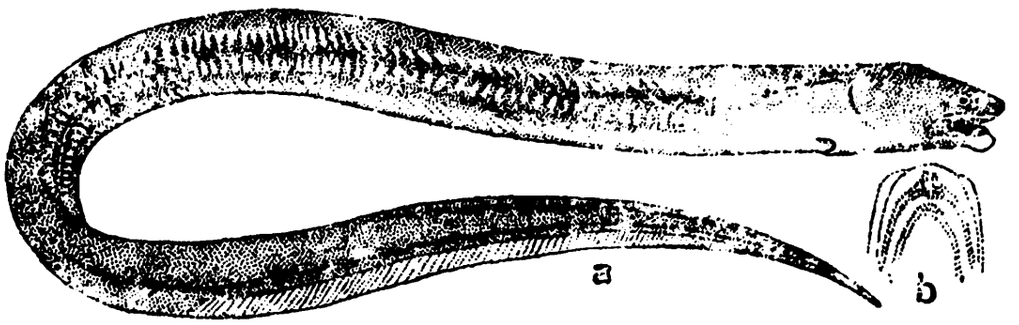


Fig. 174. a. Lateral view of *Ophisternon bengalense* McClelland. b. Dentition. (After Misra, K. S. 1962, text-fig. 134).

half of body. Caudal fin hardly conspicuous. Scales absent. Lateral line conspicuous.

Distribution.—Throughout India, Pakistan, Bangladesh to Malay Archipelago and Australia. Also found in Tropical America.

Species.—*Ophisternon bengalense* McClelland—Indo-Malayan region and Phillipine islands.

Order PERCIFORMES

Skin with scales, commonly ctenoid. Mouth may be protractile, particularly upper jaw, with the premaxillary having ascending, articular and lateral (maxillary) processes. Head and cheeks with muciferous canals, pores. Bones of head commonly with numerous pungent spines. Preopercle entire or serrated. Upper and lower pharyangeals well developed and toothed. Teeth may be present or absent on vomer and palatines, villiform on jaws with or without canines. Pseudobranchiae present. Two dorsal fins, first spinous. Pectoral fins inserted high on the sides. Pelvic fins thoracic or jugular.

A subocular shelf present on the infraorbital series in many species. Infraorbital bones frequently in contact with preoperculum. Mesocoracoid absent. Pleural ribs well developed. Lateral line when present continuous (exception *Chanda*). Air-bladder mostly physoclistic. Pyloric appendages in varying numbers.

Fishes of extremely variable form and habits, mostly marine, living in benthic and littoral areas.

21 families comprising 71 genera are dealt with here.

KEY TO FAMILIES

1. Pelvic fins united with a membrane or frenum across their base, forming a sucking disc. 2

— Pelvic fins may be close but not united as above, may be apart. 3

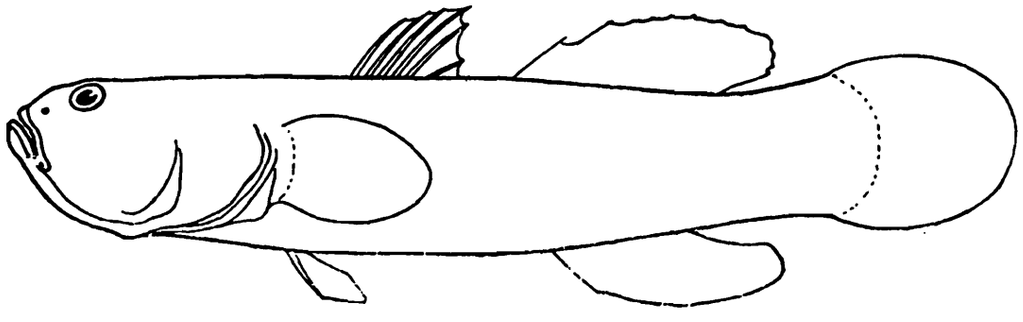


Fig. 175. Outline diagram of *Odonteleotris macrodon* (Bleeker) to show separate dorsal fin.

2. Two dorsal fins separate or connected at their bases. Body not eel-like. ... GOBIIDAE

— A single very elongate dorsal fin. Body eel-like. ... GOBIOIDIDAE

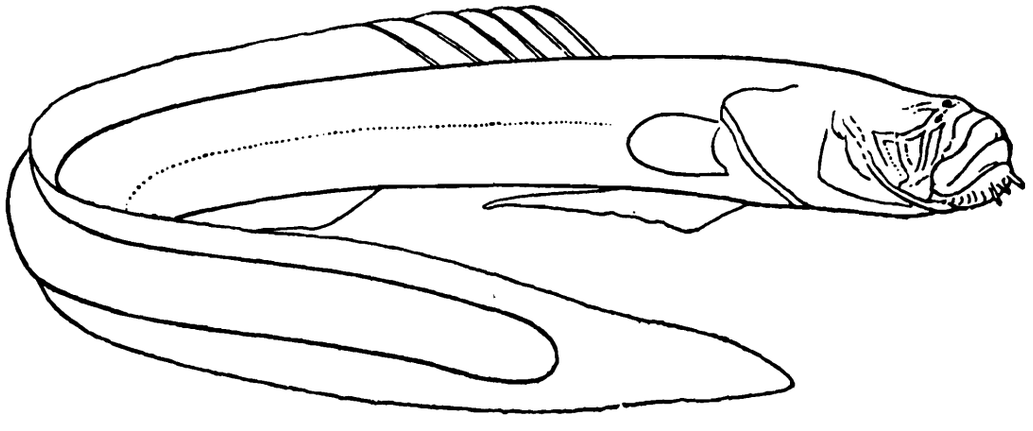


Fig. 176. Outline diagram of *Taenioides curiatus* (Blyth) to show continuous dorsal fin.

3. An accessory respiratory organ in the form of a cavity above the third or upper portion of the first branchial arch present. 4

— No such accessory respiratory organ present. 6

4.	First ray of pelvic fin produced into a long filament. Pelvic fins inserted behind or posterior to pectoral fins. ...	...	5
—	First ray of pelvic fins not produced into a long filament. Pelvic fins inserted below base of pectoral fins. ...		ANABANTIDAE
5.	Anal fin longer than dorsal fin. ...		BELONTIDAE
—	Anal fin shorter or equal to dorsal fin. ...		OSPHRONEMIDAE
6.	Dorsal and anal fin without any prominent spines, if present rudimentary, small. Fins concave or falciform. ...		STROMATEIDAE
—	Dorsal and anal fin with prominent spines. Fins not concave shaped. ...	...	7
7.	Dorsal fin rays produced, very long. ...		SILLAGINIDAE
—	Dorsal fin rays not produced. ...	...	8
8.	Pectoral fins with long detached filamentous rays. ...		POLYNEMIDAE
—	Pectoral fins without any such filamentous rays. ...	...	9
9.	Dorsal fin with a scaly sheath into which the fin can be received. ...		GERRIDAE
—	No such scaly sheath for dorsal fin present. ...	...	10
10.	Anal fin with 12-16 spines. ...		CICHLIDAE
—	Anal fin with not more than four spines. ...	...	11
11.	Anal fin with one or two spines only. ...	...	12
—	Anal fin with three or four spines only. ...	...	13
12.	Dorsal fin with 9 or 10 spines. Muciferous canal system on head well developed. Spinous and soft dorsal portion of dorsal fin continuous ...		SCIAENIDAE
—	Dorsal fin with six slender spines. Muciferous canals absent. Spinous and soft dorsal portion of dorsal fin separated at least by a notch. ...		ELEOTRIDAE
13.	Spinous and soft portion of dorsal fins well separated. ...		MUGILIDAE
—	Spinous and soft portion of dorsal fin continuous. ...	...	14
14.	A median groove under surface of lower jaw present. ...		POMADASYIDAE
—	No such median groove present. ...	...	15

15.	A forwardly directed recumbent spine before dorsal fin present. ...	CHANDIDAE	
—	No procumbent spine before dorsal fin present ...	...	16
16.	Top of head with bony ridges and a nuchal spine on nape. ...	LEIOGNATHIDAE	
—	Top of head without bony ridges and nuchal spine. ...	...	17
17.	Dorsal fin with 12-18 spines. ...	...	18
—	Dorsal fin with not more than 10 spines. ...	...	19
18.	Palate edentate. Lateral line complete. Soft dorsal and anal fin with round lobes. ...	LOBOTIDAE	
—	Palate with teeth. Lateral line interrupted. Dorsal and anal fin without lobes. ...	NANDIDAE	
19.	Dorsal fin with four or five spines, and inserted far posterior of body above anal fin. Snout produced. ...	TOXOTIDAE	
—	Dorsal fin with 7-10 spines, and inserted far anterior of body, above pectoral fin. Snout not produced. ...	...	20
20.	Dorsal fin with seven or eight spines. Preopercle with a spine. Cleft of mouth very wide. Anal fin with three spines. ...	CENTROPOMIDAE	
—	Dorsal fin with 10 spines. Preopercle without a spine. Cleft of mouth narrow. Anal fin with four spines. ...	SCATOPHAGIDAE	

Family Centropomidae

Giant Perches or Glass Perches

Body oblong, elevated, compressed. Moderate to small sized. Ctenoid scales on head up to orbit only and body. Branchiostegals seven. Preorbital and shoulder bones serrated. *Preopercle and opercle with a strong spine.* Teeth on jaws and palate. Two dorsal fins, with a spinous and soft part. Anal fin with spines. *Anal and dorsal fins with a scaly sheath. Lateral line continued on to caudal fin end.* Pyloric appendages few.

A single genus is dealt with here.

Genus **Lates** Cuvier*

Lates Cuvier 1828 IN : Cuvier & Valenciennes, *Hist. Nat. Poiss.*, **2**, p. 88 (type IN-species, *Lates nilotica* Valenciennes = *Perca nilotica* Linnaeus)—Greenwood, 1976, *Bull. Brit. Mus. Nat. Hist.*, 29 (4), pp. 12-14.

Diagnosis.—Body oblong, deep, compressed. Abdomen rounded. Head moderate, compressed. Snout obtusely rounded. Mouth wide, gape extending to anterior border of eye. Eyes moderate, supero-lateral, not visible from below ventral surface. Lower jaw longer than upper. Lips thin. Jaws and palate with villiform teeth. No teeth on tongue. Preorbital and shoulder bone serrated. Preopercle with a strong spine at its angle and *denticulated along horizontal limb* with three or four

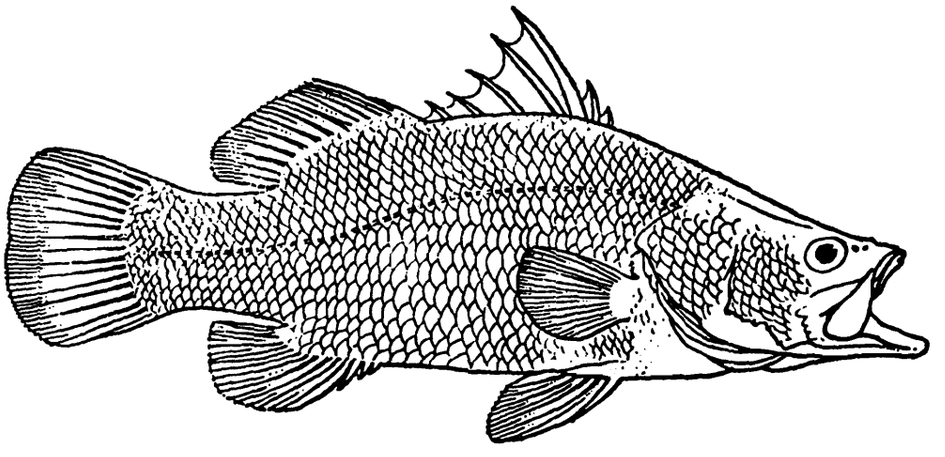


Fig. 177. Lateral view of *Lates calcarifer* (Bloch).

spines. Opercle spiny. Two dorsal fins, the first with seven or eight spines and the second with 11-13 (one simple) rays ; both fins continuous, united at base. Anal fin with three spines and eight or nine rays. Caudal fin truncate or rounded. Lateral line curved and complete with 52-60 scales. Scales finely ctenoid and of moderate size. *Lateral line scales in three series and running to the posterior margin of the caudal fin.*

Distribution.—Throughout India, Pakistan, Bangladesh. Also found in the mouth of Nile, Africa, Malay Archipelago, China and Australia. Absent from Red Sea.

Species visiting freshwater.—Lates calcarifer (Bloch)—Throughout India. Pakistan. Bangladesh. Burma. Thailand. Malaya.

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*Generally Valenciennes is considered as the author of this genus. But the authorship determinations published by Bailey (1951, p. 251 ; 1957, p. 311) clearly indicates Cuvier as the author of this genus. Vol. 2 of *Hist. Nat. Poiss* was written part by Cuvier and part by Valenciennes. The pages 1-238 are ascribed to Cuvier.

Family CHANDIDAE

Glass Fishes

Body short, elevated, oblong, compressed, slightly translucent. Moderate to small, deciduous cycloid scales on head and body. Pseudobranchiae well developed. Branchiostegals six. Lower point of preopercle with a double serrated edge. Opercle without spine. Teeth on jaws and palate, canines occasionally present. Two dorsal fins, with a spinous and soft part. Anal fin with spines. *A forwardly directed recumbent spine in front of dorsal fin present.* Lateral line complete, interrupted, incomplete or absent.

Two genera are dealt with here.

KEY TO GENERA

1.	Scales large 25 to 30 in longitudinal series ; 1 or 2 rows on cheek. Teeth present on tongue. Lateral line continuous, interrupted or obsolete. ...	***Ambassis*** Cuvier
	Scales smaller 40 or more in longitudinal series ; 3, 4 or more on cheek. No teeth on tongue. Lateral line continuous. ...	*Chanda* Hamilton

Genus **Ambassis** Cuvier*

Ambassis Cuvier, 1828, IN : Cuvier & Valenciennes, *Hist. Nat. Poiss.*, **2**, p. 176 (type species, *Centropomus ambassis* Lacépède).

Diagnosis.—Closely allied to *Chanda* Hamilton, but differing from it as below :

Teeth present on tongue. Preopercular ridge denticulate or entire except for one or two spines at angle. Scales large in size, 25 to 30 in longitudinal series, 1 or 2 rows on cheek. Lateral line continuous, interrupted or obsolate.

Distribution.—Indian and Western Pacific Ocean, on coasts often ascending rivers.

Species visiting freshwater.—

1. *A. commersonii* Valenciennes—Red Sea through seas of India, Seychelles, Nicobar Islands to N. Australia. Ascends rivers and estuaries.

*Often misspelt as *Ambassus* and *Ambasis* by some workers.

2. *A. gymnocephalus* (Lacèpède)—India : Madras. Burma. Pakistan : Sind. Very rarely caught in Kerala inland waters. Also known from Sokotra, Zanzibar, Natal to China,

3. *A. nalua* Hamilton—India : Calcutta, Kerala coast, Andaman Island. Malay Archipelago. Philippines, Sarawak.

KEY TO SPECIES

1.	Supraorbital ridge dentate at least posteriorly. ...	*A. gymnocephalus*
	Supraorbital ridge smooth with a spine. ...	... 2
2.	Interoperculum entire, not serrated. ...	*A. commersonii*
	Interoperculum, denticulate posteriorly. ...	*A. nalua*

Genus **Chanda** Hamilton*

Chanda Hamilton, 1822, *Fish Ganges*, pp. 103, 270 (type-species, *Chanda nalua* Hamilton).—Talwar, 1971, *Bull. zool. Nomencl.*, 28 (3-4), pp. 104-105 (*Chanda nama* Hamilton proposed as type species).—Greenwood, 1976, *Bull. Brit. Mus. nat. Hist.*, 29 (1), pp. 10-11 (family position).

Diagnosis.—Body short, deep, compressed, more or less diaphanous. Abdomen rounded. Head short, compressed. Snout sharp. Mouth wide, protractile, one extending to front border of orbit or slightly beyond.

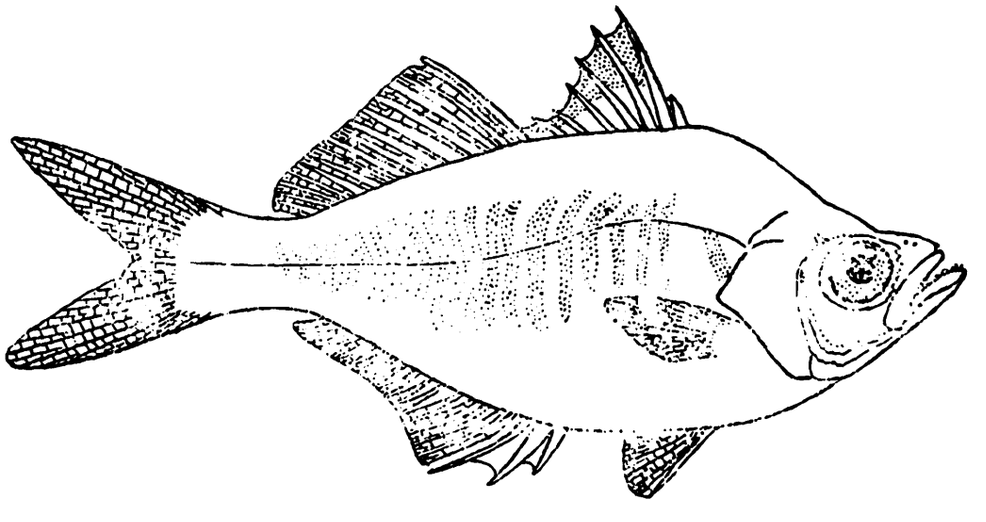


Fig. 178. Lateral view of *Chanda nama* (Hamilton). (After Misra, K. S. 1962, text-fig. 137).

Eyes large, superior, may be visible from below ventral surface. Lips thin. Lower jaw longer than upper. Jaws, palate, and tongue with villiform teeth ;

*As per opinion 1121 of the International Commission on Zoological Nomenclature (Talwar, 1971) the genus *Chanda* is now restricted to its type-species, *Chanda nama*. All the remaining species come under the genus *Parambassis* Bleeker, 1874.

canine teeth rarely present. *Lower limb of preopercle with a double serrated edge ; opercle without a prominent spine.* Two dorsal fins, the first with about seven spines ; and second 9-18 rays (one simple), the two fins continuous. *A forwardly directed recumbent spine present in the dorsal fin.* Anal fin with three spines and 9-17 rays. Caudal fin forked. Scales cycloid, small or moderate, frequently deciduous. Lateral line complete, incomplete, interrupted or absent.

Distribution.—Shores of the Indian ocean, entering freshwater.

Species visiting freshwater.—

1. *Chanda baculis* (Hamilton)—India : Orissa, W. Bengal, U.P., Bihar up to Punjab. Pakistan : Punjab, Sind. Bangladesh. Burma. Thailand.
2. *Chanda nama* (Hamilton)—India : throughout Pakistan : Punjab, Sind. Nepal. Bangladesh. Burma.
3. *Chanda ranga* (Hamilton)—India : throughout Pakistan : Punjab. Sind. Nepal. Bangladesh. Burma. Malaya. Thailand.
4. *Chanda thomassi* (Day)—India : Cochin, Kerala.

KEY TO SPECIES

1.	Interopercle's lower limb if not entire limb, serrated. ...		*C. thomassi*
	Interopercle entire, not serrated. ...	...	2
2.	Lateral line indistinct, discontinuous or absent. A dark blotch on dorsal fin's upper edge generally present. ...		*C. nama*
	Lateral line distinct. No such colour blotch on dorsal fin. ...	...	3
3.	A dark shoulder spot present. ...		*C. ranga*
	No shoulder spot present. A golden spot on occiput. ...		C. *baculis*

Family SILLAGINIDAE

Whitings

Body elongate, somewhat cylindrical. Moderate to small sized, ctenoid, deciduous scales present on head and body. *Muciferous system of canals well developed on head.* Pseudobranchiae present. Branchiostegals six. Opercle with a spine. Gill openings wide. Teeth on jaws and palatines, none on vomer. Two dorsal fins, a spinous and soft

part ; *spines very slender, elongated.* Anal fin with two spines. Lateral line not continued on to caudal fin. Air-bladder simple. Pyloric appendages few.

Two genera are dealt with here.

KEY TO GENERA

1. Preopercle entire, opercle with a spine. Second dorsal spine setaceous extending to caudal base. ... *Sillaginopsis* Gill

— Preopercle serrated, opercle without a spine. Second dorsal spine not exceeding body depth. ... *Sillago* Cuvier

Genus **Sillago** Cuvier

Sillago Cuvier, 1817, *Regne Animal*, Ed. 1, 2, p. 258 (type-species, *Sillago acuta* Cuvier).

Diagnosis.—Body elongate, somewhat cylindrical. Abdomen rounded. *Head conical with muciferous system well developed.* Snout spatulate. Mouth terminal, moderate, cleft not wide. Eyes lateral, slightly directed upwards, not visible from below ventral surface. Lips thin. Upper jaw the longer. Villiform teeth on jaws and vomer but none on palatines ; outer row of teeth on jaws conical. *Preopercle serrated in lower*

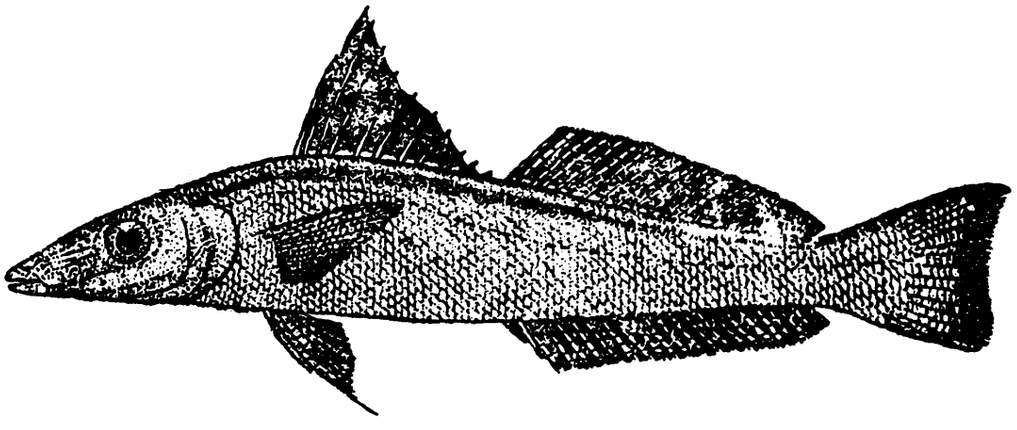


Fig. 179. Lateral view of *Sillago sihama* (Forskal). (After Misra, K. S. 1962, text-fig. 143).

half, opercle with a well developed spine. Two dorsal fins, *first with* 10 *or* 11 spines, inserted slightly behind pectorals ; *first dorsal spine short, second spine* of varying length, in large examples not exceeding depth. Second dorsal a little high in front, with 19-27 rays ; both fins separated by a short notch. Anal fin long with 20-27 rays, and *one spine.* Caudal fin emarginate or obtuse. Scales ctenoid, small, a few may be present on first dorsal fin base. Lateral line not continued on to caudal fin, with 70-74 scales. Air-bladder simple.

Distribution.—Red Sea. India. Pakistan. Burma. Thailand to Malay Archipelago and Sri Lanka and Australia. Widely distributed in Hongkong, Formosa, Korea, Japan, Philippines.

Species visiting freshwater.—*Sillago sihama* (Forskal)—distribution as of the genus.

Genus **Sillaginopsis** Gill

Sillaginopsis Gill, 1862, Proc.. *Acad. nat. Sci. Philad.*, p. 505 (type-species, *Sillago domina* Valenciennes).

Diagnosis.—Similar to *Sillago* Cuvier but differing from it as below :—

1. Preopercle entire (*vs.* serrated in *Sillago*).
2. Opercle with a spine (*vs.* opercle with a well developed spine in *Sillago*).

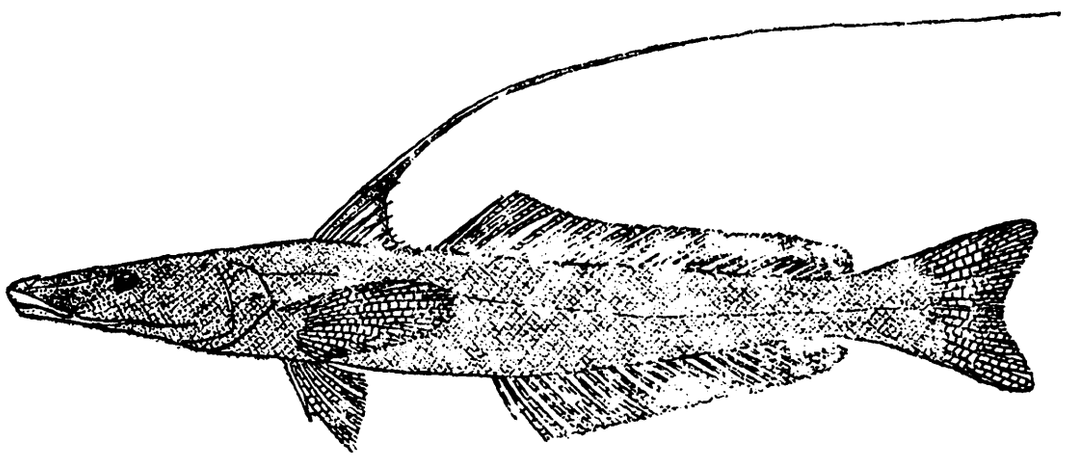


Fig. 180. Lateral view of *Sillaginopsis panijus* (Hamiton). (After Misra, K. S. 1962, text-fig. 142).

3. First dorsal fin with nine spines (*vs.* 10 or 11 spines in *Sillago*).
4. Second dorsal spine extending to caudal fin base (*vs.* not exceeding body depth in *Sillago*).
5. Lateral line scales 90 (*vs.* 70-74 in *Sillago*).

Distribution.—India : Coromandel coast, Orissa, W. Bengal and Bay of Bengal up to Pondicherry. Bangladesh. Malaya.

Species visiting freshwater.—*Sillaginopsis panijus* (Ham.)—distribution as of genus.

Family LEIOGNATHIDAE

Pony Fishes, Slip-mouths

Body oblong, or elevated, compressed, covered with small, smooth cycloid scales. Scales absent on head, and those on breast often thin and diaphnous, the breast appearing naked. Bony ridges on top of head. A nuchal crest present. Mandibles straight or concave. Mouth very protractile, the long premaxillary stalk lying in a groove on top of head, when fully protracted it forms a tube directed forwards, upwards or downwards. Lower margin of preoperculum serrate. Branchiostegal rays five. Gill membranes attached to isthmus. Pseudobranchiae absent. Lower pharyngeal bones free. Single dorsal fin. Pectorals short. Pelvic fins thoracic with an axillary scale. (After James, 1978).

Two genera are dealt with here.

KEY TO GENERA

1.	Mouth horizontal, when protracted directed downwards or forwards. ...	*Leiognathus* Lacépède
	Mouth oblique, when protracted directed upwards. ...	*Secutor* Gistel

Genus **Secutor** Gistel

Secutor Gistel, 1848, *Nat. Thierrechs—Pisces* (type-species, *Sparus insidiator* Bloch).—James, 1978, *J. mar. biol. Ass. India*, **17** (1) [1975], p. 165 (systematic review).

Diagnosis.—Body oval, compressed. Ventral profile more convex than dorsal profile. Head small. Snout pointed. *Mouth small, oblique, protractile, directed upwards when protracted. A concavity on top of head in occipital region.* Eyes lateral, in middle of head, not visible from below ventral surface. Only one post-nasal spine opposite front border of eye. Lips broad, thin, lower lip broader and smaller than upper which is like a loop over the upper. Jaws with minute villiform teeth. Palate edentate. Single dorsal fin inserted above pectoral base with eight spines and 16 or 17 rays. Anal fin with three spines and 14 rays. *Soft dorsal and anal with a scaly sheath.* Caudal fin deeply forked. Scales small, diaphnous and deciduous. Lateral line curved, complete.

Distribution.—S. Arabia. Madagascar. Seychelles. E. coast of Africa. India. Bangladesh. Pakistan. Sri Lanka. Indo-Australian Archipelago. China. Hongkong. Formosa. Philippines. Australia.

Species visiting freshwater.—

1. *Secutor insidiator* (Bloch)—Bangladesh.
2. *Secutor ruconius* (Hamilton)—distribution as of the genus.

KEY TO SPECIES

1.	Body depth 1.57-1.74 in standard length. ...	*S. ruconius*
	Body depth 1.93-2.16 in standard length. ...	*S. insidiator*

Genus **Leiognathus** Lacèpéde

Leiognathus Lacépède, 1803, *Hist. Nat. Poiss.*, **4**, p. 448 (type-species, *Leiognathus argenteus* Lacépède).—James, 1978, *J. mar. biol. Ass. India*, **17** (1) [1975], pp. 138-172 (systematic review).

Diagnosis.—Body oval, or elevated and compressed. Ventral profile more convex than dorsal profile. Head small, compressed. Snout pointed or truncate. Mouth small, horizontal or oblique, protractile, directed downwards. *Supraorbital ridges present on dorsal surface of head commencing at the inner one of a pair of post-nasal spines* the outer of which is situated near the orbital rim. Eyes moderate in middle of head, not visible from below ventral surface. Lips thin. Jaws equal with minute setiform teeth in a single series, palate edentate. Lower margin of preoperculum serrated. Dorsal fin single, inserted above base of pectoral fin, with eight spines and 15 or 16 rays. Anal

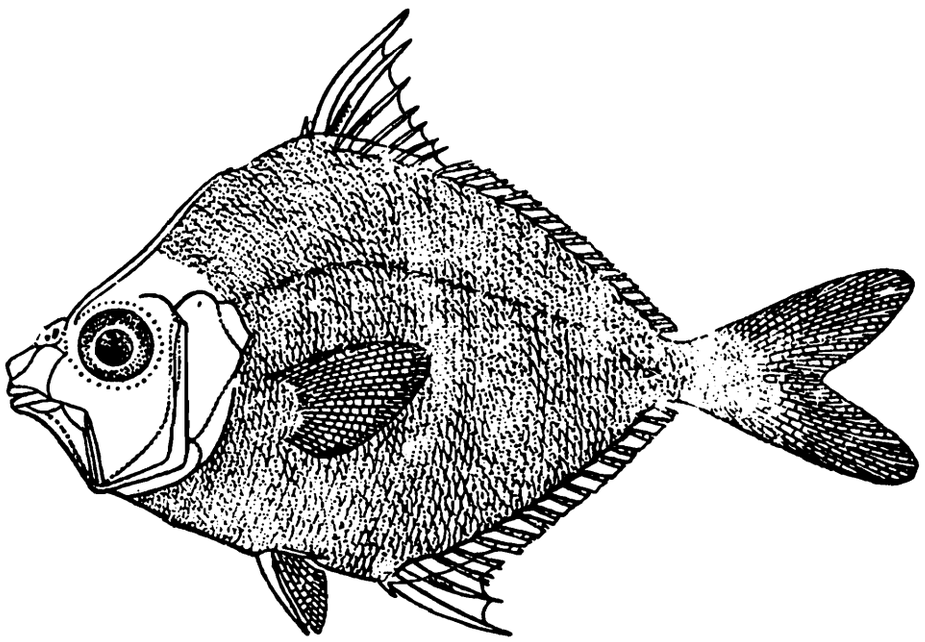


Fig. 181. Lateral view of *Leiognathus equulus* (Forskal). (After Misra, K. S. 1962, text-fig. 156).

fin with three spines and 14 rays. Soft portion of dorsal fin and anal fin with a basal scaly sheath. Caudal fin deeply forked. Scales small, cycloid, conspicuous sometimes, deciduous, absent on head and in some species on a small area of the chest. Lateral line curved with about 60 scales.

Distribution.—Red Sea, East coast of Africa through Indian Ocean and Pacific to China, Japan and Pacific islands (James, 1978).

Species visiting freshwater.—

1. *Leiognathus brevirostris* (Valenciennes)—India. South and east China seas.
2. *Leiognathus equulus* (Forskal)—India. Bangladesh. Sri Lanka. Thailand. Red Sea. Natal coast. Zanzibar. Madagascar. Mauritius. Formosa. Philippines. Indo-Australian Archipelago. Australia and Fiji Islands.
3. *Leiognathus splendens* (Cuvier)—Red Sea. Madagascar. Mauritius. India : Andaman Islands. Thailand. Sri Lanka. Formosa. Philippines. Indo-Australian Archipelago. Fiji Islands.

KEY TO SPECIES

1.	Dorsal profile more convex than ventral. ...	... 2
	Dorsal and ventral profiles more or less equal.	*L. brevirostris*
2.	Scales small, absent on breast, present all over body, including head. ...	*L. equulus*
	Scales prominent, present on breast and all over body but absent on head. ...	*L. splendens*

Family LOBOTIDAE

Triple Tails

Body elevated, oblong, compressed. Moderate to small sized ctenoid scales on head and body. Pseudobranchiae present. Branchiostegals six. Preopercle with small spines. Gill openings wide. Teeth on jaws ; palate edentate. Single dorsal fin with a long spinous and a short soft portion. Anal fin with stout spines. Lateral line curved and complete. Air-bladder simple. Pyloric appendages few.

A single genus is dealt with here.

Genus **Datnioides** Bleeker

Datnioides Bleeker, 1853, *Nat. Tijdschr. Ned. Ind.*, 5, p. 440 (type-species, *Coius polota* Hamilton).

Diagnosis.—Body oblong, elevated, compressed. Abdomen rounded. Head moderate, compressed. Snout pointed. Mouth wide, terminal, cleft not extending to anterior border of orbit. *Eyes large*, lateral, *in anterior half of* head, not visible from below ventral surface. Lips thin. Jaws equal, villiform teeth in jaws : palate edentate. Preopercle finely serrated. Two dorsal fins united at base, first inserted above half of

pectoral fin, with 12 spines, second with 13 or 14 rays. *Soft dorsal lower than spinous dorsal.* Anal fin with three spines and eight or nine rays. Caudal fin truncate. Scales ctenoid. Lateral line curved, complete.

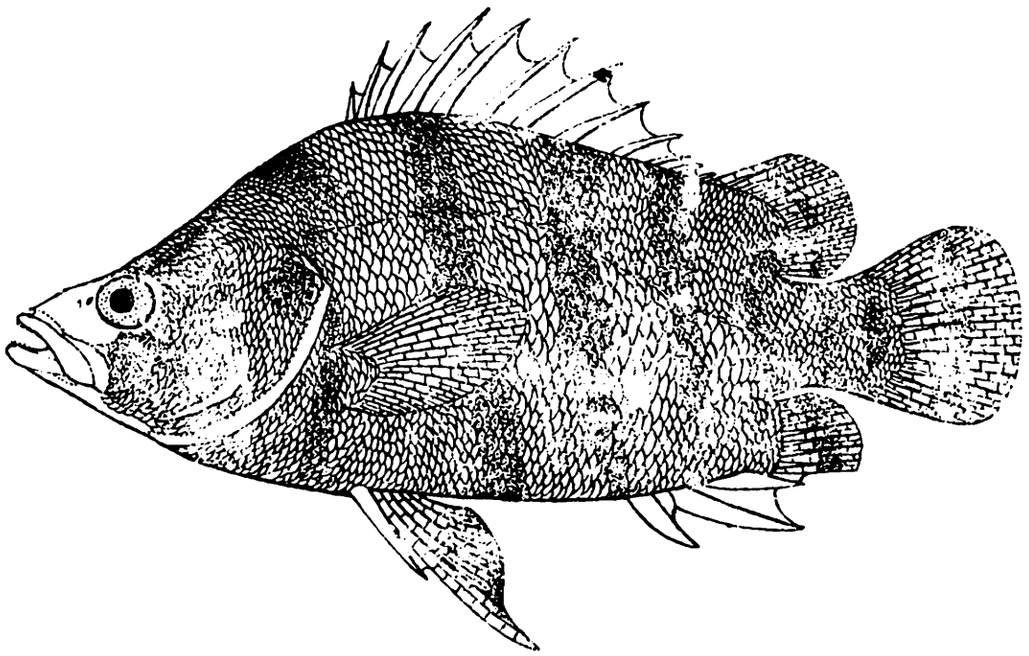


Fig. 182. Lateral view of *Datnioides quadrifasciatus* (Sevastianov). (After Misra, K. S. 1962, text-fig. 155).

