

M.Sc. FISHERY SCIENCE
LAB MANUAL
1st Semester



Prepared By
Biological Science Dept.
Fishery Science

MIDNAPORE CITY COLLEGE



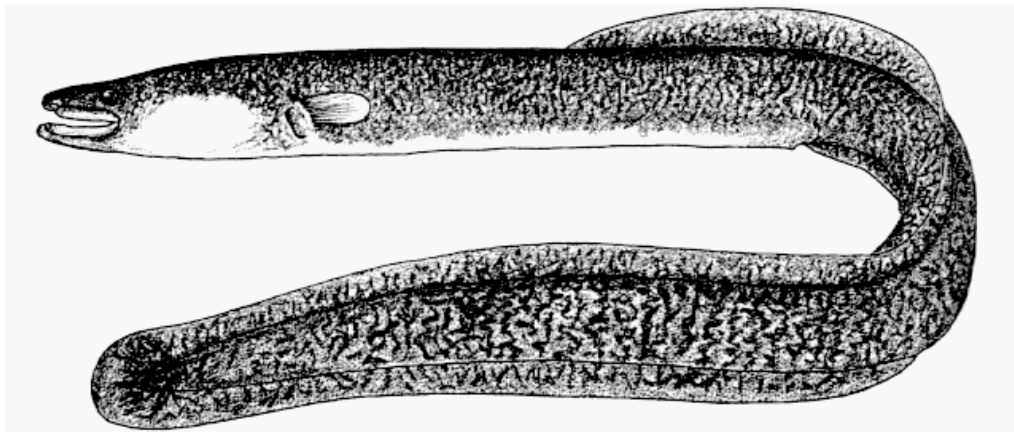
FSC-195 and FSC-196

PRACTICAL PAPER

1. Identification of common finfishes available from different aquatic resources of India.
 2. Identification of common shellfishes available from different aquatic resources of India.
 3. Identification of Agnathan fishes, Chimera, Dipnoan and Coelacanth fishes.
 4. Study of distribution and adaptive modifications of different groups of fishes.
 5. Study of migratory behavior of fishes
 6. Study the morphometry of different fishes.
 7. Preparation of taxonomic key.
 8. Construction of chart regarding study of the phylogenetic tree/evolutionary tree.
 9. Preparation of fish bar-coding.
 10. Study of the Length-Weight relationship, Relative gut length, Gastro-Somatic index of fish.
 11. Study of the feeding behavior, mouth-parts modification and gut content analysis from different fish groups.
 12. Analysis of different biodiversity indices. (Community analysis through communitymap).
 13. Biological studies of selected finfishes and shellfishes from different aquatic resources.
 14. Field visit.
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1. Study of the digestive and circulatory systems of common species of finfishes.
2. Study of the urinogenital and nervous system of locally available finfishes.
3. Study of the digestive and nervous system of shellfishes.
4. Accessory respiratory organs of fishes.
5. Study of different endocrine glands of fishes and shellfishes.
6. Study of fish histology.
7. Estimation of fish yield potential.
8. Fisheries forecasting system; Remote sensing equipment. PFZ analysis.
9. Preparation of fish-skeletons.
10. Identification of traditional and modern fishing crafts and gears used in different aquatic system of India.
11. Identification of fishing gear accessories
12. Study of the different fish finding and safety devices used in fishing vessels.
13. Identification of different fouling organisms.
14. Isolation and culture of aquatic microbes
15. Staining of microbes.
16. Study of toxicity bioassay technique.
17. Identification of different aquatic pollution indicator species.
18. Studies on important bioinformatics tools and AI in fisheries
19. Database development through the survey, collection and analysis of data from fish market/fish cooperative societies/fish farm/NGOs etc.

Specimen: 1



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Elopomorpha

Order – Anguilliformes

Family – Anguillidae

Genus – *Anguilla*

Species – *bengalensis*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Gular plate present in non eel like representatives.
- Branchiostegals usually numerous.

Hence, Super order - Elopomorpha

- Body ill like, smooth, with minute or rudimentary scales, imbedded in the skin or absent
- Gill opening in the pharynx as narrow or wide slits
- Pelvic fins are absent

Hence, Order – Anguilliformes

- Gill openings situated in the pharynx in the form of moderate slits near the base of pectoral fins.
- Nostrils lateral or superior

Hence, Family – Anguillidae

- Body elongated, cylindrical, band-shaped, Abdomen rounded, Head long and compressed, Snout pointed.
- Mouth terminal, cleft of mouth wide, extending to the posterior margin of the orbit
- Eyes are very small, superior, in middle of the head, not visible from the bellow ventral surface

- Lips are thick and well developed
- Jaws are equal
- Caudal fin continued round the end of the tail

Hence, Genus – *Anguilla*

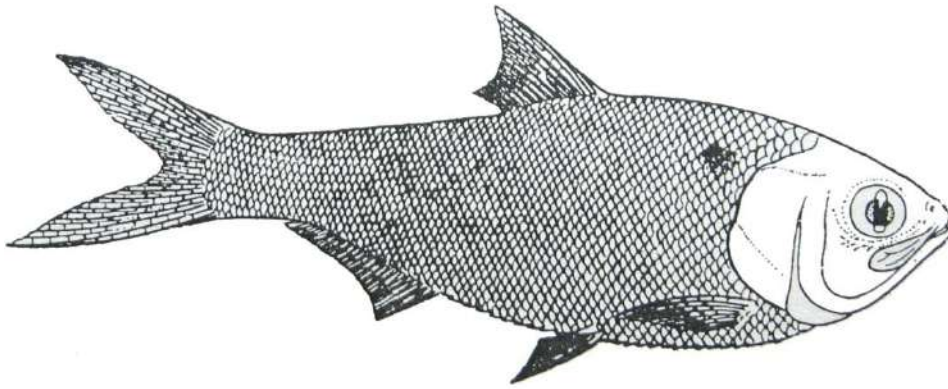
- Villiform teeth are present in the jaws and palate
- Dorsal fin inserted midway between gill opening and origin of anal fin with 220-305 rays and no spine
- Anal fin long with 200 – 250 rays
- Colouration of adult is variegated

Hence, species – *bengalensis*

Hence, the provided specimen is *Anguilla bengalensis*

Distribution - Throughout India, Pakistan, Bangladesh, Sri Lanka, Burma and Malay

Specimen: 2



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Clupeomorpha

Order – Clupeiformes

Family – Clupeidae

Genus – *Gudusia*

Species – *chapra*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Branchiostegals numbering as high as 15, usually fewer
- Mesocoracoid arch invariably present
- Usually no lateral line possess on trunk

Hence, Super Order – Clupeomorpha

- Body short, oblong, not eel like, covered with minute cycloid scales, scales are absent in head regions
- Abdomen with keeled scutes along the ventral line
- Radiating cutaneous canals on opercular bones

Hence, Order – Clupeiformes

- Maxillaries composed of three pieces and not composed with together
- Teeth when present, is rudimentary and deciduous
- Barbells absent
- Gill membranes free
- Opercular pieces four

Hence, Family – Clupeidae

- Body compressed and oblong
- Abdomen serrated, with 18 – 19 pre pelvic and 8 – 10 post pelvic scutes
- Head short and highly compressed

- Snout rounded
- Mouth slightly upturned, terminal, cleft not extending to the orbit
- Eyes large, lateral, in anterior part of the head and not visible from the ventral surface with broad adipose eyelid
- Lips thin
- Caudal fin forked

Hence, Genus – *Gudusia*

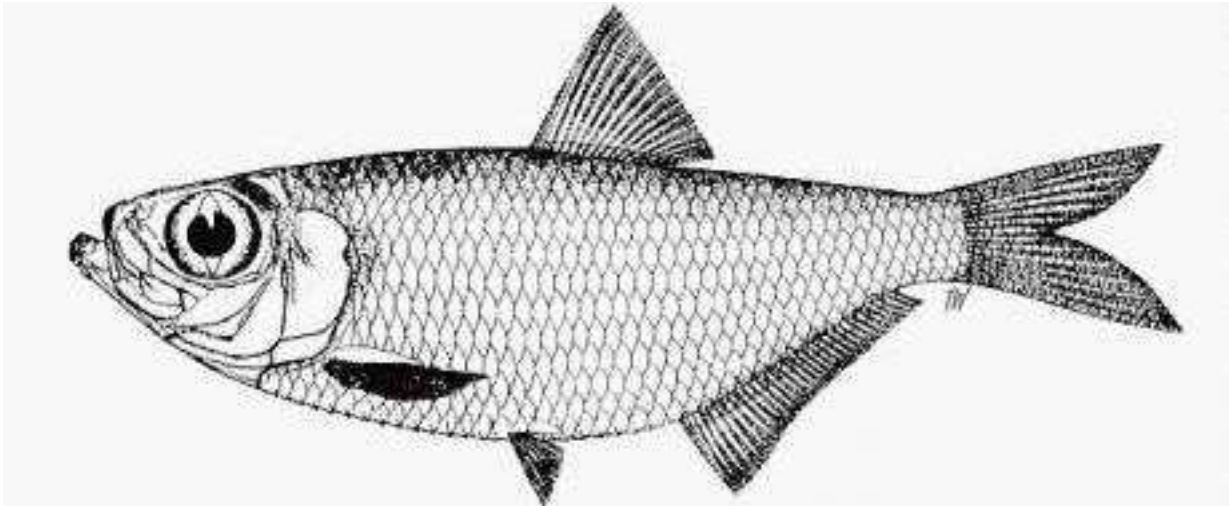
- Body without any cross bars on sides
- Dorsal fins inserted in above pelvic origin, with 16 rays
- Anal fin with 19 – 21 rays
- Caudal fin forked
- Lateral line absent, 80 – 120 scales in the lateral series

Hence, species – *chapra*

Hence, the provided specimen, *Gudusia chapra*

Distribution – India, Pakistan, Bangladesh, China and Burma, Nepal, Malaya

Specimen: 3



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Clupeomorpha

Order – Clupeiformes

Family – Clupeidae

Genus – *Pellona*

Species – *ditchela*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Branchiostegals numbering as high as 15, usually fewer
- Mesocoracoid arch invariably present
- Usually no lateral line possesses on trunk

Hence, Super Order – Clupeomorpha

- Body short, oblong, not eel like, covered with minute cycloid scales, scales are absent in head regions
- Abdomen with keeled scutes along the ventral line
- Radiating cutaneous canals on opercular bones

Hence, Order – Clupeiformes

- Maxillaries composed of three pieces and not composed with together
- Teeth when present, is rudimentary and deciduous
- Barbells absent
- Gill membranes free
- Opercular pieces four

Hence, Family – Clupeidae

- Body compressed and elongated
- Abdomen serrated, with 18 – 20 pre pelvic and 8 – 9 post pelvic scutes
- Head long and compressed

- Snout blunt
- Mouth upturned, cleft not reaching to the orbit
- Eyes large, lateral, in the middle of the head and not visible from the ventral surface with narrow adipose eyelid
- Lips thin
- Lower jaw longer than upper

Hence, Genus – *Pellona*

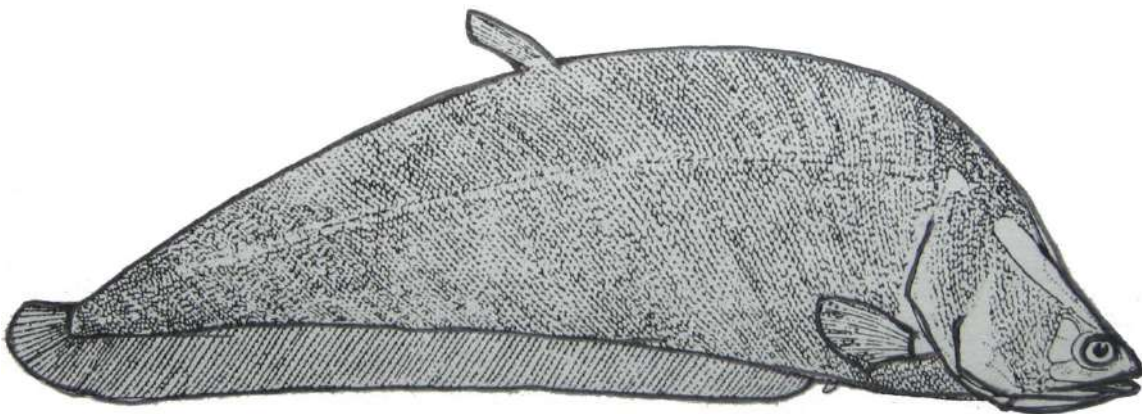
1. Dorsal fins inserted in above the tip of the pectoral fin or slightly behind, with 17 - 18 rays
2. Anal fin with 30 – 40 rays
3. Lateral line absent, 40 – 45 scales in the lateral series

Hence, species – *ditchela*

Hence, the provided specimen, *Pellona ditchela*

Distribution – India, Pakistan, Bangladesh, China and Burma, Nepal, Malaya, Thailand, Vietnam, South Africa, and Madagascar

Specimen: 4



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Osteoglossomorpha

Order – Osteoglossiformes

Family – Notopteridae

Genus – *Notopterus*

Species – *chitala*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Premaxilla firmly bound to the ethmo-vomerine region
- Branchiostegals three to five

Hence, Super Order – Osteoglossomorpha

- Maxillaries well toothed and forming the greater part of the upper jaw
- Maxillaries and premaxillaries firmly bound together and have restricted mobility
- Supra maxillae absent

Hence, Order – Osteoglossiformes

- Abdomen serrated before pelvic fins
- Dorsal profile not compressed as ventral profile
- No barbells
- Dorsal fin single belonging to the caudal portion of vertebral column

Hence, Family Notopteridae

- Body oblong, laterally compressed
- Abdomen with about 28 pre-pelvic double serration
- Mouth wide, cleft of the mouth extending up to or beyond the posterior border of the eye
- Eyes moderate, superior, in part of the head, not visible below the ventral surface
- Lips thin and jaws equal
- Gill membranes partly united

Hence, Genus – Notopterus

- Dorsal fin small, tuft like, inserted near the middle of the body, with 9 – 10 rays
- Anal fin is very low, ribbon like, 110 – 135 rays, confluent with caudal fin
- Pelvic fin rudimentary with 6 rays

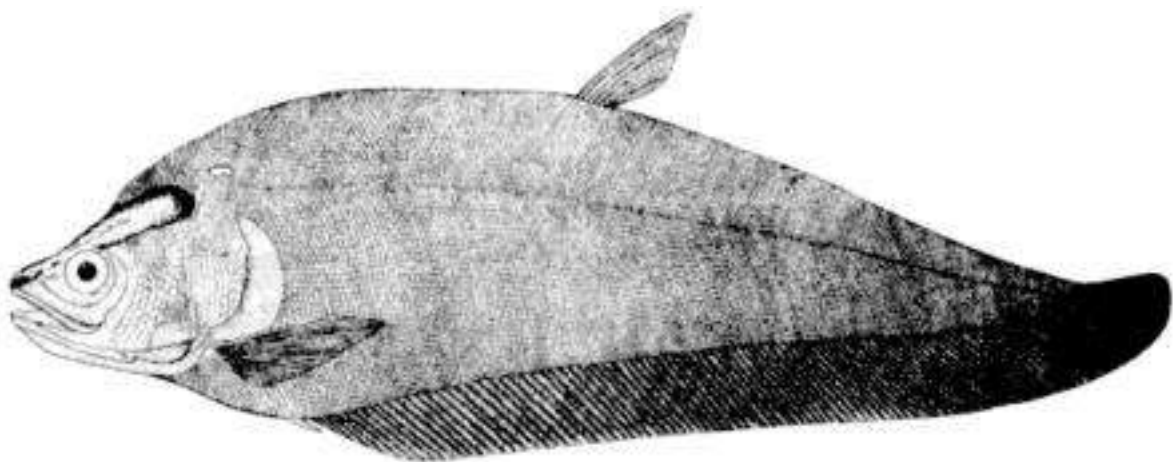
- Lateral line is more or less with 180 rays
- Gape of the mouth not extending beyond the hind edge of orbit
- Silvery on sides, copper brown on back, having 15 silvery bars dorsally

Hence, species – *chitala*

Hence, the provided specimen is *Notopterus chitala*

Distribution – India: Northern India, Pakistan, Bangladesh, and Burma

Specimen: 5



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Osteoglossomorpha

Order – Osteoglossiformes

Family – Notopteridae

Genus – *Notopterus*

Species – *notopterus*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Premaxilla firmly bound to the ethmo-vomerine region

- Branchiostegals three to five

Hence, Super Order – Osteoglossomorpha

- Maxillaries well toothed and forming the greater part of the upper jaw
- Maxillaries and premaxillaries firmly bound together and have restricted mobility
- Supra maxillae absent

Hence, Order – Osteoglossiformes

- Abdomen serrated before pelvic fins
- Dorsal profile not compressed as ventral profile
- No barbells
- Dorsal fin single belonging to the caudal portion of vertebral column

Hence, Family Notopteridae

- Body oblong, laterally compressed
- Abdomen with about 28 pre-pelvic double serration
- Mouth wide, cleft of the mouth extending upto or beyond the posterior border of the eye
- Eyes moderate, superior, in part of the head, not visible bellow the ventral surface
- Lips thin and jaws equal
- Gill membranes partly united

Hence, Genus – *Notopterus*

- Dorsal fin small, tuft like, inserted near the middle of the body, with 7 – 9 rays
- Anal fin is very low, ribbon like, 100 – 110 rays, confluent with caudal fin
- Pelvic fin rudimentary with 5-6 rays
- Lateral line is more or less with 225 rays
- Gape of the mouth extending beyond the hind edge of orbit
- Silvery white on sides, Gray on back

Hence, species – *chitala*

Hence, the provided specimen is *Notopterus notopterus*

Distribution – India: Northern India, Pakistan, Bangladesh, and Burma

Specimen: 6



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Protacanthopterygii

Order – Salmoniformes

Family – Salmonidae

Genus – *Salmo*

Species – *gairdnerii*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- A wide spread trend towards the exclusion by Premaxilla of the maxillae from the gape and development of Premaxillary possess
- Branchiostegals numerous