Distribution.—India. Bangladesh. Burma. Malay Archipelago.

Species.—*D. quadrifasciatus* (Sevastianov)—India : Ganga estuary. Bangladesh. Burma. Malay Archipelago.

Family Gerridae

Body elevated, oblong, compressed. Moderate sized, cycloid or ctenoid scales on head and body. Pseudobranchiae present. Branchiostegals six. Preopercle as a rule entire, rarely serrated. Gill membranes free from isthmus. Teeth on jaws, palate edentate. No canines. Inferior pharyngeal bones united by a suture in some species. Single long dorsal fin with spinous and soft portions. Anal fin with spines. *A scaly sheath present for dorsal and anal fin, into which the fins in whole or part can be retracted.* Lateral line curved, complete. Air-bladder simple. Pyloric appendages few.

A single genus is dealt with here.

Genus **Gerres** Cuvier

Gerres Cuvier, 1824, In : Quoy & Gaimard, *Voy. "Uranie" Zool.*, p. 293 (type-species, *G. vaigiensis* Q. G.).

Diagnosis.—Body elevated, oblong, compressed. Abdomen rounded. Head short, compressed. Snout blunt. Mouth terminal, *very protractile,*

descending when produced. Eyes large, lateral, in middle of head, not visible from below ventral surface. Lips thin. Jaws equal. Villiform teeth in jaws, no canines. Preopercle as a rule entire ; rarely serrated. Single dorsal fin, inserted above half of pectoral fin, with 9 or 10 spines and 10 or 11 rays ; *both spinous and soft portions of fin having a scaly sheath into which it can be wholly or partly received.* Anal fin with three spines and seven rays. Caudal fin forked. Scales of moderate size, cycloid or ctenoid. Lateral line curved, complete.

Distribution.—India. Pakistan. Bangladesh. Burma. All tropical seas.

Species visiting freshwater.—G. setifer (Hamilton)—India : Coast of Kutch to Kerala to W. Bengal, Chilka Lake. Pakistan : Sind, Makran. Bangladesh. Sri Lanka. Burma. Thailand. Malaya. Hongkong.

Family POMADASYIDAE

GRUNTERS

Body oblong, compressed. Moderate sized ctenoid scales on body and head up to orbit. Pseudobranchiae present. Chin with pores and grooves. Preopercle serrated. Opercle with a spine. Teeth on jaws ; Palate edentate. Pharyngeal teeth present. Single dorsal fin with a spinous and soft portion. Anal fin with spines. *Pectoral fin very long, first ray prolonged, filamentous.* Lateral line complete.

A single genus is dealt with here.

Genus **Pomadasys** Lacépède

Pomadasys Lacépède, 1803, *Hist. nat. Poiss.*, **4**, p. 517 (type-species, *Sciaena argentea* Forskal).

Diagnosis.—Body oblong, compresssd. Abdomen rounded. Head moderate, compressed. Snout obtusely rounded. Mouth terminal, horizontal, gape not wide, hardly reaching to below front border of eyes. Eyes moderate, lateral, not visible from below ventral surface. Lips thick. Jaws of nearly equal length. *A deep and central longitudinal groove below symphysis of lower jaw present.* Two small pores on chin. Preopercle serrated, opercle with indistinct points. Jaws with villiform teeth, no canines. Palate edentate. Single continuous dorsal fin inserted above pectoral base with 11-14 spines and 12-18 rays ; spinous part longer than soft part. Anal fin with three spines and 7-12 rays. Caudal fin emarginate. Scales ctenoid, of moderate or small size present on

head, preorbital and lower jaw. Lateral line complete with 45-60 scales. Air-bladder simple without any constriction.

Distribution.—All tropical seas and the Mediterranean. India. Pakistan. Sri Lanka. Burma. Malay Archipelago. Thailand. China. Philippines. Queensland. Melanesia.

Species visiting freshwater.—Pomadasys argyreus (Val.)—India to Malay Archipelago.

Family SCIAENIDAE

Jew fishes, Croakers

Body elongate, somewhat compressed. Head and body covered with ctenoid or cycloid scales ; placed in oblique sinous rows in former. Head with well developed muciferous system of canals and pores. Pseudobranchiae present. Branchiostegals seven. Cheeks unarmed ; opercles sometimes with weak spines. Barbels present in a few genera. Two dorsal fins, continuous or separated by notch ; first with spines and second with soft rays. Anal fin with two spines. Lateral line present. Air-bladder present with or without elongated appendages. Pyloric appendages generally few.

Nine genera are dealt with here.

KEY TO GENERA

1.	Solid mental barbel on chin. ...	*Dendrophysa* Trewavas	
	No such mental barbels. ...	...	2
2.	Dorsal fin with 40-43 rays. ...	*Pama* Fowler	
	Dorsal fin with less than 35 rays. ...	...	3
3.	Upper and lower jaw teeth not differentiated....	*Johnius* Bloch	
	Upper and lower jaw teeth differentiated. ...	...	4
4.	Upper jaw with one or two pairs of well developed outstanding canines. ...	*Otolithes* Oken	
	Upper jaw without canines. ...	...	5
5.	Second anal spine more than 55% of head length. ...	*Macrospinosa* Mohan	
	Second anal spine less than 55% of head length. ...	...	6
6.	Air-bladder with a pair of appendages. ...	...	7
	Air-bladder carrot or hammer shaped. ...	...	8

7.	Air-bladder with two posterior appendages lying parallel to it. Dorsal fin with 27-31 rays. Upper lateral transverse scales 18-20. ...	*Otolithoides* Fowler
	Air-bladder with 19 or 20 arborescent appendages. Dorsal fin with 24-26 rays. Upper lateral transverse scales 9-10. ...	*Bahaba* Herre
8.	Air-bladder carrot-shaped. A pair of mandibular barbels. ...	*Daysciaena* Talwar
	Air-bladder hammer-shaped. No mandibular barbels. ...	*Johnieops* Mohan

Genus **Johnius** Bloch

Johnius Bloch, 1789, *Naturges. Ausland. Fische.*, **7**, p. 132 (type-species, *Johnius carutta* Bloch).—Talwar & Shetty, 1971, *Proc. Indian Acad. Sci.*, **74** (2), pp. 74-80 (generic relationship).

Diagnosis.—Body oblong, compressed. Abdomen rounded. Head large, compressed. Snout blunt, prominent and swollen superiorly. Six small pores across snout. Mouth inferior, cleft horizontal. Eyes superior in posterior half of head, not visible from below ventral surface. Lips thin. Upper jaw somewhat longer. *Villiform teeth in lower jaw : outer row in upper jaw enlarged, but not differentiated as canines.* Palate edentate. Preopercle serrated most distinctly at its angles ; two weak opercular spines. Two dorsal fins continuous, inserted near base of pectoral fins, first with ten weak spines ; second with 26-28 rays and a feeble spine. Anal fin with two spines and seven rays. Caudal fin wedge shaped. Scales cycloid on opercles, elsewhere ctenoid. Lateral line curved with branched tubes on either side, with 48-51 scales. *Air-bladder hammer-shaped anteriorly and laterally expanded in front of a strangulation (hammer-headed) ; posteirior end tapering to a narrow tube extending to base of anal spine,* with 11 to 13 pairs of arborescent appendages.

Distribution.—India. Burma. Bangladesh and South China sea.

Species visiting freshwater.—Johnius coitor (Hamilton)—distribution as of the genus.

Genus **Johnieops** Mohan

Johnieops Mohan, 1972, *Indian J. Fisheries*, **16** (1 & 2), p. 85 (type-species, *Sciaena osseus* Day, by original designation).

Diagnosis.—Similar to *Johnius* but differing as below :—

Snout blunt projecting a little beyond upper jaw, mouth small and a little inferior. Teeth in narrow bands, moderately differentiated into

large and small, the large forming outer series in upper jaw, inner series in lower ; *no canine teeth. Air-bladder hammer-shaped with several pairs of arborescent appendages.* Dorsal fin with 9 or 10 spines followed by a deep notch. Anal fin with 2 spines and 7 or 8 soft rays. Lateral line scales reaching to tip of caudal fin.

Distribution.—India : eastern coast, Andaman Sea. Malay Archipelago.

Species visting freshwater.—J. aneus (Bloch)—India to Malay Archipelago. Common at Madras, Bombay, Andamans.

Genus **Macrospinosa** Mohan

Macrospinosa Mohan, 1969, *Curr. Sci.*, **38** (12), p. 295.—*Cantor* Talwar, 1970, *Proc. zool. Soc. Calcutta*, **23**, p. 68 (type-species, *Bola cuja* Hamilton.)

Diagnosis.—Body oblong, compressed. Abdomen rounded. Head moderate, compressed. Snout blunt, not swollen, with three pores and five large ones along edge of rostral flap. Mouth terminal, slightly oblique. Eyes superior in posterior half of head, not visible from below ventral surface. Lips thin. Jaws nearly of the same length or lower jaw slightly longer. *Outer row of upper jaw and inner row of lower jaw enlarged, not as canines.* Palate edentate. Preopercle scarcely denticulated ; two opercular spines. Two dorsal fins continuous, inserted near above pectoral base ; first with ten strong spines ; second with one weak spine and 27 or 28 rays. Anal fin with two spines and seven rays. Caudal fin rounded. Scales cycloid on head, ctenoid on body. Lateral line curved, with tubes dividing posteriorly into many branches. *Air-bladder simple with two short appendages anteriorly.*

Distribntion.—Estuaries of Ganga in India. Burma. Japan.

Species visiting freshwater.—M. cuja (Hamilton)—India : Hooghly estuary, W. Bengal.

Genus **Otolithoides** Fowler

Otolithoides Fowler, 1933, *Bull. U. S. nat. Mus.*, **12**, p. 364 (type-species, *Otolithus biauritus* Cantor).

Diagnosis.—Lower jaw slightly shorter than upper ; 6 pores on chin, 2 of them smaller than others. Teeth in narrow villiform bands in both jaws ; no canine teeth, even when the mouth is closed (after Dutt & Thankam, 1968). Air-bladder carrot shaped, with a single pair of appendages arising from posterier end of bladder.

All other characters as in *Otolithes*.

Distribution.—India to Malay Archipelago and China. Enters estuaries.

Species visiting freshwater.—*O. biauritus* Cantor—distribution as of the genus.

Genus **Pama** Fowler

Coi-bola Whiting

Pama Fowler, 1935, *Bull. U. S. nat. Mus.*, **12**, p. 360 (type-species, *Bola pama* Hamilton). Talwar, 1975, *J. Inland Fish. Soc. India*, **7**, pp. 36-42 (systematic poslition, generic position clarified).

Diagnosis.—Body oblong, compressed. Abdomen rounded. Head large, convex and compressed. Snout more or less pointed not much swollen, with two open pores on anterior surface, and two more on the free edge of skin. Mouth inferior, cleft oblique. Eyes superior, in posterior half of head, not visible from below ventral surface. Lips thin. Upper jaw longer. Lower jaw with a small open pore a little below and to one side of the symphysis. *Villiform teeth on jaws with enlarged row in lower jaw*. Palate edentate. Preopercle crenulated, with denticulations at its angle. Two dorsal fins continuous, inserted above pectoral base ; first with about *ten weak spines with filamentous prolongations*, second with one spine and *40-43 rays*. Anal fin with two spines and seven rays. Caudal fin wedge-shaped, with central rays prolonged. Scales cycloid on head, ctenoid on body. Lateral line on a raised row of scales, curved, with arborescent tubes posteriorly. Lateral line scales 55.

Distribution.—India : W. Bengal, Orissa coast. Bangladesh. Burma. Malaya. Sumatra.

Species visiting freshwater.—*Pama pama* (Ham.)—distribution as of the genus. In Hooghly adult fish have been obtained during summer months from as high as Nabadwip-Purbasthali area *ca* 300 km from the sea.

Genus **Otolithes** Oken

Otolithes (Cuvier) Oken, 1817, *Isis*, p. 1182 (type-species, *Johnius ruber* Bleeker).

Diagnosis.—Body oblong, compressed. Abdomen rounded. Head moderate, compressed. Snout a little pointed. Mouth terminal, wide, cleft extending to anterior border of eye. Eyes moderate, superior, in anterior half of head, not visible from below ventral surface. Lips thin. Jaws subequal, lower jaw longer. Villiform teeth in both jaws, with the outer row in premaxillaries enlarged ; well *developed canines in both jaws which are received into fossae in the opposite jaw when the mouth is closed*. Palate edentate, preopercle crenulated, serrated or denticulated. Two

dorsal fins united at their bases, first inserted above base of pectoral fin, with nine or ten weak spines ; second with 27-31 rays. Anal fin with one or two small spines and 7-11 small sized rays. Lateral line curved, complete. Air-bladder carrot-shaped.

Distribution.—India. Pakistan. Bangladesh. Sri Lanka. Burma. Thailand. Malaysia.

Species visiting freshwater.—O. maculatus (Kuhl & van Hasselt)—India : coasts of Kutch, Kerala to Orissa and W. Bengal. Pakistan : Sind. Bangladesh. Burma. Sri Lanka. Malaysia. Thailand. Common in estuaries and tidal rivers.

Genus **Bahaba** Herre

Otolithes (*Bahaba*) Herre, 1935, *Lingnan Sci. J.*, **14**, pp. 603-604 (type-species, *Otolithes lini* Herre = *Nibea flavolabiata* Lin 1935 = *Bahaba flavolabiata*, by original designation).—Trewavas & Talwar, *J. Fish. Biol.*, 1972, **4**, pp. 11-16 (generic relationships, description of specimens from Burma).

Diagnosis.—Body short, arched at the back, compressed. Abdomen rounded. Head short, compressed. Snout rounded, without upper pores. *Two pairs of mandibular pores present.* Mouth terminal, large, cleft extending to below posterior border of eyes. Eyes large, lateral, in anterior part of head, not visible from below ventral surface. Lips thin. Jaws equal. Teeth of a generalised sciaenid pattern ; in upper jaw an outer series of large, posteriorly diminishing and an inner band of smaller villiform teeth posteriorly broader, in lower jaw a group of subequal teeth increasing in size posteriorly. *No specialised caniniform teeth* ; palate edentate. Dorsal fin inserted above pectoral base, with ten spines and 24-26 rays ; both fins more or less continuous, except a slight notch. Anal fin with two spines and seven rays. *Caudal fin fan shaped or tapering.* Scales ctenoid except on snout and immediately behind eye, 51 or 52 pierced by the lateral line, with arborescent tubules on each scale. A series of very small ctenoid scales forming a narrow sheath at base of dorsal and caudal. Air-bladder carrot-shaped with only one pair of appendages.

Distribution.—India : estuaries of Ganga. Burma : Sittang river.

Species.—B. chaptis (Hamilton)—distribution as of the genus.

Genus **Dendrophysa** Trewavas

Dendrophysa Trewavas, 1964, *Copeia*, No. 1, p. 110 (type-species, *Umbrina russelli* Cuvier, by original designation).

Diagnosis.—Allied to *Johnius* Bloch in all features and differing from all other sciaenid genera dealt with here in *possession of a single solid barbel below chin.*

Species visiting freshwater.—*D. russelli* (Cuvier)—India to Malay Archipelago. Enters estuaries.

Distribution.—Indo West-Pacific.

Genus **Daysciaena** Talwar

Daysciaena Talwar, 1970, *Proc. zool. Soc. Calcutta*, 23, p. 192 (type-species, *Corvina albida* Cuvier).

Diagnosis.—Closely allied to *Johnius* Bloch, in most features but differing in having scales over bases of soft dorsal and anal fin only. Snout rounded, prominent with four pores at tip arranged in a transverse row of three above a median pore. Chin with five conspicuous pores. *A pair* of small tapering *mandibular barbels.* Preopercle edge serrated or crenulated. Scales on body ctenoid. Air-bladder carrot-shaped with about 17 pairs of appendages.

Distribution.—India to Malay Archipelago, China, entering estuaries of Orissa and W. Bengal. Bangladesh.

Species visiting freshwater.—*D. albida* (Cuvier).—India : Pondicherry and along the coasts, entering Hooghly, Chilka estuaries.

Family TOXOTIDAE

Archer fishes

Body oblong, posteriorly elevated, compressed. Head and body covered with cycloid scales. Teeth on jaws and palate. Pseudobranchiae present. Branchiostegals seven. Opercle, preopercle without any spines. A single dorsal fin placed in the posterior half of body with spines and soft rays. Anal fin long with spines. Lateral line curved and complete. Air-bladder simple. Pyloric appendages few.

A single genus is dealt with here.

Genus **Toxotes** Cuvier

Toxotes Cuvier 1817, *Regne Animal*, 2, p. 338 (type-species, *Labrus jaculator* Bloch & Schneider).

Diagnosis.—Body short, oblong, compressed. Abdomen rounded. Head short, anteriorly slightly depressed. *Snout pointed or rather produced.* Mouth wide, slightly upturned, cleft extending beyond midorbit. Eyes large, lateral, in anterior part of head, not visible from below ventral surface. Lips thick. Jaws subequal, lower jaw prominent. Villiform teeth

on jaws and palate. *A single dorsal fin, inserted slightly behind anal origin with four or five spines and 11 or 12 rays. Anal fin with three spines and 15-17 rays. Caudal fin cut neatly square.* Scales cycloid, moderate sized. Lateral line interrupted above pectoral fin tip.

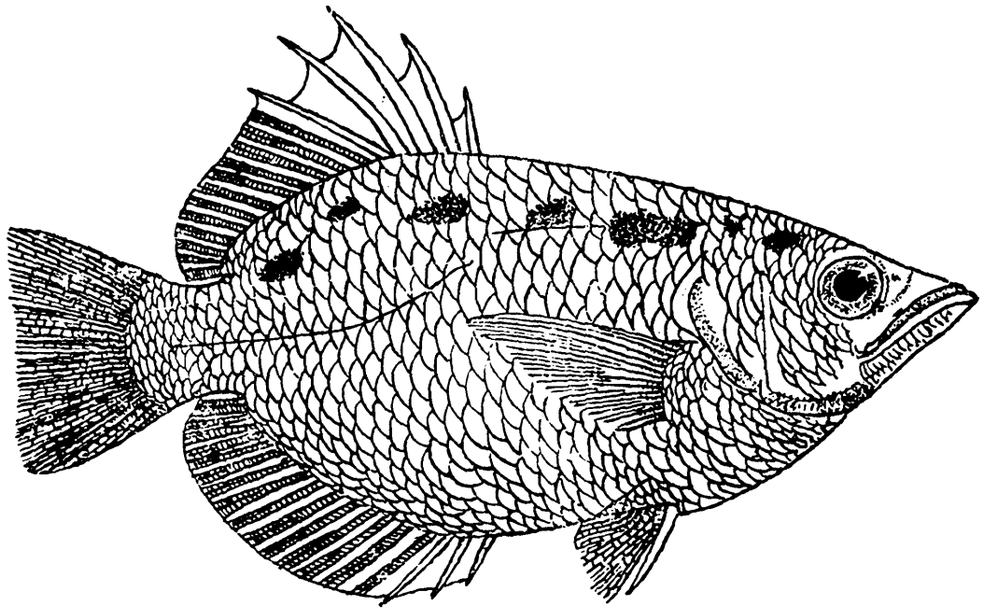


Fig. 183. Lateral view of *Toxotes chatareus* (Hamilton). (After Misra, K. S. 1962, text-fig. 165).

Distribution.—India. Pakistan. Bangladesh. Burma. Thailand. Viet-Nam. Malaysia. Indo-Australian Archipelago. Philippines. Australia.

Species visiting freshwater.—Toxotes chatareus (Hamilton)—India. Pakistan. Bangladesh. Burma. Sri Lanka. Malay Archipelago. Thailand. Viet-Nam. Philippines. Melanesia. Queensland. Found in rivers and estuaries.

Family SCATOPHAGIDAE

Scats or Butter Fishes

Body oblong, elevated, compressed. Head and body covered with minute, ctenoid scales. Teeth on jaws only, palate edentate. Pseudobranchiae present. Branchiostegals six. Gill membranes narrowly attached to isthmus. Opercle, preopercle without any spine. Two dorsal fins united at their base, first with spines of varying lengths, second with soft rays and covered with scales. First dorsal spine short, recumbent. Pectoral fin inserted on sides. Pelvic and anal fin with spines ; latter with four spines. *Lateral line curved,* complete. Air-bladder simple. Pyloric appendages rather numerous.

A single genus is dealt with here.

Genus **Scatophagus** Cuvier

Scatophagus Cuvier, 1831, *Hist. Nat. Poiss.*, **7**, p. 136 (type-species, *Chaetodon argus* Linnaeus).

Diagnosis.—Body short, elevated, much compressed. Abdomen rounded. Head short, compressed. Snout conical, of moderate length. Mouth terminal, gape short, not protractile. Eyes large, lateral, in middle of head and not visible from below ventral surface. Lips thin. Jaws equal. Villiform teeth on jaws ; palate edentate. Preopercle spineless. Two dorsal fins, united at their bases, inserted above tip of

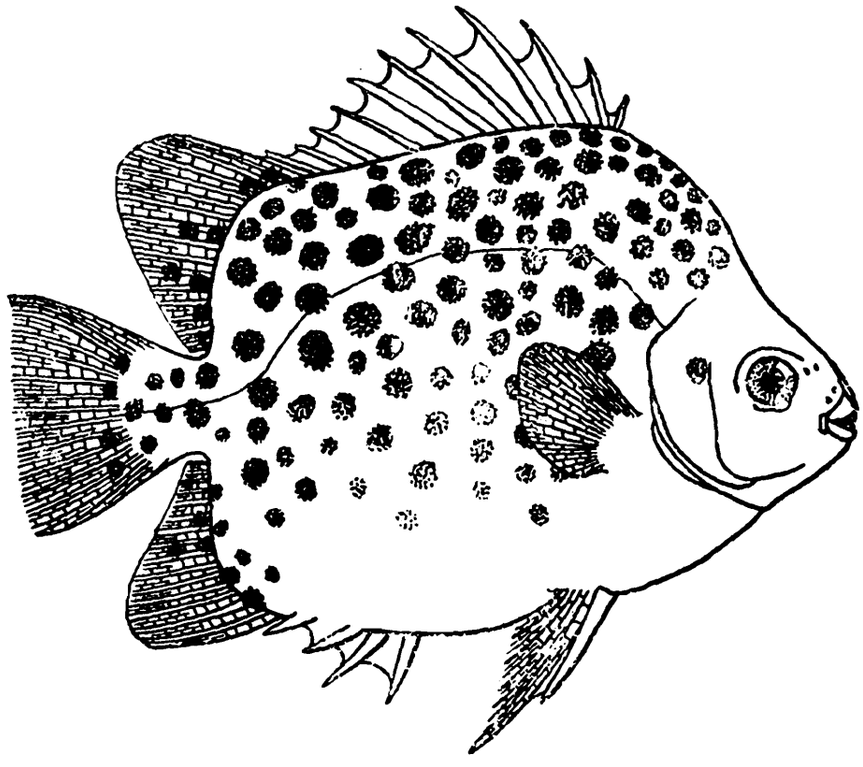


Fig. 184. Lateral view of *Scatophagus argus* (Linnaeus). (After Misra, K. S. 1962, text-fig. 168).

pectoral fins, first dorsal with ten or eleven spines *and another single recumbent forwardly directed spine*, second with one spine and 16 or 17 rays *and covered with scales. Anal fin with four spines* and 14-16 rays. Caudal fin fan shaped. Scales small. Lateral line curved, complete. Air-bladder simple. Pyloric appendages numerous.

Distribution.—Indian ocean from China to Australia. India. Bangladesh.

Species visiting freshwater.—*Scatophagus argus* (Linnaeus)—distribution as of the genus.

Family NANDIDAE

Mud perches

Body oblong, elevated, compressed with moderate sized ctenoid scales. Head covered with scales. Teeth on jaws and palate. Pseudobranchiae present in marine genera, concealed or absent in freshwater forms. Branchiostegals five or six. Operculum armed with a spine. A single dorsal fin with a spinous and a soft portion. Pelvic fins thoracic. Anal fin with spines. Lateral line interrupted or absent. Air-bladder present. Pyloric appendages few or absent.

Three genera are dealt with here.

KEY TO GENERA

1.	Mouth small, slightly protractile. Nostrils well separated, posterior very close to eye. Pyloric appendages present. ...	*Pristolepis** Jerdon
—	Mouth large, protractile. Nostrils close together, both close to eye. Pyloric appendages absent. ...	... 2
2.	Preopercle not serrated. No teeth on the tongue. ...	*Badis* Bleeker
—	Preopercle serrated. Teeth present on root of tongue. ...	*Nandus* Valenciennes

Genus **Badis** Bleeker

Badis Bleeker, 1853, *Verh. Bat. Genootsch.*, **25**, p. 106 (type-species, *Labrus badis* Hamilton = *Badis buchanani* Bleeker, by original designation).

Diagnosis.—Body moderately elongated, compressed. Abdomen rounded. Head large, compressed. Snout bluntly rounded. Mouth slightly upturned, terminal, protractile, cleft not extending to anterior margin of eye. Eyes large, supero-lateral in anterior part of head, not visible from below ventral surface. Lips thin. *Lower jaw longer. Villiform teeth on jaws, vomer and palatines; none on tongue. Opercle with one sharp spine, other bones of head armed.* A single dorsal fin, inserted above base of pectoral fin, the spinous portion longer than soft portion; with 16-18 spines and 7-10 rays. Anal fin with three spines and six to eight rays. Caudal fin wedge shaped. Scales of moderate size, ctenoid. Lateral line interrupted or absent, with 26-33 scales when present. Air-bladder large and simple.

*Misra (1962) placed this genus under Pristolepidae. Greenwood *et al.* (1966) consider Pristolepidae as synonymous with Nandidae.

Distribution.—Throughout India, Pakistan, Nepal, Bangladesh, Burma.

Species.—

1. *Badis badis* (Hamilton)—distribution as of the genus.
2. *Badis dario* (Hamilton)—India : North Bengal, Bihar, Western Ghats.

KEY TO SPECIES

1.	Lateral line present, interrupted. Body purple colored, with band or spots. ...	*B. badis*
—	Lateral line absent. Body stone colored, with three or four broad bands. ...	*B. dario*

Genus **Nandus** Valenciennes

Nandus Valenciennes, 1831, In : Cuvier & Valenciennes, *Hist. Nat. Poiss.*, **7**, p. 481 (type-species, *Nandus marmoratus* Cuvier).

Diagnosis.—Body oblong, compressed. Abdomen rounded. Head large, compressed. Snout pointed, conical. *Mouth terminal, very protractile, its cleft very wide, extending to below posterior border of eyes or slightly beyond.* Eyes in anterior part of head, large, lateral, not visible from below ventral surface. Lips thin. Jaws subequal, lower jaw longer. Villiform

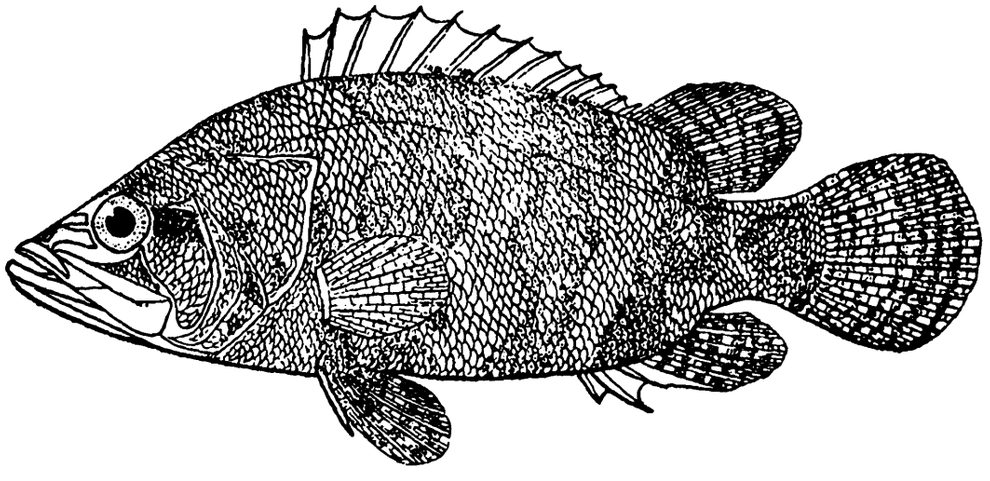


Fig. 185. Lateral view of *Nandus nandus* (Hamilton). (After Misra, K. S. 1962, text-fig. 172).

teeth on jaws, palate and on tongue. Opercle with one spine, *preopercle, preorbit, sub-and inter-opercles serrated or more or less entire* ; dorsal fins inserted above pectoral base, with 12-14 spines and 11-13 rays ; spinous portion longer than soft portion. Anal fin with three spines and seven to nine rays. Caudal fin square shaped. Scales smaller on nape than on body, extending over anal and dorsal fin rays. Lateral

line interrupted at about 36th scale, 46-57 scales along lateral line. Air-bladder large and simple.

Distribution.—Throughout India, Pakistan, Bangladesh, Burma and Thailand.

Species.—*Nandus nandus* (Hamilton) (Pl. II, fig. D).—India : Throughout India. Bangladesh. Nepal. Pakistan : Punjab, Sind. Burma. Malaya. Thailand.

Remarks.—This is a piscivorous species preying upon small carps in paddy fields, ditches. It is very tenacious of life.

Genus **Pristolepis** Jerdon

Pristolepis Jerdon, 1848, *Madras J. Lit. Sci.*, **15**, p. 141 (type-species, *Pristolepis marginatus* Jerdon).

Diagnosis.—Body short, oblong, compressed. Abdomen rounded. Head short, compressed. Snout sharply rounded. *Mouth terminal, moderately protractile.* Eyes superior, large, in anterior part of head,

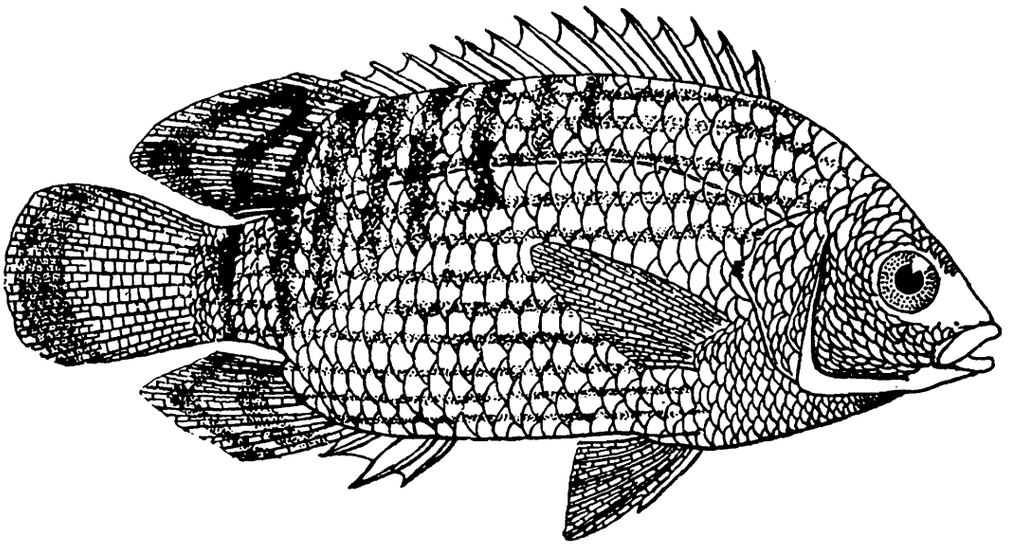


Fig. 186. Lateral view of *Pristolepis malabarica* (Günther). (After Misra, K. S. 1962, text-fig. 171).

not visible from below ventral surface. Lips thin. Jaws equal. Villiform teeth on jaws and palate ; *villiform or globular on vomer, obtusely globular on tongue.* Opercle with two flat (generally bifid) spines, preopercle and preorbital mostly serrated. Dorsal fin inserted above pectoral base, with 12-16 spines and 11-16 rays. Anal fin with three or four spines and eight rays. Caudal fin rounded. Scales large, ctenoid, present on interorbital membrane also. Lateral line interrupted.

Distribution.—India : Kerala. Burma. Thailand and Malay Archipelago.

Species.—

1. *Pristolepis fasciata* (Bleeker)—Burma. Thailand. Malay Archipelago.
2. *Pristolepis malabarica* (Günther)—India : Western ghats.
3. *Pristolepis marginata* Jerdon—India : Manantoddy river, Kerala.

KEY TO SPECIES

1.	Teeth on vomer globular. ...	*P. fasciata*
—	Teeth on vomer villiform. ...	... 2
2.	Anal fin with four spines. Body depth 3.75 in total length. ...	*P. marginata*
—	Anal fin with three spines. Body depth 2.25—2.5 in total length. ...	*P. malabarica*

Family CICHLIDAE

Body oblong, elevated, compressed. Head and body with slightly ctenoid scales. Inferior pharyngeal bones triangular with a median longitudinal suture. Teeth on jaws. Palate edentate. Pseudobranchiae absent. Branchiostegals six. Dorsal fin single with a spinous and soft part. Anal fin with spines and a soft part. Lateral line interrupted or abruptly ceasing. Air-bladder present, large and simple. Pyloric appendages absent, few when present.

Two genera are dealt with here.

KEY TO GENERA

1.	Scales cycloid (rarely indistinctly ctenoid). Anal fin with three or four spines. ...	*Tilapia* A. Smith
—	Scales slightly ctenoid. Anal fin with 12—16 spines. ...	*Etroplus* Cuvier

Genus **Etroplus** Cuvier

Pearlspot

Etroplus Cuvier, 1830, *Hist. Nat. Poiss.*, **5**, p. 486 (type-species, *Etroplus meleagris* Cuvier).