Hence, Super Order – Protacanthopterygii

- Body elongated, to sub cylindrical covered with cycloid scales, head without scales
- Abdomen non-keeled and non-serrated
- Psedobranchiae present

Hence, Order – Salmoniformes

- Body compressed, with fine scales
- Dorsal fin two, an adipose dorsal fin present
- Cleft of the mouth

Hence, Family Salmonidae

- Body elongated and sub cylindrical, with round abdomen
- Head moderate and snout obtuse
- Mouth wide and cleft of the mouth oblique, extending up to front border of the eye
- Eyes large and superior, in the middle of the head, not visible from below the ventral surface
- Lips thin and jaws equal

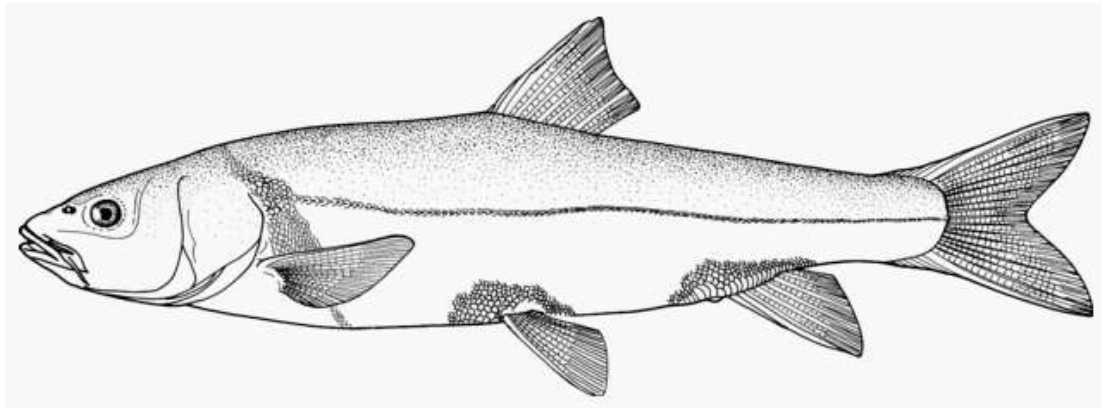
Hence, Genus – *Salmo*

- Rayed Dorsal fin inserted above the pelvic fin, with 12 – 14 rays
- Adipose dorsal fin smooth, small inserted above mid anal
- Anal fin short, 10 – 13 rays
- Caudal fin forked
- Body without spots, below the lateral line and Lateral line straight with 127 - 160 rays
- Colour of the body is still blue

Hence, species – *gairdnerii*

Hence, the provided specimen is *Salmo gairdnerii*

Distribution – India: hilly regions, Pakistan, Sri Lanka, Bangladesh, S. Africa, England and North America

Specimen: 7

Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Cypriniformes

Family – Cyprinidae

Genus – *Schizothorax*

Species – *kumoanensis*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Body oblong, compressed covered with large cycloid scales, head without scales
- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless
- Barbells often present around the mouth
- No adipose dorsal fin

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or without sucker
- Developed lips are present

Hence, Family Cyprinidae

- Body elongated and sub cylindrical, with round abdomen
- Head large and pointed anteriorly, snout rounded
- Mouth inferior and transverse
- Eyes large laterally placed, not visible from below the ventral surface

- Lips thick and fleshy, lower lip with a free posterior edge forming a sucker
- Barbells two pairs, one each rostral and other is maxilla

Hence, Genus – Schizothorax

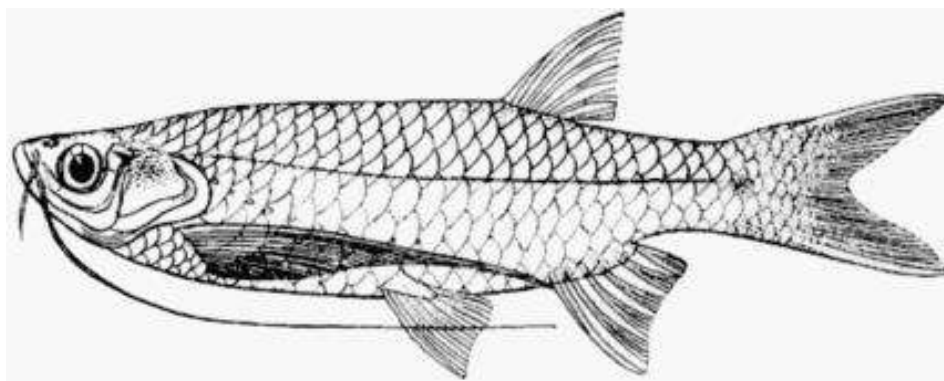
- Dorsal fin inserted slightly ahead of pelvic fin, with 11 – 12 rays and with spine which may be articulated, smooth or serrated
- Anal fin short, 7 – 8 rays
- Caudal fin forked
- Lateral line complete with 98 - 100 rays
- Body uniformly silvery without black spots (alcohol preserved specimen)

Hence, species – kumoanensis

Hence, the provided specimen is Schizothorax kumoanensis

Distribution – India: hilly regions, Pakistan, Sri Lanka, Bangladesh, S. Africa, England and North America

Specimen: 8



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Cypriniformes

Family – Cyprinidae

Genus – *Esomus*

Species – *danricus*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony

- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Body oblong, compressed covered with large cycloid scales, head without scales
- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless
- Barbells often present around the mouth
- No adipose dorsal fin

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or without sucker
- Developed lips are present

Hence, Family Cyprinidae

- Body elongated strongly compressed, with round abdomen
- Head small and blunt, snout blunt
- Mouth small, obliquely directed upwards
- Eyes inferiorly placed, visible from below the ventral surface
- Lips thin
- Barbells two pairs, maxillary pair is long, extending up to the anal fin

Hence, Genus – *Esomus*

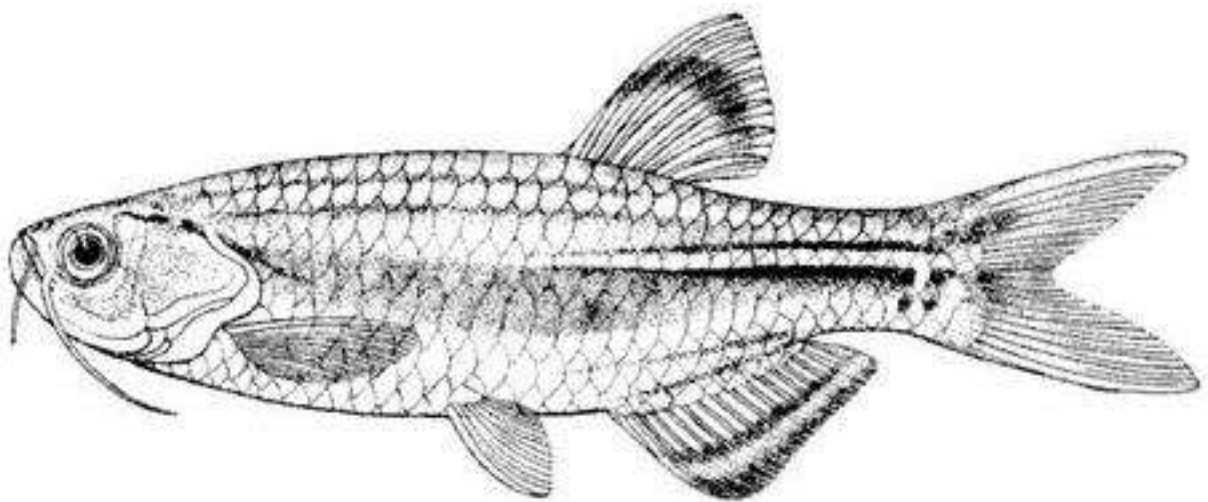
- Dorsal fin inserted in the interspaces between anal and pelvic fin, with 6 branched rays and without spine
- Anal with 5 branched rays
- Caudal fin forked
- No pre caudal spots are present, sides with broad lateral band, 14 scale round the caudal peduncle

Hence, species – danricus

Hence, the provided specimen is *Esomus danricus*

Distribution – India, Pakistan, Nepal and Bangladesh, Sri Lanka, Thailand, Malay

Specimen: 9



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Cypriniformes

Family – Cyprinidae

Genus – *Danio*

Species – *dangila*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Body oblong, compressed covered with large cycloid scales, head without scales
- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless
- Barbells often present around the mouth
- No adipose dorsal fin

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or without sucker
- Developed lips are present

Hence, Family Cyprinidae

- Body elongated compressed, sub cylindrical with round abdomen
- Head moderate and blunt, snout obtuse
- Mouth anterior, cleft of the mouth not protractile
- Eyes large centrally placed, not visible from below the ventral surface
- Lips thin and simple
- One or two pairs of barbells, rudimentary or none

Hence, Genus – *Danio*

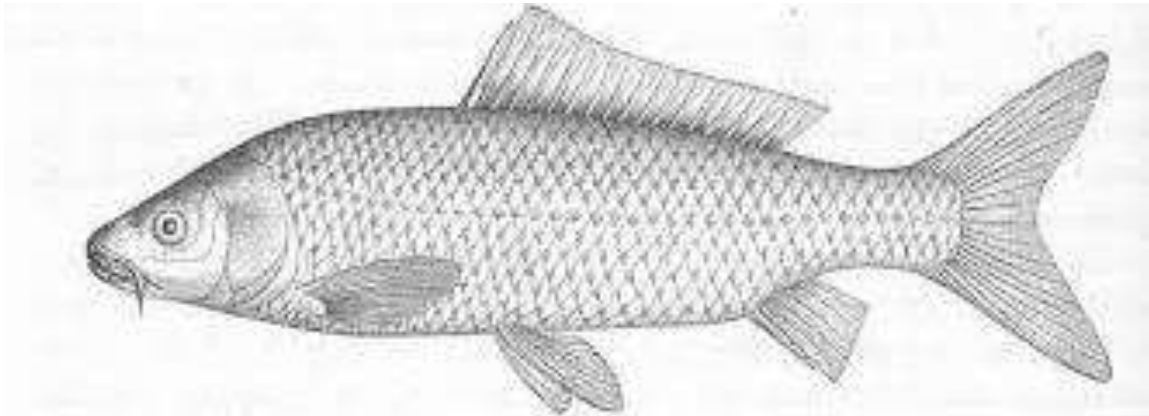
- Dorsal fin inserted in the interspaces between anal and pelvic fin, with 12 – 16 branched rays and without spine
- Anal with 13 – 20 rays
- Caudal fin forked
- Both pairs of barbells much longer than eye diameter
- Lateral line scales – 36 to 42

Hence, species – *dangila*

Hence, the provided specimen is *Danio dangila*

Distribution – India: Bihar, Bengal, Eastern Himalaya, Bangladesh, Nepal and Burma

Specimen: 10



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Cypriniformes

Family – Cyprinidae

Genus – *Cyprinus*

Species – *carpio*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Body oblong, compressed covered with large cycloid scales, head without scales
- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless
- Barbells often present around the mouth
- No adipose dorsal fin

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or without sucker

- Developed lips are present

Hence, Family Cyprinidae

- Body robust anteriorly, more or less compressed, with round abdomen
- Head moderate, snout obtusely blunt
- Mouth terminal, oblique cleft not extending to anterior margin of eyes
- Eyes moderate and super lateral, in anterior part of the head visible from below the ventral surface
- Lips fleshy
- Barbells two pairs, one pair each of rostral and maxillary

Hence, Genus – Cyprinus

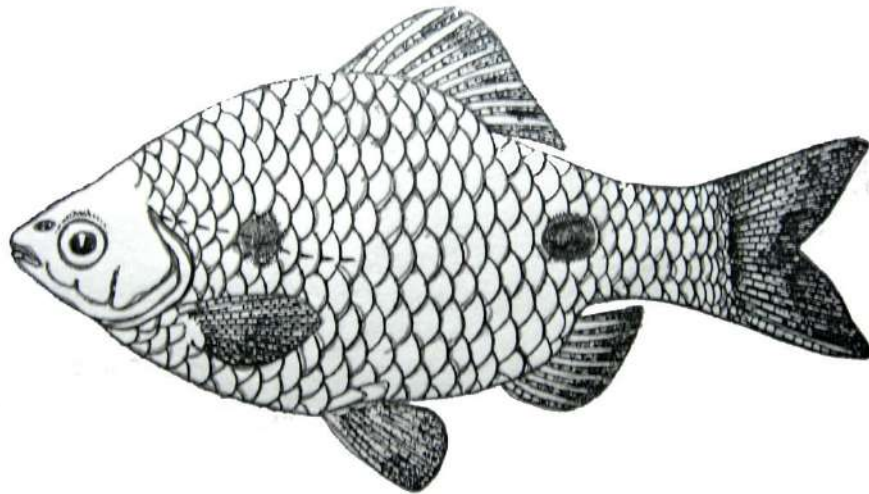
- Dorsal fin very long inserted above the tip of pectoral fin, with 3 spines and 17 rays, 3rd spine strongest and serrated
- Anal with short with 3 spines and 5 rays
- Caudal fin deeply emarginated and lobes pointed
- Lateral line straight with 36 scales

Hence, species – carpio

Hence, the provided specimen is Cyprinus carpio

Distribution – China, Korea, Japan, Taiwan, Europe, America, Introduced in India in 1939

Specimen: 11



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Cypriniformes

Family – Cyprinidae

Genus – *Puntius*

Species – *ticto*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Body oblong, compressed covered with large cycloid scales, head without scales
- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless
- Barbells often present around the mouth
- No adipose dorsal fin

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or without sucker
- Developed lips are present

Hence, Family Cyprinidae

- Body short, to moderately elongated, deeply compressed, abdomen rounded
- Head short, snout obtuse conical or pointed

- Mouth arched anterior or inferior not protrusible
- Eyes moderate to large, dorso lateral, not visible from below ventral surface
- Lips thin but covering the jaws, many have fleshy lobes, without any horny covering, jaws simple covered by lips

Hence, Genus – *Puntius*

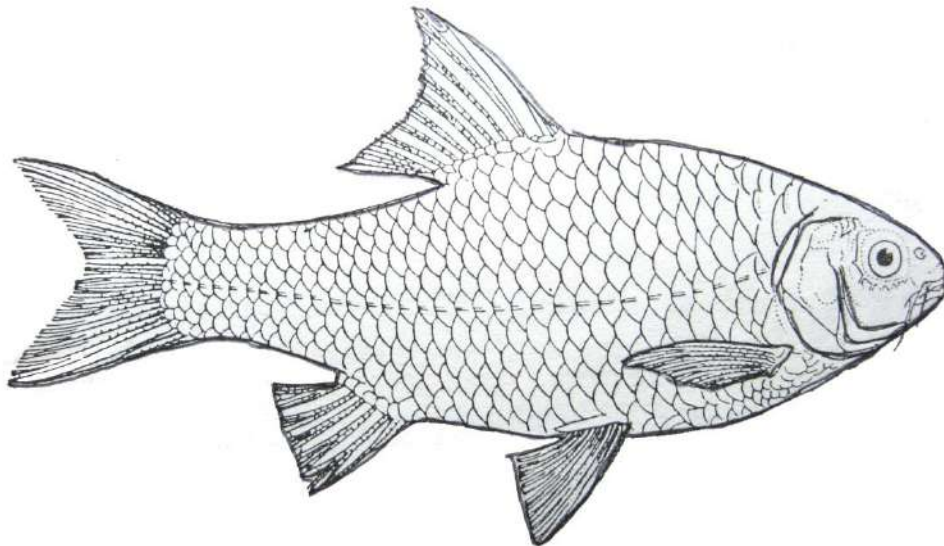
- Dorsal fin short inserted nearly opposite of the pelvic fin, with 3 to 4 soft spines and 8 rays
- Anal with short with 2-3 spines and 5 rays
- Pectoral fin with single soft spine and 12 – 14 rays
- Pelvic fin with single soft spine and 8 rays
- Lateral line straight with 23 - 25 scales

Hence, species – *ticto*

Hence, the provided specimen is *Puntius ticto*

Distribution – India, Pakistan, Nepal, Bangladesh, Sri Lanka, Burma, Malay

Specimen: 12



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Cypriniformes

Family – Cyprinidae

Genus – *Puntius*

Species – *sarana*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Body oblong, compressed covered with large cycloid scales, head without scales
- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless
- Barbells often present around the mouth
- No adipose dorsal fin

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or without sucker
- Developed lips are present

Hence, Family Cyprinidae

- Body short, to moderately elongated, deeply compressed, abdomen rounded
- Head short, snout obtuse conical or pointed
- Mouth arched anterior or inferior not protrusible
- Eyes moderate to large, dorso lateral, not visible from below ventral surface
- Lips thin but covering the jaws, many have lathery lobes, without any horny covering, jaws simple covered by lips

Hence, Genus – *Puntius*

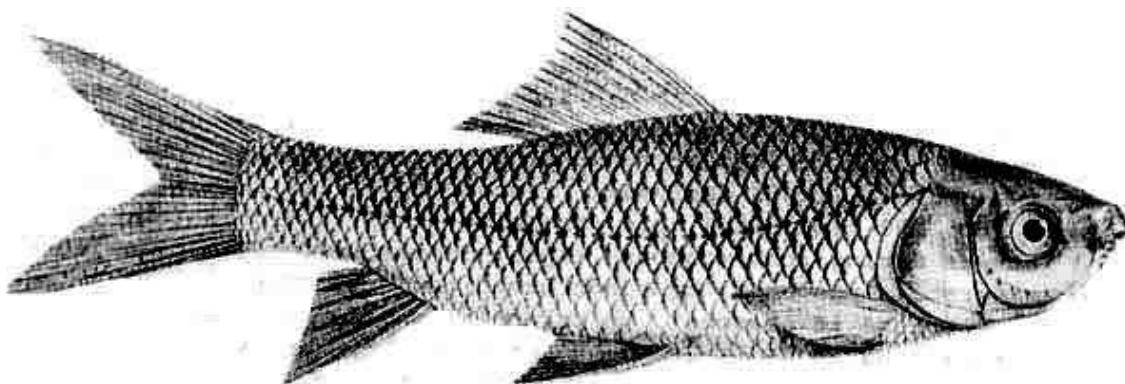
- Dorsal fin short inserted nearly opposite of the pelvic fin, with 3 to 4 soft spines and 8 rays
- Anal with short with 3 spines and 5 rays
- Pectoral fin with single soft spine and 14 – 16 rays
- Pelvic fin with single soft spine and 8 rays
- Lateral line straight with 30 - 33 scales

Hence, species – *sarana*

Hence, the provided specimen is *Puntius sarana*

Distribution – India, Pakistan, Nepal, Bangladesh, Sri Lanka, Burma, Malay

Specimen: 13



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Cypriniformes

Family – Cyprinidae

Genus – *Labeo*

Species – *rohita*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also

- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Body oblong, compressed covered with large cycloid scales, head without scales
- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless
- Barbells often present around the mouth
- No adipose dorsal fin

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or without sucker
- Developed lips are present

Hence, Family Cyprinidae

- Body moderately elongated, with round abdomen
- Head fairly large, snout truncated or rounded
- 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 the ventral surface
- Lips thick and fleshy, fringed, covering both jaws, continuous at angle of mouth forming labial fold.
- Barbells two pairs, one pair or none.

Hence, Genus – *Labeo*

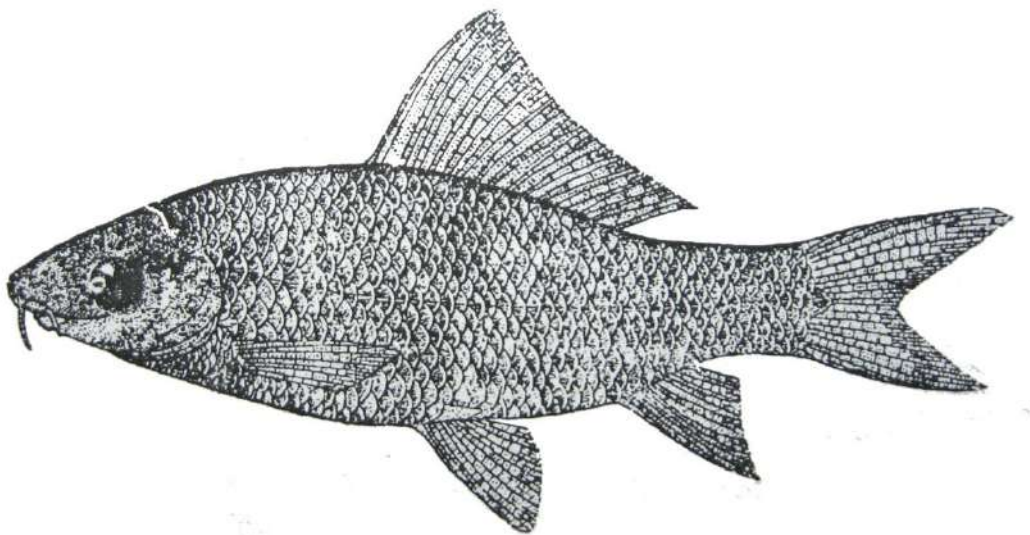
- Dorsal fin inserted above pelvic fin, and 12 - 14 rays,
- Anal fin short with 7 - 8 rays (two or three simple)
- Pectoral fin with 16 – 18 rays
- Lateral line straight with 40 - 44 scales
- Scales between lateral and pelvic fin base – 6 to 7

Hence, species – *rohita*

Hence, the provided specimen is *Labeo rohita*

Distribution – India, Pakistan, Nepal, Bangladesh, Sri Lanka, Burma, Malay

Specimen: 14



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Cypriniformes

Family – Cyprinidae

Genus – *Labeo*
Species – *calbasu*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Body oblong, compressed covered with large cycloid scales, head without scales
- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless
- Barbells often present around the mouth

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or without sucker
- Developed lips are present

Hence, Family Cyprinidae

- Body moderately elongated, with round abdomen
- Head fairly large, snout truncated or rounded
- 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 the ventral surface
- Lips thick and fleshy, fringed, covering both jaws, continuous at angle of mouth forming labial fold.

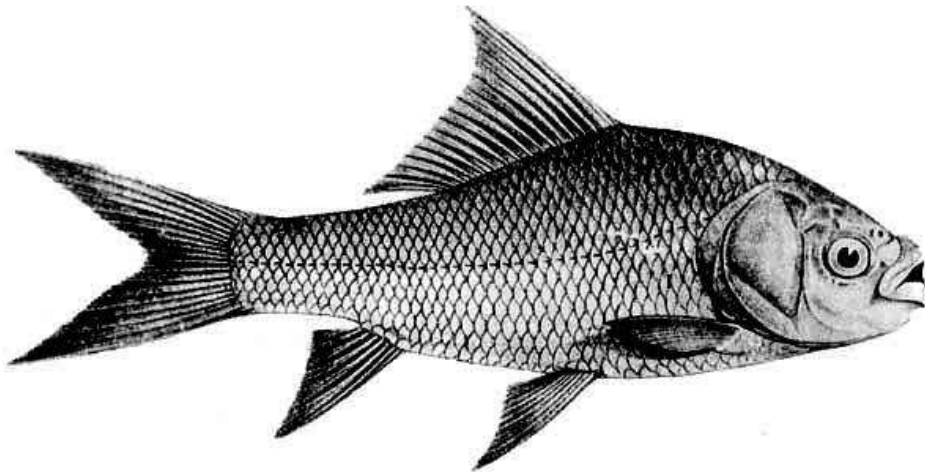
Hence, Genus – *Labeo*

- Dorsal fin inserted above pelvic fin, and 16 - 18 rays,
- Anal fin short with 5 rays (two or three simple)
- Pelvic fin with 8 rays
- Lateral line straight with 40 - 44 scales
- One pair each rostral and maxillary barbells are present
- Colour of the body black, including fins

Hence, species – *calbasu*

Hence, the provided specimen is *Labeo calbasu*

Distribution – India, Pakistan, Nepal, Bangladesh, Sri Lanka, Burma, Malay

Specimen: 15

Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Cypriniformes

Family – Cyprinidae

Genus – *Catla*

Species – *catla*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Body oblong, compressed covered with large cycloid scales, head without scales
- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless
- Barbells often present around the mouth

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or without sucker
- Developed lips are present

Hence, Family Cyprinidae

- Body short and deep
- Head broad & large, snout bluntly rounded, may be with pores and thin skin
- Mouth wide, anterior, arched
- Eyes large, in anterior half of the head, visible from below the ventral surface
- Upper lip absent, lower lip moderately thick, continuous and with free posterior margin
- Lower jaw with movable articulation, without prominent knob

Hence, Genus – Catla

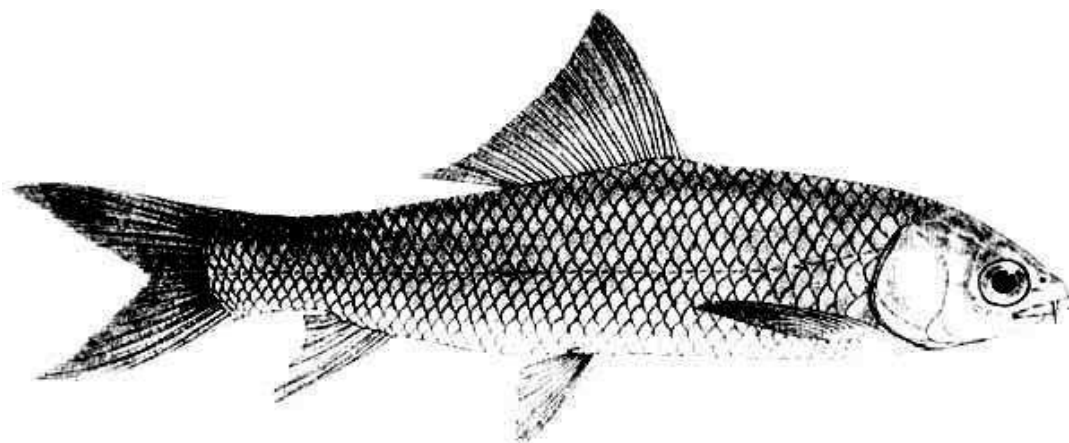
- Body attains a length of about 120 cm in three years
- Dorsal fin long, inserted above the tip of the pectoral fin with 17 to 19 rays (3/4 simple)
- Anal fin short with 8 rays (5 branched)
- Lateral line covered with 40 – 43 scales
- Caudal fin deeply forked

Hence, species – catla

Hence, the provided specimen is Catla catla

Distribution – India, Pakistan, Nepal, Bangladesh, Thailand

Specimen: 16



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Cypriniformes

Family – Cyprinidae

Genus – *Cirrhinus*

Species – *mrigala*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Body oblong, compressed covered with large cycloid scales, head without scales
- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless
- Barbells often present around the mouth

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or without sucker
- Developed lips are present

Hence, Family Cyprinidae

- Body moderate, elongated, compressed and rounded with round abdomen
- Head short, snout obtusely rounded, may be with pores and thin skin covering
- Mouth broad, transverse
- Eyes moderately large, in anterior half or middle of the head, not visible from below the ventral surface
- Upper lip fringed or entire, not continuous with lower
- Lower jaw sharp with a small tubercle at the symphysis, without any cartilaginous covering inside the jaw

Hence, Genus – *Cirrhinus*

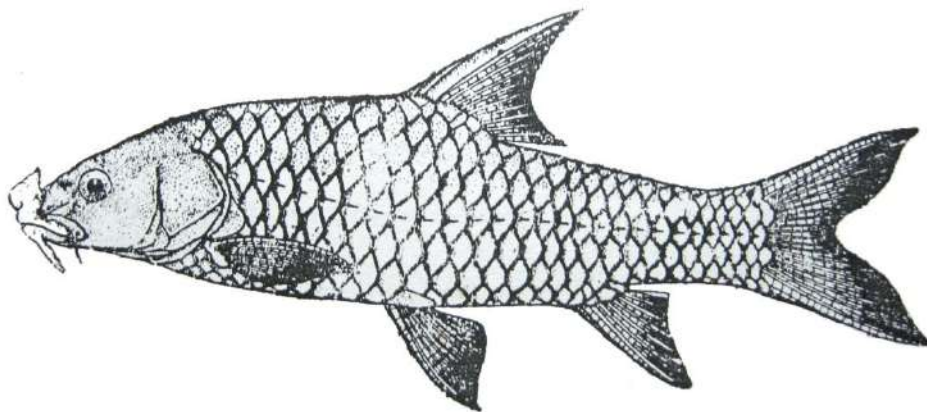
- Body attains a length of about 99 cm in three years
- Dorsal fin long, inserted ahead of the pelvic fin with 15 to 16
- Anal fin short with 7 or 8 rays (2/3 simple)
- Lateral line covered with 40 – 45 scales
- Caudal fin deeply forked or lunate

Hence, species – *mrigala*

Hence, the provided specimen is *Cirrhinus mrigala*

Distribution – India, Pakistan, Nepal, Bangladesh, Thailand, Burma

Specimen: 17



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Cypriniformes

Family – Cyprinidae

Genus – *Tor*

Species – *tor*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Body oblong, compressed covered with large cycloid scales, head without scales

- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless
- Barbells often present around the mouth

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or without sucker
- Developed lips are present

Hence, Family Cyprinidae

- Body, elongated moderately compressed with round abdomen
- Head small, broadly pointed, snout angularly rounded
- Mouth inferior and arched
- Eyes far forward and not visible from below the ventral surface
- Lips fleshy, continuous at angles of mouth, posterior lip with or without a median lobe and post labial groove continuous, lip condition variable
- Pharyngeal teeth in three rows, 5, 3, 2
- A scaly sheath present at the base of the dorsal fin

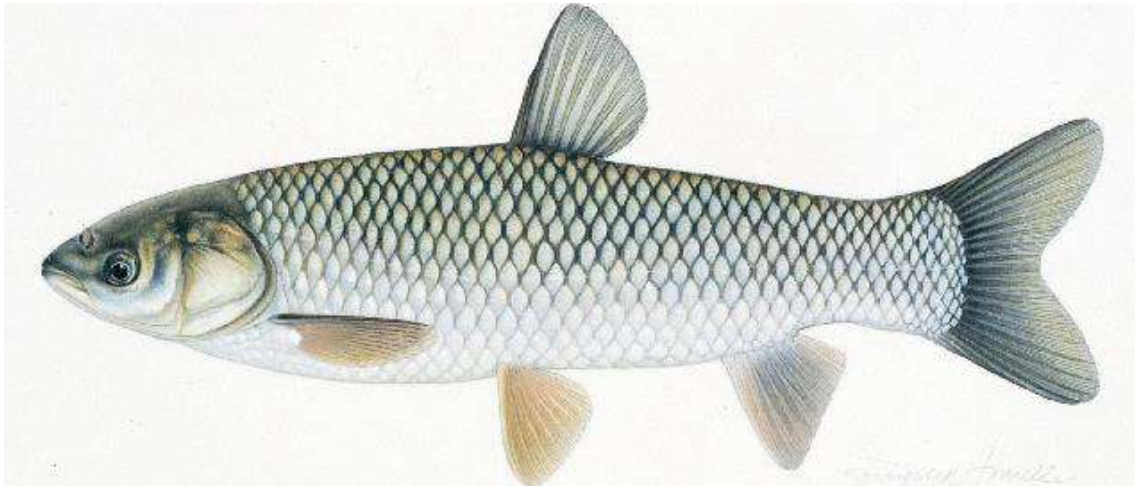
Hence, Genus – *Tor*

- Body attains a length of about 15 cm
- Ventral profile is more ahead than dorsal
- Dorsal fin, inserted above of the pelvic fin with 12 to 13 rays (8 – 9 branched)
- Anal fin with 5 rays (2/3 simple)
- Lateral line covered with 22 – 27 scales
- Caudal fin deeply forked

Hence, species – *tor*

Hence, the provided specimen is *Tor tor*

Distribution – India, Pakistan, Nepal, Bangladesh, Thailand, Burma

Specimen: 18

Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Cypriniformes

Family – Cyprinidae

Genus – *Ctenopharyngodon*

Species – *idella*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Body oblong, compressed covered with large cycloid scales, head without scales
- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless
- Barbells often present around the mouth

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or without sucker
- Developed lips are present

Hence, Family Cyprinidae

- Body moderate, elongated, compressed posterior and sub cylindrical in anterior, with round abdomen
- Head depressed and flattened, snout obtusely rounded,
- Mouth terminal, cleft not extending to the anterior margin of eyes
- Eyes large, lateral in anterior part of the head, may or may not visible just from below the ventral surface
- Lips thin without any lobes
- Upper jaw slightly longer than lower and protractile

Hence, Genus – *Ctenopharyngodon*

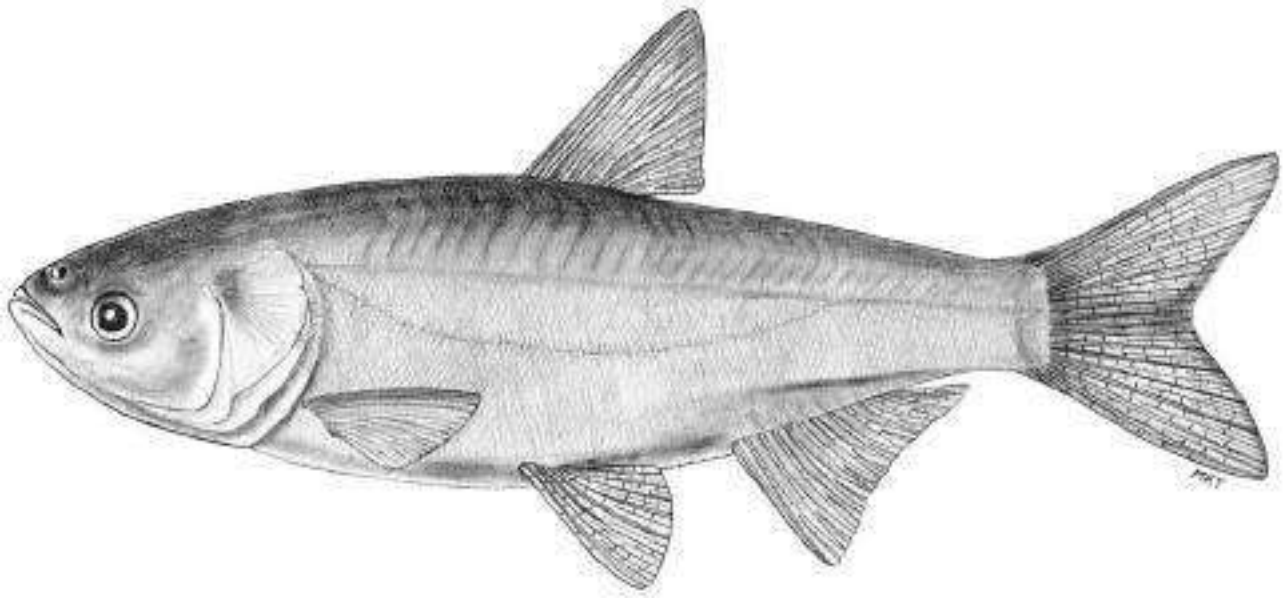
- Body attains a length of about 86 cm in three years
- Dorsal fin inserted slightly ahead of the pelvic fin with 10 rays
- Anal fin short with 10 rays (8 branched)
- Lateral line continuous slightly curved covered with 40 – 42 scales
- Caudal fin deeply forked

Hence, species – *idella*

Hence, the provided specimen is *Ctenopharyngodon idella*

Distribution – Naturally found in Amur region Siberia, North China to South China, U.S.S.R, introduced in India in 1959

Specimen: 19



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Cypriniformes

Family – Cyprinidae

Genus – *Hypophthalmichthys*

Species – *molitrix*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species, it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Body oblong, compressed covered with large cycloid scales, head without scales
- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or with out sucker
- Developed lips are present