Diagnosis.—Body elevated and compressed. Abdomen rounded. Head moderate, compressed. *Mouth terminal, cleft small. Snout spout-like.* Eyes large, lateral, in middle of head, not visible from below ventral

surface. Lips thin. Jaws equal. *Villiform teeth in two or three rows on jaws, compressed and lobate at their summits.* Palate edentate. Dorsal fin

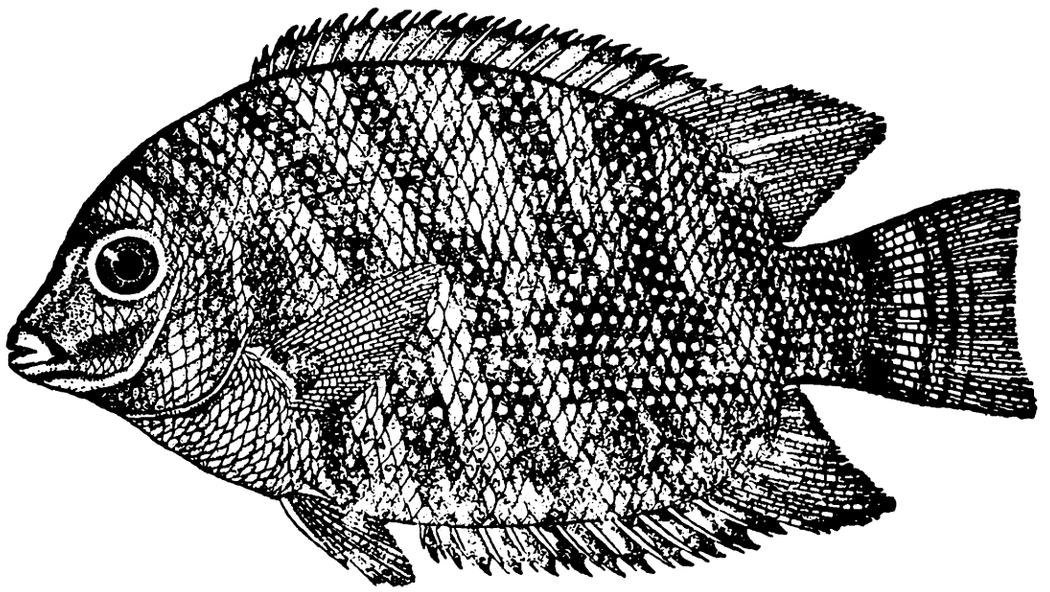


Fig. 187. Lateral view of *Etroplus suratensis* (Bloch). (After Misra, K. S. 1962, text-fig. 174).

inserted above base of pectorals with 18-22 spines and 8-15 rays, spinous portion longer than soft part. Anal fin with 12-16 spines and 6-11

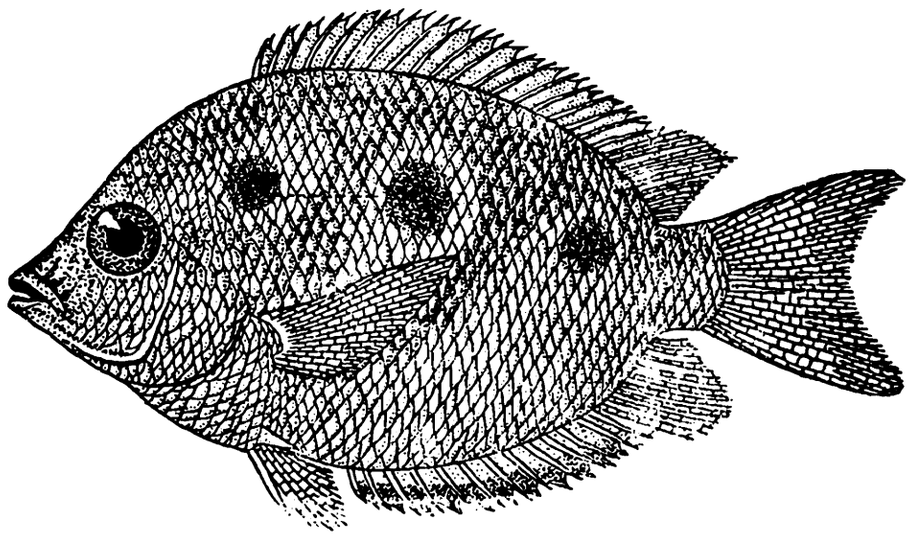


Fig. 188. Lateral view of *Etroplus maculatus* (Bloch). (After Misra, K. S. 1962, text-fig. 173).

rays. Caudal fin lunate or emarginate. Scales very slightly ctenoid, of moderate size, extending to base of soft dorsal and anal fin. *Lateral line* interrupted or abruptly ceasing *and thereafter continuing as small open pores* with 30-40 scales. Air-bladder large and simple. Body with colored spots.

Distribution.—India : South India, Orissa. Sri Lanka.

Species visiting freshwater.—

1. *Etroplus canarensis* Day—India : South Kanara.
2. *Etroplus maculatus* (Bloch)—India : Tamil Nadu, Kerala, S. Kanara. Sri Lanka.
3. *Etroplus suratensis* (Bloch)—India : Kerala, Tamil Nadu, Andhra, Orissa states. Sri Lanka.

KEY TO SPECIES

1.	Body with one to three dark blotches along sides. Dorsal fin with 17—20 spines ...	*E. maculatus*
—	Body with transverse bands. ...	... 2
2.	Dorsal fin with 18 or 19 spines. Anal fin with 12 or 13 spines and 11 or 12 spines. ...	*E. suratensis*
—	Dorsal fin with 21 or 22 spines. Anal fin with 14—16 spines and 6 or 7 spines. ...	*E. canarensis*

Remarks.—A natural inhabitant of brackish or sea-water, these fishes are easily acclimatised to freshwater and they breed well in tanks and ponds. Brackish water ponds and wells unfit for *Catla* or Goramy are ideally suited for *Etroplus*. They thrive where luxurient growth of aquatic vegetation is available. Since they are deep bodied and are armed with spines, they do not easily fall a prey to murrels. As such they can be cultivated safely along with murrels.

Genus **Tilapia** A. Smith

Tilapia A. Smith, 1849, *Ill. zool. S. Afr. Fish.* (type-species, *Chromis nilotica* Valenciennes, by original designation).

Diagnosis.—Body short, more or less elongate. Abdomen rounded. Head compressed, with concave upper profile. Mouth terminal, large, at least $\frac{3}{4}$ width of head or often nearly as wide as head, cleft extending to below anterior border of eyes, or not quite so far. Snout rounded. Eyes large, lateral, in middle of head, not visible from below ventral surface. Lips thin. Jaws equal. Teeth in two or more series, the outer bicuspid, the others tricuspid. Palate edentate. Dorsal fin inserted above base of pectoral, with 15 or 16 spines and 10 or 11 rays. Spinous portion longer than soft part, latter may be prolonged with a filamentous tip. *Anal fin with three spines* (rarely four), third spine a little longer than last dorsal. Caudal fin rounded, may be truncate in the young. Scales cycloid. Lateral line incomplete, upper one with 18-21 and lower one with 10-15 scales. Air-bladder large and simple.

Distribution.—East Africa to Natal, widely introduced in India, Pakistan.

Species visiting freshwater.—*Tilapia mossambica* Peters is the only species known in our waters, though over 90 species are known in Africa. Natural distribution in Africa is from Algoa Bay in S. Africa to the West Shebeli river in Somalia

Remarks.—The fish is reported to be unsuitable for culture along with major Indian carps, because of its depradation on carp fry. '

Family MUGILIDAE

Mullets

Body oblong to elongate, compressed, may be depressed anteriorly to a little extent. Head and body with scales. Eyes with or without adipose eyelids. Opercles with or without a spine. Teeth very fine or absent. Gill openings wide. *Two dorsal fins short, well separated,* first with spines. Anal fin slightly longer than second dorsal. Pelvics abdominal with a spine and suspended from an elongated shoulder bone. *Lateral line absent.* Pyloric appendages generally few.

Mostly marine, these economically valuable fishes are found often entering estuaries and tidal rivers. One genus *Rhinomugil* is mostly a freshwater inhabitant.

Four genera are dealt with here.

KEY TO GENERA*

1.	Opercle with a strong spine. ...	*Sicamugil* Fowler
	Opercle without a spine.	2
2.	Upper lip not forming anterior border of head, but inferior to a fleshy snout. ...	*Rhinomugil* Gill
	Upper lip forming anterior border of head, not inferior to snout.	3
3.	Maxilla markedly exposed posteriorly when the mouth is closed. ...	*Liza* Jordan & Swain
	Maxilla not exposed posteriorly.	4
4.	Adipose eyelids prominent. Anal fin origin in advance of second dorsal origin. ...	*Mugil* Linnaeus
	Adipose eyelids not well developed. Anal fin origin opposite that of second dorsal fin. ...	*Valamugil* Smith

*After Thompson (1954), and Pillay, S. R. (1962).

Genus **Mugil** Linnaeus

Mugil Linnaeus, 1758, *Syst. Nat.* ed. 10, **1**, p. 316 (type-species, *Mugil cephalus* Linnaeus)—Thompson, 1954, *Austr. J. mar. freshw. Res.*, **5**, p. 82 (revision).—Pillay, S. R. 1962, *J. Bombay nat. Hist. Soc.*, 59 (2), pp. 547-576 (revision).

Diagnosis.—Body short, compressed. Abdomen rounded. Head short, flat above, scaled, compressed. Snout obtuse or pointed. Mouth terminal. Eyes large, lateral, in anterior part of head. Adipose eyelids prominent. Lips thin, the lower projecting horizontally but not folded downwards. Jaws equal. A symphysial knob at the tip of the lower jaw present. Teeth present in one or more rows and tend to be lost or embedded in lips in older fish, the outermost row simple tipped,

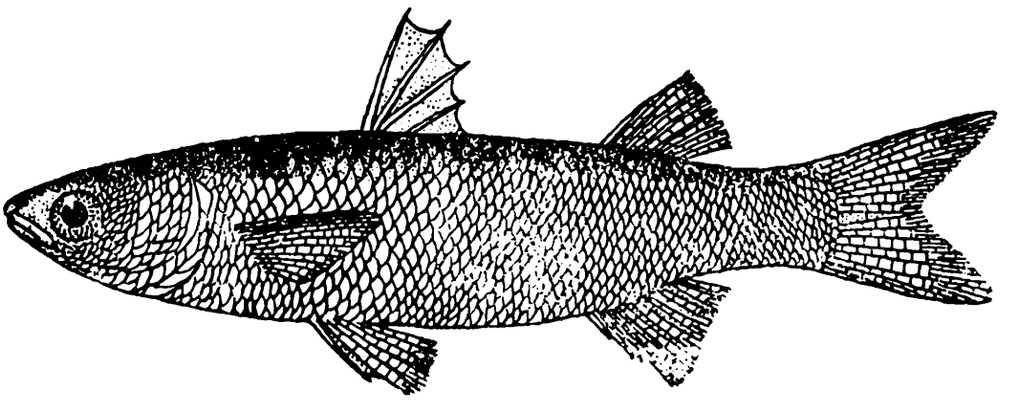


Fig. 189. Lateral view of *Mugil parsia* (Hamilton). (After Misra, K. S. 1962, text-fig. 127).

the inner row bifid or trifid ; no papillae, lamellae or posterior folds in the lips. Preorbital moderately narrow, denticulate and may be notched or straight along the anterior edge ; *maxillary not fixed anteriorly* ; *maxilla and premaxilla not hooked downwards posteriorly* ; *maxillary hidden when the mouth is closed. Nostrils widely apart*, the anterior nearer to the upper lip than to the posterior nostril ; the posterior nearer to the eye than to the anterior ; the anterior always below the level of the edge of the orbit ; the posterior usually so but sometimes above the orbit level. *Teeth absent from vomer*, palatines, pterygoids and tongue. Scales cycloid more usually feebly ctenoid. Gill membranes extending far forward, not broadly connected with isthmus.

Two dorsal fins well separated, first inserted above half to last quarter of pectoral fin with four spines, second with eight rays. Anal fin origin in advance of second dorsal origin ; anal fin with three spines. Caudal fin forked.

Distribution.—Temperate and tropical seas, estuaries and some rivers.

Species visiting freshwater.—

1. *Mugil cephalus* Linnaeus—India : very common in both east and west coasts of India, ascending tidal rivers and estuaries. Pakistan. Also in Caroline isls. East Indies. New Guinea. Japan. Hawai.

2. *Mugil oligolepis* Bleeker—India : Kathiawar to Kerala coast, Bay of Bengal up to Orissa in Chilka lake. Bangladesh. Also in S. Africa.

KEY TO SPECIES

1,	Pectoral fin shorter than head excluding snout. Lateral line with 37-42 scales. ...	*M. cephalus*
—	Pectoral fin as long as head excluding snout. Lateral line with 26-28 scales. ...	*M. oligolepis*

Genus **Liza** Jordan & Swain

Liza Jordan & Swain, 1884, *Proc. U. S. nat. Mus.*, **7**, p. 261 (type-species, *Mugil capito* Cuvier, by original designation)—Thompson, 1954, *Austral. J. mar. freshw. Res.*, **5**, p. 84.

Diagnosis.—Preorbital usually broad, notched and denticulate. *Maxillary* fixed anteriorly and *exposed posteriorly when the mouth is closed*; maxillary and premaxillary hooked downwards. *Nostrils close together*, closer than the anterior to the upper lip or the posterior to the eye ; nostrils below the level of the upper edge of the eye. *Teeth usually present on vomer*, palatines, pterygoids and tongue, occasionally absent from vomer and palatines. Anal fin origin well in advance of 2nd dorsal origin. *Adipose eyelid variably developed, but obsolescent in many species reduced to a rim about the eye.*

All other characters as in *Mugil.*

Distribution. —Temperate and tropical seas often entering estuaries and tidal rivers.

Species visiting freshwater.—

1. *Liza macrolepis.*—India : Kerala, Orissa, W. Bengal coasts. Pakistan : Sind. Bangladesh. Burma. Sri Lanka. Also east and southern coasts of Africa, Malaya, Malay Archipelago, China, Japan, Philippines, Melanesia, Micronesia, Polynesia.

2. *Liza parsia* (Hamilton)—India : West and east coasts entering tidal rivers and estuaries. Common in W. Bengal and Andamans. Bangladesh.

3. *Liza tade* (Forskal)—India : Kerala and Maharashtra coasts. Common in east coast entering tidal rivers and estuaries. Also in Andamans. Bangladesh.

KEY TO SPECIES*

1.	Adipose eyelid absent or rudimentary. ...	*L. macrolepis*
—	Adipose eyelid present. ...	... 2
2.	Interorbital space convex. Eye 2/7 in head and 1.5—2.7 in interorbital space. Anterior half of anal fin before origin of second dorsal fin. A notch present on the ventral aspect of lower jaw below the symphysial knob. ...	*L. parsia*
—	Interorbital space flat. Eye about 1/7 in head and 1.75 to 2.0 in interorbital space. Anterior 1/3 of anal fin before origin of second dorsal fin. A notch absent on the ventral aspect of the lower jaw below the symphysial knob. ...	*L. tade*

Genus **Valamugil** Smith

Valamugil Smith, J. L. B. 1948, *Ann. Mag. nat. Hist.*, (11) **14**, p. 84 (type-species, *Mugil seheli* Forskal, by original designation).

Diagnosis.—Lower lip not folded down. A symphysial knob present, denticulate. Nostrils apart nearer to the lip and the eye than to each other. *Adipose membrane variably developed. Teeth on pterygoids and tongue but not on vomer and palatine. Maxilla hidden when mouth is closed.* Scales cycloid. Anal fin origin opposite that of second dorsal fin. Pectoral fins unusually long.

All other characters as in *Mugil.*

Distribution.—Temperate and tropical seas often entering estuaries and tidal rivers.

Species visiting freshwater.—*Valamugil seheli* (Forskal).—India : Kathiawar, Bombay coast, Gulf of Mannar, Chilka lake and Andaman isls.

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*After Luther, G. (pers. communication).

Genus **Sicamugil** Fowler

Sicamugil Fowler, 1939, *Notul. Nat. Acad. Philad.*, **17**, p. 9 (type-species, *Mugil hamiltonii* Day).—Pillay; S. R. 1962, *J. Bombay nat. Hist. Soc.*, **59** (1), p. 263 (revision).

Diagnosis.—Body short, compressed. Abdomen rounded. Head short, flat above, scaled, compressed. Snout obtuse. *Mouth protrusible.* Eyes large, lateral, in anterior part of head, visible from below ventral

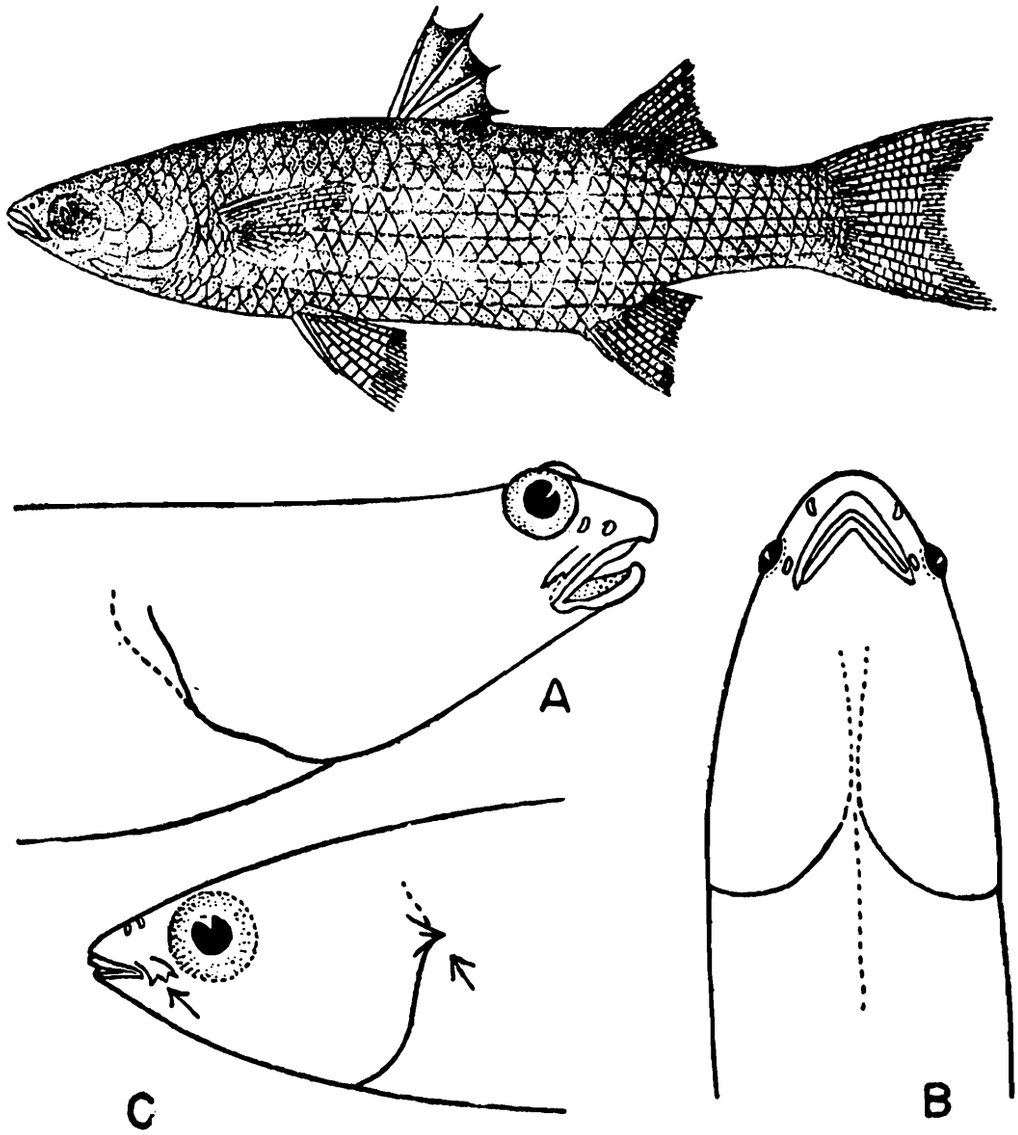


Fig. 190. Lateral view of *Sicamugil cascasia* (Hamilton). (After Misra, K. S. 1962, text-fig. 128). A. Outline sketches of *Rhinomugal corsula* (Hamilton) showing overhanging snout, elevated eyes; B. showing the position of lips and mouth. C. Lateral view of head of *Sicamugil cascasia* (Hamilton) showing the opercular spine; and the tricuspid pre-orbital spine (see arrow). (After Pillay, S. R. 1952, text-fig. 1, p. 263).

surface. Adipose eyelids absent. Lips very thin, terminal, without lobes or papillae ; upper lip forms tip of snout and part of dorsal profile. Jaws equal ; *a symphysial knob* present on lower jaw. No distinct *teeth on jaws and palate.* Anterior edge of pre-orbit without conspicuous notch

and its extremity with a few well developed spines, *opercle with one strong spine* (see fig. 190 C). Two dorsal fins, well separated, first dorsal inserted above tip of pectoral fin, with four spines, second with eight rays. Anal fin with three spines and eight or nine rays. Caudal fin forked. Scales of body strongly ctenoid, 36-39 along lateral series. Lateral line absent.

Distribution.—India : Upper reaches of Ganga, Yamuna and the Brahmaputra river systems. Pakistan : Indus river system. Burma. Bangladesh.

Species.—

1. *Sicamugil cascasia* (Hamilton)—India : Ganga, Yamuna, Brahmaputra river systems. Pakistan : Indus river system. Sri Lanka. Bangladesh.
2. *Sicamugil hamiltonii* (Day)—Burma : Sittang river system.

KEY TO SPECIES

1.	Anal fin inserted ahead of second dorsal fin. Dorsal fin inserted above 17th scale of lateral line (Burma). ...	*S. hamiltonii*
—	Anal fin inserted opposite second dorsal fin. Dorsal fin inserted above 7th scale of lateral line (India). ...	*S. cascasia*

Genus **Rhinomugil** Gill

Rhinomugil Gill, 1863, *Proc. Acad. nat. Sci. Philad.*, **15**, p. 169 (type-species, *Mugil corsula* Hamilton).—Pillay, S. R. 1962, *J. Bombay nat. Hist. Soc.*, 59 (2), p. 568 (revision).

Diagnosis.—Body elongated, compressed. Abdomen rounded. Head long, slightly depressed anteriorly. Snout flat, short, overhanging (fig.

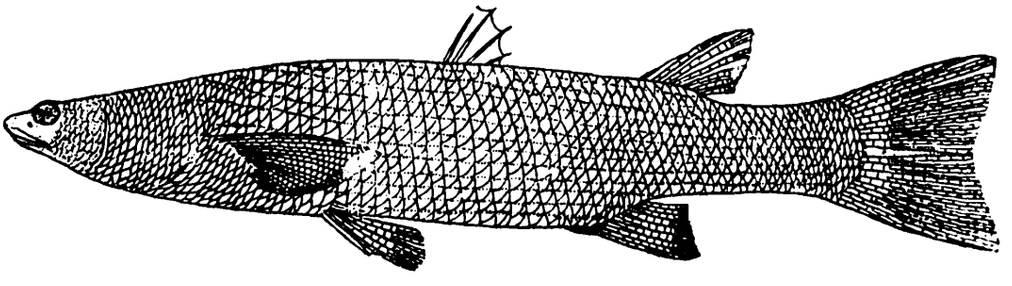


Fig. 191. Lateral view of *Rhinomugil corsula* (Hamilton). (After Misra, K. S. 1962, text-fig. 129).

190 B). *Mouth distinctly ventral and protrusible.* Eyes prominent, bulging placed in line with dorsal profile of head, in anterior part of head

not visible from ventral surface. *Adipose eyelids absent.* Lips thin ; *upper lip not forming tip of snout or part of dorsal profile*, but distinctly ventral, overhung by snout. Jaws equal ; symphysial knob present. Teeth indistinct. Anterior edge of pre-orbit without a spine. Two dorsal fins well separated : *first inserted in between pelvic and anal with four spines*, second with eight rays. Anal fin with three spines and nine rays. Caudal fin emarginate. Scales ctenoid in adults, cycloid in young, 48-52 along lateral series.

Distribution.—India : Ganga, Cauvery river systems (? introduced into the latter, Menon & Jayaram, 1977). Nepal. Burma. Bangladesh. Pakistan.

Species.—*R. corsula* (Hamilton) (Pl. VI, fig. B) is the single species known—distribution as of the genus.

Family Polynemidae

Thread Fins Indian Salmon

Body oblong, somewhat compressed. Head and body covered with small ctenoid scales. Head with well developed muciferous system of canals. Teeth on jaws and palate. Pseudobranchiae present. Branchiostegals seven. Preopercle serrated, but with no spine. A spine on the shoulder at the commencement of lateral line present. Two dorsal fins, well separated, first with spines and second with soft rays. *Pectoral fins with several articulated, free prolonged filamentous rays.* Anal fin with spines. Lateral line complete. Air-bladder when present varying in form and structure. Pyloric appendages varying in number.

Two genera are dealt with here.

KEY TO GENERA*

1. Lower lip absent at the corners of mouth. Teeth extending on to the exterior part of jaws. Free pectoral filaments not more than four. ... *Eleutheronema* Bleeker

— Lower lip well developed and extending forward but not to symphysis. Teeth extending to anterior part of jaws. Free pectoral filaments five or more. ... *Polynemus*** Linnaeus

*After Kagwade, P. V. 1970. *Bull. Cent. mar. fish. Res. Inst.*, No. **18**, 69 pp.

**_Polydactylus_ Lacépède is considered a synonym of _Polynemus_.

Genus **Polynemus** Linnaeus

Thread fins

Polynemus Linnaeus, 1758, *Syst. Nat.*, **1**, Ed. 10, p. 317 (type-species, *Polynemus paradiseus* Linnaeus).—Kagwade, 1970, *Bull. Cent. mar. fish Res. Inst.*, No. **18**, 69 pp. (review).

Diagnosis.†—Body oblong, compressed. Abdomen rounded. Head large, compressed. Snout pointed, with a lateral cleft. Mouth ventral, moderately wide. Eyes large, covered with a membrane, lateral, not visible from below ventral surface. Lips thin. Jaws subequal. Villiform teeth in broad bands on jaws and palatines ; a round patch on vomer. Two dorsal fins ; first one inserted above half of pectoral fin, with seven spines ; second separated from the first by a considerable interspace and with one spine and 15 or 16 rays. Pectoral fins falciform, two or three rays simple, and the remaining 15 branched ;

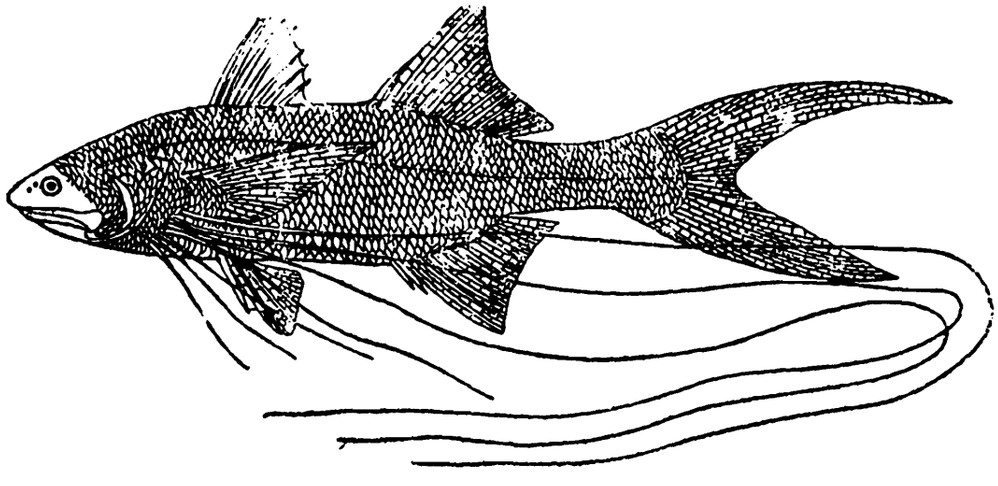


Fig. 192. Lateral view of *Polynemus paradiseus* Linnaeus. (After Misra, K. S. 1962, text-fig. 131).

first three filaments free, the longest, reaching about twice the length of fish but variable, other four fin rays also prolonged. Anal fin with two spines and 12 rays. *Caudal fin deeply forked, with long pointed lobes which are usually prolonged into filaments, the lower being mostly the longer.* Scales present on dorsal, anal and caudal fins. Lateral line continued to end of lower caudal lobe and with 70 scales. Air-bladder large.

Distribution.—Madagascar. Mauritius. India. Pakistan. Bangladesh. Burma. Sri Lanka. Malacca. Australia and Society Islands.

† The description given here applies only to species listed.

Species visiting freshwater.—

1. *Polynemus indicus* (Shaw)—India : Andhra Pradesh, Coromandel coast. Also Sri Lanka and Bangladesh.
2. *Polynemus paradiseus* Linnaeus—India. Bangladesh. Burma. Malay Archipelago.

KEY TO SPECIES

1.	Free filaments seven.	...	*P. paradiseus*
—	Free filaments five.	...	*P. indicus*

Genus **Eleutheronema** Bleeker

Eleutheronema Bleeker, 1862, *Versl. Akad. Amsterdam*, **14**, p. 110 (typo-species, *Polynemus tetradactylus* Shaw).—Kagwade, 1970, *Bull. Cent. mar. fish Res. Inst.*, No. **18**, 69 pp. (review).

Diagnosis.—Similar to *Polynemus* but differing from it as below.—

1. Lower lip absent (*versus* present in *Polynemus*).
2. Teeth extending to exterior of jaws (*versus* extending only to anterior part of jaws in *Polynemus*).
3. Free pectoral filaments not more than four (*versus* five or more than five in *Polynemus*).
4. Air-bladder absent (*versus* present in *Polynemus*).

Distribution.—East and West coast of India, Andamans. Bangladesh. Sri Lanka. Thailand. Malacca. China. Formosa. Philippines. North and West Australia.

Species visiting freshwater.—*Eleutheronema tetradactylum* (Shaw). (Pl. IV, fig. D)—distribution as of the genus.

Remarks.—This species ascends higher up the rivers than any others of the family. In West Bengal (Hooghly estuary) and Orissa (Chilka lake) the fishery is mainly of juveniles. Migration takes place with the increase in salinity of the estuarine waters.

Family Gobiidae†

Body varying from oblong to very elongate, eel-like in some genera. Head generally with mucous canals and open pores. Five branchiostegal

† Miller (1973) has recently published a new classification of gobioid fishes. The arrangement of subfamilies and included genera are however after the work of Koumans (1941, 1953).

rays. Two dorsal fins united with each other or separated narrowly by a notch, or well separated, with soft flexible spines and/or rays. First dorsal fin may be absent. *Pelvic fins united*, sometimes totally or posteriorly incised or free. Basal membrane present or absent. Anal fin short, or long, or continuous with caudal fin. Anal papilla present. Lateral line absent, exposed pit-organs present. Scales ctenoid or cycloid, sometimes partly or totally absent.

A large group of fishes inhabiting the seas all over the world, especially common in the temperate and tropical regions. Many enter freshwater rivers, brackishwaters and estuaries.

Four subfamilies and 22 genera* are dealt with here.

KEY TO SUBFAMILIES

1.	Teeth on lower jaw in more than one row. ...	GOBIINAE
—	Teeth on lower jaw in a single row. ...	... 2
2.	Second dorsal fin elongated. ...	APOCRYPTINAE
—	Second dorsal fin not elongated. ...	... 3
3.	Eyes prominent, above the dorsal profile. Base of pectoral fin muscular. ...	PERIOPHTHALMINAE
—	Eyes not prominent, not at level of dorsal profile, but below. Base of pectoral fin not muscular. ...	SICYDIAPHINAE

Subfamily GOBIINAE

No scales between and before eyes on head. Teeth simple, top of teeth not incised, second dorsal fin longer than first. Gill openings moderate to wide.

KEY TO GENERA

1.	Caudal fin long, pointed or lanceolate, longer than head. ...	... 2
—	Caudal fin short, obtuse or truncate or rounded. ...	... 7
2.	Some fleshy flaps on inner edge of pectoral girdle present. ...	*Stenogobius* Bleeker
—	Fleshy flaps on inner edge of pectoral girdle absent. ...	... 3

*Rao V. V. (1971) records *Ctenogobius* Gill with *C. cringer* (Valenciennes) and *C. godavariensis* Rao from Godavary estuary. The position of this genus in Indian waters is uncertain. Hence it is excluded.

3.	Teeth in upper jaw in a single row.	...	*Oxyurichthys* Bleeker
—	Teeth in upper jaw in several rows.	...	... 4
4.	Head naked, without scales.	...	*Silhouettea* Smith
—	Head with scales.	...	... 5
5.	Barbels along rami of lower jaw present.	...	*Parachaeturichthys* Bleeker
—	No barbels along rami of lower jaw.	...	... 6
6.	Head with ridges and papillae. Anterior nostril in a long tube.	...	*Callogobius* Bleeker
—	Head plain without ridges or papillae. Anterior nostril in a short tube.	...	*Acentrogobius* Bleeker
7.	Maxillary prolonged posteriorly.	...	*Stigmatogobius* Bleeker
—	Maxillary not prolonged posteriorly.	...	... 8
8.	Head naked, without scales. Lips fleshy, turned upwards.	...	*Chiramenu* Rao
—	Head scaled above and behind eyes. Lips thin.	...	... 9
9.	Tongue rounded.	...	*Gobiopsis* Steindachner
—	Tongue bilobate.	...	... 10
10.	Some fleshy flaps on inner edge of pectoral girdle.	...	*Awaous* Valenciennes
—	No such fleshy flaps on inner edge of pectoral girdle.	...	... 11
11.	Tongue rounded.	...	*Brachygobius* Bleeker
—	Tongue bilobate.	...	... 12
12.	Gill openings continued forward below, isthmus narrow. Caudal fin oblong to pointed. 28-36 scales along lateral series.	...	*Glossogobius* Gill
—	Gil opening nearly not continued forward below, isthmus broad or moderate. Caudal fin obtuse. 35-40 scales along lateral series.	...	*Bathygobius* Bleeker

Genus **Stenogobius** Bleeker

Stenogobius Bleeker, 1874, *Arch. neerl. Sci.*, 9, p. 317 (type-species, *Gobius gymnepomus* Bleeker, by original designation).

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head short, compressed, scaled above and behind eyes. Snout blunt. Mouth oblique, cleft just extending to front border of eye. Eyes large, superior, in anterior part of head, not visible from below ventral surface. Lips thin. Jaws subequal, lower jaw a little prominent. Villiform teeth on both jaws, outer row enlarged, pointed ; outer row on lower jaw extending only up to halfway. No canines. Tongue truncate, not emarginate. Gill openings not very wide, isthmus broad. Two dorsal fins, separated by

an interspace between the two, first dorsal inserted above half of pectoral fin, with six rays, third, fourth ray slightly prolonged, second with 10-12 rays. Pectoral fins without free silk-like rays. *Some fleshy flaps on inner edge of pectoral girdle.* Pelvic fins united, oblong. Anal fin with 10-12 rays. Caudal fin obtuse to lanceolate. *Scales* mostly ctenoid on part of body, becoming *cycloid on neck and belly,* 50-55 along lateral series.

Distribution.—India : Tamil Nadu, Kerala, Goa in backwaters.

Species visiting freshwater.—*S. malabaricus* (Day)—distribution as of the genus.

Genus **Parachaeturichthys** Bleeker

Parachaeturichthys Bleeker, 1874, *Arch. neerl. Sci.*, **9**, p. 325 (type-species, *Chaeturichthys polynema* Bleeker, by original designation).

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head somewhat depressed, scaled. Snout short, blunt. Mouth oblique, cleft extending to below middle of eye. Eyes large, superior, in anterior part of head, not visible from below ventral surface. Lips thin. Jaws equal, with multiserial teeth. *Barbels along rami of lower jaw present.* Outer row of teeth in lower jaw enlarged, extending halfway, last tooth a weak canine. In upper jaw on each side in front four or five caninoid teeth present. Tongue subtruncate, free. Gill openings extending below, beyond the level of lower-most pectoral fin ray, isthmus moderate. Two dorsal fins, separated by a notch, first dorsal inserted above three-fourth of pectoral fin, with six spines, second dorsal with one spine, and nine or ten rays and nearly as high as the first dorsal fin. Pectoral fin pointed without free silk-like rays. Pelvic fins united. Anal fin with one spine and nine or ten rays. Caudal fin lanceolate. Scales ctenoid on nape, cycloid on head, breast and belly, 27-29 along lateral series.

Distribution.—East coast of south Africa. Coasts of India. Ambon. China. Japan. Viet-Nam. N. E. and Western Australia.

Species visiting freshwater.—*Parachaeturichthys polynema* (Bleeker)—India : Godavary estuary, Hooghly river mouth, besides other areas as of the genus.

Genus **Oxyurichthys** Bleeker

Oxyurichthys Bleeker, 1860, *Act. soc. sci. Indo-Neerl.*, **8**, p. 44 (type-species, *Gobius belosso* Bleeker).

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head compressed, neck more or less scaled, preopercle and opercle generally

naked. Snout blunt. Mouth oblique, cleft extending to below hind edge of orbit. *Eyes* moderate, superior, placed close together, *sometimes with a tentacle at upper margin*, not visible from below ventral surface. Lips thin. Jaws equal, lower jaw prominent. *Teeth in upper jaw in one row*, in lower two to four rows, sometimes inner row enlarged. Teeth of upper jaw strongly developed, caninoid, no true canines. Tongue rounded. Gill openings not very wide, isthmus broad. Two dorsal fins placed close together with a little space, first inserted above half of pectoral fin without free silk-like rays. Pelvic fins united, oblong. Anal fin with 10-14 rays. Caudal fin pointed, long. Scales ctenoid posteriorly, cycloid anteriorly, with 52-65 scales along lateral series.

Distribution.—India. Bangladesh. Indo-Australian Archipelago. China. Philippines.

Species visiting freshwater.—

1. *O. microlepis* (Bleeker)—India : Chilka lake, Godavary estuary, Ennur backwaters, Madras. Pakistan : Sind. Sri Lanka. Bangladesh.
2. *O. nijsseni* Menon and Govindan—India : Ennore estuary, Madras ; Godavary and Mahanadi estuaries.
3. *O. tentacularis* (Valenciennes)—India : Chilka lake, Godavary estuary, Andaman island, Cochin backwaters, Kerala.