Hence, Family Cyprinidae

- Body stout and compressed abdomen strongly compressed with a sharp keel from abdomen to vent
- Head moderate, snout bluntly rounded,
- Mouth anterior, large, wide, cleft not extending to the anterior margin of eyes

- Eyes rather small, anterior sub inferior anterior part of the head, sub inferior visible from below the ventral surface
- Lips thin
- Upper jaw slightly protruded upward a little longer than lower

Hence, Genus – *Hypophthalmichthys*

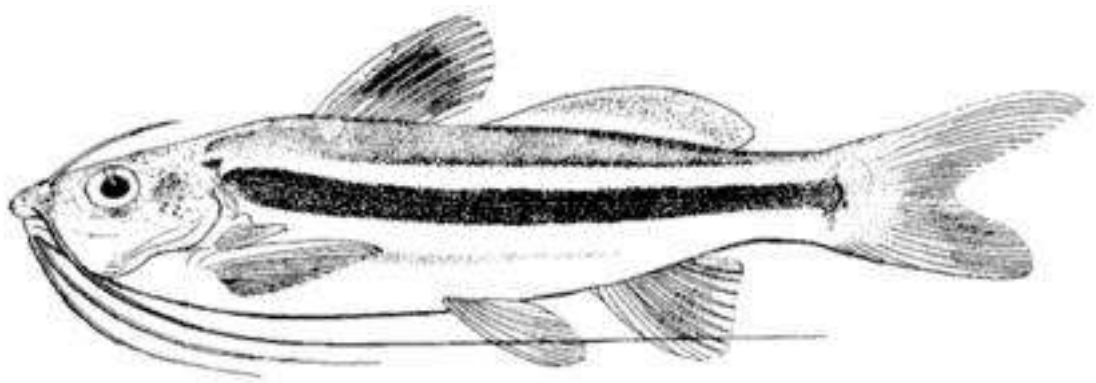
- Body attains a length of about 82 cm in three years
- Dorsal fin inserted behind the pelvic fin or above the tip of the pectoral fin with 10 rays
- Anal fin short with 14 – 17 rays (12 – 14 branched)
- Lateral line continuous slightly curved covered with 110 – 115 scales
- Caudal fin deeply forked

Hence, species – *molitrix*

Hence, the provided specimen is *Ctenopharyngodon idella*

Distribution – Naturally found in Amur region Siberia, North China to South China, U.S.S.R, introduced in India in 1959

Specimen: 20



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Siluriformes

Family – Bagridae

Genus – *Mystus*

Species – *vittatus*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Skin naked with or without bony scutes or plates, never with true scales
- Nearly always one to four pair of barbells
- Adipose fin generally present

Hence, Order – Siluriformes

- Generally large sized and more or less elongated fish
- Nostrils widely separated
- Barbell six or eight, generally well developed

Hence, Family – Bagridae

- Body short or moderately elongated, compressed with round abdomen
- Head moderate in size and compressed
- Mouth terminal, transverse and moderately wide
- Eyes moderately large, supra lateral, in anterior part of the head not visible from below the ventral surface
- Lips thin
- Jaws sub equal
- Barbells four pairs, one each of maxillary, nasal, and two mandibular, generally longer than head

Hence, Genus – *Mystus*

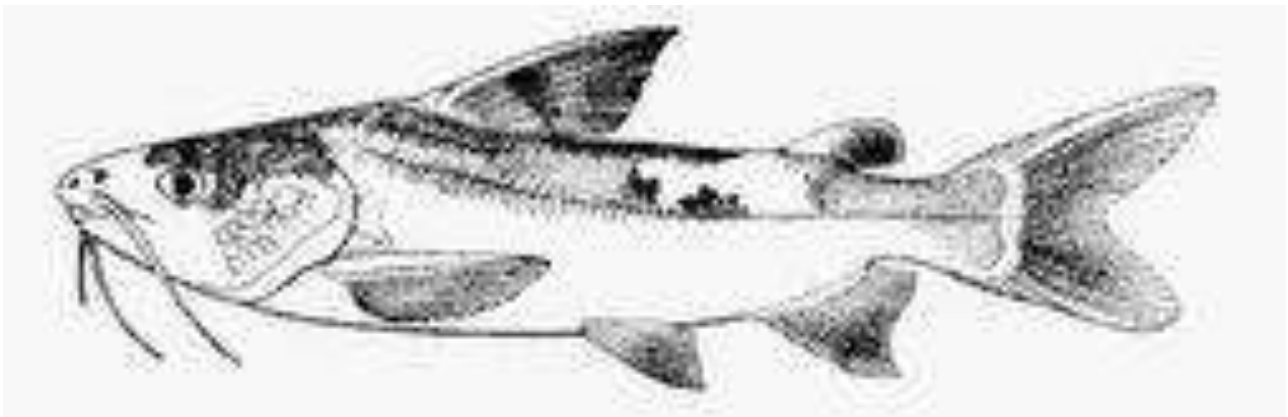
- Rayed dorsal fin inserted above the last quarter of the pectoral fin with 7 rays and a spine
- Adipose dorsal fin low of varying length
- Pectoral fin with 9 rays
- Body with 3 – 4 longitudinal colour bands above and below the lateral line
- A dark shoulder spot present
- No spot at the base of caudal fin

Hence, Species – *vittatus*

Hence, the provided specimen is *Mystus vittatus*

Distribution: India, Nepal, Pakistan, Bangladesh, Burma, Thailand, China, Sri Lanka

Specimen: 21



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Siluriformes

Family – Siluridae

Genus – *Ompok*

Species – *pabda*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Skin naked with or without bony scutes or plates, never with true scales
- Nearly always one to four pair of barbells
- Adipose fin generally present

Hence, Order – Siluriformes

- Generally large sized elongated fish with compressed body
- Nostrils separated by each other with short distance
- Barbell six or eight, generally well developed

Hence, Family – Siluridae

- Body elongated, compressed with round abdomen
- Head small, broad and depressed
- Mouth superior, moderately wide, its cleft oblique, not extending to the front borders of eyes, snout bluntly rounded, depressed
- Eyes small, ventral border on the level with corner of mouth, visible from under side of the head
- Lips thin, Jaws sub equal, lower jaw prominent
- Barbells two pairs, one pair each of maxillary and mandibular, latter occasionally small or rudimentary

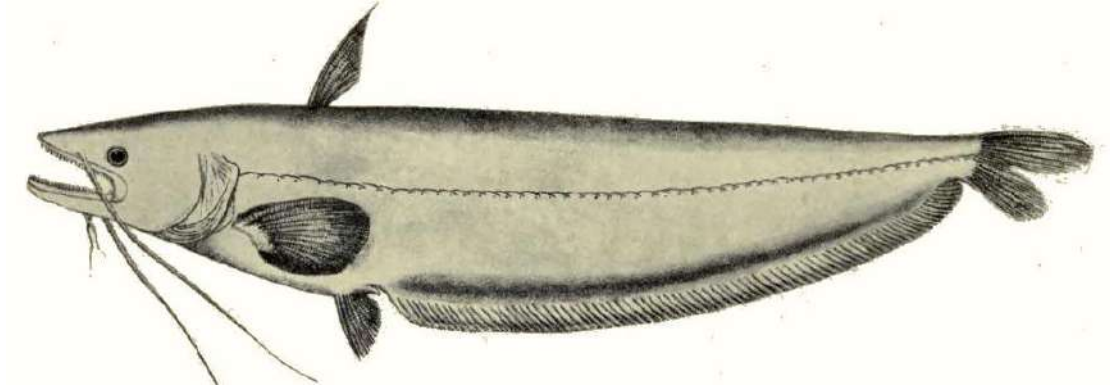
Hence, Genus – *Ompok*

- Body attains 17 cm
- Rayed dorsal fin inserted above the last half of the pectoral fin with 4-5 rays and without any spine
- Adipose dorsal fin absent
- Pectoral fin with 11-14 rays
- Anal fin with 22-56 rays, very long, close to caudal fin, free from it
- Caudal fin forked

Hence, Species – *pabda*

Hence, the provided specimen is *Ompok pabda*

Distribution: India, Nepal, Pakistan, Bangladesh, Burma, Thailand, China, Sri Lanka

Specimen: 22

Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Siluriformes

Family – Siluridae

Genus – *Wallago*

Species – *attu*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophys

- Skin naked with or without bony scutes or plates, never with true scales
- Nearly always one to four pair of barbells
- Adipose fin generally present

Hence, Order – Siluriformes

- Generally large sized elongated fish with compressed body
- Nostrils separated by each other with short distance
- Barbell six or eight, generally well developed

Hence, Family – Siluridae

- Body elongated, compressed with round abdomen
- Head large and depressed, snout spatulate, protruded
- Mouth sub terminal, gape wide, reaching to or beyond anterior border of the eyes.
- Eyes small, above the level with corner of mouth, not visible from below ventral surface
- Lips thin, Jaws sub equal, lower jaw longer and prominent
- Barbells two pairs, one pair each of maxillary and mandibular

Hence, Genus – Wallago

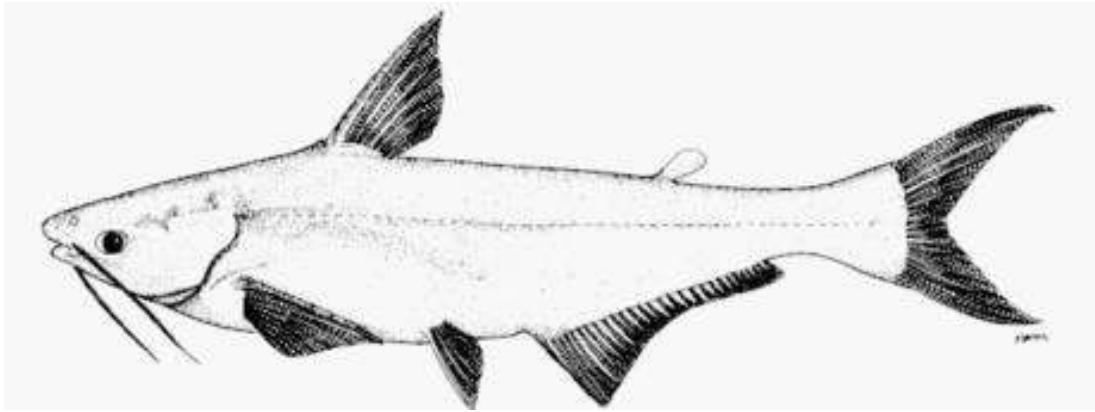
- Rayed dorsal fin inserted above half of the pectoral fin with 5 rays and without any spine
- Adipose dorsal fin absent
- Pectoral fin with 13-15 rays, and feeble smooth spine
- Anal fin long with 86-89 rays, free from caudal fin
- Caudal fin forked with rounded lobes
- Lateral line complete, well marked and simple

Hence, Species – attu

Hence, the provided specimen is Wallago attu

Distribution: India, Nepal, Pakistan, Bangladesh, Burma, Thailand, China, Sri Lanka

Specimen: 23



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Siluriformes

Family – Pangasiidae

Genus – *Pangasius*

Species – *pangasius*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Skin naked with or without bony scutes or plates, never with true scales
- Nearly always one to four pair of barbells
- Adipose fin generally present

Hence, Order – Siluriformes

- Generally large sized fish with compressed body
- Nostrils widely separated, anterior ones wide, situated along the front border of the snout
- Barbell four, moderately developed

Hence, Family – Pangasiidae

- Body elongated, compressed with round abdomen
- Head moderate, exceptionally granulated and blunt. snout prominent, rounded
- Mouth sub terminal, horizontal or slightly ascending
- Eyes large, behind the corner of the mouth, visible bellow the ventral surface
- Lips thin, Jaws sub terminal, upper jaw slightly longer
- Barbells two pairs, one pair each of maxillary and mandibular

Hence, Genus – Pangasius

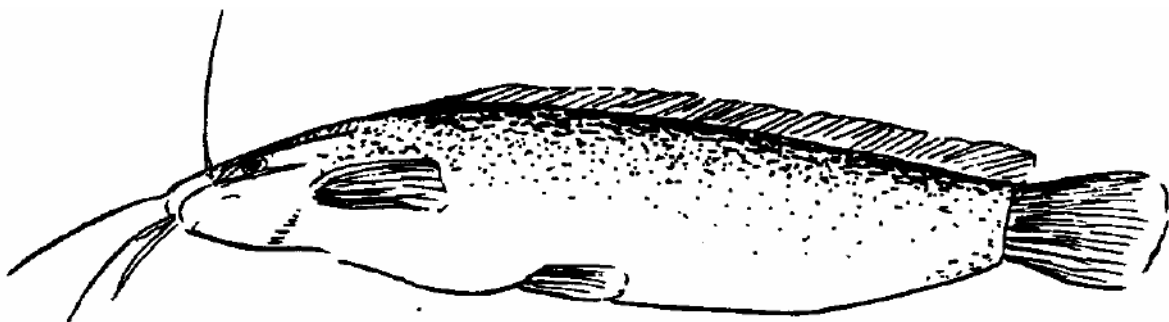
- Rayed dorsal fin inserted above last quarter of the pectoral fin with 6-7 rays and a spine
- Adipose dorsal fin absent, short and posteriorly free
- Pectoral fin with 9-12 rays, and a strongly serrated spine
- Anal fin long with 30-34 rays, free from caudal fin
- Caudal fin forked
- Lateral line complete, and simple

Hence, Species – pangasius

Hence, the provided specimen is *Pangasius pangasius*

Distribution: India, Nepal, Pakistan, Bangladesh, Burma, Thailand, China, Sri Lanka, Viet-Nam, Indonesia

Specimen: 24



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Siluriformes

Family – Clariidae

Genus – *Clarias*

Species – *batrachus*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Skin naked with or without bony scutes or plates, never with true scales
- Nearly always one to four pair of barbells
- Adipose fin generally present

Hence, Order – Siluriformes

- Generally large sized elongated fish with compressed body
- Nostrils widely separated, anterior tubular, situated near the tip of the snout
- Barbells 8, moderately developed

Hence, Family – Clariidae

- Body elongated, compressed with round abdomen
- Head moderate, generally depressed, covered with osseous plate dorsally and latterly forming a cask covering a diverticulum of gill cavity of
- Snout broadly rounded and pointed
- Mouth terminal, fairly wide, transverse
- Eyes small, dorso lateral with free orbital margin, not visible from ventral surface
- Lips fleshy and papillated, jaws sub equal, upper jaw longer
- Barbells four pairs, one pair each of maxillary and mandibular

Hence, Genus – *Clarias*

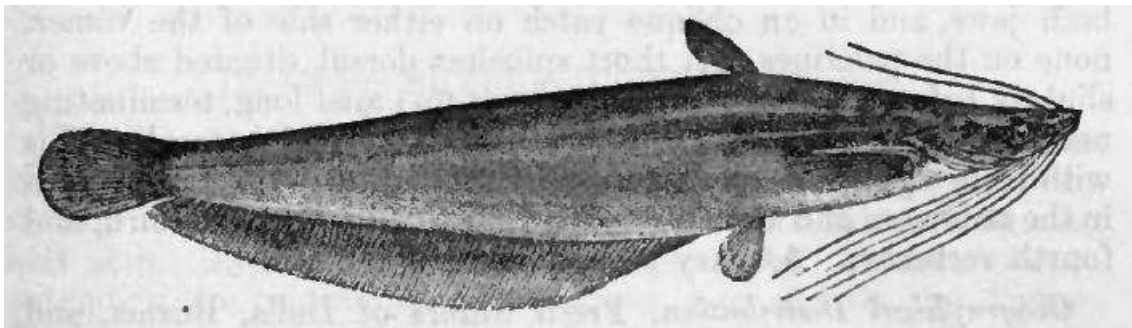
- Rayed dorsal fin long with 62-77 rays without any spine
- Adipose dorsal fin absent,
- Pectoral fin with 7-11 rays, and a strongly serrated spine, enveloped in a skin
- Anal fin long with 45-63 rays
- Caudal fin almost rounded
- Lateral line complete, and simple

Hence, Species – *batrachus*

Hence, the provided specimen is *Clarias batrachus*

Distribution: India, Nepal, Pakistan, Bangladesh, Burma, Thailand, China, Sri Lanka, Viet-Nam, Indonesia

Specimen: 25



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Ostariophysi

Order – Siluriformes

Family – Heteropneustidae

Genus – *Heteropneustes*

Species – *fossilis*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Major trends towards the reduction of number of jaw teeth, may be absent also
- Branchiostegals generally few in numbers, but in some species it may be 15
- Otophysic connections involving the intercalation of bony elements in all

Hence, Super Order – Ostariophysi

- Skin naked with or without bony scutes or plates, never with true scales
- Nearly always one to four pair of barbells
- Adipose fin generally present

Hence, Order – Siluriformes

- Moderate sized elongated fish with compressed body
- Nostrils widely separated, anterior produced into short tube on the tip of the snout
- Barbells 8, well developed

Hence, Family – Heteropneustidae

- Body elongated, compressed with round abdomen
- Head moderate, greatly depressed, covered with thin skin, Snout flat
- Mouth terminal, transverse and narrow
- Eyes small, lateral in anterior part of the, not visible below ventral surface
- Lips fleshy and papillated, jaws sub equal
- Barbells four pairs, one pair each of maxillary nasal and 2 of mandibular

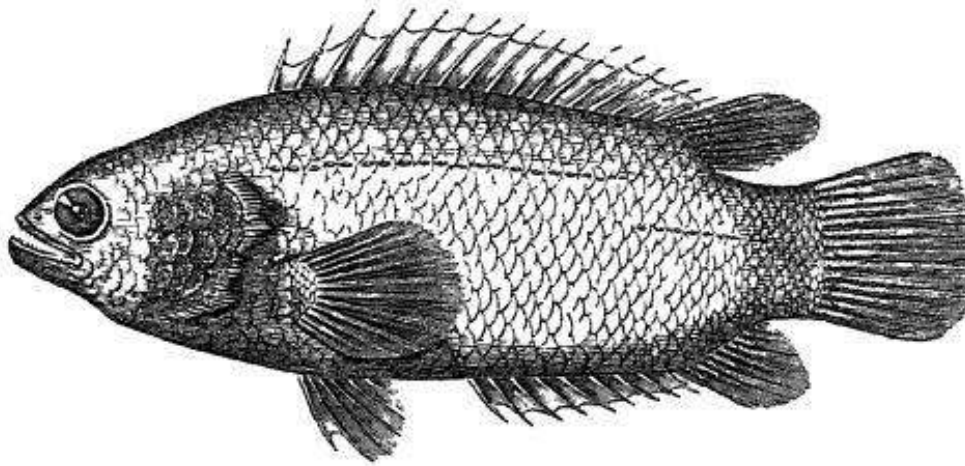
Hence, Genus – *Heteropneustes*

- Rayed dorsal fin short inserted above the tip of the pectoral fin with 6-8 rays without any spine
- Adipose dorsal fin absent, or represented by low adipose ridge, along the posterior third of the caudal region
- Pectoral fin with 7-8 rays, and a strong spine, serrated along the inner edge
- Anal fin long with 60-79 rays, separated from the caudal fin with deep notch
- Caudal fin almost rounded
- Pelvic fin with 6 rays
- Lateral line complete, and simple

Hence, Species – *fossilis*

Hence, the provided specimen is *Heteropneustes fossilis*

Distribution: India, Nepal, Pakistan, Bangladesh, Burma, Thailand, China, Sri Lanka

Specimen: 26

Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Acanthopterygii

Order – Perciformes

Family – Anabantidae

Genus – *Anabas*

Species – *testudineus*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Upper and lower pharyngeal well developed and toothed
- Branchiostegals generally blade like or hair like
- Bones of head with numerous pungent spine
- Otophysic connection rare

Hence, Super Order – Acanthopterygii

- Skin scales, commonly ctenoid,
- Fins are with strong spines

Hence, Order – Perciformes

- Moderately elongated compressed body,
- Head and body covered with ctenoid scales

Hence, Family – Anabantidae

- Body oblong, compressed with round abdomen
- Head moderate, compressed, Snout slightly conical
- Mouth small, terminal, oblique, cleft not wide

- Eyes large, lateral in anterior part of the head, not visible below the ventral surface
- Lips thin, jaws equal

Hence, Genus – *Anabas*

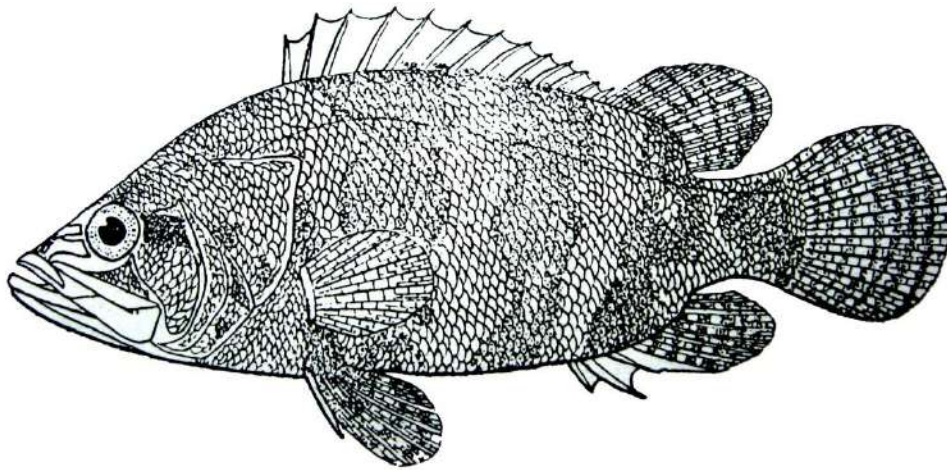
- Single dorsal fin inserted above the pectoral base, with 17-18 spine & 8-10 rays, number of spine variable
- Anal fin with 8-10 spines and 9-11 rays,
- Caudal fin rounded
- Lateral interrupted, with 21-29 scales

Hence, Species – *testudineus*

Hence, the provided specimen is *Anabas testudineus*

Distribution: India, Nepal, Pakistan, Bangladesh, Burma, Thailand, China, Sri Lanka

Specimen: 27



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Acanthopterygii

Order – Perciformes

Family – Nandidae

Genus – *Nandus*

Species – *nandus*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Upper and lower pharyngeal well developed and toothed
- Branchiostegals generally blade like or hair like
- Bones of head with numerous pungent spine
- Otophysic connection rare

Hence, Super Order – Acanthopterygii

- Skin scales, commonly ctenoid,
- Fins are with strong spines

Hence, Order – Perciformes

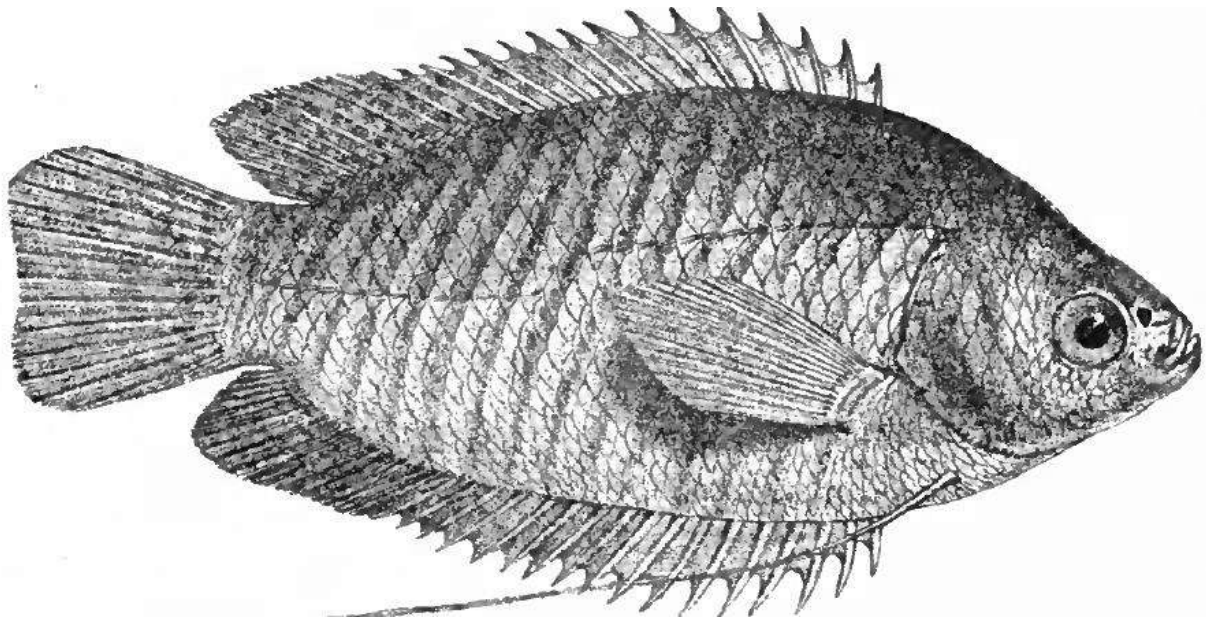
- Body oblong, elevated, compressed with moderate sized ctenoid scales
- Head and body covered with ctenoid scales
- Teeth on jaws and palate
- Operculum armed with spine
- A single dorsal fin with spine and soft portion

Hence, Family - Nandidae

- Body oblong and compressed
- Mouth terminal and very protractile
- Opercle with one spine, preopercle, pre orbit, sub and inter opercle serrated or more or less entire.
- Dorsal fin with 12-14 spines and 7-9 rays.
- Lateral line interrupted at about 36th scales, 46-57 scales along with the lateral line.

Hence the Specimen is *Nandus nandus*

Specimen: 28



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Super order – Acanthopterygii

Order – Perciformes

Family – Belontiidae

Genus – *Colisa*

Species – *fasciata*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony
- Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony
- Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Upper and lower pharyngeal well developed and toothed
- Branchiostegals generally blade like or hair like
- Bones of head with numerous pungent spine
- Otophysic connection rare

Hence, Super Order – Acanthopterygii

- Skin scales, commonly ctenoid,
- Fins are with strong spines

Hence, Order – Perciformes

- Body is short and compressed, anteriorly depressed in slight extent
- Head and body covered with ctenoid scales

Hence, Family – Belontiidae

- Body elevated, compressed
- Head moderate, compressed, Snout blunt
- Mouth upturned, terminal, cleft small.

- Eyes large, lateral in middle of the head, not visible bellow the ventral surface
- Lips thin, jaws sub equal, little protractile

Hence, Genus – Colisa

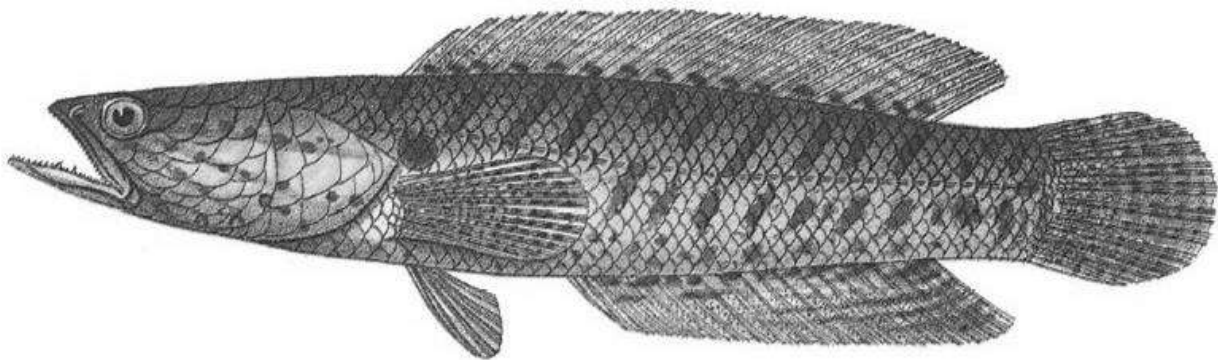
- Single dorsal fin commencing above from near pectoral base, with 15-18 spine & 7-13 rays, number of spine variable
- Anal fin with 15-20 spines and 11-19 rays, number of spines in anal and dorsal fin is variable
- Pelvic fin form, single elongated, filliform ray
- Caudal fin slightly emarginated or truncate
- Lateral interrupted, with 27-31 scales
- Bands on body, 14 or more

Hence, Species – fasciata

Hence, the provided specimen is Colisa fasciata

Distribution: India, Nepal, Pakistan, Bangladesh, Burma,

Specimen: 29



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Order – Channiformes

Family – Channidae

Genus – *Channa*

Species – *punctatus*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony, Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony, Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Body elongated with scales, head with plate like scales
- Suprabranchial accessory respiratory organ well developed

- Branchiostegals five

Hence, Order – Channiformes

- Body elongated and sub-cylindrical anteriorly
- Cephalic pits present
- Gills four.

Hence, Family – Channidae

- Body elongated, sub cylindrical anteriorly
- Head depressed with plate like scales
- Mouth opening moderate to wide extending below the orbit
- Eyes lateral and moderate
- Lips are moderate
- Teeth present in jaws

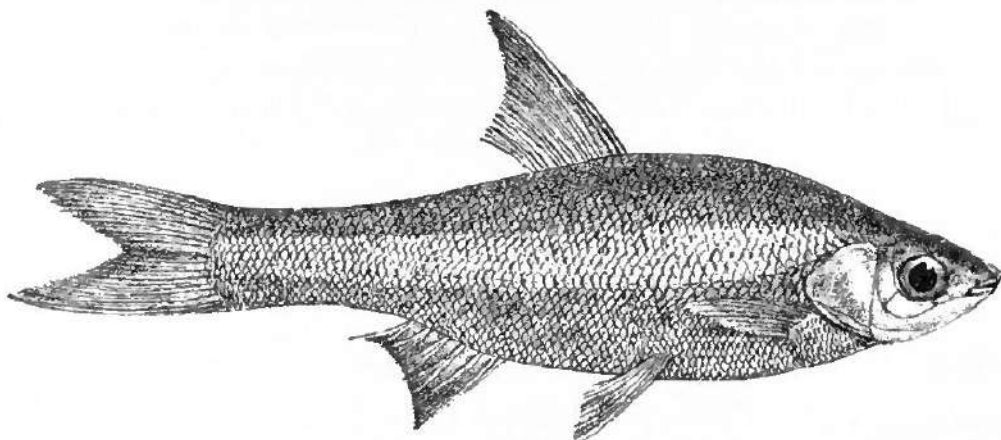
Hence, Genus – *Channa*

- Pelvic fin is more than half of the pectoral fin
- Dorsal fin and anal fin free from caudal fin

Hence, species – *punctatus*

Hence, the provided specimen is *Channa punctatus*

Specimen: 30



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Order – Cypriniformes

Family – Cyprinidae

Genus – *Amblypharyngodon*

Species – *mola*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony, Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony, Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Body oblong, compressed covered with large cycloid scales, head without scales
- Bony plates never developed
- Jaws, palatine and pterygoid bones are toothless
- Barbells often present around the mouth

- No adipose dorsal fin

Hence, Order – Cypriniformes

- Eyes never covered with skin
- Mouth transverse, superior inferior or terminal, with or without sucker
- Developed lips are present

Hence, Family Cyprinidae

- Body moderately elongated and sub cylindrical, with round abdomen
- Head conical and compressed, snout obtusely rounded
- Mouth wide antero lateral, not protractile
- Upper lip absent
- No barbells present

Hence, Genus – *Amblypharyngodon*

- Lateral line scales – 65 to 75
- Body depth 4 to 4.25 of total body length
- A silvery lateral band with dark markings present on dorsal anal and caudal fin

Hence, species – *mola*

Hence, the provided specimen is *Amblypharyngodon mola*

Specimen: 31



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Order – Mastacembeliformes

Family – Mastacembelidae

Genus – *Mastacembelus*

Species – *pancalus*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class - Gnathostomata

- Endoskeleton is bony, Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony, Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Body eel like, compressed and elongated
- Mouth non-protractile, elongated and supported by an elongated rod.
- Dorsal and anal fin long.

Hence, Order – Mastacembeliformes

- Body eel like, compressed and elongated, covered with minute scales
- Palatine flap like, fused to the ethmo-vomer, vomer toothless
- Pyloric appendages two

Hence, Family – Mastacembelidae

- Snout long, conical, without any transversely striated bones/ bony plates on under surface.
- Preopercle generally spiny at its angle, a pre orbital spine may be absent.
- Dorsal fin inserted above middle of the pectoral with 24-39 detached, depressible spines and 50-90 rays.
- Anal fins with 3 spines and 31-98 rays.
- Caudal fin round

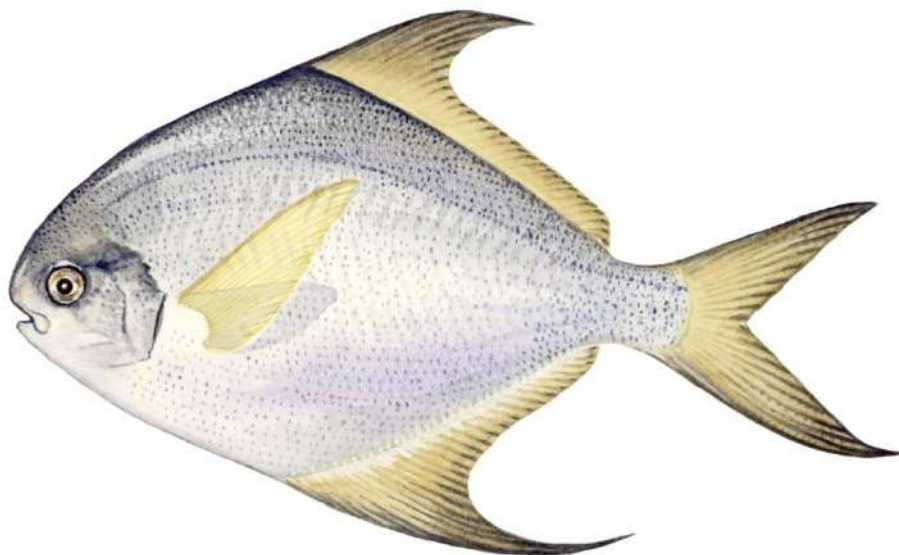
Hence, Genus – *Mastacembelus*

- Dorsal fin with 24 – 31 spines, 30 – 42 rays.

Hence, species – *pancalus*

Hence, the specimen is *Mastacembelus pancalus*

Specimen: 32



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Order – Perciformes

Family – Stromateidae

Genus –

Species –

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, super class - Gnathostomata

- Endoskeleton is bony, Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony, Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Body eel like, compressed and elongated
- Mouth non-protractile, elongated and supported by an elongated rod.