KEY TO SPECIES

1.	A tentacle at upper margin of eye present. ...		*O. tentacularis*
—	No tentacle on eye. ...		... 2
2.	50-55 scales in lateral series. ...		*O. microlepis*
—	26-28 scales in lateral series. ...		*O. nijsseni*

Genus **Chiramenu** Rao

Chiramenu Rao, V.V. 1970, *J. mar. Biol. Ass. India*, **12** (1&2), pp. 183-186 (type-species, *Chiramenu fluviatilis* Rao, by monotypy and original designation).

Diagnosis.—Body slender, elongated, anteriorly cylindrical, posteriorly compressed. Abdomen rounded. *Head long, naked.* Preopercular margin with a pore. Papillate rows on head and chin. Snout acute. Mouth inferior, cleft just extending to anterior border of eye. Eyes large, superior, in anterior part of head, not visible from below ventral surface of head. *Upper lip fleshy, expanded forwards, spatulate.* Upper jaw a little longer, prominent. A single row of 50-56 closely set teeth on upper jaw, tips more or less rounded, gradually decreasing

in size from middle towards sides. Lower jaw with three rows much enlarged, inner row extending to half the jaw on each side ; *no canines. Tongue bilobate.* Gill openings extend slightly below pectoral base. Two dorsal fins well separated, first inserted above half of pectoral fin, with six rays ; second with one spine and ten rays. Pectoral fins without free silk-like rays. Pelvic fins united. Anal fin with one spine and ten rays. Caudal fin emarginate. Scales ctenoid on body in line behind pectoral base to behind first dorsal base, 54-58 along lateral series.

Distribution.—India : Godavary estuary.

Species visiting freshwater.—*C. fluviatilis* Rao—distribution as of the genus.

Genus **Silhouettea** Smith

Silhouettea Smith, J. L. B. 1959, *Ichthyol. Bull. Rhodes Univ.*, No. **13**, p. 213 (type-species, *Silhouettea insinuans* Smith).

Diagnosis.—Body narrow, elongated, slightly tapering posteriorly. Abdomen rounded. Head without scales, depressed behind eye without any pores or papillae. Snout obtuse. Mouth oblique, cleft, extending to anterior border of orbit. Eyes large, close together, superior, in anterior part of head and not visible from below ventral surface. Lips thin. Jaws subequal, lower jaw prominent. No sensory canals behind eye. *Nostrils in a line, anterior on a short tube* and posterior a simple pore. Four rows of teeth in both jaws, the outer and inner rows slightly enlarged and curved, the outer row in lower jaw extending only half way the jaws. *Tongue emarginate.* Gill openings not wide, isthmus broad. Two dorsal fins separated by a notch, first inserted behind base of pectoral, with six rays, second with one spine and ten rays. Pectoral fin without free silk-like rays. Pelvic fins united. Anal fin with one spine and 12 rays. Caudal fin lanceolate. Scales ctenoid, 28 along lateral series.

Distribution.—Tropical seas

Species visiting freshwater.—*S. indicus* Rao, V. V.—India : Godavary estuary.

Genus **Acentrogobius** Bleeker

Acentrogobius Bleeker, 1874, *Arch. neerl. Sci*, 9, p. 321 (type-species, *Gobius chlorostigma* Bleeker).

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head a little compressed, scaled above and behind the eyes. Mucous canals

longitudinally over cheek. Some open pores round the eyes and along preopercle. Snout obtuse. Mouth oblique, cleft extending to anterior border of eye. Eyes moderate, lateral, in anterior part of head, not visible from below ventral surface. Jaws equal, lower jaw prominent. *Teeth in both jaws in several rows, outer row enlarged, inner also a little enlarged ; in lower jaw last teeth in outer row canines ; in both jaws some caninoid teeth larger than rest present.* Tongue truncate to scarcely bilobate. Gill openings not, or only a little continued forward below, isthmus moderate. Two dorsal fins, separated ; first inserted above half to last quarter of pectoral fin, with six rays ; second with six to seventeen rays. Pectoral fins with or without free silk-like rays, base scaled. Pelvic fins united, oblong. Anal fin obtuse to pointed, scales ctenoid, becoming cycloid on nape, breast and belly, 28-42 scales along lateral series.

Distribution.—India. Pakistan. Bangladesh. Thailand. Indo-Australian Archipelago.

Species visiting freshwater.—

1. *A. cyanamos* (Bleeker)—India : Chilka lake, Cochin backwaters. Thailand. Indo-Australian Archipelago.
2. *A. globiceps* (Hora)—India : Chilka lake, Ennur backwaters near Madras, Calcutta. Java.
3. *A. madraspatensis* (Day)—India : Ennur backwaters near Madras, Vishakhapatnam.
4. *A. masoni* (Day)—India : Chilka lake, Bombay.
5. *A. reichei* (Bleeker)—India : Vishakhaptnam, Port Blair. Burma : Mergui. S. E. Africa. Philippines. Indo-Australian Archipelago.
6. *A. viridipunctatus* (Valenciennes)—India : Cochin, Bombay, Madras, Vishakhapatnam, Port Blair. Zanzibar. Philippines. China. Indo-Australian Archipelago.

KEY TO SPECIES

1.	Predorsal scalas 14-30. ...	...	2
—	Predorsal scales less than 14. ...	...	4
2.	Predorsal scales about 30. ...		*A. viridipunctatus*
—	Predorsal scales 14-25. ...	...	3
3.	A broad papilla on each side of chin present. Cheek naked, opercle scaled in upper part. Predorsal scales about 25. ...		*A. masoni*
—	No such papilla. Predorsal scales 14. ...		*A. cyanomos*

4.	Five to eight narrow vertical black lines on ventral half of body between base of pelvic fin and middle of anal fin.	...	*A. madraspatensis*
—	No such colour markings.	...	... 5
5.	Predorsal scales 12, from which the foremost 9 or 10 fall out easily.	...	*A. reichei*
—	Predorsal scales seven or eight.	...	*A. globiceps*

Genus **Callogobius** Bleeker

Callogobius Bleeker, 1874, *Arch. neerl. Sci.*, **9**, p. 318 (type-species, *Eleotris hasseltii* Bleeker, by original designation).

Diagnosis.—Body elongate, anteriorly subcylindrical, posteriorly compressed. Abdomen rounded. Head depressed, broader than deep, with papillae and sensory canal pores and ridges, scaled above behind eyes, cheek. Mouth small or oblique, cleft extending to below eye. Eyes large, superior, looking upwards, in anterior part of head and not visible from below ventral surface. *Anterior nostril in a long tube.* Lips thin. Jaws equal. Teeth in both jaws in several rows, the outer of which is enlarged. *No canines. Tongue rounded, sometimes emarginate.* Gill openings not wide, isthmus broad. Two dorsal fins separated by a notch, first with six rays, inserted above three fourth of pectoral fin, second with one spine and seven to 15 rays. Pectoral fin without free silk-like rays. Pelvic fins united. Anal fin with one spine and 7 to 12 rays. Caudal fin lanceolate. Scales ctenoid posteriorly, becoming cycloid anteriorly or wholly cycloid, 25-35 in lateral series.

Distribution.—India to the Pacific.

*Species visiting freshwater**—*C. seshaiyai* Jacob & Rangarajan—India : Vellar estuary.

Genus **Gobiopsis** Steindachner**

Gobiopsis Steindachner, 1860, *S. B. Akad. Wiss. Wien*, **42** (23), p. 291 (type-species, *Gobiopsis macrostomus*, by original designation).

Diagnosis.—Body elongate, cylindrical anteriorly, compressed posteriorly. Abdomen rounded. Head short, depressed, flat above, scaled from end of halfway to preopercle. Nape scaled with small cycloid scales.

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*Rao, V. V. (1971) described *C. melanoptera* from Godavary estuary. From the description it appears that the species having non-tubular nostril and without sensory canal pores on head, may not belong to this genus.

**_Barbatogobius_ Koumans, 1941, is a synonym.

Snout short, a little longer than eye. Mucous canal with open pores present. Mouth a little oblique, cleft extending to below eye. Anterior nostril in a tube, posterior nostril with a flap on chin. Eyes large, superior, in anterior part of head, not visible from below ventral surface. *Several barbels present on snout*, two barbels on chin, four on each side of median ramus of lower jaw. Jaws subequal. Teeth in each jaw in several rows enlarged ; outer row enlarged, of lower jaw extending to halfway of jaw, *no canines*. Tongue feebly emarginate. Gill openings not wide, isthmus broad. Two dorsal fins very close, but separate, first dorsal inserted above half to three fourth of pectoral fin, with six spine and ten rays. Pectoral fins without free silk-like rays. Pelvic fins united. Anal fin with 9-11 rays. Caudal fin rounded. Scales about 34 along lateral series.

Distribution.—Tropical Indo-Pacific.

Species visiting freshwater.—G. macrostomus Steindachner*—India : Hooghly, Godavary and Vellar estuaries and along the west coast. Thailand.

Genus **Awaous** Valenciennes

Awaous Valenciennes, 1837, In : Cuvier & Valenciennes, *Hist. Nat. Poiss.*, **12**, p. 97 (type-species, *Gobius ocellaris* Valenciennes).

Diagnosis.—Body elongate, posteriorly compressed. Abdomen subcylindrical. Head short, elongate, scaled above behind the eye and sometimes on upper part of preopercle and opercle. Snout slightly conical, longer than eye. Mouth oblique, cleft extending to anterior border of eye. Eyes moderate, superior, in anterior part of head, not visible from below ventral surface. Lips thick. Jaws subequal ; upper jaw prominent, villiform teeth on both jaws in several rows ; outer row enlarged. No canines. Tongue bilobate. Gill openings a little longer than pectoral base ; isthmus broad. Two dorsal fins, separated by a notch ; first dorsal inserted above base of pectoral fin, with six rays ; second with 9-11 rays. Pectoral fins without free silk-like rays, base scaled. Pelvic fins united, oblong. Anal fin moderate with ten rays. *Some fleshy flaps on inner edge of pectoral girdle.* Caudal fin obtuse. Scales ctenoid, breast and belly scaled, 50-58 scales along lateral series.

Distribution.—India. Philippines. Indo-Australian Archipelago. Hawaii.

**Barbatogobius asanai* Koumans, 1941 is a synonym of this species.

Species visiting freshwater.—

1. *A. grammepomus* (Bleeker)—in rivers and estuaries of India, Sri Lanka, Philippines, East Indian Archipelago.

2. *A. stamineus* (Valenciennes)—In rivers and estuaries of India, Malaya, Bangladesh, Philippines, Hawaii, East Indies.

KEY TO SPECIES

1.	50-52 scales along lateral series. L. tr. 13—15.	*A. grammepomus*
—	51-58 scales along lateral series. L. tr. 16—19. Predorsal scales 17—24. ...	*A. stamineus*

Genus **Glossogobius** Gill

Glossogobius Gill, 1860, *Proc. Acad. nat. Sci. Philad.*, (1859), p. 146 (type-species, *Gobius platycephalus* Richardson, by original designation).

Diagnosis.—Body elongate, anteriorly cylindrical, compressed. Abdomen rounded. Head depressed, pointed, scaled above behind eyes. Snout obtusely rounded or pointed, not longer than eye. Mouth a little oblique, cleft not extending to eye. Eyes large, superior, in middle of head, not visible from below ventral surface. Lips thick.

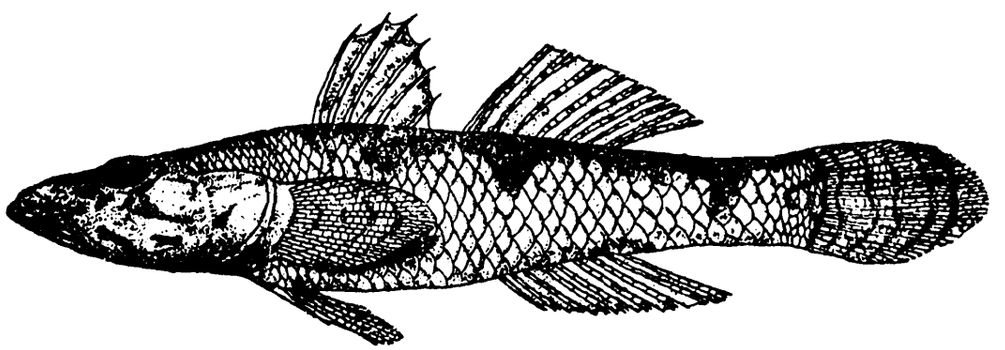


Fig. 193. Lateral view of *Glossogobius giuris* (Hamilton). (After Misra, K. S. 1962, text-fig. 188).

Jaws with villiform teeth in several rows, outer and inner one enlarged, uneven, widely set; outer row curved. *Tongue bilobate. Gill openings continued far forward below isthmus* narrow. Two dorsal fins, separated by a short interspace ; first dorsal inserted adove half or three-fourth of pectoral fin with six rays and second with six to ten rays, *not elongated.* Pectoral fins without free silk-like rays, base scaled. *Pelvic fins united, oblong.* Anal fin with eight or nine rays. *Caudal fin oblong to rounded.* Scales ctenoid on body, cycloid on head. 28-36 *scales along lateral series.* Air-bladder when present, small.

Distribution.—Throughout India, Pakistan, Nepal, Bangladesh, Burma, Sri Lanka. It has a wide range from the East coast of Africa to Japan, Australia and South Pacific.

Species visiting freshwater.—

1. *Glossogobius biocellatus* (Val.)—India : Godavary estuary, other areas as in the genus.
2. *Glossogobius giuris giuris* (Hamilton) (Pl. V, fig. A ; Pl. X, Fig. C.) —distribution as of the genus.

KEY TO SPECIES

1.	Seven to nine scales in a transverse line. First dorsal fin with two ocelli. Iris of eye with a process in pupil. ...	*G. biocellatus*
—	9-14 scales in a transverse line. First dorsal fin with one black spot or without it. Iris without process in pupil. ...	*G. giuris giuris*

Genus **Stigmatogobius** Bleeker

Stigmatogobius Bleeker, 1874, *Arch. neerl. Sci.*, **9**, 323 (type-species, *Gobius pleurostigma* Bleeker).

Diagnosis.—Body elongate, a little compressed. Abdomen rounded. Head little compressed to depressed, scaled above and behind eyes. Snout short, blunt. Mouth oblique, cleft extending to beyond anterior border of eyes. Eyes lateral, in anterior part of head, not visible from below ventral surface. Lips thin. Jaws equal. *Teeth in both jaws in several rows, outer row enlarged, in lower jaw of each side of symphysis a canine row.* Tongue rounded to feebly emarginate. Gill openings not wide, isthmus broad. Two dorsal fins, well separated ; first inserted above half of pectoral fin, with six rays, second to fourth rays slightly prolonged ; second with six to eight rays. Pectoral fins without free silk-like rays, base scaled. Pelvic fins. united. Anal fin with six to eight rays. Caudal fin obtuse. Scales ctenoid posteriorly, cycloid anteriorly ; 25-32 scales along lateral series.

Distribution.—India. Bangladesh. Sri Lanka. Thailand. Malay Peninsula to Fiji islands and Indo-Australian Archipelago.

Species visiting freshwater.—

1. *S. javanicus* (Bleeker)—India : Bombay, Madras, Chilka lake, Port Blair. Philippines. Queensland. Tasmania. Indo-Australian Archipelago.

2. *S. micrognathus* Rao, V. V.—India : Godavary estuary.
3. *S. minima* (Hora)—India : Chilka lake, Godavary estuary.
4. *S. poecilosoma* (Bleeker)—India : Sunderbans, W. Bengal, Yenna river, Satara dist., Maharashtra. Singapore. Australia. Indo-Australian Archipelago.
5. *S. sadanundio* (Hamilton) (Pl. IX, fig. D)—India : Sunderbans, Calcutta, W. Bengal ; Godavary estuary. Bangladesh. Sri Lanka. Malaya. Indo-Australian Archipelago.
6. *S. yanamensis* Rao, V V.—India : Godavary estuary.

KEY TO SPECIES

1.	Lower jaw prominent. ...	*S. sadanundio*
—	Upper jaw prominent. ...	... 2
2.	Teeth of inner row in lower jaw laterally enlarged. ...	*S. poecilosoma*
—	Teeth of inner row in lower jaw laterally not enlarged. ...	... 3
3.	No blotches and stripes on body. No spot on first dorsal fin. ...	*S. minima*
—	Body with colour blotches and/or stripes. First dorsal fin banded or with spots. ...	... 4
4.	Tongue rounded. 25-27 scales in lateral series. ...	*S. javanicus*
—	Tongue truncate. 27—29 scales in lateral series. ...	... 5
5.	A pore behind eye and two pores connected by a short tube in the middle of the preopercular margin. A row of papillae on opercle from behind the upper pore of the preopercular margin to the ventral margin of opercle. Body with four oval spots along sides. ...	*S. yanamensis*
—	Two pores before and two behind eye, the pores joined by a short tube in the vertical preopercular margin. Two parallel rows of papillae from lower jaw to the corner of preopercle. Body with spots on sides, not well defined ...	*S. micrognathus*

Genus **Bathygobius** Bleeker

Bathygobius Bleeker, 1878, *Arch. neerl. Sci.*, **13**, p. 54 (type-species, *Gobius nebulopunctatus* Valenciennes, by original designation).

Diagnosis.—Body elongate, anteriorly subcylindrical, posteriorly compressed. Abdomen rounded. Head depressed, scaled above behind

eyes. Cheek may be scaled or naked. Snout short about as long as eye. A mucous canal from snout to angle of mouth present. Mouth a little oblique, cleft just extending to anterior margin of orbit. Jaws subequal, lower jaw a little prominent. Teeth in several rows, in lower and upper jaws outer rows enlarged, in former extending to halfway the jaw, inner row laterally enlarged, some times some of these teeth are caniniform. Tongue bilobate. *Gill openings may or may not continued forward below isthmus which is broad or moderate.* Two dorsal fins separate, first inserted near base of pectoral fin with six rays, second with one spine and eight to eleven rays. Pectoral fin with some free silk-like rays at the upper margin. Pelvic fins united, oblong. Anal fin with one spine and seven to nine rays. Caudal fin obtuse. *Scales* cycloid and ctenoid, *35-40 in lateral series.*

Distribution.—All tropical seas and estuaries.

Species visiting freshwater.—

1. *B. fuscus* (Rüppell)—India : Hooghly, Godavary, Rukmavati river, Gujarat and other areas as of the genus.
2. *B. orbicularis* (Rao)*—India : Godavary estuary.

KEY TO SPECIES

1.	Predorsal scales eight. Tongue rounded. ...	*B. orbicularis*
—	Predorsal scales rudimentary about 19. Tongue bilobate or emarginate. ...	*B. fuscus*

Genus **Brachygobius** Bleeker

Brachygobius Bleeker, 1874, *Arch. neerl. Sci.*, 9, p. 315 (type-species, *Gobius doriae* Günther, by original designation).

Diagnosis.—Body elongate, compressed. Abdomen subcylindrical. Head depressed, head and nape with very thin cycloid scales, falling off easily. Snout blunt. Mucous canal under eye, and opercle prominent. Mouth oblique, its cleft extending to anterior border of eye. *Neck with a median longitudinal groove.* Eyes large, superior, in mid part of head, not visible from below ventral surface. Lips thick. Jaws subequal, lower jaw a little prominent. Villiform teeth on both jaws, outer row enlarged. No canines. *Tongue rounded.* Gill openings not continued forward below ; isthmus broad. Two dorsal fins separated by an interspace ; first dorsal inserted above base of pectoral fin with six rays ; second with eight or nine rays. Pectoral fin with free silk-like

*Originally described by Rao, V.V. (1971) under the genus *Paragobiopsis* Koumans, 1941.

rays. Pelvic fins united, oblong. Anal fin with 7-10 rays. *Caudal fin rounded.* Scales ctenoid on opercle, 25-27 scales along lateral series.

Distribution.—India. Malaya. East Indies. Bangladesh.

Species visiting freshwater.—*B. nunus* (Hamilton)—India : R. Hooghly. Bangladesh. Burma.

Subfamily PERIOPHTHALMINAE

Scales above on cheek and opercle of head region. Teeth in upper jaw in one or two rows, in lower jaw in a single row. Scales cycloid to weakly ctenoid. Second dorsal fin not much longer than the first one.

KEY TO GENERA

1. Teeth in upper jaw in a single row.	...	*Periophthalmus* Bloch & Schneider
— Teeth in upper jaw as two rows.	...	*Periophthalmodon* Bleeker

Genus **Periophthalmus** Bloch & Schneider

Periophthalmus Bloch & Schneider, 1801, *Systema Ichthyologia* p. 63 (type-species, *Periophthalmus papilio* Bloch & Schneider).

Diagnosis.—Body elongate, slightly compressed. Abdomen subcylindrical. Head short, compressed, scaled above behind eyes, cheek, and opercle. Snout blunt ; *profile from eyes to snout very steep.* Mouth horizontal, cleft not extending to orbit. *Eyes close together, prominent, large,* eyelids well developed, *placed on top of head,* in anterior part of head, not visible from below ventral surface. Lips thick. Jaws subequal. Uneven conical teeth in a single row on jaws, anterior ones more or less caninoid. Tongue rounded, nearly totally adnate to the floor of mouth. Gill openings narrow ; isthmus broad. Two dorsal fins separated by an interspace, first dorsal inserted above base of pectoral fin, with 8-17 rays, anterior rays prolonged ; second with 10-14 rays. *Pectoral fins with a muscular base.* Pelvic fins united at the base only, rays completely separate. Anal fin with 9-12 rays. Caudal fin asymmetrical, dorsal rays longer than ventral one. Scales cycloid to very weakly ctenoid, 60-95 along lateral series.

Distribution.—Tropical seas of Africa, Red Sea to Pacific, Australia.

Species visiting freshwater.—

1. *P. koelreuteri* (Pallas)—India : mouth of river Hooghly, Sunderbans, W. Bengal, Port Blair, Nankauri Isls., Nicobars. Also East Africa to Samoa Isls.

2 *P. pearsei* Eggert—India : Port Canning, Sunderbans, W. Bengal. Burma.

3. *P. weberi* Eggert—India : Roopnarayan river at Tamluk, W. Bengal. Also New Guinea.

KEY TO SPECIES

1.	50-55 scales in lateral series. ...	*P. weberi*
—	65-90 scales in lateral series.	2
2.	First dorsal fin lower than body, triangular, with eight to ten rays. Predorsal scales 22-24. ...	*P. pearsei*
—	First dorsal fin higher than body convex, with 10-17 rays. Predorsal scales 32-34. ...	*P. koelreuteri*

Genus **Periophthalmodon** Bleeker

Periophthalmodon Bleeker, 1874, *Arch. neerl. Sci.*, 9, p. 326 (type-species, *Gobius schlosseri* Bleeker.—Koumans, 1953, *Fish. Indo-Austral. Archipel.*, **10**, p. 215.

Diagnosis.—Body elongate, a little compressed. Abdomen rounded. Head entirely scaled, compressed. Snout blunt. Mouth horizontal, cleft extending beyond anterior border of orbit. *Eyes close together, superior, prominent above dorsal profile, in anterior part of head,* not visible from below ventral surface. Lips moderate. Jaws equal. *Teeth in upper jaw in two rows, outer row with anterior teeth enlarged, caninoid,* inner row smaller. In lower jaw one row partly caninoid. Tounge rounded, nearly totally adnate to the floor of mouth. Gill openings narrow. Two dorsal fins, close together, but separate; *first may be absent,* if present composed of very short spines or 3-14 rays ; second with 11-14 rays. Pectoral fins with a muscular base. Pelvic fins nearly totally united, infundibuliform with a low basal membrane ; or only united with their bases and not infundibuliform, the rays completely separated. Anal fin with 11-13 rays. Caudal fin asymmetrical, oblong. Scales cycloid, 45-60 in lateral series.

Distribution.—India : coast and rivers of W. Bengal. Bangladesh. Burma. Andamans to Malay Archipelago and beyond.

Species visiting freshwater.—

1. *P. schlosseri* (Pallas)—Mudflats in India. Bangladesh. Pakistan. East Indies. Philippines. Melanesia. Queensland. Fiji. Australia.
2. *P. tredcemradiatus* (Hamilton)—India. Bangladesh. Burma. Thailand. Sumatra.

KEY TO SPECIES

1.	Pelvic fins totally united ; basal membrane well developed. ...	*P. schlosseri*
—	Pelvic fins nearly separate, only a narrow membrane at the base ; basal membrane absent. ...	*P. tredcemradiatus*

Subfamily SICYDIAPHIINAE

Scales above and behind the eyes of head. Cheek naked. A single row of simple teeth on lower jaw ; in upper jaw a row of teeth behind which, sometimes some hidden rows are present. Scales mixed, cycloid and ctenoid. Second dorsal fin not elongated. Gill openings not very wide, isthmus broad.

KEY TO GENERA

1.	Pelvic fins united forming together a sucking disc which is attached to the belly. ...	*Sicyopterus* Gill
—	Pelvic fins united but not adherent to the belly. ...	*Gobiopterus* Bleeker

Genus **Sicyopterus** Gill

Sicyopterus Gill, 1860, *Proc. Acad. nat. Sci. Philad.*, p. 101 (type-species, *Sicyopterus stimpsoni* Gill, by original designation).

Diagnosis.—Body elongate, nearly cylindrical, compressed. Abdomen rounded. Head moderate, a little depressed, scaled above and behind eyes, cheek naked. Snout blunt. Mouth nearly horizontal, cleft just extending to anterior margin of eye. Eyes moderate, superior, in anterior part of head, not visible from below ventral surface. Lips thick. Jaws subequal, *upper jaw with a single row of numerous movable teeth*; lower jaw with a row of widely set conical teeth, *a pair of canines behind symphysis*. Gill openings of moderate width. Two dorsal fins, separated by a notch, first inserted above last quarter of pectoral fin with six rays ;

second with 10-12 rays. Pectoral fins without free silk-like rays. *Pelvic fins united into a short, cup-shaped disc.* Anal fin with 10-12 rays. Caudal fin wedge-shaped. Scales ctenoid and cycloid, 52-80 along lateral series.

Distribution.—Madagascar to the Pacific.

Species visiting freshwater.—*S. griseus* (Day)—India : Madras in backwaters.

Genus **Gobiopterus** Bleeker

Gobiopterus Bleeker, 1874, *Arch. neerl. Sci.*, 9, p. 311 (type-species, *Apocryptes brachypterus* Bleeker).

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head compressed, without scales. Snout blunt. Mouth very oblique, cleft vertical, extending to anterior border of orbit. Eyes moderate, superior, in anterior part of head, not visible from below ventral surface. Lips thin. Jaws subequal, teeth large, conical in both *jaws in one row, in upper jaw caninoid*, in lower jaw *anterior ones caninoid*, lateral ones smaller ; in lower jaw behind symphysis on each side a canine, implanted a little more inwards. No labial teeth. Tongue bilobate. Two dorsal fins, separate, first inserted above half of pectoral fin, with five or six rays, second with seven or eight rays. Pectoral fins without silk-like rays. Pelvic fins united, but free from belly. Anal fin with 7-13 rays. Caudal fin truncate. Scales ctenoid, 27 along lateral series.

Distribution.—India. Bangladesh. Thailand. Singapore.

Species visiting freshwater.—*G. chuno* (Hamilton)—India : W. Bengal ; Chilka lake, Orissa ; Ennur backwaters. Bangladesh.

Subfamily Apocryptinae

Scales above and on sides of head. Teeth in upper jaw in one row, in lower jaw subhorizontal. An erect canine present on each side of symphysis in lower jaw. Scales cycloid. Second dorsal fin elongated. Gill openings narrow to moderate.

KEY TO GENERA

1.	Free lower eyelid present. ...	...	2
—	Free lower eyelid absent. ...	...	3
2.	No barbel on head. Lower jaw teeth obliquely notched. ...		*Boleophthalmus* Valenciennes
—	Lower side of head with barbels. Lower jaw teeth pointed. ...		*Scartelaos* Swainson

3.	Teeth in lower jaw, obtuse or bilobate. ...	*Apocryptes* Valenciennes
—	Teeth in lower jaw pointed, anterior teeth in upper jaw caninoid. ...	... 4
4.	Scales minute, more than 200 along lateral series. ...	*Pseudapocryptes* Bleeker
—	Scales moderate, about 80 along lateral series. ...	*Parapocryptes* Bleeker

Genus **Pseudapocryptes** Bleeker

Pseudapocryptes Bleeker, 1874, *Arch. Neerl. Sci.*, 9, p. 328 (type-species, *Apocryptes lanceolatus* Cantor, by original designation).

Diagnosis.—Body very long, compressed. Abdomen subcylindrical. Head large, subcylindrical, totally or nearly totally scaled. Snout conical. Mouth a little oblique, or horizontally cleft, extending to middle or hind edge of orbit. Eyes moderate, placed on top of head in line with dorsal profile, in anterior part of head, not visible from below ventral surface. Lips thin. Jaws subequal, upper jaw a little prominent. Villiform teeth, sparsely set on each jaw ; in upper jaw front teeth much larger than lateral ones. *In lower jaw, a canine on each side behind the symphysis.* Tongue rounded, nearly totally adnate to mouth. Gill openings not very wide, isthmus broad. Two dorsal fins, nearly continuous ; *first inserted just behind tip of pectoral fin with rays* : second long, with 27-30 rays. Pectoral fins without free silk-like rays, base scaled. Pelvic fins united, oblong. *Anal fin with 25-29 rays. Caudal fin lanceolate.* Scales small, cycloid.

Distribution.—India to Malay Archipelago.

Species visiting freshwater.—P. lanceolatus (Bloch & Schneider) (Pl. IX, Fig. A)—India. Bangladesh. East Indies. Penang. West coast of Malaya. Thailand. China. Japan. Tahiti.

Genus **Parapocryptes** Bleeker

Parapocryptes Bleeker, 1874, *Arch. Neerl. Sci.*, 9, p. 327 (type-species, *Apocryptes microlepis* Bleeker).

Diagnosis.—Body very elongate, compressed posteriorly. Abdomen subcylindrical. Head subcylindrical, naked or scaled behind eyes, laterally scaled from under eye on cheek and opercle. , Snout conical. Mouth a little oblique, cleft extending to below hind edge of orbit. Eyes moderate, superior in middle of head, not visible from below ventral surface. Lips thin. Jaws subequal. Teeth in both jaws in one row, in upper jaw anterior ones caninoid ; in lower jaw horizontal,

pointed, on each side behind symphysis a canine. *Upper jaw with a concavity receiving tip of lower jaw. Tongue truncate, nearly totally adnate to floor of mouth.* Two dorsal fins, close together, separated by a short interspace, first above tip of pectoral fin, with six rays, second with 19-29 rays. Pectoral fins without free silk-like rays, base scaled. Pelvic fins united, oblong. Anal fin with 19-28 rays. Caudal fin pointed. Scales deciduous, cycloid, 65-75 scales along lateral series.

Distribution.—India. Bangladesh. Burma. Thailand. China.

Species visiting freshwater.—

1. *P. batoides* (Day)—Bangladesh. Burma : Moulmein.
2. *P. rictuosus* (Valenciennes)—India : Chilka lake, Ennur backwaters, Vishakhapatnam.
3. *P. serperaster* (Richardson)—India : Port Canning, W. Bengal ; Madras. Burma : Rangoon. Thailand : Nontaburi.

KEY TO SPECIES

1.	Body depth 7.0 to 9.0 in total length. ...	*P. serperaster*	
—	Body depth 11.0 to 14.0 in total length. ...	...	2
2.	Dorsal fins not united. ...	*P. batoides*	
—	Dorsal fins united. ...	*P. rictuosus*	

Genus **Apocryptes** Valenciennes

Apocryptes Valenciennes, 1837, In : Cuvier & Valenciennes, *Hist. Nat. Poiss.*, **12**, p. 142 (type-species, *Gobius pectinirostris* Gmelin).

Diagnosis.—Body very elongate, compressed. Abdomen subcylindrical. Head with scales, short, subcylindrical. Snout conical. Mouth oblique, cleft exending to below hind border of eyes. Eyes moderate, superior, in middle of head, not visible from below ventral surface. Lips thick. Jaws subequal, lower jaw slightly the longer. *Conical teeth in a single fixed row on either jaw,* with usually a pair of canines in the lower jaw behind the symphysis. Tounge rounded, nearly totally adnate to floor of mouth. Gill openings not very wide ; isthmus broad. Two dorsal fins ; separated by a short interspace or slightly united ; first inserted just behind tip of pectoral fin with five or six flexible spines ; second long with 21 or 22 rays. Pectoral fins with free silk-like rays. Pelvic fins united, forming a disc and only attached by their bases. Anal fin long with 21-23 rays. Caudal fin lanceolate. Scales cycloid, large and small ones intermixed, about 100 along lateral series.

Distribution.—India : Orissa and Lower Bengal. Bangladesh. Burma.

Species visiting freshwater.—*A. bato* (Hamilton)—(Pl. IX, Fig. B) distribution as of the genus.

Genus **Boleophthalmus** Valenciennes

Boleophthalmus Valenciennes, 1837, In : Cuvier & Valenciennes, *Hist. Nat. Poiss.*, **12**, p. 198 (type-species, *Gobius boddarti* Pallas, by original designation).

Diagnosis.—Body very elongate, compressed. Abdomen subcylindrical. Head oblong, covered with a warty skin, totally scaled, or with rudimentary scales. Snout blunt. Mouth a little oblique, cleft extending beyond anterior border of eye. *Eyes very prominent, situated on top of head, close together, with outer eyelids well developed,* in anterior part of head not visible from below ventral surface. Lips thick. Jaws subequal, lower jaw a little longer. A single row of teeth on each jaw ; in upper jaw conical with anterior ones caninoid, in lower jaw subhorizontal, flattened and obliquely notched ; on each side of symphysis a curved canine present. Tongue truncate, nearly adnate to floor of mouth. Gill openings obliquely placed, isthmus broad. Two dorsal fins, separated by an interspace ; first inserted above three fourth of pectoral fin with five rays ; second with 22-27 rays. Pectoral fins without free silk-like rays, base muscular, scaled. Pelvic fins united, oblong. Anal fin long with 24-27 rays. Caudal fin oblong, asymmetrical. Scales small, cycloid, 75-125 along lateral series.

Distribution.—Coastal regions of tropical Indo-Pacific.

Species visiting freshwater.—

1. *B. boddarti* (Pallas)*—India : Madras, Bombay, Vishakhapatnam, Sunderbans, W. Bengal. Bangladesh. Burma. Pakistan. Thailand. Malaya. East Indies.
2. *B. dussumieri* Valenciennes—India : Bombay, Sunderbans, W. Bengal. Pakistan : Baluchistan, Sind. Iraq.

KEY TO SPECIES

1.	Body with oblique bands.	...	*B. boddarti*
—	Body without oblique bands.	...	*B. dussumieri*

*Day (1876, *Fish. India*, p. 307 uses the spelling *B. boddearti* which is incorrect.

Genus **Scartelaos** Swainson

Scartelaos Swainson, 1839, *Nat. Hist. Class. Fish.*, 2, pp. 183, 279 (type-species, *Gobius viridis* Hamilton).

Diagnosis.—Body very elongate, posteriorly compressed. Abdomen subcylindrical. Head a little depressed, *covered with a warty skin.* A row of short barbels along lower side of head on each side. Snout blunt. Mouth a little oblique. *Eyes moderate, close together, movable to above dorsal profile of head,* in anterior part of head, not visible from below ventral surface ; *lower eyelid well developed.* Lips thick. Teeth in both jaws in a single row, in upper jaw caninoid, in lower jaw anteriorly subhorizontal, posteriorly more erect ; both jaws pointed. A pair of canines behind symphysis of lower jaw. Tongue rounded, nearly totally adnate to floor of mouth. Two dorsal fins, separate, first inserted above half to three fourth of pectoral fin, with five or six rays ; second with 24-28 rays. Pectoral fins without free silk-like rays, base muscular. Pelvic fins united, oblong. Anal fin with 23-25 rays. Caudal fin lanceolate. Scales minute, rudimentary.

Distribution.—India. Bangladesh. Pakistan. Also Mesopotomia extending to Pacific.