- Dorsal and anal fin long.
- Upper and lower pharyngeal well developed and toothed
- Branchiostegals generally blade like or hair like
- Bones of head with numerous pungent spine
- Otophysic connection rare

Hence, Super Order – Acanthopterygii

- Skin scales, commonly ctenoid
- Fins are with strong spines

Hence, Order – Perciformes

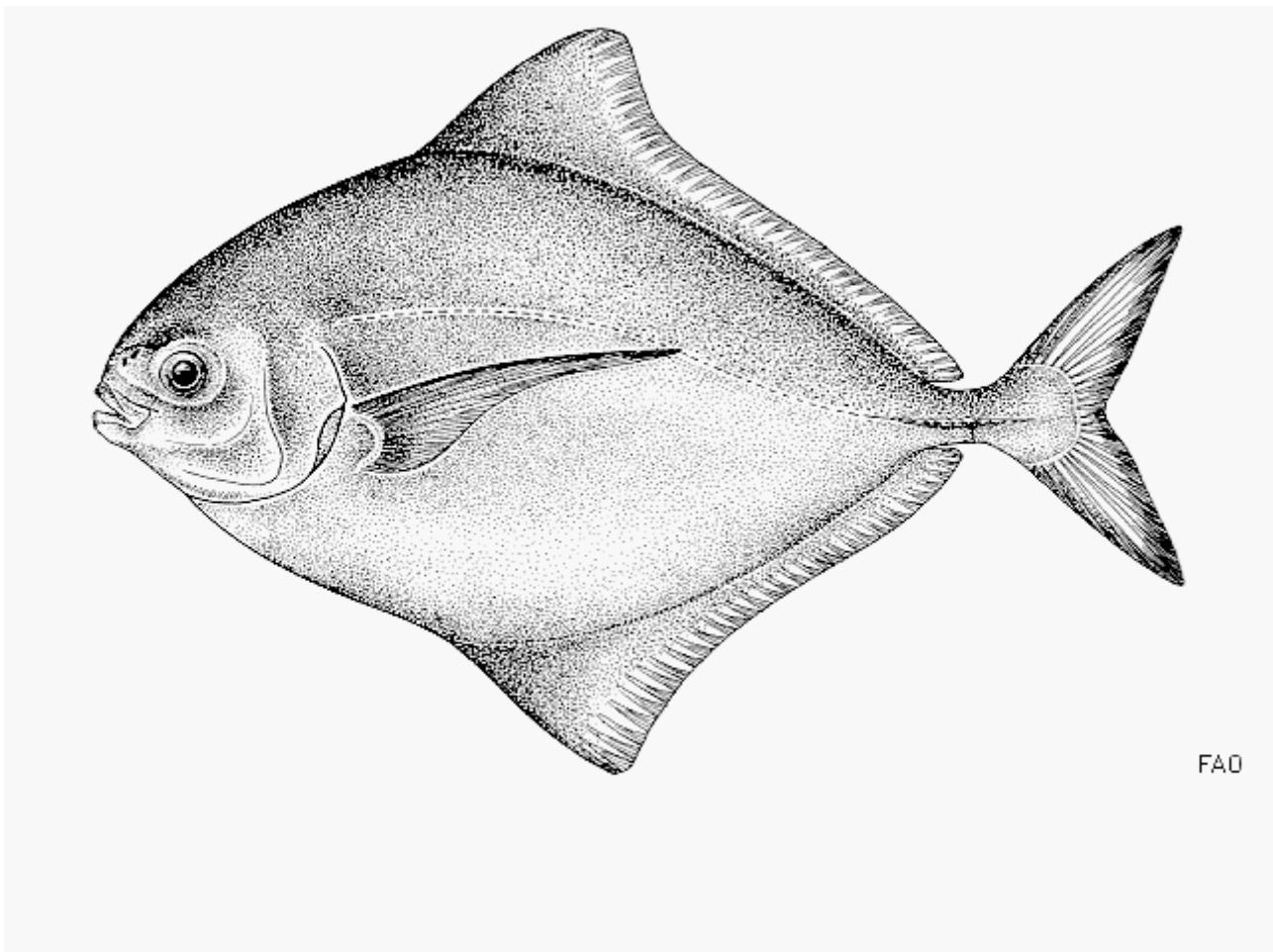
- Medium-sized fishes with a deep, compressed body of a bluish or silvery colour.
- Eye and mouth small. Dorsal fin single and long-based, longer than the similar anal fin; anterior rays longer than those which follow, but fins not falcate.
- Pectoral fins broad and wing-like, but not prolonged; pelvic fins absent (except possibly in very small specimens).
- Scales small, cycloid, easily shed, extending onto the bases of dorsal and anal fins; top of head naked.

Hence, Family – Stromateidae

- Dorsal spines (total): 0; dorsal soft rays (total): 37-43; Vertebrae: 34 - 37.
- Body firm, very deep, oval, and compressed. Operculum absent; gill opening reduced to a vertical slit on the side of the body; gill membrane broadly united to isthmus.
- Dorsal and anal fins preceded by a series of 5 to 10 blade-like spines with anterior and posterior points.
- Pelvic fins absent. Caudal fin deeply forked, the lower lobe longer than the upper.
- Colour is grey above grading to silvery white towards the belly, with small black dots all over the body. Fins are faintly yellow; vertical fins with dark edges.

Hence, the Specimen - *Pampus argenteus*

Specimen: 33



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Osteichthyes

Order – Perciformes

Family – Stromateidae

Genus – *Parastromateus*

Species – *Parastromateus niger*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, super class - Gnathostomata

- Endoskeleton is bony, Skin is provided with mucous gland
- Scales are ganoids, ctenoid, cycloid, types, some are scale less
- Paired fins are provided with fin rays, which may be cartilaginous or bony
- Gill arches are bony, Gill Chambers are covered by bony operculum

Hence, Class – Osteichthyes

- Body eel like, compressed and elongated
- Mouth non-protractile, elongated and supported by an elongated rod.
- Dorsal and anal fin long.
- Upper and lower pharyngeal well developed and toothed
- Branchiostegals generally blade like or hair like
- Bones of head with numerous pungent spine

- Otophysic connection rare

Hence, Super Order – Acanthopterygii

- Skin scales, commonly ctenoid
- Fins are with strong spines

Hence, Order – Perciformes

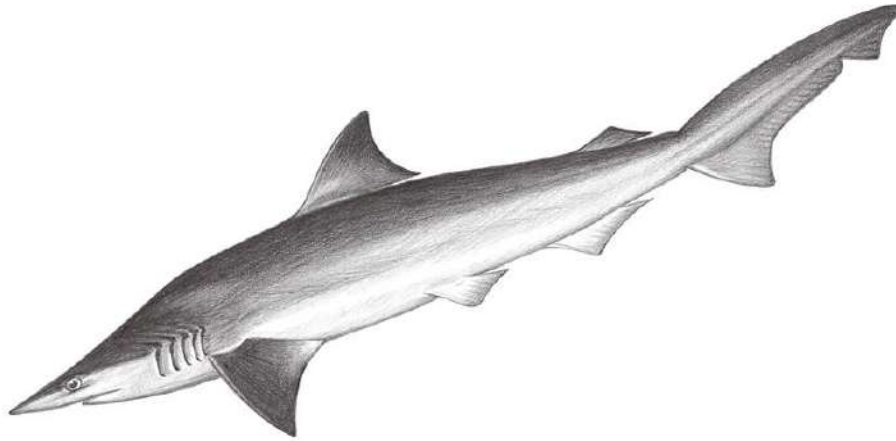
- Medium-sized fishes with a deep, compressed body of a bluish or silvery colour.
- Eye and mouth small. Dorsal fin single and long-based, longer than the similar anal fin; anterior rays longer than those which follow, but fins not falcate.
- Pectoral fins broad and wing-like, but not prolonged; pelvic fins absent (except possibly in very small specimens).
- Scales small, cycloid, easily shed, extending onto the bases of dorsal and anal fins; top of head naked.

Hence, Family – Stromateidae

- Dorsal spines (total): 2 - 6; Dorsal soft rays (total): 41-46; Anal spines: 2;
- Anal soft rays: 35 - 40; Vertebrae: 24. Deep-bodied and strongly compressed fishes.
- Lateral line ends in weakly-developed scutes on the caudal peduncle.
- Pelvic fins lost in individuals over 9 cm.
- Color is brown above, silvery-white below.
- The anterior parts of the dorsal and anal fins bluish-gray. The other fins yellowish.

Hence, the Specimen - *Parastromateus niger* (Bloch, 1795), Black pomfret

Specimen: 34



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Chondrichthyes

Order – Carcharhiniformes

Family – Carcharhinidae

Genus – *Scoliodon*

Species – *laticaudus*

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class – Gnathostomata

- Skeletons made of cartilage rather than bone.
- Chondrichthyans have tough skin covered with dermal teeth.
- Chondrichthyans have toothlike scales called dermal denticles or placoid scales.
- All chondrichthyans breathe through five to seven pairs of gills, depending on the species.

Hence, Class - Chondrichthyes

- nictitating eyelids present
- mouth behind front of eyes
- five pairs of gill slits
- both dorsal fins without spines
- anal fin present

Hene, Order – Carcharhiniformes

- Most members of this family are medium to large in size, usually ranging from about 1 - 3m, though some smaller members are less than a metre in length and larger ones may be over 7m.
- Eyes are round and have an internal nictitating membrane for protection.
- The sharks have arched mouths with blade-like teeth. The teeth of the upper jaw are often broader than those in the lower jaw.
- The pectoral fins are situated behind the gill slits. The first dorsal fin is bigger than the second and usually set well ahead of the pelvic fins. The upper lobe of the caudal fin is bigger than the lower. One anal fin present.

Hence, Family – Carcharhinidae

- *Scoliodon* has an elongated, spindle-shaped, body tapered at the ends, making it a very fast swimmer.
- The trunk and tail are laterally compressed, while the head region is dorsoventrally compressed.
- The entire body is covered by an exoskeleton of placoid scales. The mouth is located on the ventral side and is bound on both sides by jaws.
- It has two rows of homodont or polyphyodont teeth, which are homologous to the placoid scales covering the body.

Hence, specimen - *Scoliodon laticaudus*

Specimen: 35



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Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Chondrichthyes

Order – Carcharhiniformes

Family – Sphyrnidae

Specimen – *Sphyrna* sp.

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class – Gnathostomata

- Skeletons made of cartilage rather than bone.
- Chondrichthyans have tough skin covered with dermal teeth.
- Chondrichthyans have toothlike scales called dermal denticles or placoid scales.
- All chondrichthyans breathe through five to seven pairs of gills, depending on the species.

Hence, Class - Chondrichthyes

- Members of this order are characterized by the presence of a nictitating membrane over the eye,
- Two dorsal fins, an anal fin, and five gill slits.

Hence, Order – Carcharhiniformes

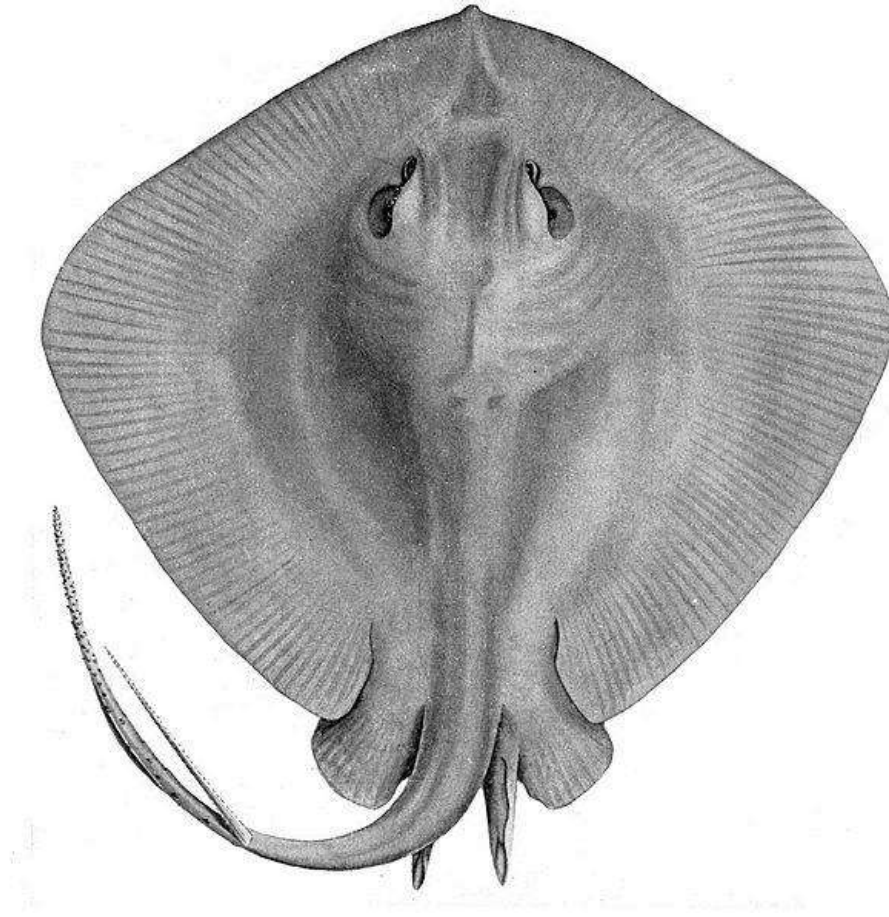
- They are usually light gray and have a greenish tint to them.
- Their bellies are white which allows them to blend into the ocean when viewed from the bottom and sneak up on their prey.
- Their heads have lateral projections which give them a hammer-like shape.

Hence, Family – Sphyrnidae

- Head variably spade, mallet or axe-shaped in dorsoventral view and moderately broad, width across head about 17 to 33% of total length;
- lateral blades of head broad, not winglike; nostrils short, their widths 7 to 14 in internarial width and less than half mouth width;
- No bumps along anterior margin of head.
- Upper precaudal pit transverse and crescentic.

Hence, Genus – *Sphyrna* sp.

Specimen: 36



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Chondrichthyes

Order – Myliobatiformes

Family – Dasyatidae

Specimen – *Dasyatis* sp.

Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class – Gnathostomata

- Skeletons made of cartilage rather than bone.
- Chondrichthyans have tough skin covered with dermal teeth.
- Chondrichthyans have toothlike scales called dermal denticles or placoid scales.
- All chondrichthyans breathe through five to seven pairs of gills, depending on the species.

Hence, Class - Chondrichthyes

- The disc is strongly depressed and varies from oval longitudinally to much broader than long;
- the tail is well marked off from the body sector, very short to long and whiplike, and equipped with a poisonous spine in some species;
- the pectoral rays are either continuous along the side of the head or separate from the head and modified to form rostral lobes or finlike rostral appendages (cephalic fins);
- The dorsal fin, if present, is near the base of the tail; and development is ovoviviparous.
- Sometimes an individual ray may have two or three, very rarely four, tail spines rather than the usual one.

Hence, Order – Myliobatiformes

- Medium to large rays (disc width to 2.1 m), the disc rhomboid to oval, its width ranging from greater to less than its length;
- snout obtuse and little produced to acute and moderately produced, head not elevated from disc; tail distinct from disc, slender and whip-like, equal to or much longer than distance from snout to cloaca, with one or several serrated spines on top near base, keels or membranous folds along upper or lower sides (or both) present in some species.
- Nostrils separated from mouth, but front margins greatly expanded to reach back and join each other. Mouth almost straight or arched, with a transverse row of bulbous papillae along floor, teeth small and numerous.

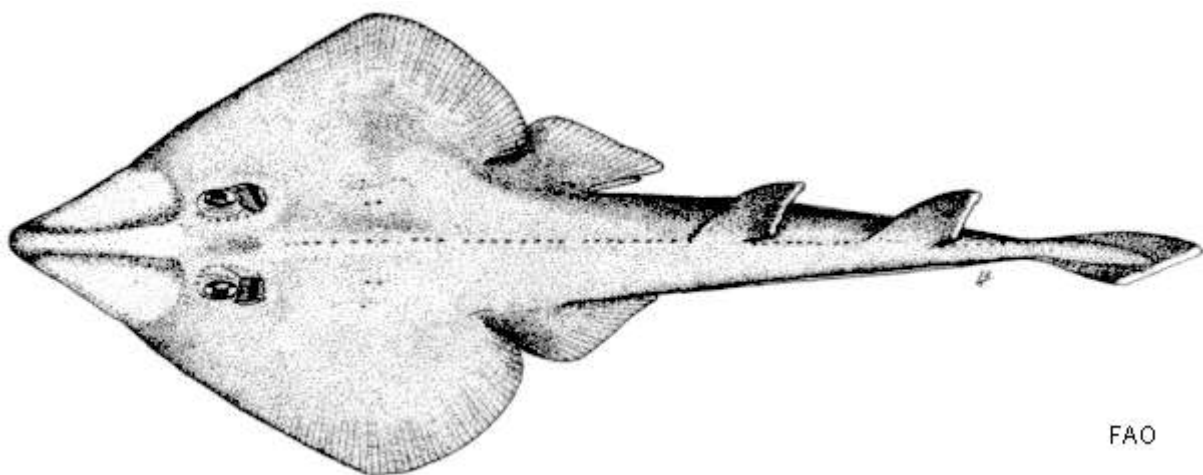
- Spiracles well developed, without tentacle-like processes. Dorsal and caudal fins absent, pectoral fins joined to side of head, the finrays beginning at tip of snout. Upper surfaces naked or covered with tubercles, thorns or thornlets.
- Benthic on soft bottoms, generally in shallow tropical and warm temperate waters, but also to depths of 200 m.

Hence, Family – *Dasyatidae*

- Snout obtuse and little produced to acute and strongly produced;
- disc more or less rhomboid, but not circular; tail whip-like,
- Filamentous near tip, with or without a membranous fold or ridge above, but with a fold below (beginning at level of spine).
- Upper surfaces with or without bucklers, tubercles and thorns with conical cusps.

Hence, Specimen – *Dasyatis* sp.

Specimen: 37



Phylum – Chordata

Subphylum – Vertebrata

Super Class – Gnathostomata

Class – Chondrichthyes

Order – Rajiformes

Family – Rhinobatidae

Specimen – *Rhinobatos productus*.Identifying Character:

- All members possess either in adult or larval stage a notochord, which forms the axial skeleton of the body
- Pharyngeal gill slits are present in all members

Hence, Phylum – Chordata

- Notochord is replaced by vertebral column
- Brain is well developed with brain box or cranium
- Gills are present as primary respiratory organ

Hence, Subphylum – Vertebrata

- Mouth bounded with jaws

Hence, Super class – Gnathostomata

- Skeletons made of cartilage rather than bone.
- Chondrichthyans have tough skin covered with dermal teeth.
- Chondrichthyans have toothlike scales called dermal denticles or placoid scales.
- All chondrichthyans breathe through five to seven pairs of gills, depending on the species.