Species visiting freshwater.—*S. histophorus* (Val.)* (Pl. X, Fig. D.) India : Canning, W. Bengal ; Chandipore, Balasore, Orissa ; Bulsan, Maharashtra. Bangladesh.

Family Gobioididae

Body very elongate, eel-like. Head with several ridges of papillae. Ventral side of head with barbels. A long dorsal fin continuous up to caudal fin, with a distinct spinous part. *Pelvic fins united.* Eyes small to indistinct. Isthmus broad. Anal fin long, separated from caudal by a notch. Air-bladder usually absent. Lateral line absent. Scales cycloid or absent. Very unique eel-like gobies, found in seas and estuaries.

Two genera are dealt with here.

KEY TO SUBFAMILIES

1. No pit in upper margin of opercle opening to a cavity, which is separate from the gill cavity. ... TAENIONINAE
— A pit in upper margin of opercle opening to a cavity, which is separate from the gill cavity. ... TRYPAUCHENINAE (Genus *Trypauchen* Valenciennes)

*The name *Gobius viridis* Hamilton is preoccupied by *Gobius viridis* Otto, 1821 : hence the specific name is changed to *histophorus* (Koumans, 1953, p. 263).

Subfamily TAENIONINAE

Body eel-like. No pit or depression in upper margin of opercle. Eyes small, rudimentary. Dorsal and anal fin long, more or less connected with caudal fin. Scales minute or rudimentary.

KEY TO GENERA

1. Cleft of mouth nearly vertical. Pectoral fin much shorter than pelvic fin, about 3.0 in head length. ... *Taenioides* Lacépède
— Cleft of snout very oblique. Pectoral fin as long as pelvic fin, about 1.5 in head length. ... *Odontamblyopus* Bleeker

Genus **Taenioides** Lacépède

Taenioides Lacépède, 1798, *Hist. Nat. Poiss.*, 2, p. 532 (type-species, *Taenioides hermannianus* Lacépède)

Diagnosis.—Body much elongated, almost eel-like, compressed. Abdomen rounded. Head long, cylindrical, almost naked without scales. Several ridges of papillae on head radiating from eye on cheek, opercle and on lower jaw. Some barbels on ventral side of head. Snout blunt. *Mouth almost vertical,* cleft not extending to orbit. Eyes minute, reduced, hidden, in anterior part of head, not visible from below ventral surface. Lips laterally fringed. Jaws subequal : lower jaw prominent. Truncate to obtusely pointed teeth on both jaws, placed in a band of several rows : outer row separate, widely set, enlarged, more or less caninoid. Tongue rounded. Gill openings not very wide, isthmus broad. Two dorsal fins ; first spinous, inserted behind pectoral fin but continuous with soft part, with 43-49 rays (five or six simple). Pectoral fins fleshy. Pelvic fins large, oblong, united. Anal fin very long with 45-49 rays. Both dorsal and anal fins separated from caudal by a notch. Caudal fin rhomboidal, tapering. Scales rudimentary, almost absent.

Distribution.—East coast of Africa to Pacific.

Species visiting freshwater.—

1. *T. anguillaris* (Linnaeus)—India : Uttarbhag, Sunderbans, Calcutta, W Bengal, Port Blair, Andamans. Burma : Penang. China.
2. *T. cirratus* (Blyth) (Pl. X, Fig. B)—India : Calcutta, Port Blair. Bangladesh. Indo-Australian Archipelago. Zanzibar.

KEY TO SPECIES

1. Second dorsal fin and anal separated by a deep notch from caudal fin. ... *T. cirratus*

— Second dorsal fin and anal continuous with caudal fin. ... *T. anguillaris*

Genus **Odontamblyopus** Bleeker

Odontamblyopus Bleeker, 1874, *Arch. neerl. Sci.*, 9. p. 330 (type-species, *Gobioides rubicundus* Hamilton, by original designation).

Diagnosis.—Body very elongate, eel-like, compressed. Abdomen rounded, cylindrical. Head long, compressed, nearly totally scaled with minute rudimentary scales. Snout-blunt. *Mouth oblique*, cleft wide, extending to beyond orbit. Eyes very small, superior, near dorsal profile of head, in anterior part of head, not visible from below ventral surface. Lips thick. Jaws subequal ; lower jaw prominent. Teeth in upper jaw on each side, four canines on outer row, in lower jaw on each side four to six canines. A pair of canines behind symphysis of lower jaw. *A row of about three indistinct barbels on lower side of head on either side.* Two dorsal fins, first spinous, inserted above half of pectoral fin, with soft part continuous with 35-40 rays (six simple). Pectoral fins long. Pelvic fins united, oblong. Anal fin with 33-38 rays. Dorsal and anal separated from caudal by a notch. Caudal fin pointed, long. Scales minute, rudimentary, in the form of crypts on head, minute ones begin to appear on body in its last half, becoming more distinct on tail.

Distribution.—India to Japan, Indo-Australian Archipelago.

Species visiting freshwater.—O. rubicundus (Hamilton) (Pl. X, Fig. A).—India : Hooghly, W. Bengal. Bangladesh. West coast of Malaya. China. Japan.

Subfamily Trypaucheninae

Body eel-like. A pit at upper margin of opercle present. Eyes small. Dorsal and anal fin long, connected to caudal fin. Scales large.

Genus **Trypauchen** Valenciennes

Trypauchen Valenciennes, 1837, In : Cuvier & Valenciennes, *Hist. Nat. Poiss.*, **12**, p. 162 (type-species, *Gobius vagina* Bloch & Schneider).

Distribution.—Body very elongate, compressed. Abdomen rounded. *Head* compressed, naked, *with a median crest on occiput.* Snout conical, but not sharp. Mouth very oblique, cleft extending to behind orbit.

Eyes very small, covered by skin, in anterior part of head, not visible from below ventral surface. Lips thin. Jaws equal. Teeth in both jaws in two or three rows, outer one strongly enlarged, caninoid. Tongue rounded. *Two dorsal fins, continuous*, inserted above half of pectoral fin, with six simple rays and 41-49 branched rays. Pectoral fins small. *Pelvic fins very small*, united, forming a disc. Anal with 40-46 rays, *both dorsal and anal fins connected with caudal fin.* Caudal fin pointed. Scales cycloid, 80-115 scales along lateral series.

Distribution.—India. Pakistan. Bangladesh. Also from Persian Gulf to Indo-Australian Archipelago. China.

Species visiting freshwater.—T. vagina (Bloch & Schneider)—India : Hooghly, Matlah river, W. Bengal ; Vishakhapatnam, Buslan, Maharashtra, Goa. Bangladesh. Burma : Mandalay. Thailand : Tale Sap.

Family ELEOTRIDAE*

Body varying from oblong to elongate. Head with mucous canals and open pores. Two dorsal fins, united with each other or separated. *Pelvic fins separate.* Anal fin moderate to long, free from caudal fin. Lateral line absent. Scales cycloid or ctenoid, mostly present.

Found in all seas. *Eleotris fusca* is very common in freshwater rivers far inland.

Five genera are dealt with here.

KEY TO GENERA

1.	Preopercle with a single downward facing, curved, strong spine at its angle. ...	*Eleotris* Bloch & Schneider
—	Preopercle without a spine. ...	... 2
2.	Head with well developed bony crests. ...	*Butis* Bleeker
	Head without bony crests ...	... 3
3.	Scales of body cycloid. ...	*Odonteleotris* Gill
—	Scales of body cycloid and ctenoid. ...	... 4
4.	Scales of body 30-40 along lateral series, ctenoid posteriorly. Caudal fin rounded. ...	*Ophiocara* Gill
—	Scales of body 62 along lateral series, cycloid in front and on tail region. Caudal fin subtruncate. ...	*Incara* Rao

*Greenwoood *et al.* (1966) have treated this along with Gobiidae. Nelson (1976) has kept Eleotridae as a separate family. This is adopted here.

Genus **Eleotris** Bloch & Schneider

Eleotris Bloch & Schneider, 1801, *Syst. Ichth.*, p. 65 (type-species, *Gobius pisonis* Gmelin after Gronow).

Diagnosis.—Body oblong to elongate, posteriorly compressed. Abdomen rounded. Head oblong, depressed, scaled above from between eyes or behind eyes, partly or totally scaled on sides. Snout blunt. Mouth oblique, cleft extending to anterior border of eyes. Eyes moderate, superior, in anterior part of head, not visible from below ventral surface. Lips thick. Jaws subequal, lower jaw prominent. Teeth on jaws in several rows, outer row enlarged. No canines. Tongue rounded. Gill openings extend up to base of pectoral fin only ; isthmus brcad. *A single downward curved spine at angle of preopercle.* Two dorsal fins separated by a notch, or nearly continuous ; first inserted above half to three-fourth of pectoral fin, with six spinous rays ; second with eight or nine rays. Pectoral fins rounded with thick base, scaled. Pelvic fins placed close together but separate. Anal fin with one spine and eight or nine rays. Caudal fin rounded. Scales ctenoid, posteriorly becoming cycloid before dorsal fin, with 50-65 scales along lateral series.

Distribution.—Tropical seas, mostly found along shores, estuaries and tidal rivers.

Species visiting freshwater.—E. fusca (Bloch & Schneider) (Pl. IX, Fig. C)—Red sea and east coast of Africa to the Pacific. Common along coasts of India, Pakistan, Bangladesh to Malay Archipelago. Found in inland waters hundred miles and more from the sea.

Genus **Butis** Bleeker

Butis Bleeker, 1874, *Arch. neerl. Sci.*, 9, p. 304 (type-species, *Cheilodipterus butis* Hamilton, by original designation).

Diagnosis.—Body elongate posteriorly. Abdomen rounded. *Head* large, *flat*, subcylindrical, scaled above from between or behind the eyes. Cheek scaled or naked. Snout long, pointed. *Bony crests on head in inter-orbital and around eyes.* Mouth terminal, wide, cleft extending to anterior border of eyes. Eyes moderate, superior, in middle of head, not visible from below ventral surface. Lips thick. Jaws nearly equal ; lower jaw prominent. Small pointed teeth in many rows ; outer row not enlarged, inner row on lower jaw a little enlarged. Two or three open pores on posterior margin of preopercle. Two dorsal fins, separated by a short interspace ; first inserted above half to three-fourth of

pectoral fins, with six rays ; second with eight or nine rays. Pectoral fins long, base not muscular. Pelvic fins separate. Anal fin with one spine and eight or nine rays. Caudal fin ovate. Scales ctenoid, 30 along lateral series.

Distribution.—East Africa, India to Taiwan and Queensland.

Species visiting freshwater.—B. melanostigma (Bleeker)—Seas and estuaries of India, Pakistan, Bangladesh to Malay Archipelago.

Genus **Odonteleotris** Gill

Odonteleotris Gill, 1863, *Proc. Acad. nat. Sci. Philad.*, **15**, p. 270 (type-species, ***Eleotris macrodon*** Bleeker, by original designation).

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head short, depressed, scaled except on snout. Snout obtuse. A number of short mucous canals radiate under eye ; two on cheek. Mouth oblique, wide, cleft extending to middle of orbit. Eyes moderate, superior, in anterior part of head, not visible from below ventral surface. Lips thick. Jaws subequal, upper jaw slightly shorter than

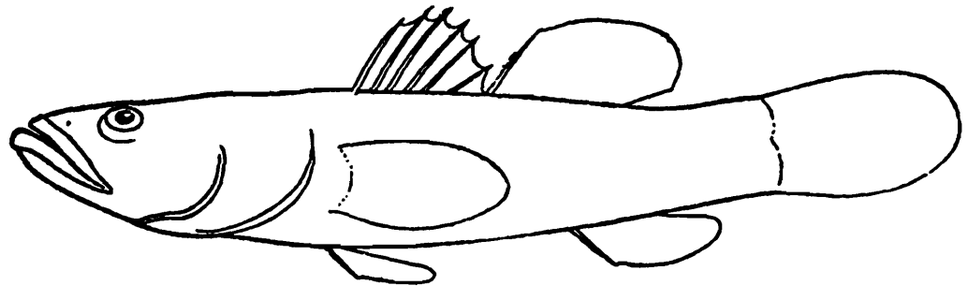


Fig. 194. Outline drawing of *Odonteleotris obscura* (Temm. & Schlegel) to show dorsal fins separated by a notch.

lower. Conical teeth in several rows on upper and lower jaw, lower jaw with about eight caninoid teeth in outer row. Two dorsal fins separated by an interspace ; first inserted above half of pectoral fin with six spinous rays ; second with nine rays. Pectoral base not muscular. Pelvic fins separate. Anal fin with one spine and eight rays. Caudal fin rounded. *Scales cycloid in irregular rows over head and lower jaw* ; posterior half of caudal fin scaled. 90 scales along lateral series.

Distribution—India. Pakistan. Bangladesh. Burma through Malay Archipelago to Australia.

Species visiting freshwater.—O. macrodon Bleeker—India : W. Bengal. Burma. E. Indies.

Genus **Ophiocara** Gill

Ophiocara Gill, 1863, *Proc. Acad. nat. Sci. Philad.*, **15**, p. 270 (type-species, ***Eleotris*** *ophiocephalus* Valenciennes, by original designation).

Diagnosis.—Body elongate, compressed. Abdomen rounded. Head large, obtuse, flat, depressed, totally scaled. Snout pointed. Mouth oblique, cleft extending to anterior border of eye or slightly beyond. Eyes moderate, lateral, in anterior part of head not visible from below ventral surface. Lips thick. Jaws subequal, lower jaw prominent. Conical teeth in several rows on both jaws, outer row a little enlarged in upper jaw, inner row enlarged in lower jaw. No canines. Gill openings extending to ventral surface, isthmus narrow. Two dorsal fins, separated by a short interspace, first inserted above half of pectoral fin with six rays. Pectoral fin base muscular. Pelvic fins separate. Anal fin with one spine and six to nine rays. Caudal fin rounded. Scales ctenoid, 30-40 along lateral series.

Distribution.—Madagascar to Australia.

Species visiting freshwater.—*O. porocephalus* (Valenciennes)—India. Bangladesh. Malaya. Thailand, in estuaries.

Genus **Incara** Rao

Incara Rao, V. V. 1969, *J. mar. biol. Ass. India*, **11** (1 & 2) pp. 323-332 (type-species, *Incara multisquamatus* Rao, by original designation and monotypy).

Diagnosis.—Body robust, elongated, anteriorly cylindrical, posteriorly compressed. Abdomen rounded. *Head* cylindrical, profile slightly concave above eyes, *without bony crests.* Snout blunt. Mouth oblique, cleft extending to anterior border of orbit. Lips thin. Eyes large, normally developed, superior, in anterior part of head and not visible from below ventral surface. Lower jaw prominent. In upper jaw many rows of small teeth, outer row enlarged, strong and curved, increasing in size posteriorly, a strong recurved canine on each side in front. *Lower jaw with many rows of small* sharp teeth, outer row enlarged, extending to half the length of jaw, each side with two strong recurved canines at the end and one in front, inner row also enlarged extending to a little before junction of the jaws, two strong recurved canines at either extremity. Tongue obtuse. No *spines at preopercle.* Two dorsal fins, well separated, *first* inserted above half of pectoral fin, *with six rays.* Second with one spine and nine rays. Pectoral fins without silk-like rays. *Pelvic fins well separated*, with five rays. *Anal fin with* one spine and *eight rays.* Caudal fin subtruncate.

Scales cycloid and ctenoid on head, *62 along lateral series*. Scales on body arranged characterstically, opercle covered with large ctenoid scales, ctenoid scales on body in line behind middle of second dorsal fin base to upper edge of pectoral base and origin of anal to lower edge of pectoral base increasing in size posteriorly ; round cycloid scales in front to behind middle of eyes, on preopercle from down anterior third of eye, on breast, belly and pectoral base ; oval cycloid scales on caudal fin in between rays extending to more than half the length in middle. No scales on other fins. (After Rao, V V. 1969).

Distribution.—India : Godavary estuary.

Species visiting freshwater.—*I. multisquamatus* Rao—distribution as of the genus.

Family STROMATEIDAE

Pomfrets

Body oblong, elevated, compressed. Head and body covered with small scales. Infraorbital bones do not articulate with preopercle. Pseudobranchiae present. Branchiostegals five to seven. Gill openings restricted. Opercle, preopercle without any spine. Teeth on jaws only, laterally compressed simple or with three to five cusps ; palate edentate. A single dorsal fin without any spinous portion : spines if present rudimentary. Pelvic fins thoracic, present in juveniles only. Anal fin concave, with two to six weak spines. Lateral line as a rule smooth. Air-bladder absent. Pyloric appendages numerous.

Two genera are dealt with here.

KEY TO GENERA

1.	Lateral line smooth. Jaws equal. ...	*Pampus* Bonaparte
—	Lateral line in the form of a raised keel with lateral shields. ...	*Parastromateus* Bleeker

Genus **Pampus** Bonaparte

Pampus Bonaparte, 1837, *Iconogr. Fauna. Ital.*, **3**, pt. 9 (type-species not named, but *Stromateus candidus* Cuver, by indication).

Diagnosis.—Body short, elevated, compressed, Abdomen round. Head short, compressed. Snout bluntly obtuse, overhanging the mouth. Mouth terminal, cleft narrow, not extending to orbit. Eyes large, lateral, in middle of head, not visible from below ventral surface. Lips

thin. Jaws equal. A single row of deciduous teeth on jaws. Gill opening restricted to a slit on sides. Two dorsal fins, continuous,

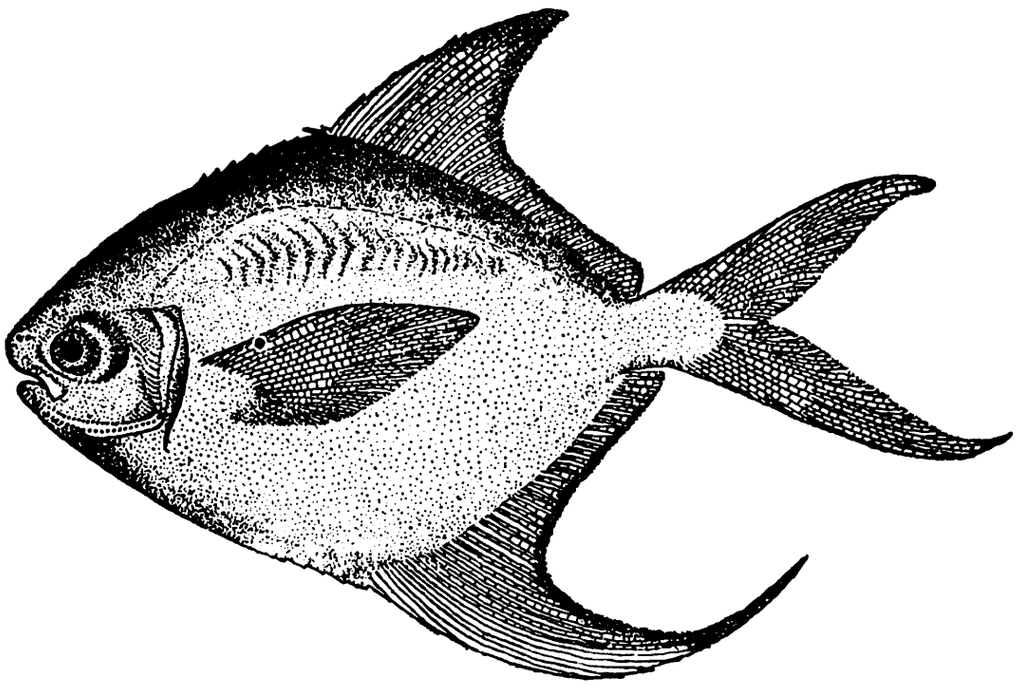


Fig. 195. Lateral view of *Pampus argenteus* (Euphrasen). (After Misra, K. S. 1962, text-fig. 184).

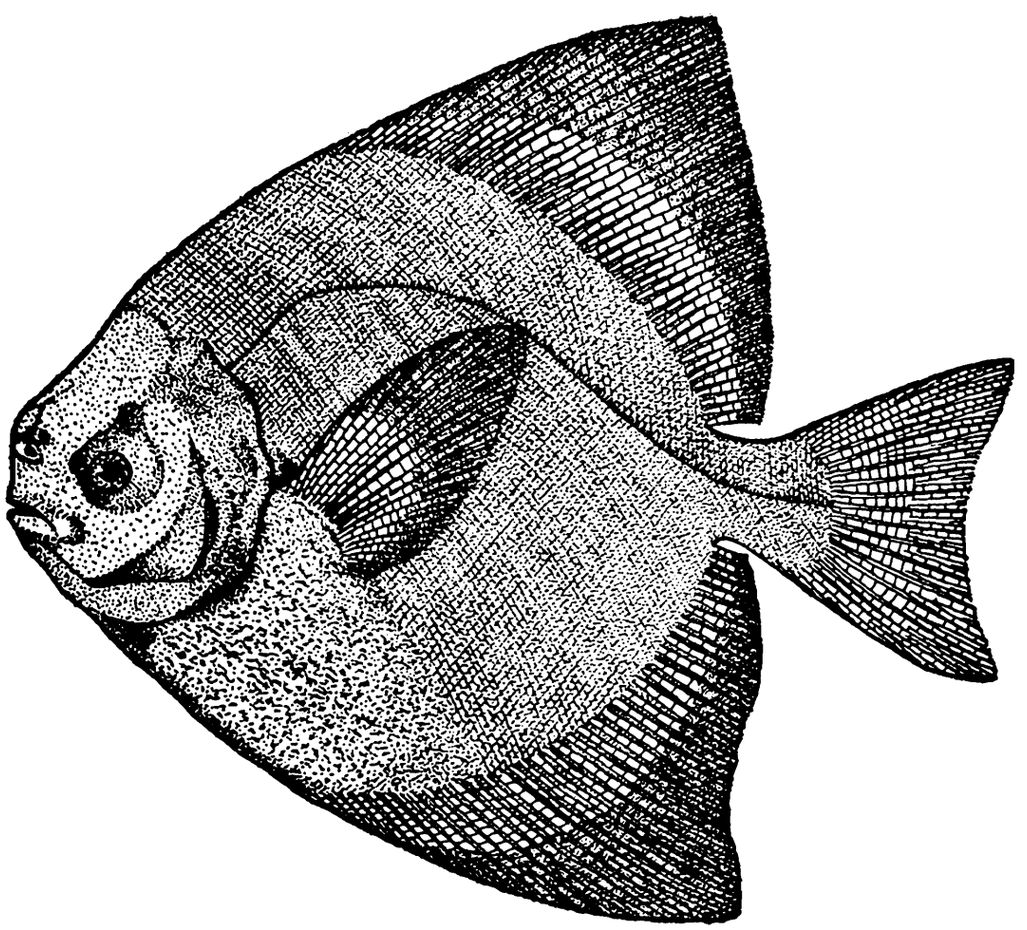


Fig. 196. Lateral view of *Pampus chinensis* (Euphrasen). (After Misra, K. S. 1962, text-fig. 185).

first with five or six spines, very rudimentary, commencing above base of pectoral fins ; second with 38-50 rays much elevated and semilunar in shape and with a concave margin. Anal fin with 32-42 rays similar to dorsal fin in shape and with few rudimentary spines. Caudal fin deeply forked. Scales small, covering the vertical fins. *Lateral line smooth.*

Distribution.—Mostly marine, found in tropical and temperate seas, India. Pakistan. Bangladesh.

Species visiting freshwater.—

1. *P. argenteus* (Euphrasen)—India : coast of Kutch, Baroda, Bombay, Malabar, Kerala, Tamil Nadu, Andhra, Orissa, W. Bengal. Pakistan : Sind. Bangladesh. Sri Lanka. Also in Malaya. Malay Archipelago. Thailand. Viet-Nam. China. Korea. Japan. Philippines. Hawaii.
2. *P. chinensis* (Euphrasen)—India : Kerala to W. Bengal along the coast. Bangladesh. Malay Archipelago. China.

KEY TO SPECIES

1. Spines present before dorsal and anal fins. Body depth less than half total length. ... *P. argenteus*

— Spines absent before dorsal and anal fins. Body depth more than half total length. ... *P. chinensis*

Genus **Parastromateus** Bleeker*

Black Pomfret

Parastromateus Bleeker, 1865, *Ned. Tijds. Dierk.*, **4**, p. 174 (type-species, *Stromateus niger*, by original designation).

Diagnosis.—Similar to *Pampus* but differing as below.—

(1) Lower jaw longer (*vs.* equal in *Pampus*).

(2) Lateral line in the form of a raised keel with lateral shields (*vs.* smooth in *Pampus*).

Distribution.—India to Malay Archipelago and China. Common in Kerala.

*Witzel, W. N. 1977 (*Matsya*, 3, pp. 72-82), has ably demonstrated that *Parastromateus niger* (Bleeker) is a synonym of *Apolectus niger* and that the Black Pomfret should be placed in a separate family Apolectidae.

Species visiting freshwater.—*P. niger* (Bleeker)—India : Kutch to W. Bengal along the coast, Andaman Islands. Pakistan : Sind, Makran. Bangladesh. Sri Lanka. Also in Persian Gulf. Zanzibar. Natal. Malaya, Malay Archipelago. Thailand. Viet-Nam. China. Japan. Taiwan. Philippines. Queensland.

Family Anabantidae

Body compressed, moderately elongated. Head and body covered with ctenoid scales. Teeth on jaws and on extremities of prevomer which has two rows of conical teeth. Palate edentate. Suprabranchial organ well developed. Branchial arches with toothed tubercles. Branchiostegals six. Posterior border of opercular and postero-ventral border of interopercular serrated. A single long dorsal fin with spinous and soft part. First ray of pelvic fin not produced into a long filament. Pelvic fin inserted *below* base of pectoral fins. Anal fin with spines. Lateral line interrupted. Air-bladder bifid posteriorly with either extremity produced. Pyloric appendages few or absent.

Extrascapulars present overlying the epiotics and intercalaries. Post-temporal bases absent. Foramen magnum small ; its walls and roof are formed by the exoccipitals. Parasphenoid underlies the greater part of basioccipital, with its process well developed and toothed. Entire straight border of opercular united with posterior border of preopercular. Ectopterygoid present. Meta-pterygoid united with symplectic process of the hyomandibular. Vertebrae 25. (After Liem, 1963).

A single genus is dealt with here.

Genus **Anabas** Cuvier

Climbing perches

Anabas Cuvier, 1817, *Le Regne Animal.*, 2, p. 339 (type-species, *Perca scandens* Daldorf, by monotypy).

Diagnosis.—Body oblong, compressed. Abdomen rounded. Head moderate, compressed. Snout slightly conical, or bluntly rounded. Mouth small, terminal, oblique, cleft not wide. Eyes large, lateral in anterior part of head, not visible from below ventral surface. Lips thin. Jaws equal. Villiform teeth on jaws and on anterior and posterior extremities of vomer ; none on palatines. A cavity above the third, or

upper portion of the first branchial arch contains an elaborate accessory breathing apparatus. Single dorsal fin, inserted above pectoral base, with 17 or 18 spines and 8-10 rays ; number of spines variable. Anal

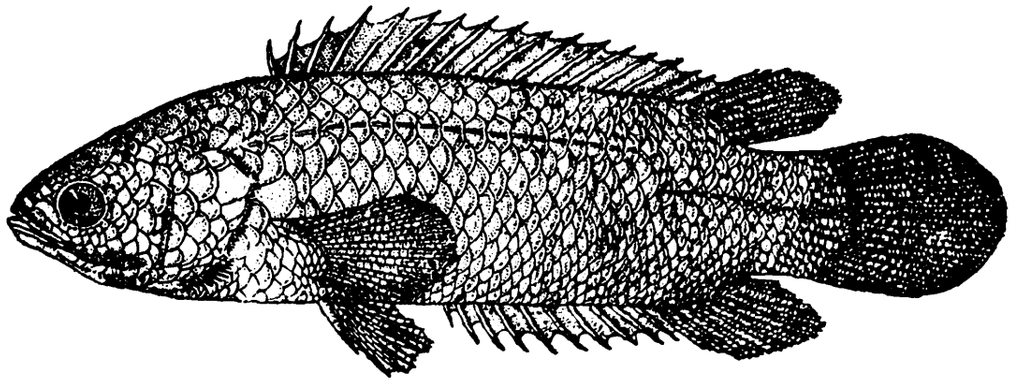


Fig. 197. Lateral view of *Anabas testudineus* (Bloch). After Misra, K, S. 1962, text-fig. 186).

fin with eight to ten spines and 9-11 rays ; number of spines variable. Caudal fin rounded. Scales ctenoid and of moderate size. Lateral line interrupted, with 21-29 scales. Air-bladder present or absent.

Distribution.—Fresh and brackish waters of Asia and South Africa.

Species.—

1. *Anabas oligolepis* Bleeker—India : Bhimavaram, W. Godavari dist., Andhra Pradesh, also Orissa and W. Bengal.
2. *Anabas testudineus* (Bloch)—Throughout India. Pakistan. Bangladesh. Sri Lanka. Burma. Malay Archipelago. Singapore. Philippines.

KEY TO SPECIES*

1.	Body depth 3.1 to 3.5 in standard length. Pectoral fins long, with 13-15 rays. Dorsal fin with eight or nine rays. ...	*A. testudineus*
—	Body depth 2.5 to 2.9 in standard length. Pectoral fins short, with 14-16 rays. Dorsal fin with nine or ten rays. ...	*A. oligolepis*

Remarks.—This fish flourishes most in canals, ditches, lakes, ponds and swamps, though found in other freshwater areas such as streams. It can live in water deficient in oxygen because of its accessory respiratory organ. Because of this it can also go on dry land and by means

*After Rao, B. V. Seshagiri. 1968. *Proc. Indian Acad. Sci.*, **57** (5), pp. 207-214.

of lateral movements of the tail and paired fins, it is able to cross some dry patches. It may be of interest to note that one Danish missionary by name Daldorf was the first to observe its habit of "walking or climbing" at Tranquebar, S. India.

Family Belontidae

A specialised group of Anabantid fishes in which the body is short, compressed, anteriorly depressed to a slight extent. Head and body covered with ctenoid scales generally. Teeth on jaws, none on palate. Pseudobranchiae rudimentary or absent. Branchiostegals five or six. Gill openings rather narrow, membranes united below isthmus. A suprabranchial cavity present. A single dorsal fin with spines and soft rays. *First ray of pelvic fins modified into a filiform ray, or with few rays. Pelvic fins inserted behind base of pectoral fin.* Anal fin with spines. Lateral line vestigial, rudimentary or absent. Air-bladder may be present or absent. Pyloric appendages when present few.

Extrascapulars wanting. Post-temporal fossa well developed. Posterio-inferior portion of the supraoccipital forms part of the roof of the relatively large foramen magnum. A prominent, bilobed pharyngeal process of the basioccipital is present. No transverse process of the parasphenoid, but a well developed pharyngeal process of the parasphenoid present. Interopercular not serrated. Angular and dentary with distinct ascending processes. (After Liem, 1963).

Four genera are dealt with here.

KEY TO THE SUBFAMILIES

1.	Lateral line vestigial or incomplete. Branchiostegal rays six. Suborbital shelf formed by suborbital 2-5. ...	MACROPODINAE
	Lateral line absent. Branchiostegal rays five. Suborbital shelf formed by second suborbital only. ...	TRICHOGASTERINAE

Subfamily Macropodinae

Metapterygoid not articulating with symplectic process of hyomandibular. Suprabranchial cavity not supported by epipleurals. No supraoccipital crest. Epiotics do not reach foramen magnum. Six branchiostegal rays articulating with ceratohyal. Suborbital shelf formed by suborbital 2-5. Lateral line incomplete or vestigial. (After Liem, 1963).

KEY TO GENERA

1. Dorsal fin inserted in posterior half of body above mid anal fin. ... *Ctenops* McClelland
— Dorsal fin inserted above half of pectoral fin. ... *Macropodus* Lacépède

Genus **Ctenops** McClelland

Ctenops McClelland, 1845, *Calcutta J. nat. Hist.*, **5**, p. 281 (type-species, *Ctenops nobilis* McClelland, by original designation).—Tilak, 1976, *Rec. zool. Surv. India*, **70**, (1-4), pp. 14-19 (revision).

Diagnosis.—Body oblong, compressed. Abdomen rounded. Head short, acute, compressed. Snout short, spout like. Mouth terminal, horizontal, cleft wide. Eyes large, lateral, in middle of head, may be visible from below ventral surface. Lips thin. *Upper and lower jaws elongated to form a somewhat pipe-shaped mouth*; *lower jaw longer than upper*. Upper jaw *protrusible*. Conical teeth on jaws, outer row enlarged : palate edentate. Angle and lower border of preoperculum denticulated. A supra-branchial organ present. *Dorsal fin inserted in posterior half of body, above mid-anal fin*, with four to six spines and six or eight rays. *Pelvic fins with a strong spine* and five rays, the first ray produced as a filament. Anal fin with four or five spines and 23-28 rays. Caudal fin rounded. Scales moderate, ciliated on body, but may not be ciliated on head. Median fins covered with scales. Lateral line vestigial with 28-34 scales. Air-bladder extends to caudal region.

Distribution.—India : N. E. Bengal, Assam, Bihar, Sikkim. Bangladesh.

Species visiting freshwater.—*Ctenops nobilis* McClelland—distribution as of the genus.

Genus **Macropodus** Lacépède

Macropodus Lacépède, 1802, *Hist. Nat. Poiss.*, **3**, p. 416 (type-species, *Macropodus viridiauratus* Lacépède)

Diagnosis.—Body oblong, compressed. Abdomen rounded. Head short, compressed. Snout blunt. *Mouth* terminal, small and *little protractile*. Eyes superior, moderate, in anterior part of head, not visible from below ventral surface. Lips thin. Jaws subequal, upper jaw longer. Villiform teeth on jaws ; palate edentate. Preorbital serrated. A supra-branchial organ present. *Single dorsal fin, inserted above half of pectoral fin*, with 14-17 spines and five to ten rays ; spinous part longer than soft part. Pelvic fins with one spine and five well

developed rays, some of which usually elongate. Anal fin with 14-19 spines and 9-12 rays. Caudal fin lanceolate. Scales rather large, ctenoid. Lateral line interrupted, sometimes partially or even entirely absent. Air-bladder simple.

Distribution.—India : South India. Pakistan. Sri Lanka. Bangladesh. Malay Archipelago. Malaya. Java.

Species visiting freshwater.—

1. *Macropodus cupanus* Valenciennes—India : Kerala, Coromandel coasts. Bangladesh. Pakistan. Sri Lanka. Malaya. Malay Archipelago.
2. *Macropodus signatus* (Günther)—Sri Lanka. Java.

KEY TO SPECIES

1.	Dorsal fin with 14-16 spines and 5-7 rays. Body depth 4 in total length (India : W. ghats). ...	*M. cupanus*
—	Dorsal fin with 16-17 spines and 8-10 rays. Body depth 3.3 to 3.5 in total length (Sri Lanka. Java) ...	*M. signatus*

Subfamily TRICHOGASTERINAE

Metapterygoid not reaching symplectic process of hyomandibular. Supra branchial cavity not supported by epipleurals. No supraoccipital crest. Epiotics reach foramen magnum. Five branchiostegal rays articulating with ceratohyal. Suborbital shelf formed by suborbital only. Lateral line absent.

KEY TO GENERA

1.	Dorsal fin with 15-18 long spines, inserted above posterior part of pectoral fin. ...	*Colisa* Cuvier
—	Dorsal fin with four short spines, inserted above anterior part of pectoral fin. ...	*Parasphaerichthys* Prashad & Mukerji

Genus **Parasphaerichthys** Prashad & Mukerji

Parasphaerichthys Prashad & Mukerji, 1929, *Rec. Indian Mus.*, **31**, p. 216 (type-species, *Parasphaerichthys ocellatus*, Prashad & Mukerji, by monotypy).