Hence, Class - Chondrichthyes

- Rajoids typically have a dorsoventrally flattened body.
- The snout is slender and pointed and the wide mouth, often covered with a fleshy nasal flap, is on the underside of the head.
- The eyes and well-developed spiracles are located on the top of the head. In most species, the spiracles are large and are the main means of drawing water in for respiration.
- There is no nictitating membrane and the cornea is continuous with the skin surrounding the eyes.
- The gill slits are on the ventral surface just behind the head and there are five in all species except the sixgill stingray (*Hexatrygon bickelli*).

Hence, Order – Rajiformes

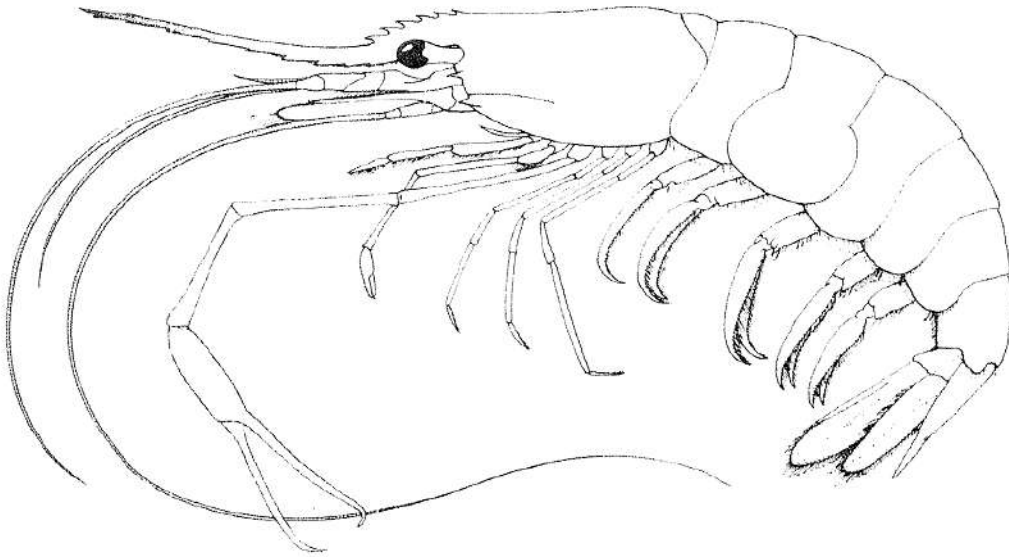
- They have a body form intermediate between those of sharks and rays.
- The tail has a typical shark-like form, but in many species, the head has a triangular, or guitar-like shape, rather than the disc-shape formed by fusion with the pectoral fins found in other rays.

Hence, Family – Rhinobatidae

- Shovelnose guitar fish most resemble sharks in posterior body shape, with a flattened anterior like a ray.
- Their snouts are pointed and shovel-like, and they have broad pectoral fins.
- Their dorsal surfaces are smooth except for rows of small thorns around the eyes and tail. The tail is rather thick with a rounded caudal fin (characteristic of a benthic fish), lacking the lower lobe that most other sharks possess.
- Shovelnose guitarfish have two equally-sized dorsal fins positioned close to the end of the tail. This species' body colour ranges from sandy brown to olive, with a white underside; the distal end of the snout is partially translucent.
- Their teeth are small and rounded, and range in number from 102 to 112.
- Females usually grow larger than males, reaching up to 137 centimetres when fully grown, while males may reach up to 120 centimetres.

Hence, Specimen - *Rhinobatos productus*

Specimen No. – 1



Systematic Position

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Crustacea

Class: Malacostraca

Order: Decapoda

Infraorder: Caridea

Family: Palaemonidae

Genus: *Macrobrachium*

Species: *M. rosenbergii*

Identification

1. Having an exoskeleton (external skeleton), a segmented body, and jointed appendages.
2. Presence cuticle made of chitin, often mineralized with calcium carbonate.
3. The rigid cuticle inhibits growth, so it replaces periodically by molting.

Hence, Phylum – Arthropoda

1. The body is composed of body segments, which are grouped into three regions: the cephalon or head, the thorax, and the pleon or abdomen.
2. The head and thorax may be fused together to form a cephalothorax, which may be covered by a single large carapace.
3. The shell around each somite can be divided into a dorsal tergum, ventral sternum and a lateral pleuron.

Hence, Subphylum – Crustacea

1. Its members are characterized by the presence of three tagmata (specialized groupings of multiple segments) – a five-segmented head, an eight-segmented thorax and an abdomen with six segments and a telson, except in the Leptostraca, which retain the ancestral condition of seven abdominal segments.
2. These have abdominal appendages, a fact that differentiates them from all other major crustacean taxa except Remipedia.

Hence, Class – Malacostraca

1. All have ten legs, in the form of five pairs of thoracic appendages on the last five thoracic segments.
2. The front three pairs function as mouthparts and are generally referred to as maxillipeds; the remainder are pereopods.
3. In many decapods, however, one pair of legs has enlarged pincers; the claws are called chelae, so those legs may be called chelipeds.

Hence, Order – Decapoda

1. Telson elongate, with 2 pairs of dorsal spines and 2 or 3 pairs of posterior spines.
2. First and second pairs of pereopods with pincers. First pair of pereopods shorter and more slender than second; pincers well developed, normal.
3. Second pair of pereopods more robust than first, often very long and strong in adult males; pincers normal, carpus and merus not subdivided
4. Last 3 pereopods simple without pincers.
5. Exopods on none of the legs.
6. Males without petasma, females without thelycum.
7. Males with an appendix masculine and an appendix interna on the endopods of second pleopods.

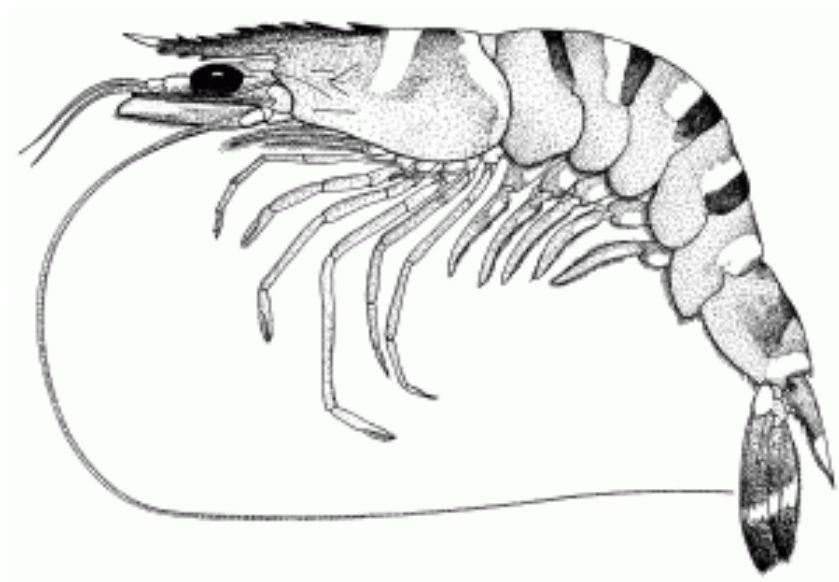
Hence, Family – Palaemonidae

1. Presence of chelae (movable claws) on the first two pairs of walking legs, and the third thoracic segment overlapping the second.

2. The second pair of walking legs greatly lengthened, often equaling or exceeding body length, with very prominent chelae.
3. The rostrum is long in young males (1.2-1.4 X carapace length), but proportionately shorter in older specimens (0.8-1.0 X carapace length). It is curved somewhat upwards, bearing 11-14 dorsal teeth, and 8-10 ventral teeth.
4. Males reach 320 mm, and females can reach 250 mm.

Hence, the Specimen is *Macrobrachium rosenbergii*

Specimen No. – 2



Systematic Position

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Crustacea

Class: Malacostraca

Order: Decapoda

Family: Penaeidae

Genus: *Penaeus*

Species: *Penaeus monodon*

Identification

1. Having an exoskeleton (external skeleton), a segmented body, and jointed appendages.
2. Presence cuticle made of chitin, often mineralized with calcium carbonate.
3. The rigid cuticle inhibits growth, so it replaces periodically by molting.

Hence, Phylum – Arthropoda

1. The body is composed of body segments, which are grouped into three regions: the cephalon or head, the thorax, and the pleon or abdomen.
2. The head and thorax may be fused together to form a cephalothorax, which may be covered by a single large carapace.
3. The shell around each somite can be divided into a dorsal tergum, ventral sternum and a lateral pleuron.

Hence, Subphylum – Crustacea

1. Its members are characterized by the presence of three tagmata (specialized groupings of multiple segments) – a five-segmented head, an eight-segmented thorax and an abdomen with six segments and a telson, except in the Leptostraca, which retain the ancestral condition of seven abdominal segments.
2. These have abdominal appendages, a fact that differentiates them from all other major crustacean taxa except Remipedia.

Hence, Class – Malacostraca

1. All have ten legs, in the form of five pairs of thoracic appendages on the last five thoracic segments.
2. The front three pairs function as mouthparts and are generally referred to as maxillipeds; the remainder are pereopods.
3. In many decapods, however, one pair of legs has enlarged pincers; the claws are called chelae, so those legs may be called chelipeds.

Hence, Order – Decapoda

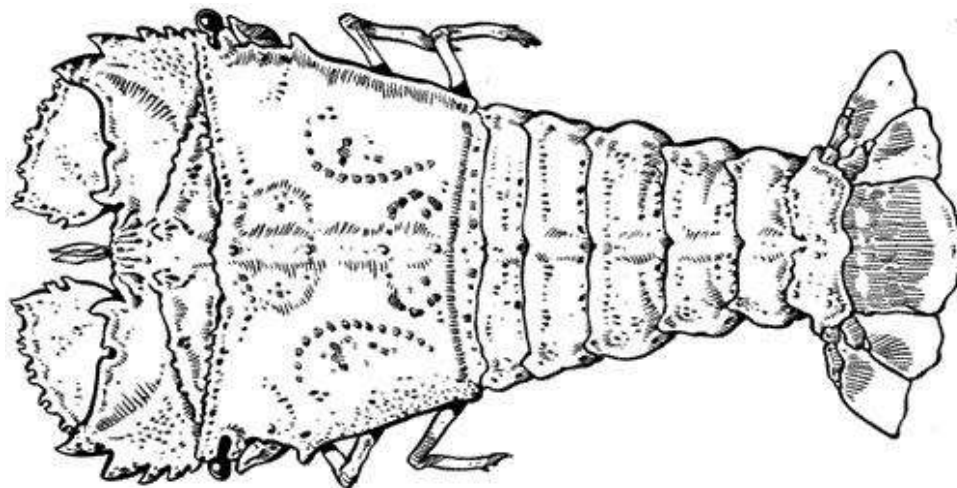
1. The pleurae on either side of the second abdominal segment overlap only the third segment.
2. The first three pairs of pereopods are chelate in penaeids.
3. For transferring sperms the male penaeids has petasma and for storing sperms the female has thelycum.

Hence, Family – Penaeidae

1. Females can reach about 33 cm (13 in) long, but are typically 25–30 cm (10–12 in) long and weight 200–320 g (7–11 oz); males are slightly smaller at 20–25 cm (8–10 in) long and weighing 100–170 g (3.5–6.0 oz).
2. The rostrum, extending beyond the tip of the antennular peduncle, has usually seven dorsal and three ventral teeth, and is sigmoid in shape.
3. The adrostral carina reaches almost to the epigastric spine. The carina reaches to the posterior edge of the carapace.
4. The fifth pereopods have no exopod.
5. The abdomen is carinated dorsally from the anterior one-third of the fourth to sixth somite.
6. Carapace and abdomen are transversely banded with red and white. The antennae are greyish brown. Pereiopods are brown and fringing setae red. When kept in ponds, the colour changes to dark brown, and often to a blackish hue.

Hence, the Specimen - *Penaeus monodon* (giant tiger prawn)

Specimen No. – 3



Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Crustacea

Class: Malacostraca

Order: Decapoda

Family: Scyllaridae

Genus: *Thenus*

Species: *Thenus orientalis*

Identification

1. Having an exoskeleton (external skeleton), a segmented body, and jointed appendages.
2. Presence cuticle made of chitin, often mineralized with calcium carbonate.
3. The rigid cuticle inhibits growth, so it replaces periodically by molting.

Hence, Phylum – Arthropoda

1. The body is composed of body segments, which are grouped into three regions: the cephalon or head, the thorax, and the pleon or abdomen.
2. The head and thorax may be fused together to form a cephalothorax, which may be covered by a single large carapace.
3. The shell around each somite can be divided into a dorsal tergum, ventral sternum and a lateral pleuron.

Hence, Subphylum – Crustacea

1. Its members are characterized by the presence of three tagmata (specialized groupings of multiple segments) – a five-segmented head, an eight-segmented thorax and an abdomen with six segments and a telson, except in the Leptostraca, which retain the ancestral condition of seven abdominal segments.
2. These have abdominal appendages, a fact that differentiates them from all other major crustacean taxa except Remipedia.

Hence, Class – Malacostraca

1. All have ten legs, in the form of five pairs of thoracic appendages on the last five thoracic segments.
2. The front three pairs function as mouthparts and are generally referred to as maxillipeds; the remainder are pereopods.
3. In many decapods, however, one pair of legs has enlarged pincers; the claws are called chelae, so those legs may be called chelipeds.

Hence, Order – Decapoda

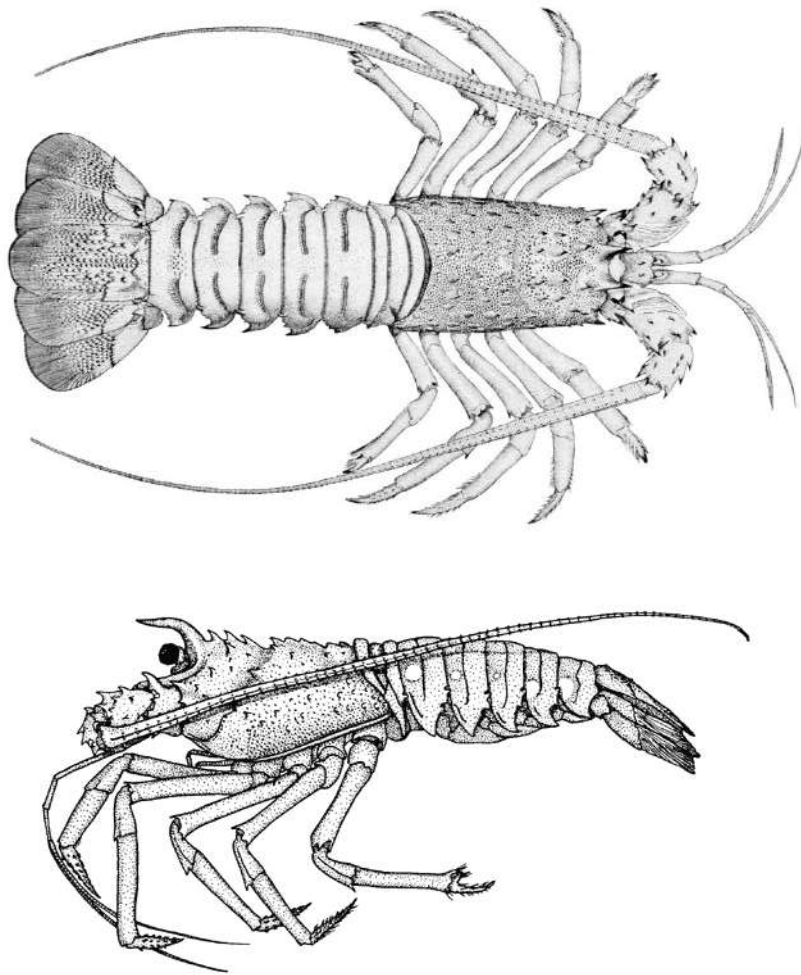
1. It is immovably connected with the antennular somite and the carapace, thereby forming an integral part of the orbit.
2. The fourth element is large, broad and flat; it usually bears teeth on its margins.
3. Carapace is often depressed always with distinct lateral margin.
4. Rostrum is small, and enclosed by antennular somite.

Hence, Family – Scyllaridae

1. Body strongly depressed.
2. Lateral margin of the carapace with only the cervical incision.
3. No teeth on the lateral margin of the carapace, apart from the anterolateral and postcervical.
4. Orbits on the anterolateral angle of the carapace.
5. Exopod of third and first maxilliped without a flagellum; the flagellum of the second maxilliped transformed into a single laminate segment.
6. Fifth leg of female without a chela.
7. Maximum total body length about 25 cm; maximum carapace length about 8 cm.

Hence, the Specimen - *Thenus orientalis* (Flathead lobster).

Specimen No. – 4



Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Crustacea

Class: Malacostraca

Order: Decapoda

Family: Palinuridae

Genus: *Panulirus*Species: *Panulirus argus***Identification**

1. Having an exoskeleton (external skeleton), a segmented body, and jointed appendages.
2. Presence cuticle made of chitin, often mineralized with calcium carbonate.
3. The rigid cuticle inhibits growth, so it replaces periodically by molting.

Hence, Phylum – Arthropoda

1. The body is composed of body segments, which are grouped into three regions: the cephalon or head, the thorax, and the pleon or abdomen.
2. The head and thorax may be fused together to form a cephalothorax, which may be covered by a single large carapace.
3. The shell around each somite can be divided into a dorsal tergum, ventral sternum and a lateral pleuron.

Hence, Subphylum – Crustacea

1. Its members are characterized by the presence of three tagmata (specialized groupings of multiple segments) – a five-segmented head, an eight-segmented thorax and an abdomen with six segments and a telson, except in the Leptostraca, which retain the ancestral condition of seven abdominal segments.
2. These have abdominal appendages, a fact that differentiates them from all other major crustacean taxa except Remipedia.

Hence, Class – Malacostraca

1. All have ten legs, in the form of five pairs of thoracic appendages on the last five thoracic segments.
2. The front three pairs function as mouthparts and are generally referred to as maxillipeds; the remainder are pereopods.
3. In many decapods, however, one pair of legs has enlarged pincers; the claws are called chelae, so those legs may be called chelipeds.