Diagnosis.—Body more or less oblong, compressed. Head large, compressed. Snout bluntly pointed. Mouth superior, oblique, cleft

very small, and greatly protractile. Eyes very large, in anterior part of head and visible from below ventral surface. Lips fleshy. *Jaws unequal*, lower jaw considerably longer than upper ; with small conical teeth ; palate edentate. Preorbital finely serrated. *Dorsal fin single*, commencing above last of pectoral fin, *with four spines and six rays. Anal fin with 13* spines and 12 rays. Pelvic fin with a long spine and five rays ; *first ray produced into a long simple filament reaching as far as middle of anal.* Caudal fin rounded. Both anal and caudal fins with scales at their bases. Scales large. *Laterat line absent* ; 27-28 scales in a longitudinal series.

Distribution.—Burma : Myitkyina district.

Species.—*Parasphaerichthys ocellatus* Prashad & Mukerji—Burma : Streams along Kamaing Jade Mines Road, Myitkyina district.

Genus **Colisa** Cuvier

Colisa Cuvier, 1831, In : Cuvier & Valenciennes, *Hist. Nat. Poiss.*, **7**, p. 359 (type-species, *Colisa vulgaris* Cuvier).

Diagnosis.—Body elevated, compressed. Head moderate, compressed. Snout blunt. *Mouth upturned*, terminal, cleft small. Eyes large, lateral, in middle of head, not visible from below ventral surface. Lips thin. Jaws subequal, a little protractile. Small villiform teeth on jaws ; palate edentate. Opercles entire, preopercle usually serrated. A suprabranchial organ present , branchial arches with toothed tubercles. A *single dorsal fin commencing above from near pectoral base*, with 15-18 spines and 7-13 rays. Anal fin with 15-20 spines and 11-19 rays. Number of spines in anal and dorsal fins variable. *Pelvic fin in the form of single elongate, filiform ray.* Caudal fin slightly emarginate or truncate. Scales may form a sheath to anal and dorsal fin bases, moderate. Lateral line when present interrupted, with 27-31 scales. Air-bladder divided posteriorly into two portions.

Distribution.—India : up to Krishna river in the South. Pakistan. Nepal. Bangladesh. Burma.

Species.—

1. *Colisa fasciata* (Schneider)—India : North India. Nepal. Pakistan : Sind, Punjab, N. W. F. P. Bangladesh. Burma.
2. *Colisa labiosus* (Day)—Burma.

3. *Colisa lalius* (Hamilton)—India : Ganga, Yamuna river systems. Pakistan : Punjab, Sind. Bangladesh. Borneo.

4. *Colisa sota** (Hamilton)—India : Gangetic provinces, Assam. Bangladesh.

KEY TO SPECIES

1.	Body with a single black longitudinal band from eye, along side to lower half of tail. ...	*C. sota*
—	Body with many oblique bands from back to belly.	2
2.	Soft part of dorsal and anal fins not produced, but rounded. Body with scarlet and light blue vertical bands. ...	*C. lalius*
—	Soft part of dorsal and anal fins produced to a varying degree. Body with oblique bands.	3
3.	Bands on body 8 to 10. Caudal fin wedge shaped. ...	*C. labiosus*
—	Bands on body 14 or more. Caudal fin slightly notched or cut square. ...	*C. fasciata*

Family Osphronemidae

Goramies

Body elevated, compressed. Head and body with ctenoid scales. Branchiostegals six. Opercle without a spine. A suprabranchial organ present. Teeth on jaws and palate. A single dorsal fin with a spinous and a soft part. Anal fin with spines. Outer pelvic fin ray elongated. Lateral line incomplete. Air-bladder present. Pyloric appendages two.

Ethmoid horizontal and not articulating with prevomer which forms a rostral fossa. Second and third suborbital serrated. No suborbital shelf. Parietals large and appear as inverted V's. Supraoccipital forms the roof of the relatively small foramen magnum, separating the exoccipitals widely. Subopercular, interopercular, preopercular serrated. Ectopterygoid present, 29 vertebrae. (After Liem, 1963).

Only a single genus is known.

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*_Colisa chuna_ (Ham.) is a junior synonym of this species (Menon, A. G. K. 1974, p. 99).

Genus **Osphronemus*** Lacépède

Osphronemus Lacépède, 1802, *Hist. Nat. Poiss.*, 3. p. 116 (type-species, *Osphronemus gouramy* Lacépède).

Diagnosis.—Body moderately elevated, compressed. Abdomen rounded. Head short, compressed. Snout blunt. *Mouth small, oblique, terminal, protractile.* Eyes moderate in anterior part of head, not visible from below ventral surface. Lips thin. Jaws equal. Villiform teeth on jaws ; palate edentate. *Opercle without a spine,* preorbital serrated. *A suprabranchial organ present.* A single dorsal fin inserted

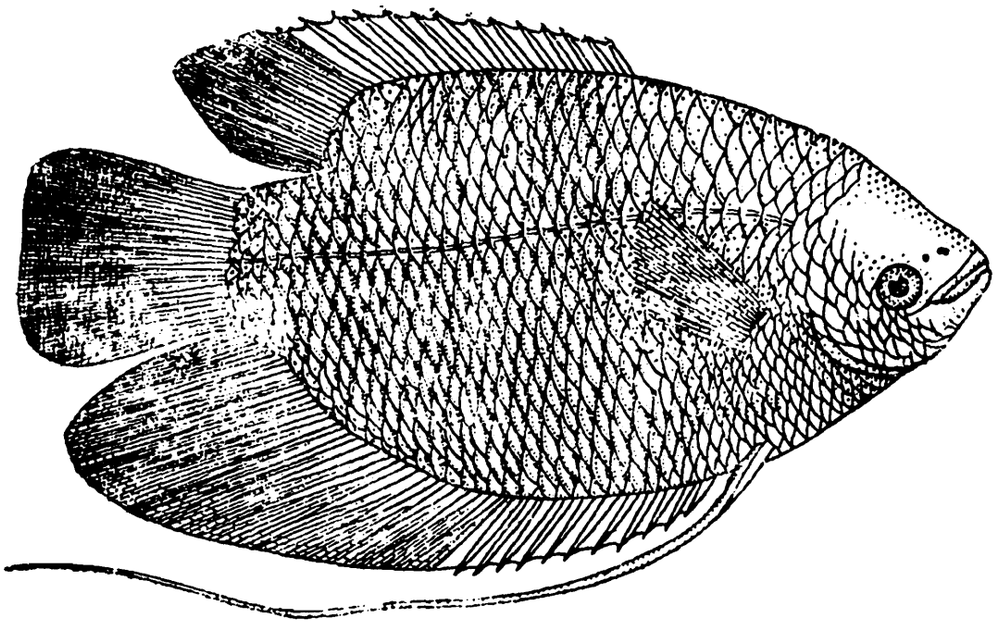


Fig. 198. Lateral view of *Osphronemus goramy* Lacépède. (After Misra, K. S. 1962, text-fig. 187).

above tip of pectoral fin, with 11-14 spines and 11 or 12 rays ; spinous portion longer than soft part. *Outer ray of pelvics much elongated, reaching beyond caudal fin.* Anal fin with 9-12 spines and 19-21 rays. Caudal fin rounded. Scales moderate, ctenoid. Lateral line complete and straight, with 30-33 scales. Air-bladder simple.

Distribution.—An exotic species, from Mèlanesia, introduced in our waters. Found throughout India, Pakistan, Sri Lanka. Also in Mauritius, Seychelles, Malaya, Malay Archipelago, Thailand, China.

Species.—*Osphronemus goramy* Lacépède—distribution as of the genus.

Remarks.—The male fish is known to build nests for its young hatchlings and eggs. Admirably suited for cultivation in small ponds,

*Written *Osphromenus* by Günther, 1861.

in gardens and in plantations, these fishes do not thrive in brackish or saline waters. It is a vegetable feeder and eats with relish, water lilies and other flowering plants. It also eats grass and many common garden plants.

Order MASTACEMBELIFORMES

Body eel-like, compressed and elongated, with minute scales. Mouth non-protractile. Snout elongated and supported by a cartilaginous rod and ending in a sensitive tip flanked by the tubular anterior nostrils which are thus remote from the posterior. Palatines flake-like fused to the vomer. Dorsal and anal fins long preceded by 7 to 40 detached depressible dorsal spines and one to three anal spines. Pelvic fins absent. Caudal fin short either confluent with dorsal and anal or narrowly separated.

Post-temporal bone absent except its lateral line component. Pectoral girdle not attached to skull. Air-bladder, without an open duct. Skull elongated. Roof smooth. Nasal and frontals large. Parietals separated by supraoccipital. Pterotics, sphenotics, and epiotics present. Prootic long separating the pleurosphenoid from the parasphenoid. Vomer toothless. Pterygoids movably united to lateral ethmoid outside the palatine. (After Sufi, 1956).

Three families and four genera are dealt with here.

KEY TO FAMILIES

1.	Free spines present before dorsal and anal fins. Scales present. ...	MASTACEMBELIDAE
—	No spines before dorsal and anal fins. Scales absent. ...	... 2
2.	Caudal fin confluent with dorsal and anal fins. A very distinct fleshy rostral process present. Branchiostegals six. ...	PILLAIDAE
—	Caudal fin free from dorsal and anal fins. Fleshy rostral process absent. Branchiostegals five. ...	CHAUDHURIIDAE

Family MASTACEMBELIDAE

Spiny eels

Body eel-like, compressed and elongate, covered with minute scales. Mouth non-protractile. Snout elongate and supported by a cartilaginous rod ; nostrils tubular, anteriorly placed on the sensitive snout. Upper

jaw formed by dentigerous premaxilla and edentate maxilla. Branchiostegals six. Preoperculam with or without spines. Dorsal fin with 7 to 40 detached depressible dorsal spines ; anal fin with one to three spines. Pelvic fins and girdle absent. Pectoral fins with 17-27 rays. Caudal fin short, either confluent with dorsal and anal or narrowly separated ; homocercal. Pyloric appendages two.

Palatines flap-like, fused to the ethmo-vomer ; vomer toothless. Post-temporal and opisthotic bones absent (except its lateral line components). Pectoral girdle attached to skull. Cleithrum present. Pectoral radials present. Five to seven hypurals bearing 15 or more branched rays. Large nasals separated in mid-line by narrow upper edge of ethmoid. Infraorbital bone large, articulating with the small lateral ethmoid. Frontals large. Parietals separated by supraoccipital. Vomer toothless. Palatines narrow, in the form of flakes of bone. Vertebrae 85-96.

Two genera are dealt with here.

KEY TO GENERA

1. Snout very long with a concave prolongation of the upper jaw consisting of a paired series of toothed bony plates. ... *Macrognathus* Lacépède

— Snout long, conical without any prolongation of the upper jaw. ... *Mastacembelus* Scopoli

Genus **Macrognathus** Lacépède

Macrognathus Lacépède, 1800, *Hist. Nat. Poiss.*, **2**, 283 (type-species, *Ophidium aculeatum* Bloch).—Sufi, 1956, *Bull. Raffles Mus.*, No, **27**, pp. 99-105 (synoptic review).

Diagnosis.—Body eel-like, elongated, compressed. Head long, pointed. *Snout long, fleshy, accommodating a concave prolongation of the upper jaw consisting of a paired series of toothed bony plates.* Mouth

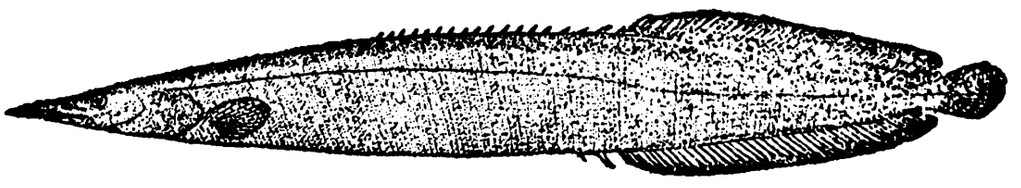


Fig. 199. Lateral view of *Macrognathus aculeatus* (Bloch). (After Misra, K. S. 1962, text-fig. 196).

inferior, cleft narrow. Eyes small, superior, in middle of head, not visible from below ventral surface. Lips thin. Jaws subequal. Small pointed teeth present on both jaws and on the segmented anterior

extension of the upper jaw, also on palate and on vomer. *No spines on either preorbital or preoperculum.* No gill rakers. Dorsal fin inserted far behind end of pectoral with 14-22 *detached, depressible spines* and 42-58 rays. Anal fin with three spines and 42-58 rays. Caudal fin rounded, distinctly separated from the dorsal and anal fins. Scales small, cycloid, present between and around eyes and posterior nostril and up to maxilla. Top of snout, interorbital space, internasal space, and top of head as far as hind edge of preoperculum naked. Lateral line present. Air-bladder elongate.

Distribution.—Throughout India, Pakistan, Nepal, Bangladesh, Burma, Sri Lanka, Malay Archipelago, Thailand, Viet-Nam, China.

Species.—*Macrognathus aculeatus* (Bloch)—distribution as of the genus.

Genus **Mastacembelus** Scopoli*

Mastocembelus Scopoli, 1777, *Introd. Hist. Nat.*, p. 458 (type-species, *Ophidium mastocembelus* Solander)—Sufi, 1956, *Bull. Raffles. Mus.*, No. 27, pp. 105-143 (systematic review).

Diagnosis.—Body eel-like, elongated, compressed. long, pointed. *Snout long, conical without any transversely striated bony plates on the under surface.* Mouth inferior, cleft narrow. Eyes small, superior, in middle of head, not visible from below ventral surface. Lips thin.

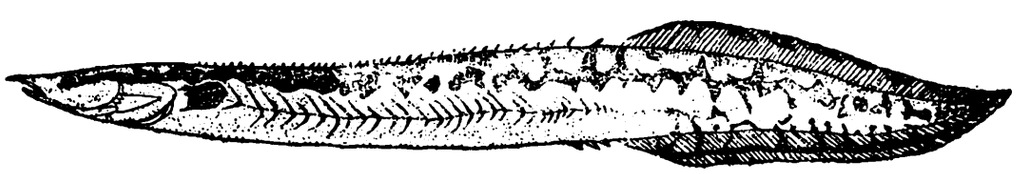


Fig. 200. Lateral view of *Mastocembelus armatus armatus* (Lacépède). (After Misra, K. S. 1962, text-fig. 195).

Jaws subequal. Minute teeth on jaws and on palate. *Preopercle generally spiny at its angle* ; *a preorbital spine* may be absent. Dorsal fin inserted above middle of pectoral, with 24-39 detached, depressible spines and 50-90 rays. Anal fin with three spines and 31-98 rays. Caudal fin rounded ; dorsal and anal fin may or may not be confluent with the caudal. Scales present. Air-bladder elongated.

Distribution.—Fresh and brackishwaters of West Africa, Syria. Pakistan. India. Nepal. Sri Lanka. Bangladesh. Burma and Malay Archipelago.

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*Gronow, 1763 used the name *Mastacembelus* which Scopoli in 1777 erroneously amended as *Mastocembelus*. The correct spelling is *Mastacembelus* (see Sufi, S. M. K. 1956).

Species.—

1. *Mastacembelus alboguttatus* Boulenger—Burma : Sittang river.
2. *Mastacembelus armatus armatus*—Throughout India. Pakistan. Nepal. Bangladesh. Sri Lanka. Burma. Thailand. Viet-Nam. Tonkin. Hainan Island. S. China. Malaya. Sumatra. Java.
3. *Mastacembelus caudiocellatus* Boulenger—Burma : Inle Lake basin, Shan States.
4. *Mastacembelus guentheri* Day—India : Kerala, Assam.
5. *Mastacembelus oatesii* Boulenger—Burma : Inle Lake, Shan States.
6. *Mastacembelus pancalus* (Hamilton) (Pl. VI, Fig. A)—India : throughout. Pakistan : Punjab, Sind, N. W. F. P. Bangladesh.
7. *Mastacembelus unicolor* (Valenciennes)—Burma. Malay peninsula. Java. Sumatra. Moluccas. Borneo. Banka.
8. *Mastacembelus zebrinus* Blyth—Burma : Rivers Irrawaddy, Sittang, Salween.

KEY TO SPECIES*

1.	No preopercular spines. ...	*M. caudiocellatus*	
—	Preopercular spines present, occasionally hidden beneath the skin. ...	...	2
2.	Dorsal spines and soft rays not exceeding 100 (exceptionally more in *M. guentheri*) ...	...	3
—	Dorsal spines and soft rays more than 100. ...	...	6
3.	Caudal fin rays 11-16. ...	...	4
—	Caudal fin rays 17-21. ...	...	5
4.	Dorsal fin with 24-31 spines, and 30-42 rays or even fewer. ...	*M. pancalus*	
—	Dorsal fin with 27-30 spines and 58-74 rays. ...	*M. guentheri*	
5.	Top of snout with scales. Pectoral fins with 17-19 rays. ...	*M. zebrinus*	
—	Top of snout without scales. Pectoral fins with 23 or 24 rays. ...	*M. oatesii*	
6.	Gape of mouth 12 to 13% of total length. ...	*M. alboguttatus*	
—	Gape of mouth 14 to 22% of total length. ...	...	7
7.	Gape of mouth extending to below posterior nostrils or beyond. ...	*M. armatus armatus*	
—	Gape of mouth not extending to below posterior nostrils. ...	*M. unicolor*	

*After Sufi, S. M. K. 1956.

Family PILLAIIDAE

Body eel-like, subcylindrical and elongated. Head depressed anteriorly. Head and body without scales. *Upper jaw with a single large strong hockey-stick shaped bone bearing teeth.* Branchiosteagal rays six. Preoperculum with one spine. *Dorsal and anal fins long without any spine.* Pelvic girdle and pelvic fins absent, pectoral fins with seven to nine rays. Lateral line present.

Supracleithrum attached to vertebral column. Cleithrum present. Post-temporal absent. Pectoral radials absent. Caudal fin homocercal, short, confluent with dorsal and anal fins. Two large hypurals united at their bases, fused with last centrum bearing 8-10 unbranched rays. Nasals large, separated in the middle by a spindle-shaped ethmoid. Infraorbital bone large. Parietals separated by supraoccipital. Vomer toothless. Palatines narrow flakes of bone movably united to parasphenoid and vomer. Pterygoid movably united to lateral ethmoid outside the palatine. Vertebrae 62, 26 precaudal+36 caudal. No pyloric appendages. (After Yazdani, 1977).

Only a single genus is known.

Genus **Pillaia** Yazdani

Pillaia Yazdani, 1972, *J. Bombay nat. Hist. Soc.*, 69 (1), pp. 134-145 (type-species, *Pillaia indica* Yazdani, by monotypy and original designation).

Diagnosis.—Body small, eel-like, subcylindrical. Abdomen rounded. Head moderately elongate, anteriorly depressed. Snout conical with *an indistinct fleshy rostral appendage bearing anterior tubular nostrils.* Mouth wide, terminal and horizontal, its gape extending to anterior border of eye. Eyes fairly prominent, placed dorsally in anterior part of head, not visible from below ventral surface. Lips thick, flap-like laterally. Jaws equal with small, sharply pointed inwardly curved teeth in rows ; palate edentate. *No spines on body before fins or anywhere* else. Gill openings wide, extending dorsally to pectoral origin. Gill membranes free from each other and also from isthmus. Dorsal fin at posterior half of body, slightly in advance of vertical from vent, fused with caudal and with 34-36 rays. Anal fin with 34-36 rays also fused with caudal. Caudal fin tapering posteriorly, *with 8-12 rays.* Scales absent. Lateral line clearly seen on head, and less distinct on body.

Distribution.—India : Khasi and Jaintia hills near Shillong, Meghalaya.

Species.—

1. *Pillaia indica* Yazdani—India : summer streams near Shillong, Khasi and Jaintia hills, Meghalaya.
2. *Pillaia khajuriai* Talwar, Yazdani and Kundu—India : Rongrengiri, Garo hills dist., Meghalaya ; Baguri (Kaziranga Wild life Sanctuary, Sibsagar dist., Assam).

KEY TO SPECIES

1.	Pectoral fin with 7-9, caudal fin with 8-10 rays. Head depressed. ...	*P. indica*
—	Pectoral fin with 19 or 20, caudal fin with 12 rays. Head conical. ...	*P. khajuriai*

Family CHAUDHURIIDAE

Body eel-like, compressed, without scales. Nostrils lateral. Gill openings separate and integument covering them supported by few branchiostegal rays. All pharyngeal slits wide. Four fully developed gill-bearing branchial arches. Snout without rostral appendage. Branchiostegal rays five. Heart close to branchial arches. Vent situated a long distance from head. Teeth arranged in bands on jaws only. Dorsal and anal fins long without spines. Pelvic fins and girdle absent. Caudal fin homocercal, fan shaped, practically free, provided with well developed rays and supported by a pair of hypural bones. Pectoral fins present. Pectoral girdle attached to skull.

Cleithrum completely fused with supracleithrum. Post-temporals absent. Pectoral radials absent. Frontals paired. Ethmoid and vomer distinct, former separating the maxillaries in front. Well developed zygapophyses on the vertebrae. Two large hypurals. Nasal very largely expanded, not separated in the middle by the ethmoid. Lateral ethmoids small. Frontals large. Parietals separated by supraoccipital. Palatines large joined to the pterosphenoid. Vertebrae 70. No pyloric appendage.

Only a single genus is known.

Genus **Chaudhuria** Annandale

Chaudhuria Annandale, 1918, *Rec. Indian Mus.*, **14**, p. 40 (type-species, *Chaudhuria caudata* Annandale, by original designation and monotypy).

Diagnosis.—Body much elongated, cylindrical, eel-like, compressed. Head conical, compressed. Snout acuminate, but not produced. Mouth small, horizontal non-protractile. Eyes well developed, superior, in

anterior part of head, not visible from below ventral surface. Lips tumid, but the lower lip only so at the sides. Lower jaw slightly longer. Teeth small, sharply pointed, slightly curved and in a band on jaws only ; palate edentate. A single dorsal fin, with 39-40 rays. Anal fin with 42-43 rays ; both fins confined to the caudal region *and united with the caudal fin by a low membrane. Caudal fin rays completely* segregated. Caudal fin markedly asymmetrical when fully expanded, slightly rounded or subtruncate, and more strongly developed on the ventral than on dorsal side. Scales very small, embedded in the skin. Lateral line complete. Caudal regions strongly compressed and tapering considerably.

Distribution.—Burma : Inle Lake, S. Shan States.

Species.—*Chaudhuria caudata* Annandale—distribution as of the genus.

Order TETRAODONTIFORMES

Body rounded or broad, inflatable, globular in inflated condition. Skin with more or less regularly arranged spines, generally restricted to some parts of the fish, leaving the other parts naked ; spines may have double or treble roots. Teeth coalesced, forming a beak with jaws, *each jaw with a median suture.* Spinous dorsal, pelvic fins absent. Pectoral, caudal fins present. Nasal organs raised up into a tubular papilla bearing the two nostrils ; nostrils may be confluent into one and the nasal organ appears as a circular tube produced terminally into two more or less distinct tentacles. This tube may be short and constricted so that the nasal organ appears as two tentacles joined at their bases. Air-bladder present, horse-shoe shaped.

Tropical and subtropical seas entering estuaries. A few are found in freshwaters.

A single family with two genera are dealt with here.

Family TETRAODONTIDAE

Puffers

Body more or less short. *Skin covering modified into small or large spines or laminae in the form of a beak, having a cutting edge and covered with a layer of ivory-like substance.* A median suture present. Gill openings narrow immediately in front of pectoral fins. A single dorsal and anal fin without spines, belonging to the caudal portion of the vertebral column. Pectoral fins present. Pelvic fins absent. *A portion of oesophagus dilatable and capable of being distended with air.* No lateral line. Air-bladder present, horse-shoe shaped.

Two genera are dealt with here.

KEY TO GENERA

1. Dorsal and anal fin with many (23-28) rays. ... *Xenopterus* Bibron

— Dorsal and anal fins with few (8-16) rays. ... *Tetraodon* Linnaeus

Genus **Xenopterus** Bibron

Xenopterus Bibron, 1855, *Rev. Mag. zool.*, 8, p. 281 (type-species, *Xenopterus bollengeri* Bibron = *Tetraodon naritus* Richardson).

Diagnosis.—Body short, with a rounded back. Abdomen rounded. Head large, oval-shaped. Snout blunt. Mouth terminal, transverse, cleft narrow. Eyes large, superior, in middle of head, not visible from below ventral surface. Lips thick and fringed. One or two nostrils on each side, funnel-shaped with fringed margins. Jaws equal, both jaws divided by a median suture, with a cutting edge and covered with a layer of ivory-like substance ; palate edentate. *Dorsal fin* inserted ahead of anal, near tip of pectoral and with 32-38 rays and *no spine*. *Anal fin with 28-32 rays.* Pelvic fins absent. Part of body covered with fine dermal spines, having double or treble roots. A portion of oesophagus dilatable. Air-bladder present.

Distribution.—Rivers, estuaries and coasts of Burma to the Malay Archipelago.

Species visiting freshwater.—*Xenopterus naritus* (Richardson)—distribution as of the genus.

Genus **Tetraodon** Linnaeus

Tetraodon Linnaeus, 1758, *Systema Naturae*, Ed. 10, p. 332 (type-species, *Tetraodon lineatus* Linnaeus).

Diagnosis.—Body more or less short, with a broad back or compressed into a ridge. Abdomen rounded. Head oval shaped. Snout blunt. Mouth terminal, transverse, cleft narrow. Eyes large, superior, in posterior part of head, not visible from below ventral surface. Lips thick, fleshy. One or two nostrils on each side. Jaws equal, *both with a median suture*, upper jaw slightly longer, both have a cutting-edge and are covered with a layer of ivory-like substance, palate edentate. *Dorsal fin* inserted above, slightly ahead of anal *with 10-16 rays and no spine.* Anal fin with 10-13 rays. Pelvic fins absent. Caudal fin emarginate or truncate or rounded. Body covered with fine dermal spines, wholly or partially or the spines may be absent. A portion of

oesophagus dilatable and capable of being distended with air. Air-bladder present, horse-shoe shaped.

Distribution.—Tropical and subtropical seas.

Species visiting freshwater.—

1. *Tetraodon cutcutia* Hamilton—Freshwaters of Orissa, W. Bengal, and Assam. Bangladesh.
2. *Tetraodon fluviatilis* Hamilton—Seas and estuaries of India to Malay Archipelago and beyond. Found in rivers in Burma (Amherst district). Bangladesh.

KEY TO SPECIES

1.	A simple circular nasal cavity present. Body without spines. ...	*T. cutcutia*
—	Two solid nasal tentacles on each side and an impervious nasal fossa present. Back and abdomen with spines. Sides spineless. ...	*T. fluviatilis*

ADDENDA

The manuscript of this Handbook was completed in November 1979, and the first proofs were received a year later. As far as possible all information known up to June 1981 have been incorporated in this final MS. However, subsequent to the start of final printing some additional data and taxonomic changes relevant to this book have come to my notice which are given in the following pages.

Page 69 Add

Diptychus pakistanicus Mirza & Awan—Pakistan : Kanjub, Gilgit river drainage.

Described by Mirza & Awan (1979) this species differs from *D. maculatus* by the color pattern, the body being provided with irregularly scattered small crescent shaped markings (absent in *maculatus*) ; body depth 7.78-8.21 in total length (6.04-6.95 in *maculatus*) and greater number of gill rakers.

Page 88 Add

The genera *Inlecypris* Howes and *Raiamas* Jordan can be differentiated from *Barilius* by the following key :

1.	Pectoral axial scale absent. A prominent post-pelvic keel present.	*Inlecypris* Howes*
	Pectoral axial scale present. Post-pelvic keel not prominent.	2
2.	Lower jaw always longer than the combined lengths of the snout and eye. Maximum length of the 3rd intraorbital exceeds that of snout. ...	*Raiamas* Jordan
	Lower jaw always shorter or equal to the combined lengths of the snout and eye. Maximum length of the 3rd intraorbital not exceeding that of snout. ...	*Barilius* Hamilton

Page 89 Add

Barilius menoni Sen—India : Saharsa district, N. Bihar. Described by Sen (1976) this species differs from the other species of *Barilius* in having no barbels, 62 scales along the lateral line and 18 or 19 indistinct bluish vertical bars on body.

*This genus now falls under the subfamily Cultrinae.

Page 103 Add

Puntius saberi Datta & Karmakar—India : Sukma, Cneroguru talao, Pujaripal village, Bastar dist., Madhya Pradesh.

Described by Datta and Karmakar (1981) this species differs from its close allies *P. sarana sarana* and *P. pinnauratus* in having longer dorsal fin ray besides other body proportions.

Page 209 Add

Genus **Pinniwallago** Gupta, Jayaram & Hajela

Pinniwallago Gupta, Jayaram & Hajela, 1981, *J. Bombay nat. Hist. Soc.*, 77 (2), pp. 290-291 (type-species, *Pinniwallago kanpurensis* Gupta, Jayaram & Hajela, by monotypy).

Diagnosis.—Very similar to *Wallago*, but differing from it in having the second dorsal fin modified in the form of a spineless rayed fin instead of being smooth as usual.

Distribution.—India : Ganga river system, ponds in and around Kanpur, Uttar Pradesh.

Species.—*Pinniwallago kanpurensis* Gupta, Jayaram & Hajela is the only species known so far.

GLOSSARY*

ABDOMEN—Part of body containing, among other things, the intestine. Synonym of BELLY.

ABDOMINAL CAVITY—Wide cavity within the fish body, to about the level of vent containing intestine, liver, kidneys, gonads, etc.

ABDOMINAL VERTEBRAE—See under VERTEBRA.

ADIPOSE—Containing fat.

ANTERIOR—Nearer to head. Forward of another organ. The opposite of POSTERIOR.

ANTRORSE—Facing forward.

ANUS—Part of VENT being the opening by which excrement is expelled.

AQUATIC—That which grows or lives in water, or is associated with water.

AUTOSTYLIC—Suspension of the jaw directly to the skull without the intervention of the hyomandibula as in Holocephali.

AXILLA—Cavity behind base of a fin.

AXILLARY—Pertaining to the AXILLA.

AXILLARY PROCESS—Small process or appendage situated in several species of fishes at the axil of the pelvic fins.

AXIS OF BODY—An imaginary line running through body of fish, length wise.

BARBELS—A flexible tactile filament ("whisker") under the chin, either side of mouth, or above or under the snout in certain fishes. Barbels vary in number, length and position according to species of fish.

BASE—The part where fin joins body as in length of base of dorsal fin or anal fin.

BELLY—Synonym of ABDOMEN.

BODY AXIS—See AXIS OF BODY.

BRANCHIOSTEGAL—Pertaining to those anatomical parts which cover the gills. For branchiostegal ray, see BRANCHIOSTEGAL MEMBRANE.

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*Modified after Legendre, V. 1954.

BRANCHIOSTEGAL MEMBRANE—In fishes having a pair of branchial (gill) openings closed by an opercle (gill cover). This is a membrane situated on either side of the head and containing, within its thickness, numerous tiny bones called BRANCHIOSTEGAL RAYS (BR). (See Fig. 201.).

BREAST—In fishes, that part of the body situated between head and pectoral fins. This part contains, among other things, the heart.

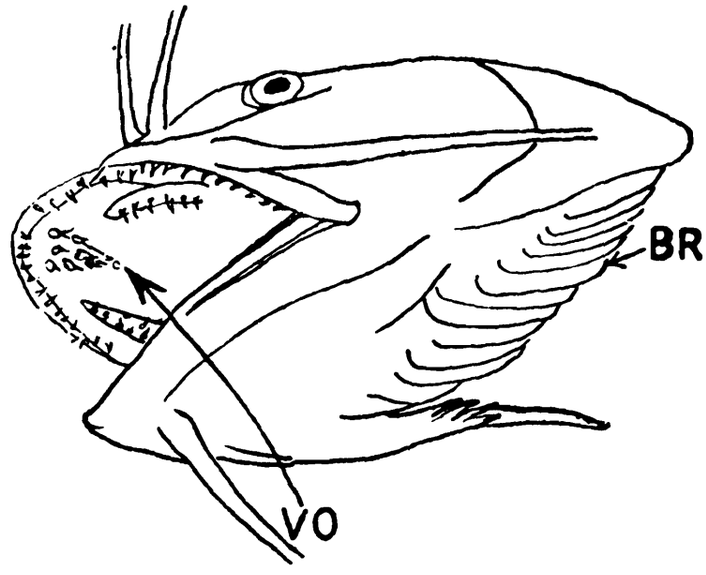


Fig. 201. Outline diagram of head to show Vomerine teeth and branchiostegal rays. VO = Vomer. BR = Branchiostegal rays.

CANINE—See TOOTH.

CARTILAGE—White or bluish white substance, homogenous, transparent, elastic, tough but easily cut with a knife; and constituting a part or the whole of the pieces composing the skeleton of Vertebrates.

CAUDAL—Pertaining to the TAIL.

CAUDAL FIN—See Fig. 69, p. 161 for different shapes.

CAUDAL VERTEBRAE—See under VERTEBRA.

CENTRUM—Central part of a VERTEBRA.

CHEEK—In fishes, that part of the lateral surface of the head between the eye and the PREOPERCLE (Fig. 202).

CHIN—Lower anterior surface of the mandible (Fig. 202).

CLEITHRUM—One of the bones of the pectoral girdle, hard, polished or rough on which the pectoral fin is hinged.

CLOACA—Terminal part of gut into which kidney and reproductive ducts open ; in such cases there is only one posterior opening to the body, the cloacal aperture, instead of a separate anus and urogenital openings.

CTENOID, CYCLOID—See SCALE.

CRANIUM—Skull. Box formed of cartilage or bone, or both, containing the mouth, the GILLS and the BRAINBOX which in turn contains the ENCEPHALON or brain.

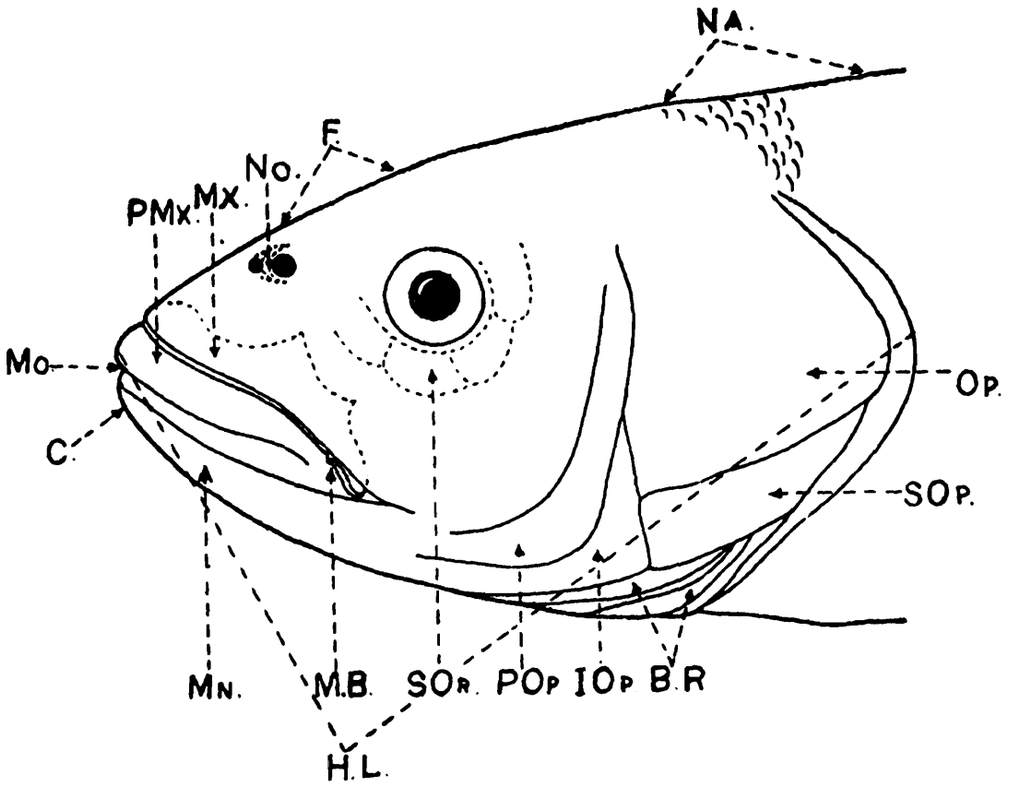


Fig. 202. Outline diagram of head portion to show different parts of a soft rayed fish.
BR=Branchiostegal ray. C=Chin. F=Forehead. HL—Head length. IOP=Interopercle. MB=Maxillary barbel. MN=Mandible. MO=Mouth. MX=Maxillary. NA=Nape. NO=Nostrils. OP=Opercle. PMX=Premaxillary. POP=Preopercle. SOP=Subopercle. SOR=Suborbital. (After Hibbs & Lagler, K. S. 1947.)

DENTARY or DENTAL BONE—Each of the two bones constituting either side of the lower jaw. The lower teeth are set in the dentaries.

DORSAL—Pertaining to the back that is, to that part which is opposite to the underpart. The opposite of VENTRAL.

DORSAL SURFACE—The outside surface of a Vertebrate, usually turned upward, on which side are found the cranium and the central nervous system (SPINAL CORD), as opposed to the VENTRAL SURFACE, usually turned downward, on which side are found the mouth, abdominal cavity and vent.

DUCTUS PNEUMATICUS—Vessel connecting the air-bladder to the throat or organs of hearing in physostomus fishes such as carps and catfishes.

EYE LIDS—See Fig. 203 for different positions.

FALCATE or FALCIFORM—Scythe-shaped.

FORK—In fishes, the place where the dorsal and ventral lobes of the caudal fin separate.

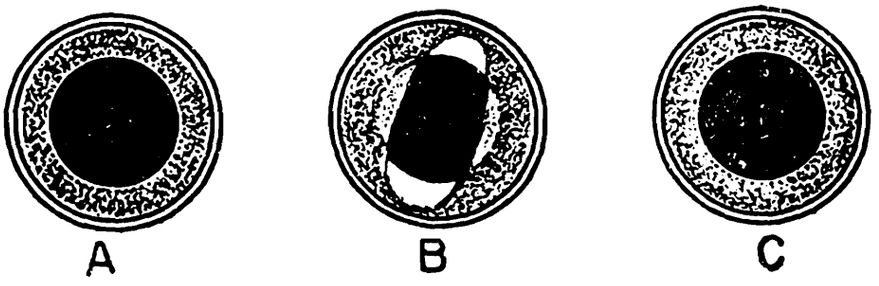


Fig. 203. Diagram to show the types of eye-lids in fishes. A. With circular eye-lid. B. With lateral eye-lid. C. With an adipose growth of skin. (After Hora, S. L. and Mukerji, D. D. 1938. *Health Bull.*, No. 12, Text-fig. 5).

GILL—Respiratory organ of many aquatic animals. In fishes, the gills, red in colour and made up of comblike blades, are situated on either side of bottom of mouth. See also GILL OPENING, GILL COVER, OPERCLE, GILL ARCH.

GILL ARCH—Aggregate of small bones or cartilages upon which are planted several red lamellae of the gills. Curved outward, the gill arches extend downward from the bottom of the palate to the root of the tongue. On their outer edge, inside the gill openings, the gill arches carry the gill lamellae. On their inner edge, on the same side as the mouth there are often points called GILL RAKERS or BRANCHIOSPINES. The first branchial arch is the anteriormost one. (See Fig. 7, p. 14).

GILL COVER—In most fishes that have but one pair of GILL OPENING on either side of head, a group of flat bones joined together by the skin, and covering the GILLS. It closes the gill opening.

GILL OPENING—An opening (sometimes one of several openings) situated on either side of the head of fishes, in which GILL may be seen. The water used for breathing enters by the mouth and is expelled through the gill openings. The GILL OPENINGS are not to be confused with the spaces between the gills, which spaces are called GILL SLITS.

GILL SLIT—Each of the narrow space between the GILL ARCHES.

GONOPODIUM—Modified anal fin rays, elongated, thickened and functioning as an organ of transference of spermatophores to the body of the female. (See Fig. 165, p. 292).

HAEMAL ARCH—See under VERTEBRA.

HOMOLOGOUS—Having the same function and the same embryonic origin.

HORNY—Having the nature of horn or fingernail.

HORNY COVERING—A pad of cartilaginous cover found on inside lips of some fishes (such as *Labeo*). (See Fig. 38, p. 63).

HYOSTYLIC—Suspension of the jaw from the skull through the intervention of the hyomandibula.

INTERMUSCULAR—Situated between the muscles.

INTERMUSCULAR BONES—Bones found within the thickness of the abdominal wall or of the dorsal muscles.

ISTHMUS—Anterior portion of breast of fishes, generally pointed forward dividing the two gill openings below and serving, in part, to attach the MANDIBLE to body.

JAWS—See Fig. 204 for different shapes.

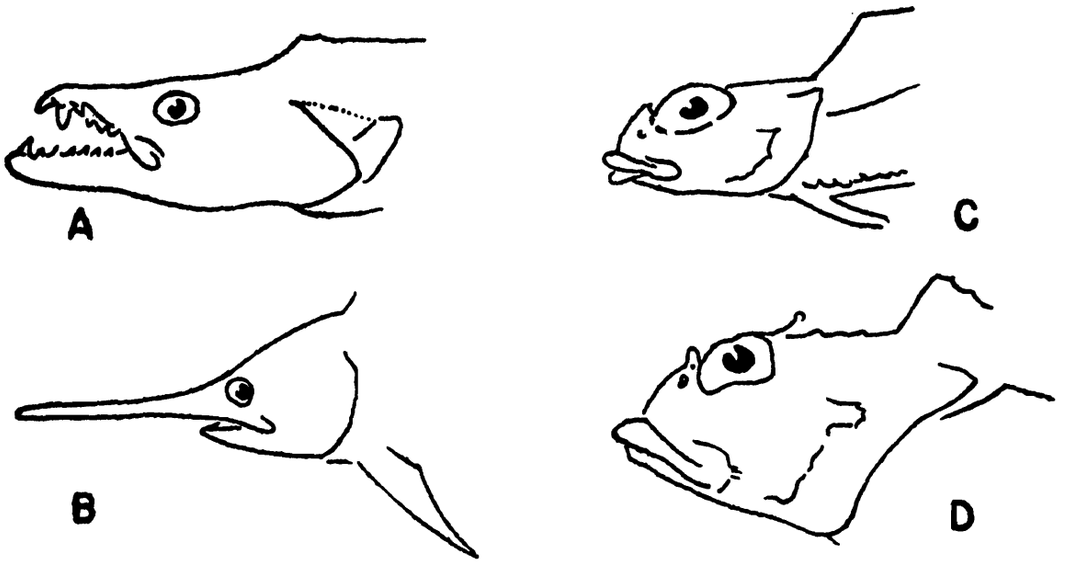


Fig. 204. Diagrams to show various jaw positions. A. Lower jaw projecting beyond upper jaw. Teeth caniniform. B. Upper jaw prolonged into a sword like beak. C. Jaws and lips terminal. D. Upper jaw overhanging the lower, lower lip inferior.

KEY—In natural history, a quick guide or an easy means to the names of plants, animals or rocks.

LATERAL LINE—Line formed along each side of body by a series of PORES or tiny tubes in scales or skin. Most species of fish have a lateral line. The line may also exist on the head only, or incomplete on only a part of each side of the body, or it may be hardly visible or totally absent. The lateral line is, so to speak, the fish's external ear, used for the perception of sounds and noises. The LATERAL LINE is incomplete, when it stops abruptly without running the length of the fish (see Fig. 51, p. 97). It is COMPLETE if it extends till the caudal fin base. It is INTERRUPTED when it is broken into two halves which may .be in a straight line or at different levels as in *Toxotes* (see Fig. 183, p. 332).

LOBE—Projecting part of an organ, such as of snout, lips.

MANDIBLE—The lower jaw bones.

MAXILLARY—In fishes, a bone included in the upper jaw.

MEDIAL—Pertaining to an organ situated middle of other homologous organs. Thus the rays in the middle of the caudal fin are the MEDIAL rays of that fin.

MEDIAN—An organ situated on the lengthwise centre-line of the dorsal surface or ventral surface of the fish. Thus the dorsal fin is situated on the centre-line of the back, in other words on the dorsal MEDIAN line; thus the dorsal is a median fin and so also is the anal fin and the caudal fin.

MEMBRANE—A thin sheath of an organ or part of an organ. For BRANCHIOSTEGAL MEMBRANE, see that term.

NAPE—See Fig. 202.

NARE, NARIS, NOSTRIL—On the snout of fishes, the opening of the olfactory organ or organ of smell. In fishes, there are generally two nostrils on either side of the head, making four in all, or two pairs.

NICTITATING MEMBRANE—Transparent fold of skin forming a third eye lid. When open lies at inner (anterior) corner of eye or below lower eye-lid.

OCCIPUT—In fishes, the line of demarcation between head and back, on the dorsal surface. In most scaly fishes, the scales generally stop at the occiput, not covering the top of the head. However, *Channa* and a few others have scales over the head to the end of the snout.

OPERCLE, OPERCULUM—The large flat bone of the GILL COVER hinging the gill cover on the CRANIUM. Thus, it permits the alternating movements of opening and closing of the GILL OPENING during the respiration of fish.

ORIGIN—The origin of a fin is the anteriormost extremity of the BASE of the fin, at the front point where the first ray is inserted into the body of the fish.

OTOPHYSIC—A connection of the air-bladder with the otic or the ear region.

OVIPAROUS—Producing eggs.

PECTORAL—Pertaining to the breast or shoulder.

PECTORAL GIRDLE—Aggregate of bones attaching the pectoral fin to the body. The pectoral girdle is also called shoulder girdle, but fishes have no real shoulder.

PELVIC—Pertaining to the pelvic or PELVIC GIRDLE.

PELVIC GIRDLE—Aggregate of bones attaching the pelvic fin to the body. In fishes, this girdle generally has no fixed connection with any other part of the skeleton, but hanging loosely within the musculature of the abdominal wall. Also called PELVIC.

PHYSOCLISTIC—Fishes on which the air-bladder when present is not connected by a duct to the throat e.g., Gobies, Mullets.

PHYSOSTOMOUS—Fishes in which the air-bladder is connected to the throat by a duct (e.g.) Cyprinids, Catfishes.

PLAITED—See Fig. 205.

PORE—Very small opening or hole pierced into the skin.

POSTERIOR—Further back than the head or behind another organ. The opposite of ANTERIOR.

PREANAL—Pertaining to that portion of the ventral surface situated before anal fin.

PREOPERCLE—Bones on side surface of head, situated before the gill cover or opercle.

RETRORSE—Curved downward and backward. The opposite of ANTRORSE.

RIBS—Small bones attached on each side directly to the vertebrae or spiny processes within the abdominal wall.

RUDIMENTARY—Small, tiny, malformed or incomplete.

SCALE—One of the thin, bony or horny plates covering the whole or part of the body of most fishes. Scales can be microscopic, as on the Eel ; small, as on *Chela*, large, as on *Labeo* (up to three inches in diameter). A fish may have no scales as the Catfishes.

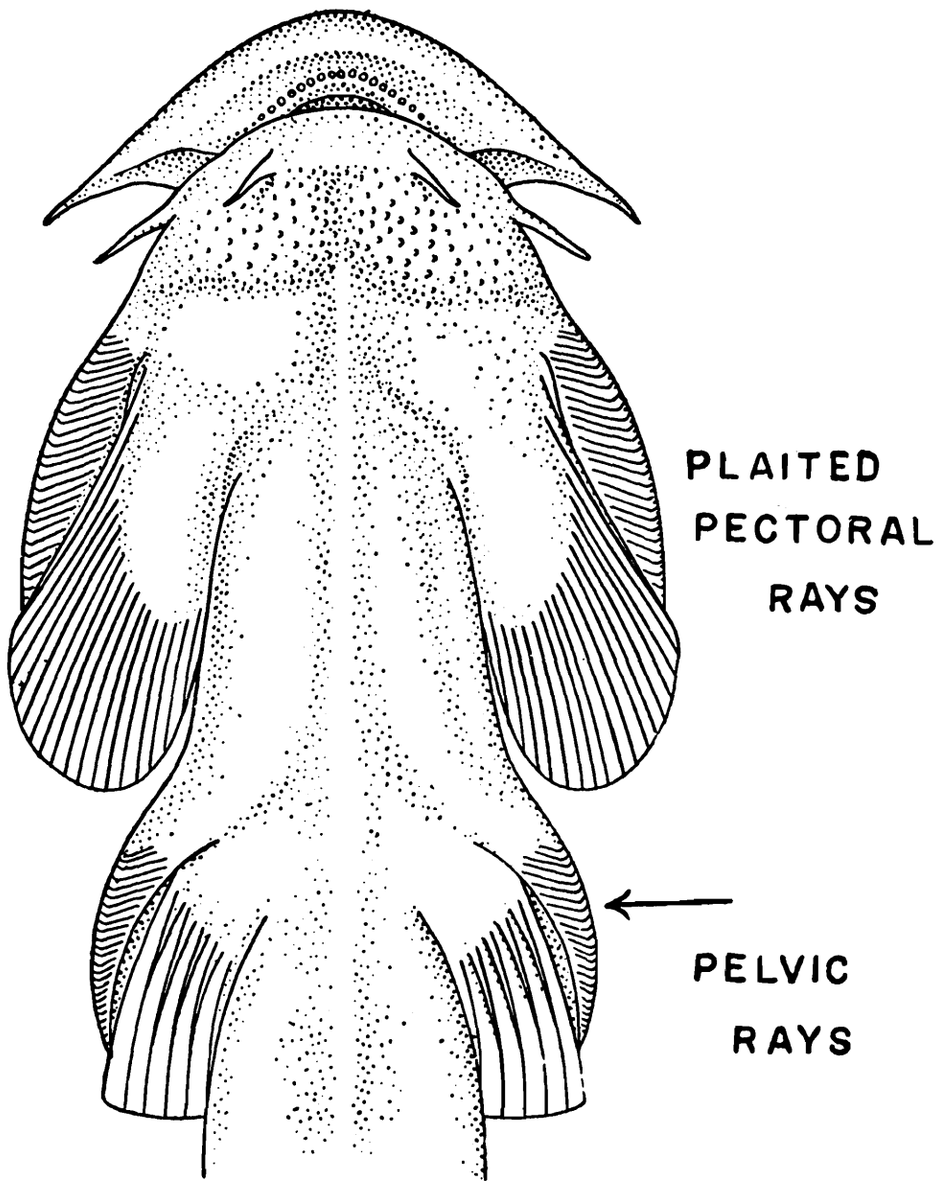


Fig. 205. Ventral view of *Euchiloglanis hodgarti* Hora to show plaited nature of pectoral and pelvic fin rays.

CYCLOID SCALES are where the edges or margins are evenly curved, unbroken, smooth, eg. *Labeo*. CTENOID scales have the edges or margins with sharp tooth-like spines. (See Fig. 206)

SHOULDER GIRDLE—Synonym of PECTORAL GIRDLE.

SIZE—In fishes, length measured in a straight line from snout to tail. This measurement may be taken in various ways. Size is *not*, as often in humans, a measure of girth ; this measure would be called the CIRCUMFERENCE of a fish.

SNOUT—The whole of that of the head in front of the eyes. See Fig. 207 for shapes.

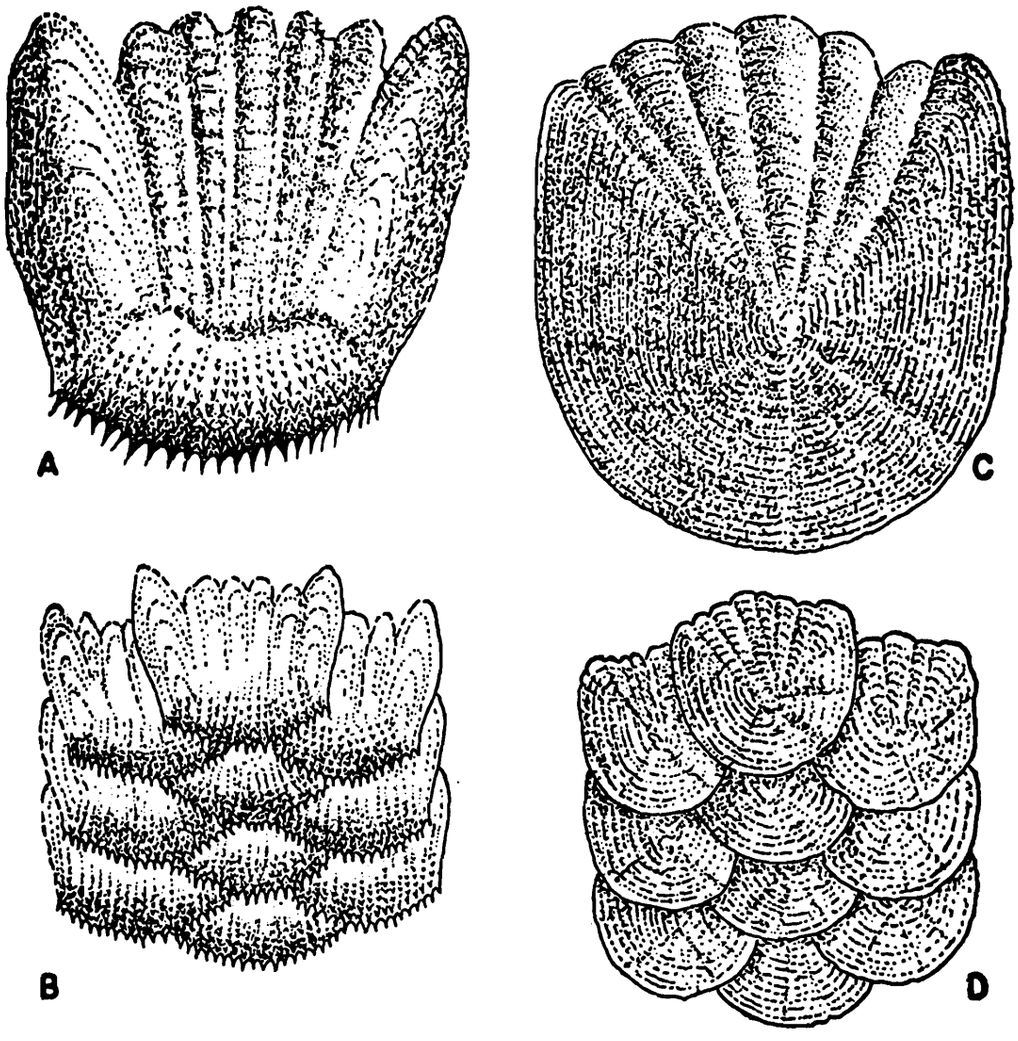


Fig. 206. Different kinds of scales. A, B, Ctenoid C, D, Cycloid.

SPINE—A fin ray which is ossified.

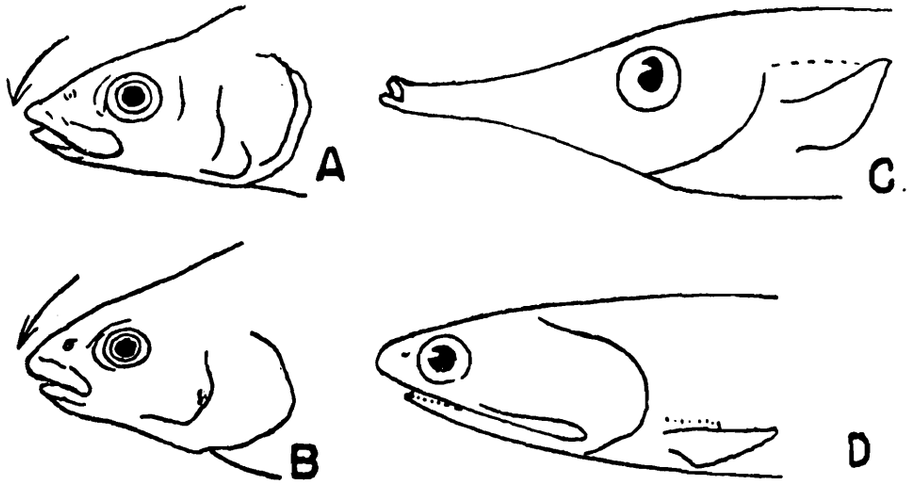


Fig. 207. Diagrams to show different shapes of snout. A. Snout tip pointed. B. Snout tip rounded. C. Snout tubular with jaws at tip. D. Snout overhanging the mouth.

TAIL—In fishes, that part of the body which corresponds to the caudal vertebrae (Latin : *cauda*—tail). After the tail comes the caudal fin. Roughly speaking, the tail is that part of a fish's body from the vent posteriorly to, but not including, the caudal fin.

UROSTYLE—The posteriormost vertebra, that has the modified form of a triangular and vertical plate to which are joined most of the rays of the caudal fin.

VENT—Opening in ventral surface of fish, comprising genital, urinary and alimentary canal orifices.

VENTRAL—Situated on the abdomen of animals. The oppsite of DORSAL.

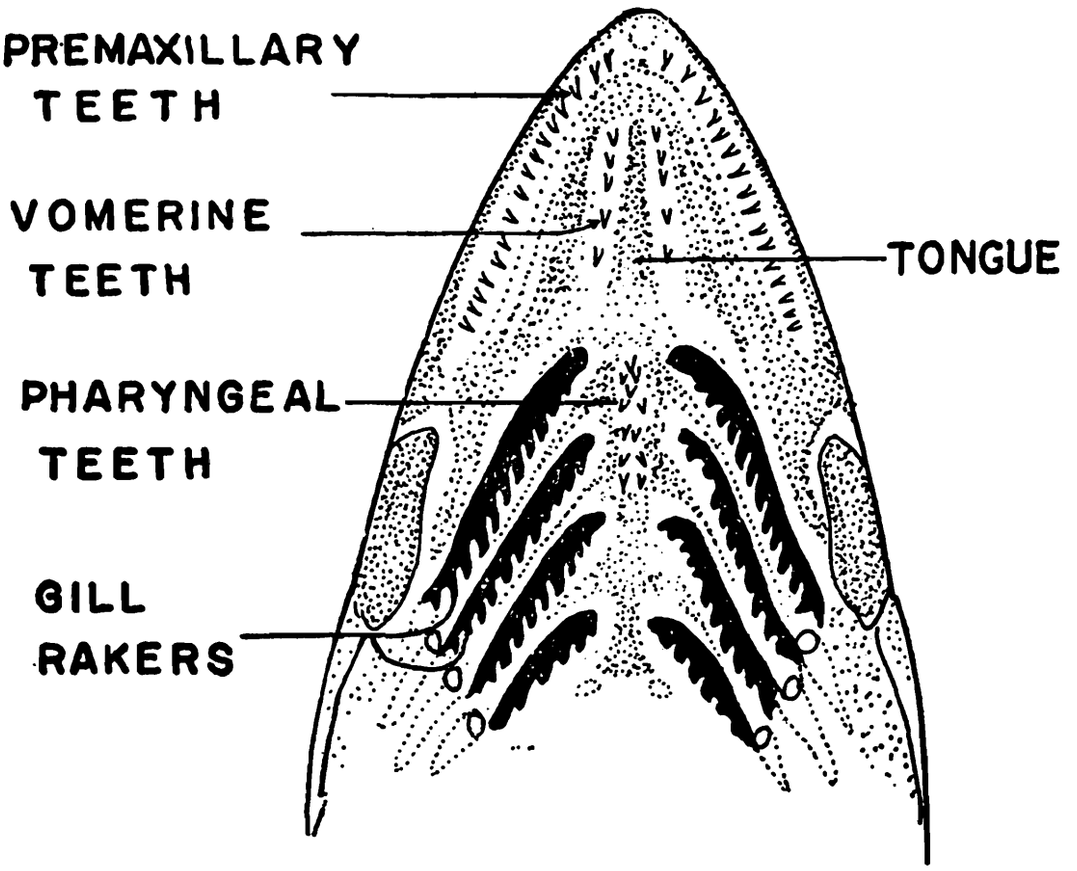


Fig. 208. Diagram of the floor of the mouth, showing bones with teeth, and tongue.

VERTEBRAE—Each of the bones between the head and end of the tail in the VERTEBRAL COLUMN. Just above each vertebra, the spine is called the neural spine which forms a fork, or NEURAL ARCH for the passage of a part of the nervous system. Below each vertebra there are often spiny processus. Vertebrae above the abdominal cavity with unjointed spiny processes, or even without them, are called ABDOMINAL VERTEBRAE. Those vertebrae in which these spiny processes join solidly to form the HAEMAL ARCH within which the aorta passes, are called the CAUDAL VERTEBRAE.

VIVIPAROUS—Producing living young instead of eggs.

VOMER—Bone in mid-palate, often bearing teeth (see Figs. 201, 208)

TOOTH : VILLIFORM—indicates numerous small or fine teeth of approximately the same size, usually in a band or patch (as in most catfishes). CONICAL teeth are with sharp points. INCISORS are chisel-shaped teeth. CANINE or CANINOID are conical tooth that notably projects, beyond the other teeth (as in Gobioids). MOLARS are flat-tipped teeth (as in *Rita*, see Fig. 84, p. 192).

PHARYNGEAL—See Figs, 7, 208.

PREMAXILLARY—See Fig. 208.

TONGUE—See Fig. 208.

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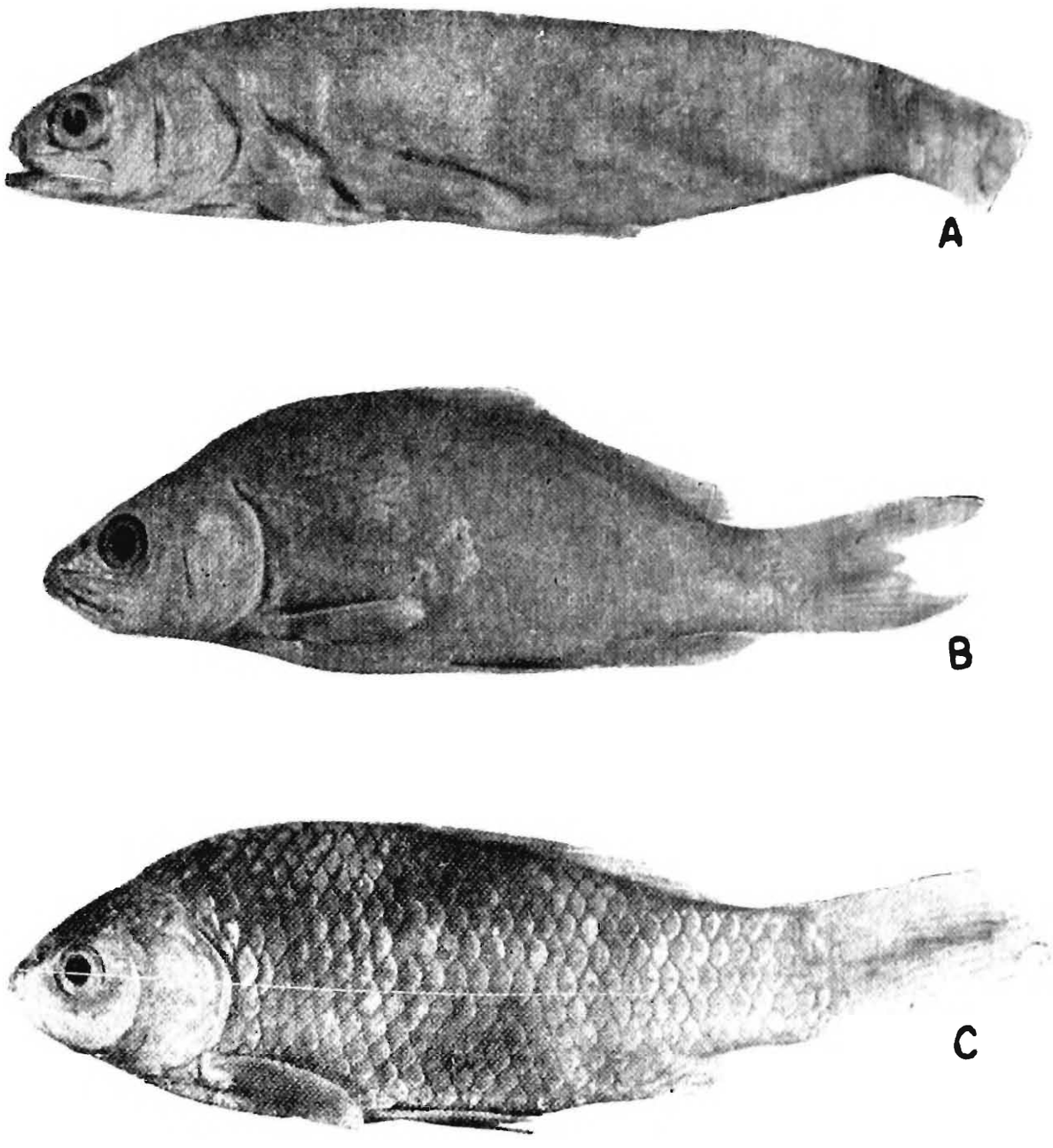
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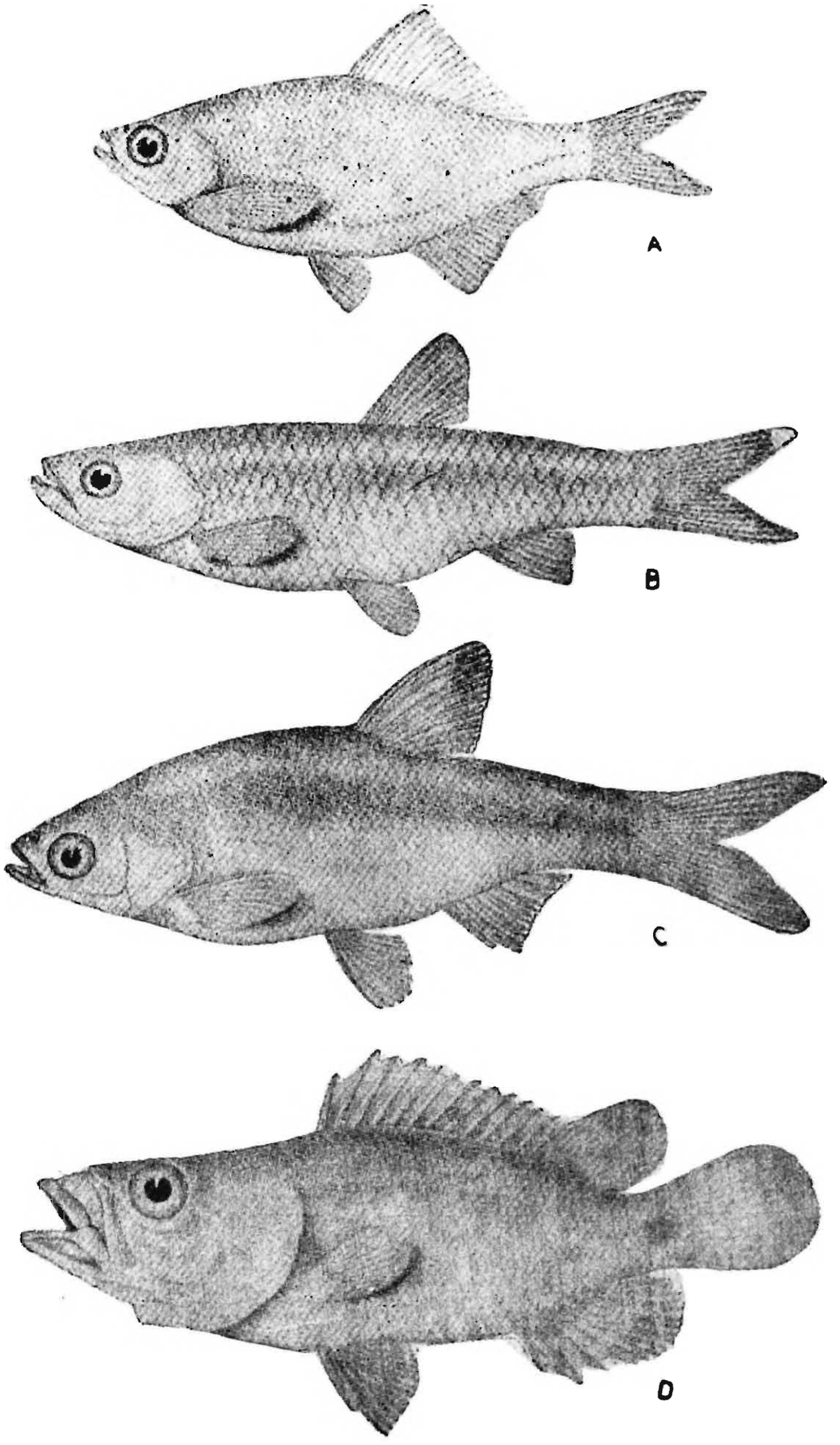
PLATES

PLATE I



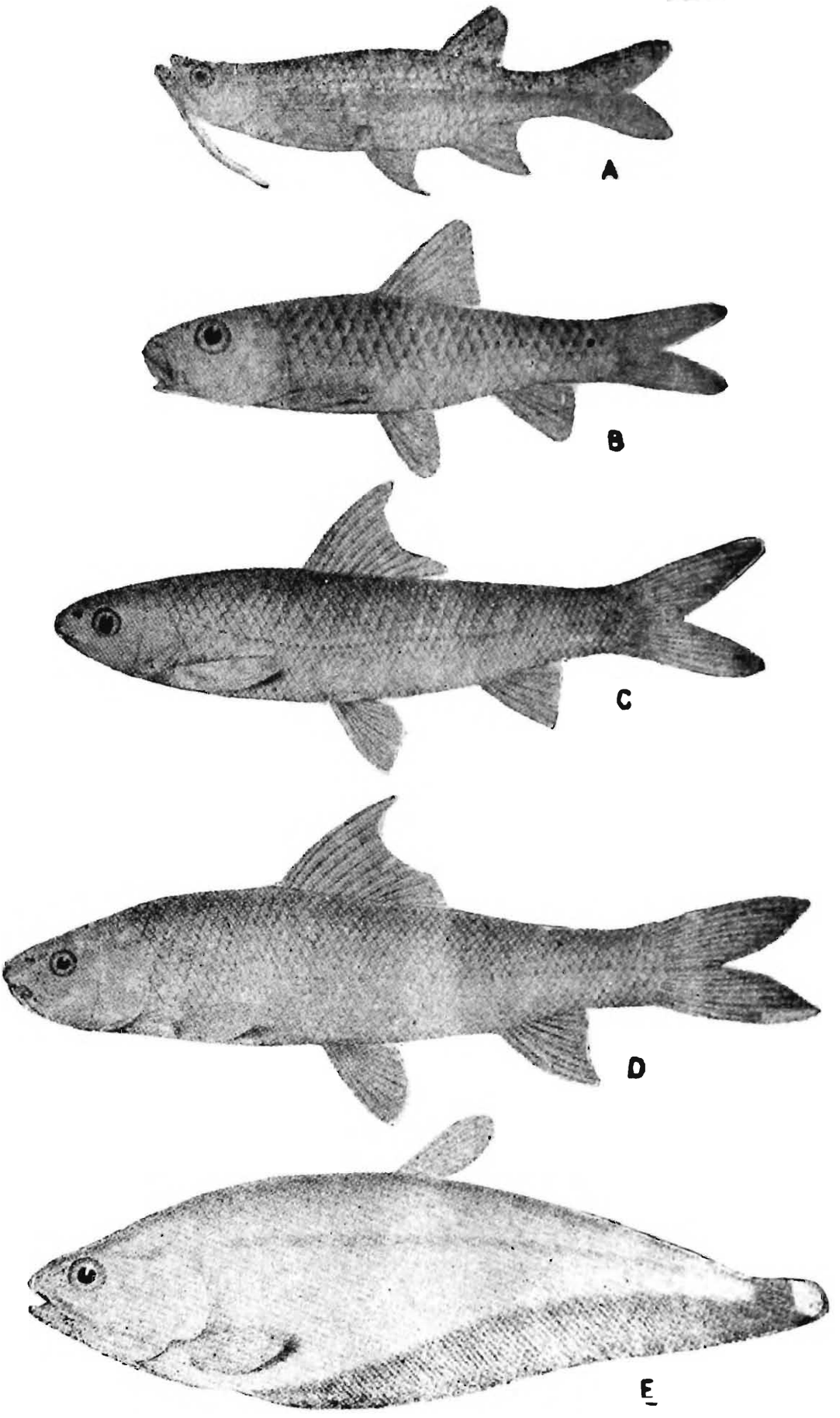
A. *Salmo levenensis* Walker, Photo of specimen No.1212 ZSI, from Nilgiris.
B. *Carassius auratus* Linn, Photo of specimen No. 641 ZSI.
C. *Cyprinus carpio communis*, Photo of specimen No. F. 11644/1 ZSI.

PLATE II



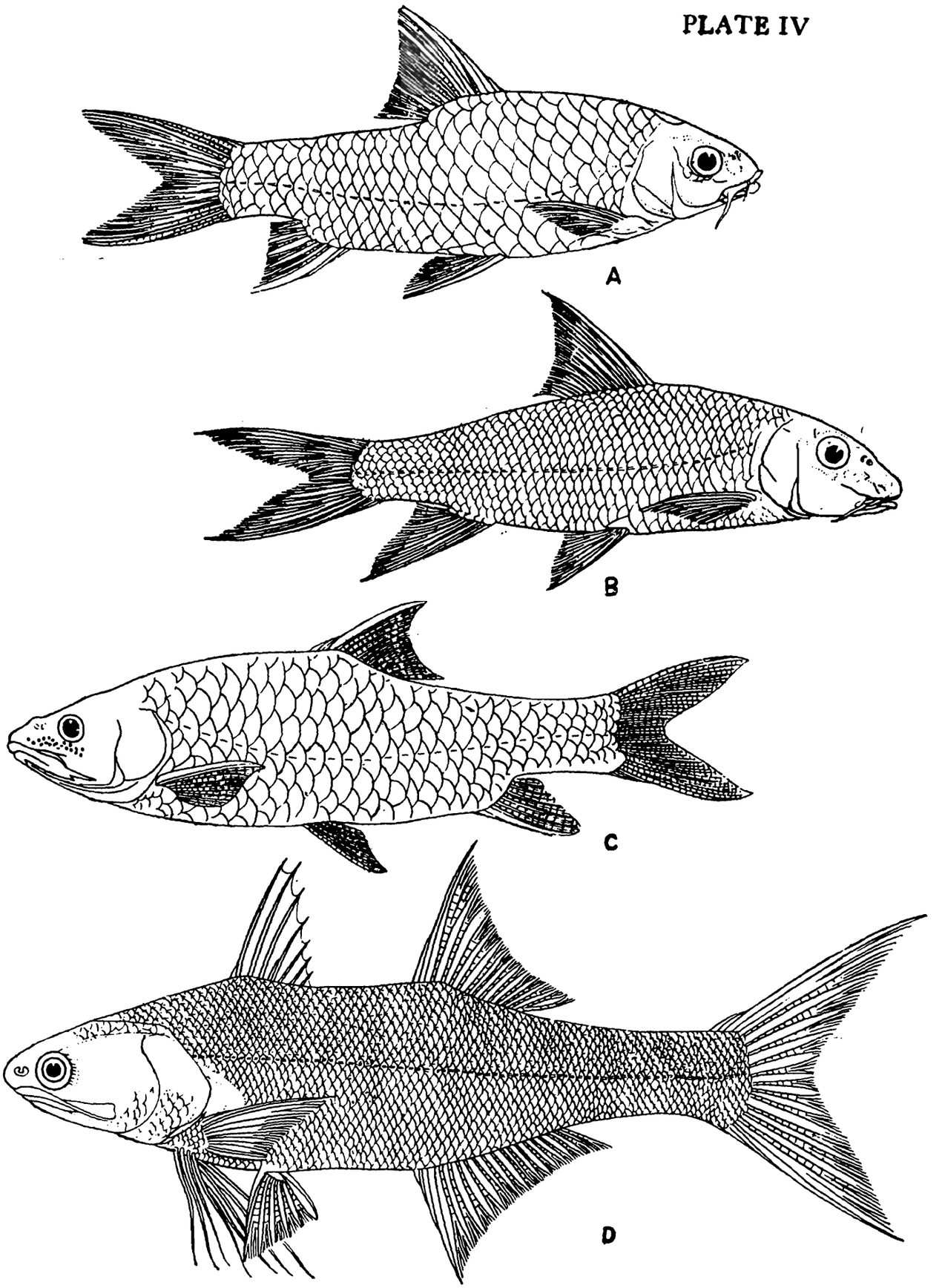
A. *Danio devario* (Hamilton). B. *Rasbora daniconius daniconius* (Hamilton). C. *Amblypharyngodon mola* (Hamilton). D. *Nandus nandus* (Hamilton). (After Chauhan, B. S. and Ramakirshna, G. 1954. *Rec. Indian Mus*, 51, Plate XIII)

PLATE III

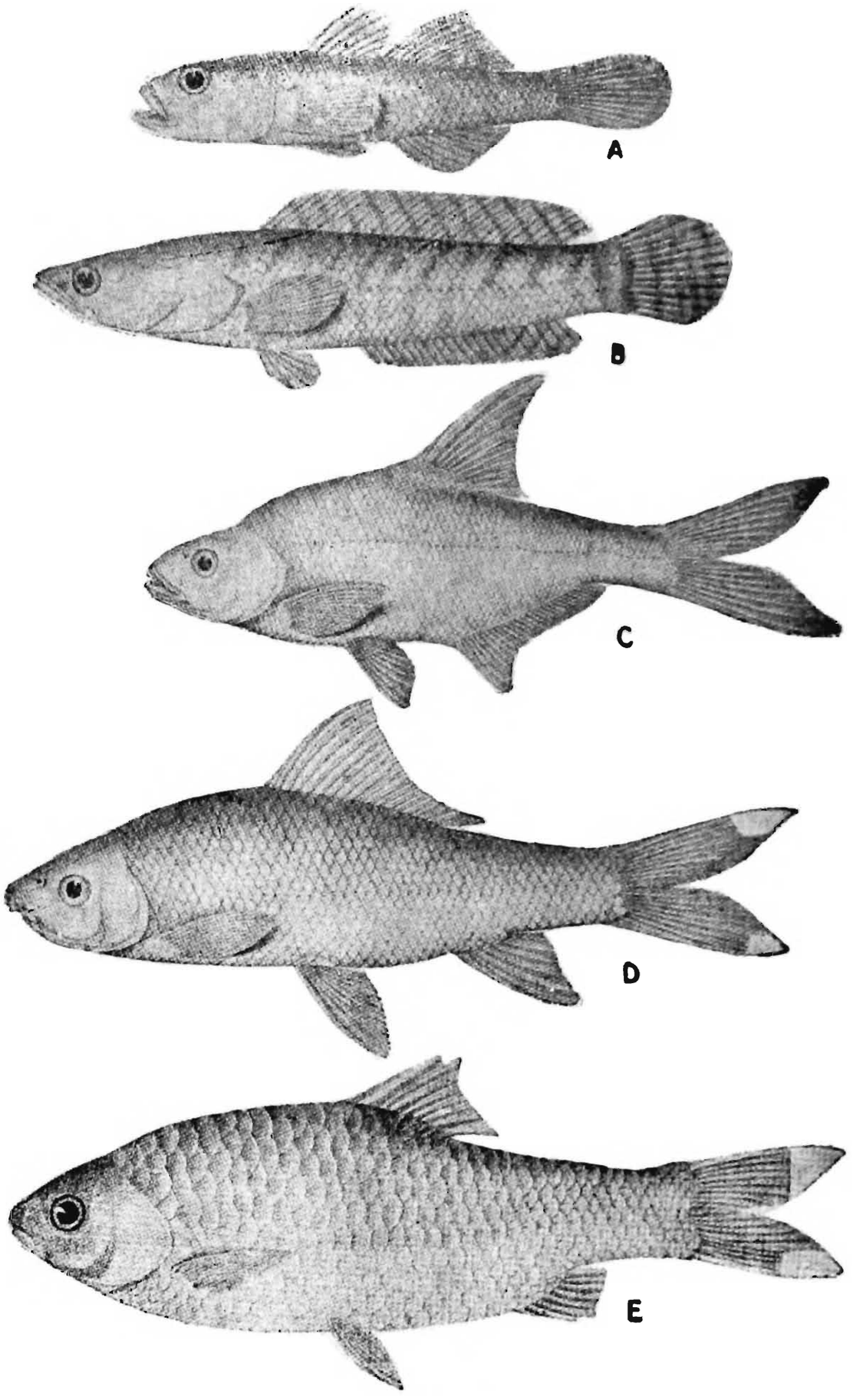


A. *Esomus danricus* (Hamilton). B. *Tor khudree* (Sykes). C. *Labeo boggut* (Sykes). D. *Cirrhinus reba* (Hamilton). E, *Notopterus notopterus* (Pallas) (After Chauhan, B, S, and Ramakrishna G. 1954. *Rec. Indian Mus.* 51 Plate XII)

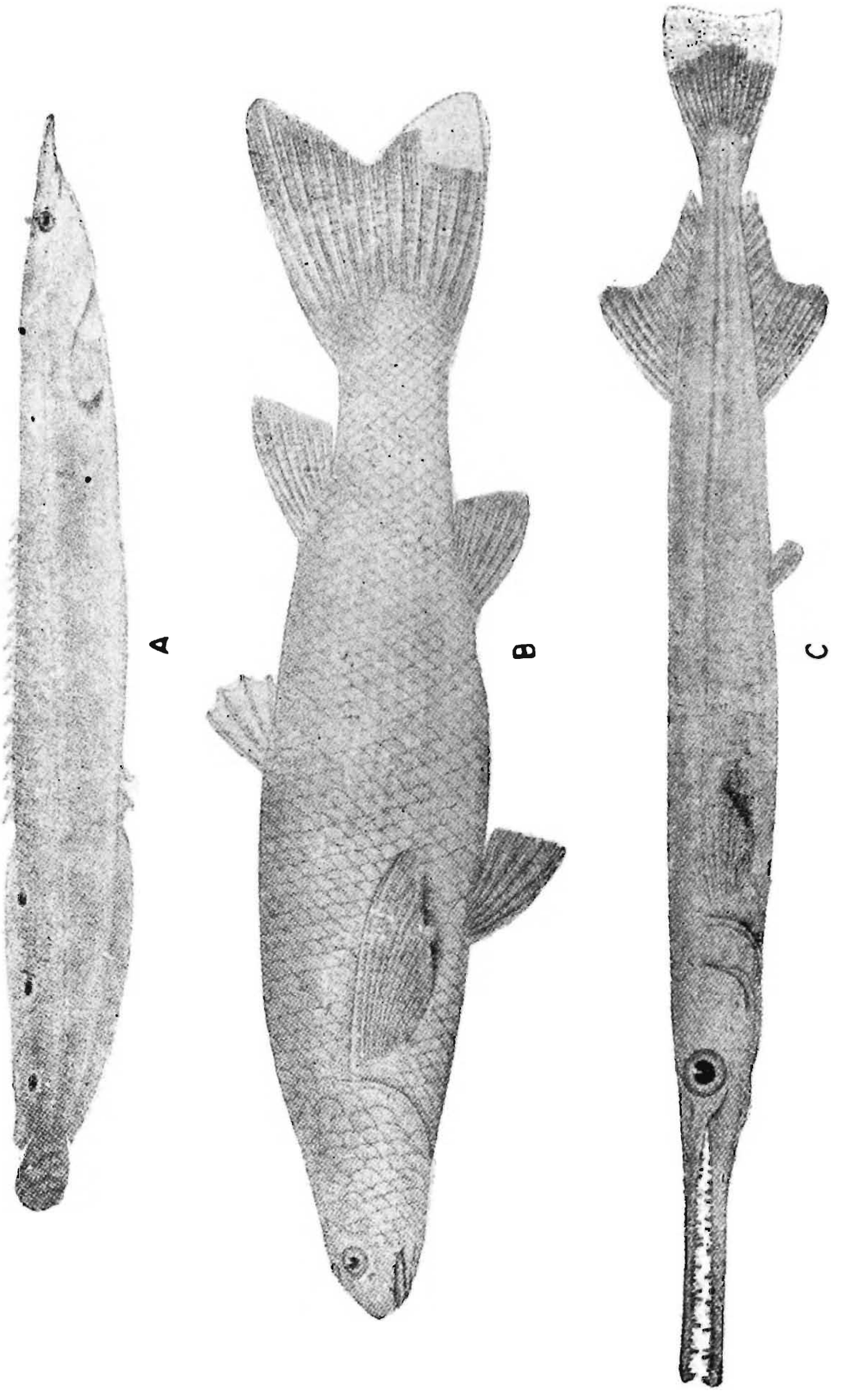
PLATE IV



A. *Puntius carnaticus* (Jerdon). B. *Puntius curmuca* (Hamilton).
C. *Tor mussuallah* (Sykes). D. *Eleutheronema tetradactylum* (Shaw). (After Hora, S. L. 1961. *J. Asiat. Soc. Bengal*, 17, Plate XX)

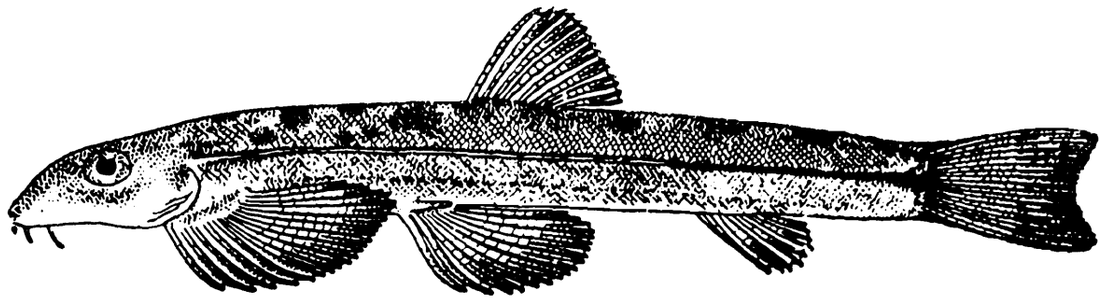


A. *Glossogobius giuris giuris* (Hamilton) B. *Channa punctatus* (Bloch)
C. *Osteobrama vigorsii* (Sykes) D. *Labeo fimbriatus* (Bloch) E. *Puntius sarana sarana* (Hamilton) (After Chauhan, B. S. and Ramakrishna, G. 1954 *Rec. Indian Mus.*, 51, Plate XI)



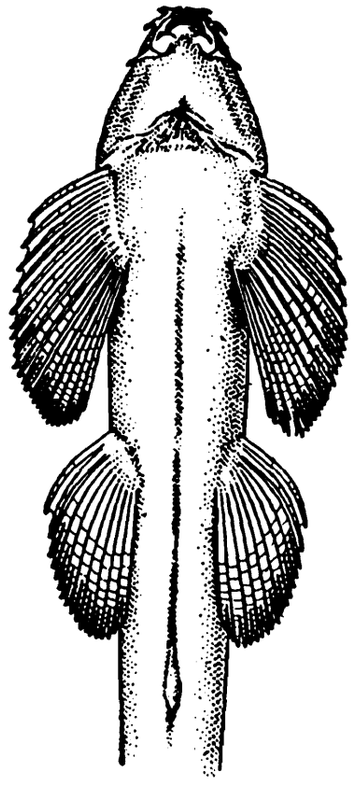
A. *Mastacembelus pancalus* (Hamilton) B. *Rhinomugil corsula* (Hamilton) C. *Xenentodon cancila* (Hamilton) (After Chauhan B. S. and Ramakrishna, G. 1954. *Rec. Indian Mus.*, 51, plate XIV)

PLATE VII



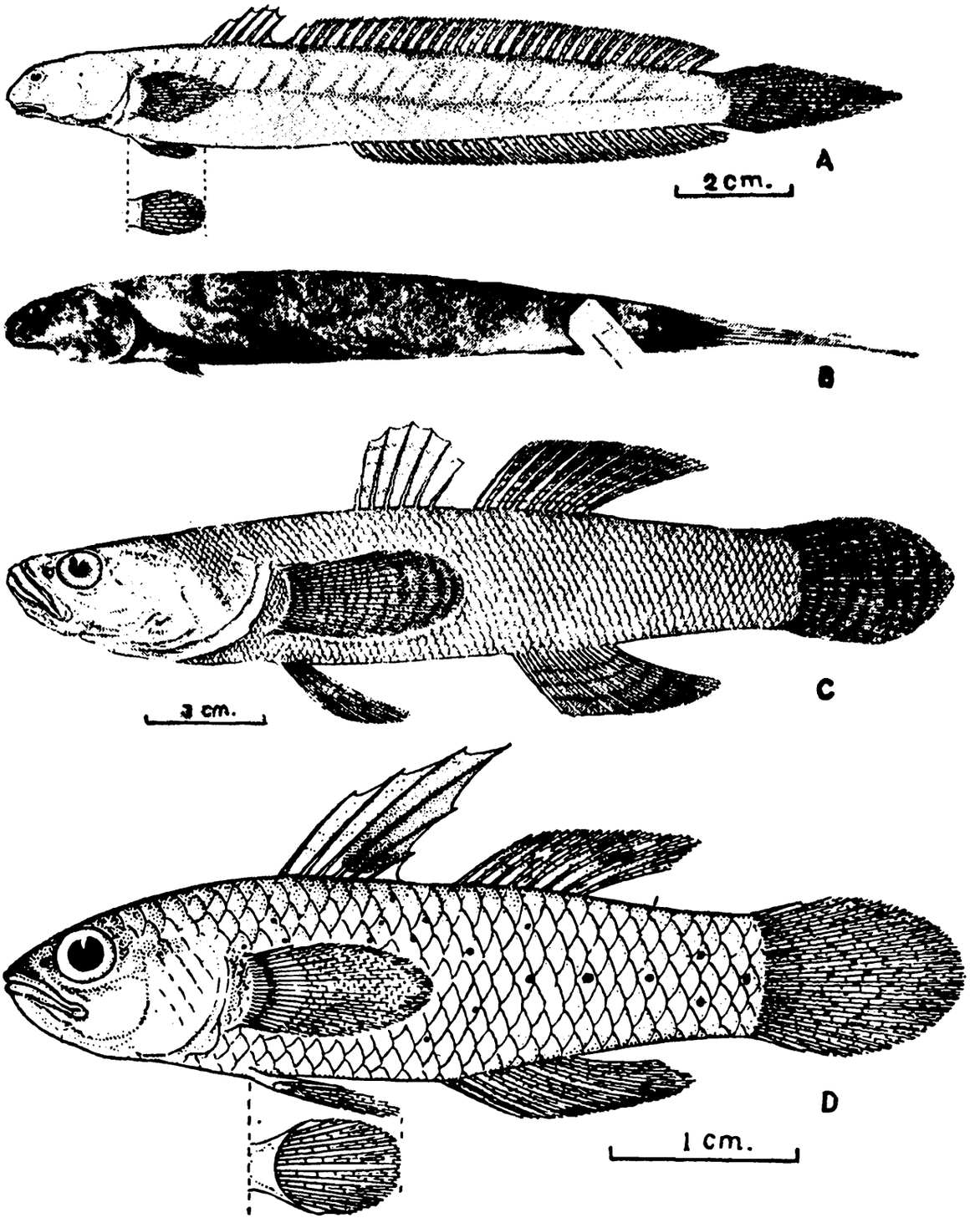
Lateral view of Homaloptera montana Herre

PLATE VIII



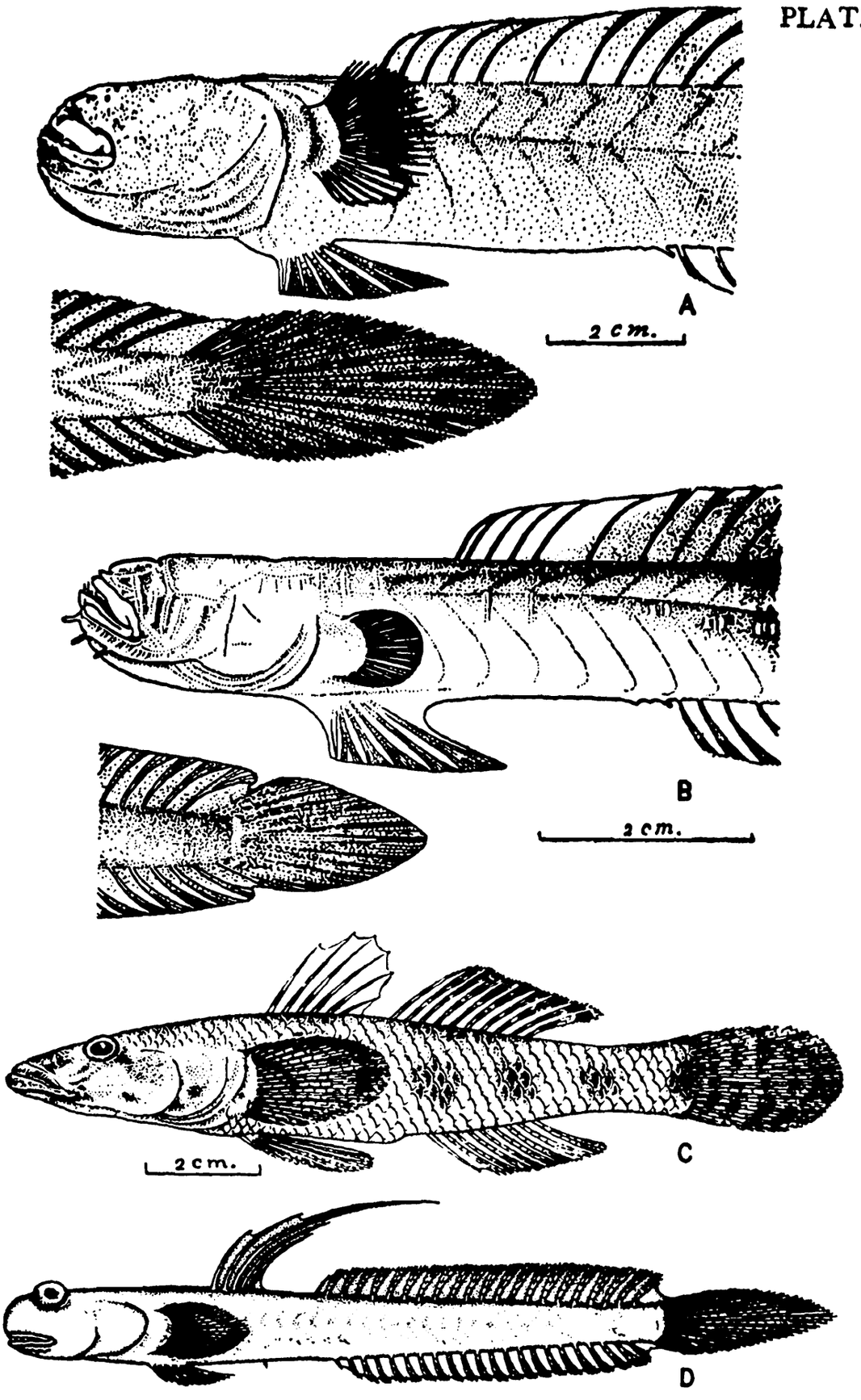
Vertical view of *Homaloptera montana* Herre (After Silas, E.G. 1958. *Rec. Indian Mus.*, 50, plate V).

PLATE IX



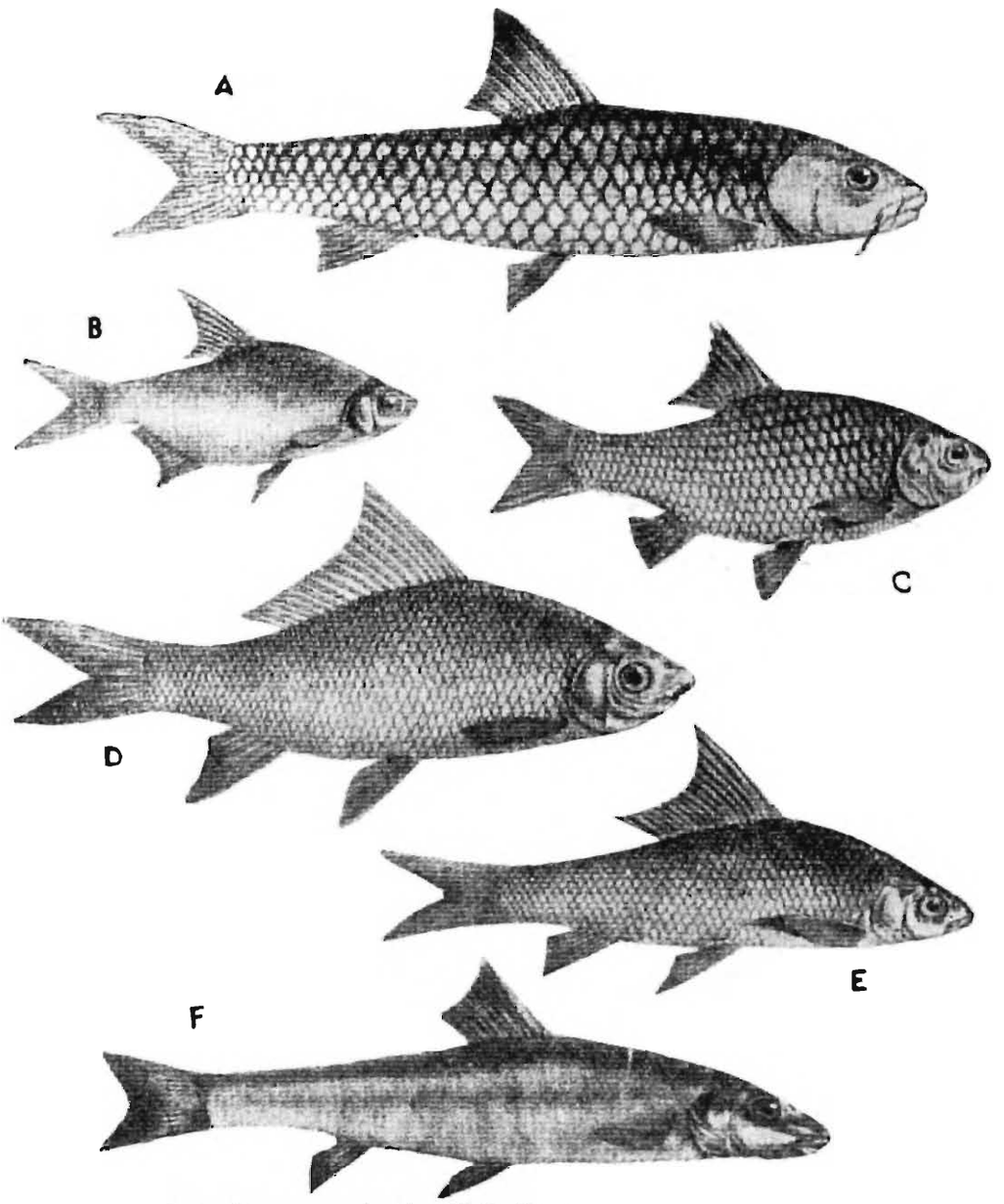
A. *Pseudapocryptes lanceolatus* (Bloch & Schneider) B. *Apocryptes bato* (Hamilton) C. *Eleotris fusca* (Bloch & Schneider) D. *Stigmatogobius sadanundio* (Hamilton)

PLATE X



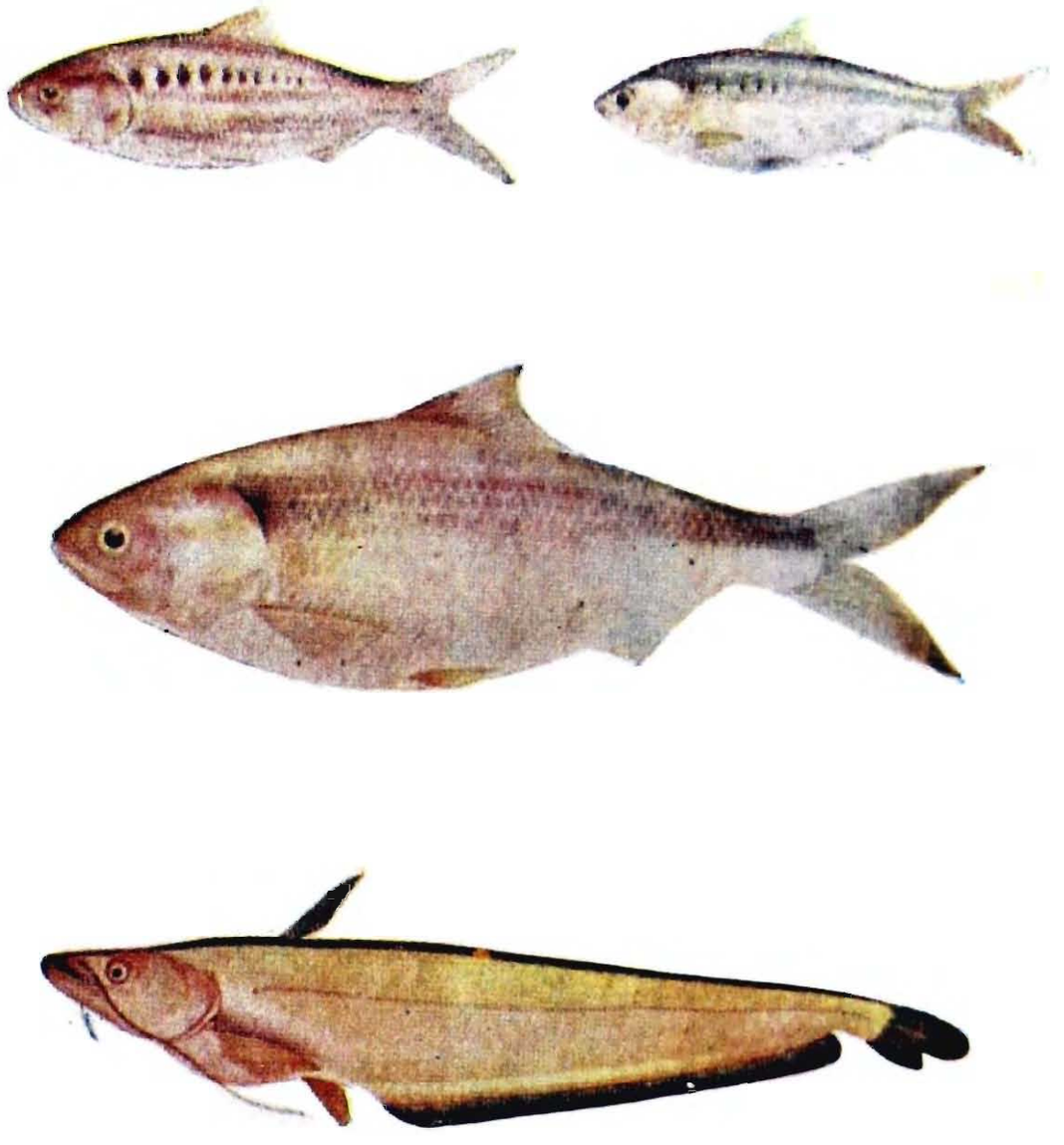
A. *Odontamblyopus rubicundus* (Hamilton) B. *Taenioides cirratus* (Blyth)
C. *Glossogobius giuris giuris* (Hamilton) D. *Scartelaos histophorus* (Val.)

PLATE XI



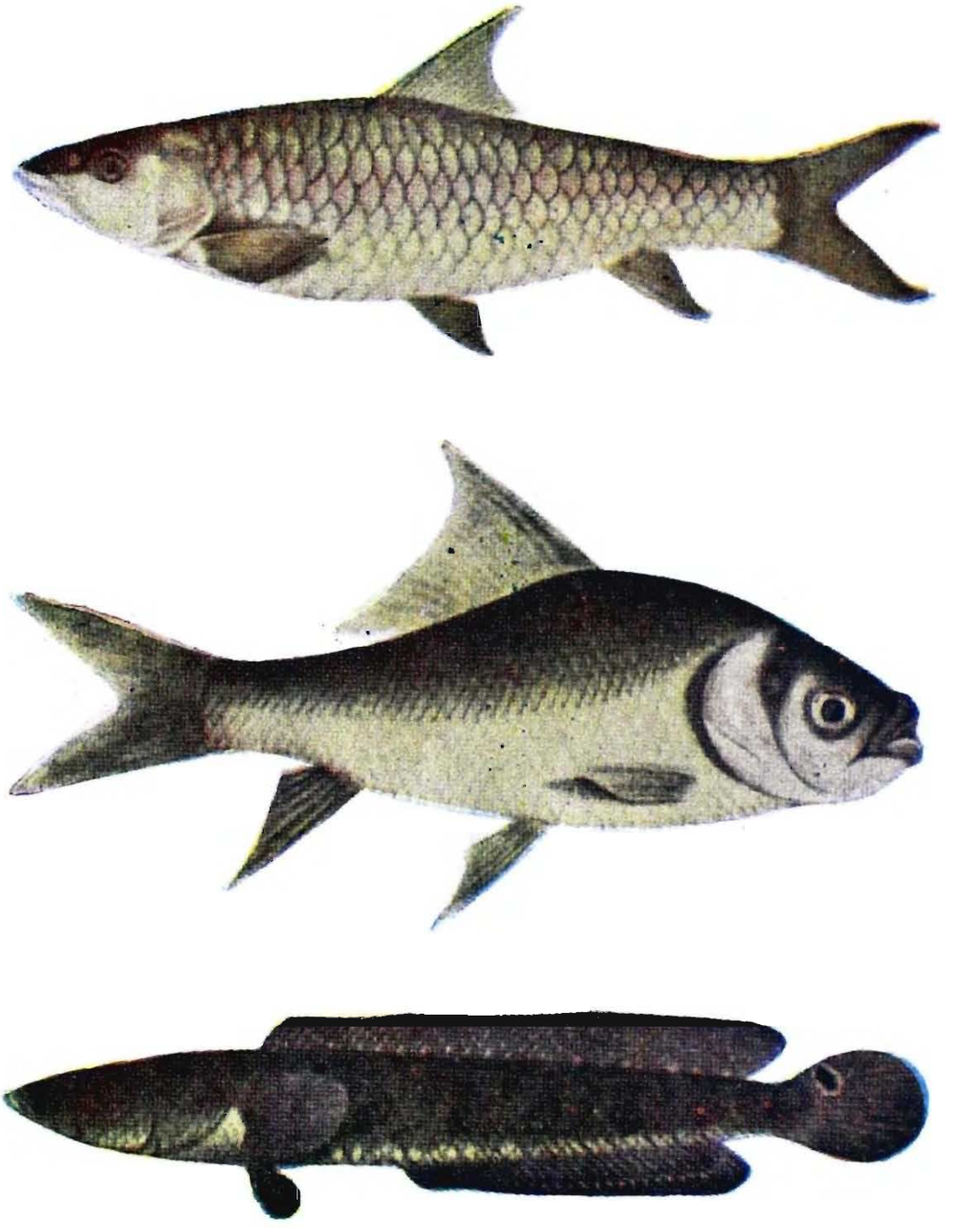
A. *Accrossocheilus hexagonolepis* (McClelland) B. *Rohtee (Rohtee) ogilibil* Sykes C. *Puntius sarana sarana* (Hamilton) D. *Labeo fimbriatus* (Bloch) E. *Cirrhinus cirrhosa* (Bloch) F. *Schizopyge progastus* (McCleliand) (*After, Wealth of India*, 4, Fish & Fisheries, Pl. IV, 1962).

PLATE XII



Top : *Hilsa ilisha* (Hamilton) —Young. Middle : *Hilsa ilisha* (Hamilton)—Adult, Bottom : Wallago attu (Schneider) (After, *Wealth of India*, 4, Fish & Fisheries, Pl, III, 1962).

PLATE XIII



Top : *Tor tor* (Hamilton) Middle : *Catla catla* (Hamilton)
Bottom : *Channa marulius* Hamilton (After, *Wealth of India*, 4, Fish & Fisheries, Fl. V, 1962).



Dr. K. C. JAYARAM joined the Zoological Survey of India in 1947 and came directly under the guidance of the celebrated Indian Ichthyologist the late Dr. Sunder Lal Hora. He obtained his research degrees from the Madras University, for his dissertations on Systematic Ichthyology and Zoogeography of Indian freshwater fishes, particularly on the Siluroid fishes of the family Bagridae. He has specialised in the taxonomy of the Siluroidea and was recently an FAO Consultant for preparation of Identification sheets for Ariidae of the Western Indian Ocean (Area 51). He has several papers to his credit published in India and abroad. He is presently posted as Deputy Director in the Zoological Survey of India at Calcutta.