Hence, Order – Decapoda

1. Characterized by the lack of chelae on their first pair of pereopods and the presence in their development of a phyllosoma larval stage.
2. Have typically a slightly compressed carapace, lacking any lateral ridges.
3. Their antennae lack a scaphocerite, the flattened exopod of the antenna.
4. This is fused to the epistome (a plate between the labrum and the basis of the antenna).
5. The flagellum, at the top of the antenna, is stout, tapering and very long. The ambulatory legs (pereopods) end in claws (chelae).

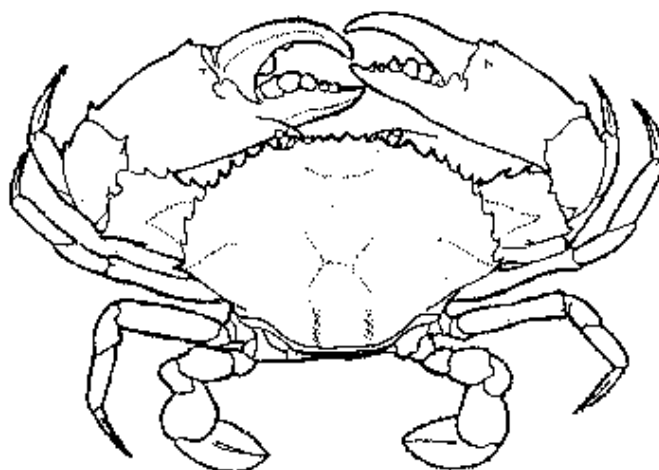
Hence, Family – Palinuridae

1. Long, cylindrical bodies covered with spines.
2. Two large spines form forward-pointing "horns" above the eyestalks.
3. They are generally olive greenish or brown, but can be tan to mahogany. There is a scattering of yellowish to cream-colored spots on the carapace and larger (usually four to six) yellow to cream-colored spots on the abdomen.
4. They have no claws (pincers).
5. The first pair of antennae are slender, black or dark brown and biramous. The second pair of antennae are longer than the body, and covered with forward pointing spines.

6. The legs are usually striped longitudinally with blue and yellow and terminate in a single spine-like point.
7. May reach up to 60 cm (24 in) long, but typically around 20 cm (7.9 in), and is fished throughout its range. Sexual maturity in females is reached at a carapace length of 54–80 mm (2.1–3.1 in).

Hence, the Specimen - *Panulirus argus* (Spiny lobster).

Specimen No. – 5



Systematic Position

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Crustacea

Class: Malacostraca

Order: Decapoda

Family: Portunidae

Genus: *Scylla*

Species: *Scylla serrata*

Identification

1. Having an exoskeleton (external skeleton), a segmented body, and jointed appendages.
2. Presence cuticle made of chitin, often mineralized with calcium carbonate.
3. The rigid cuticle inhibits growth, so it replaces periodically by molting.

Hence, Phylum – Arthropoda

1. The body is composed of body segments, which are grouped into three regions: the cephalon or head, the thorax, and the pleon or abdomen.
2. The head and thorax may be fused together to form a cephalothorax, which may be covered by a single large carapace.
3. The shell around each somite can be divided into a dorsal tergum, ventral sternum and a lateral pleuron.

Hence, Subphylum – Crustacea

1. Its members are characterized by the presence of three tagmata (specialized groupings of multiple segments) – a five-segmented head, an eight-segmented thorax and an abdomen with six segments and a telson, except in the Leptostraca, which retain the ancestral condition of seven abdominal segments.
2. These have abdominal appendages, a fact that differentiates them from all other major crustacean taxa except Remipedia.

Hence, Class – Malacostraca

1. All have ten legs, in the form of five pairs of thoracic appendages on the last five thoracic segments.
2. The front three pairs function as mouthparts and are generally referred to as maxillipeds; the remainder are pereopods.
3. In many decapods, however, one pair of legs has enlarged pincers; the claws are called chelae, so those legs may be called chelipeds.

Hence, Order – Decapoda

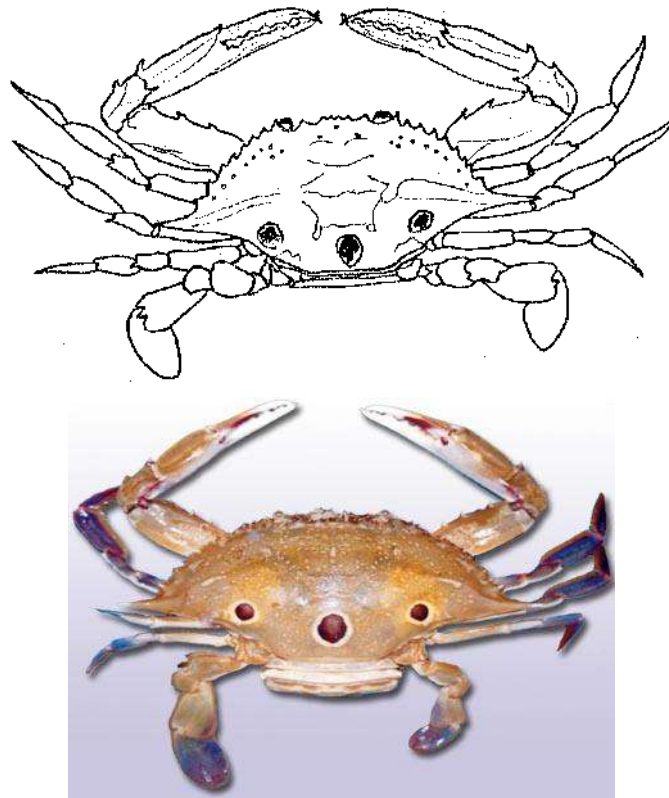
1. Portunid crabs are characterized by the flattening of the fifth pair of legs into broad paddles, which are used for swimming.
2. This ability, together with their strong, sharp claws, allows many species to be fast and aggressive predators.

Hence, Family – Portunidae

1. Carapace smooth and glabrous with exception of granular lines on the gastric regions and an epibranchial line starting from the tip of the last antero-lateral tooth and reaching to the branchial regions;
2. Front with 4 subequal and equally spaced teeth with acute to rounded tips; antero-lateral borders with 9 very acute and subequal teeth, last one the smallest. Basal antennal joint short and broad, with a lobule at its antero-external angle.
3. Chelipeds heterochelous; merus with 3 spines on anterior border and 2 spines on posterior; carpus with a strong spine on inner corner and another on outer face; propodus with 2 acute spines at distal end of upper face and a strong knob on inner face at base of fixed finger.
4. Swimming leg without spines on posterior border of either of the joints.

Hence, the Species - *Scylla serrata*

Specimen No. – 6



Systematic Position

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Crustacea

Class: Malacostraca

Order: Decapoda

Family: Portunidae

Genus: *Portunus*

Species: *Portunus sanguinolentus*

Identification

1. Having an exoskeleton (external skeleton), a segmented body, and jointed appendages.
2. Presence cuticle made of chitin, often mineralized with calcium carbonate.

3. The rigid cuticle inhibits growth, so it replaces periodically by molting.

Hence, Phylum – Arthropoda

1. The body is composed of body segments, which are grouped into three regions: the cephalon or head, the thorax, and the pleon or abdomen.
2. The head and thorax may be fused together to form a cephalothorax, which may be covered by a single large carapace.
3. The shell around each somite can be divided into a dorsal tergum, ventral sternum and a lateral pleuron.

Hence, Subphylum – Crustacea

1. Its members are characterized by the presence of three tagmata (specialized groupings of multiple segments) – a five-segmented head, an eight-segmented thorax and an abdomen with six segments and a telson, except in the Leptostraca, which retain the ancestral condition of seven abdominal segments.
2. These have abdominal appendages, a fact that differentiates them from all other major crustacean taxa except Remipedia.

Hence, Class – Malacostraca

1. All have ten legs, in the form of five pairs of thoracic appendages on the last five thoracic segments.
2. The front three pairs function as mouthparts and are generally referred to as maxillipeds; the remainder are pereiopods.
3. In many decapods, however, one pair of legs has enlarged pincers; the claws are called chelae, so those legs may be called chelipeds.

Hence, Order – Decapoda

1. Portunid crabs are characterized by the flattening of the fifth pair of legs into broad paddles, which are used for swimming.
2. This ability, together with their strong, sharp claws, allows many species to be fast and aggressive predators.

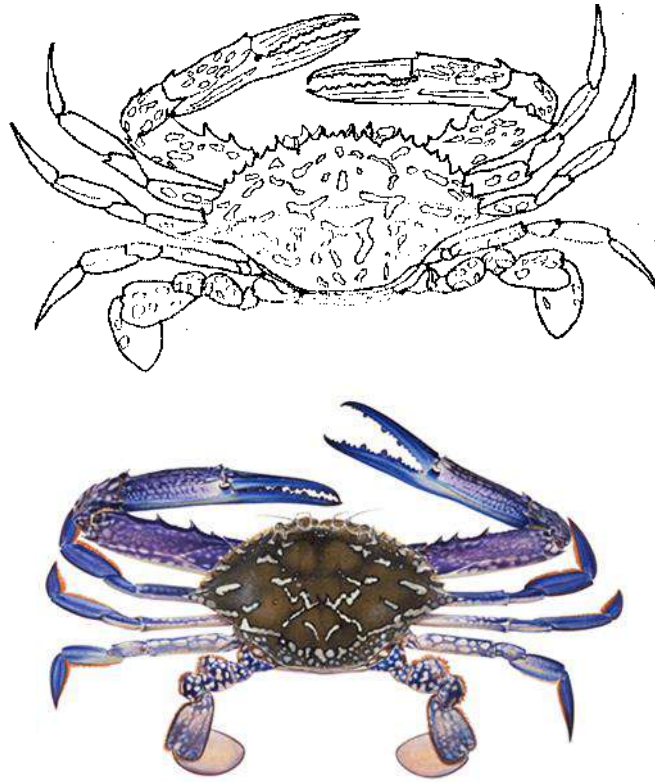
Hence, Family – Portunidae

1. Carapace very broad (breadth 2.0-2.5 times length), with 3 red spots in posterior half, persisting quite long in preserved specimens; surface finely granulated anteriorly, smooth posteriorly; with recognizable mesogastric, epibranchial, and metagastric ridges;
2. Front with 4 triangular teeth, outer pair broader and very slightly more prominent than inner ones;
3. Antero-lateral borders with 9 teeth, first clearly longer and much more pointed than following 7, last one very large and projecting straight out laterally;
4. Postero-lateral junction rounded.

5. Cheliped merus with postero-distal border smooth, anterior border with 3-4 sharp spines; carpus with inner and outer spines;
6. Lower surface of palm smooth. Posterior border of swimming leg without spines or spinules.

Hence, the Species - *Portunus sanguinolentus*

Specimen No. – 7



Systematic Position

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Crustacea

Class: Malacostraca

Order: Decapoda

Family: Portunidae

Genus: *Portunus*

Species: *Portunus pelagicus*

Identification

1. Having an exoskeleton (external skeleton), a segmented body, and jointed appendages.
2. Presence cuticle made of chitin, often mineralized with calcium carbonate.
3. The rigid cuticle inhibits growth, so it replaces periodically by molting.

Hence, Phylum – Arthropoda

1. The body is composed of body segments, which are grouped into three regions: the cephalon or head, the thorax, and the pleon or abdomen.

2. The head and thorax may be fused together to form a cephalothorax, which may be covered by a single large carapace.
3. The shell around each somite can be divided into a dorsal tergum, ventral sternum and a lateral pleuron.

Hence, Subphylum – Crustacea

1. Its members are characterized by the presence of three tagmata (specialized groupings of multiple segments) – a five-segmented head, an eight-segmented thorax and an abdomen with six segments and a telson, except in the Leptostraca, which retain the ancestral condition of seven abdominal segments.
2. These have abdominal appendages, a fact that differentiates them from all other major crustacean taxa except Remipedia.

Hence, Class – Malacostraca

1. All have ten legs, in the form of five pairs of thoracic appendages on the last five thoracic segments.
2. The front three pairs function as mouthparts and are generally referred to as maxillipeds; the remainder are pereopods.
3. In many decapods, however, one pair of legs has enlarged pincers; the claws are called chelae, so those legs may be called chelipeds.

Hence, Order – Decapoda

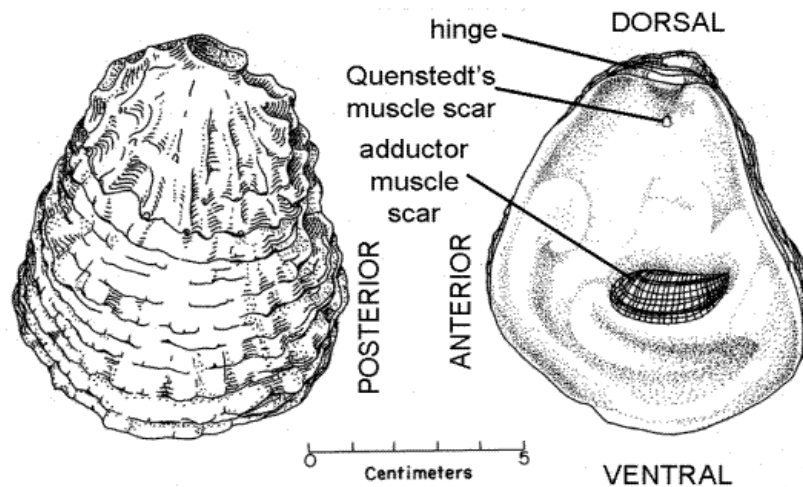
1. Portunid crabs are characterized by the flattening of the fifth pair of legs into broad paddles, which are used for swimming.
2. This ability, together with their strong, sharp claws, allows many species to be fast and aggressive predators.

Hence, Family – Portunidae

1. Carapace very broad (breadth just over 2-2 1/3 times length); surface coarsely granulated, frequently with a short but dense pubescence between the granules;
2. Usually with recognizable mesogastric, epibranchial, and indistinct metagastric ridges, cardiac and mesobranchial ridges with low granular eminences; front with 4 acute teeth, outer pair larger and more prominent than inner ones;
3. Antero-lateral borders with 9 teeth, last one very large and projecting straight out laterally; postero-lateral junction rounded.
4. Cheliped merus with postero-distal border spinous, anterior border with 3-4 (usually 4) sharp spines;
5. Carpus with inner and outer spines; lower surface of palm smooth. Posterior border of swimming leg without spines or spinules.

Hence, the Species – *Portunus pelagicus*

Specimen – 8:



Systematic Position

Kingdom: Animalia

Phylum: Mollusca

Class: Bivalvia

Order: Ostreoida

Family: Ostreidae

Genus: *Crassostrea*

Specimen – *Crassostrea madrasensis*

Identification

1. Presence of a mantle with a significant cavity used for breathing and excretion,
2. Radula rescent.
3. This has a single, "limpet-like" shell on top, which is made of proteins and chitin reinforced with calcium carbonate, and is secreted by a mantle covering the whole upper surface.
4. The underside of the animal consists of a single muscular "foot".

Hence, Phylum – Mollusca

1. The shell of a bivalve is composed of calcium carbonate, and consists of two, usually similar, parts called valves covers the laterally compressed bodies. These are joined together along one edge (the hinge line) by a flexible ligament that, usually in conjunction with interlocking "teeth" on each of the valves, forms the hinge.

2. The shell of a bivalve is composed of calcium carbonate, and consists of two, usually similar, parts called valves. These are joined together along one edge (the hinge line) by a flexible ligament that, usually in conjunction with interlocking "teeth" on each of the valves, forms the hinge.
3. They have no head.

Hence, Class – Bivalvia

1. The shell is characterized by two unequal valves, the interior either porcelain-like or mother-of-pearl.
2. The hinge is dysodont (lacking teeth).

Hence, Order – Ostreoida

1. Shell thick, rugose; inequivalve,
2. Left (lower) valve convex, often forming a deep bowl and frequently overlapping the right valve, usually cemented to the substratum when small, right valve flat or slightly concave.
3. Inequilateral, umbones anterior to midline.
4. Juveniles with small taxodont teeth on each side of the umbones, absent in adults.
5. Ligament internal, thick; inner surface nacreous, with a single adductor scar, elliptical, distinct, and often recessed.

Hence, Family – Ostreidae

1. Abductor muscle elliptical or oblong.
2. Pigmentation if present, is mainly on middle and inner lobes. It doesn't or rarely extends on the surface of inner lobe.
3. Mantle with or without pigmentation.
4. Anal portion of the rectum $\frac{1}{2}$ to 1 mm in length, slightly directed out of the body.
5. Anal tip with variously folded collar.
6. Anal opening situated at the middle of the ventral margin of abductor muscle.

Hence, the Specimen – *Crassostrea madrasensis*

Specimen – 9:**Systematic Position**

Kingdom: Animalia

Phylum: Mollusca

Class: Bivalvia

Order: Ostreoida

Family: Ostreidae

Genus: *Crassostrea*

Specimen – *Crassostrea gryphoides*

Identification

1. Presence of a mantle with a significant cavity used for breathing and excretion,
2. Radula present.
3. This has a single, "limpet-like" shell on top, which is made of proteins and chitin reinforced with calcium carbonate, and is secreted by a mantle covering the whole upper surface.
4. The underside of the animal consists of a single muscular "foot".

Hence, Phylum – Mollusca

1. The shell of a bivalve is composed of calcium carbonate, and consists of two, usually similar, parts called valves covers the laterally compressed bodies. These are joined together along one edge (the hinge line) by a flexible ligament that, usually in conjunction with interlocking "teeth" on each of the valves, forms the hinge.

2. The shell of a bivalve is composed of calcium carbonate, and consists of two, usually similar, parts called valves. These are joined together along one edge (the hinge line) by a flexible ligament that, usually in conjunction with interlocking "teeth" on each of the valves, forms the hinge.
3. They have no head.

Hence, Class – Bivalvia

1. The shell is characterised by two unequal valves, the interior either porcelain-like or mother-of-pearl.
2. The hinge is dysodont (lacking teeth).

Hence, Order – Ostreoida

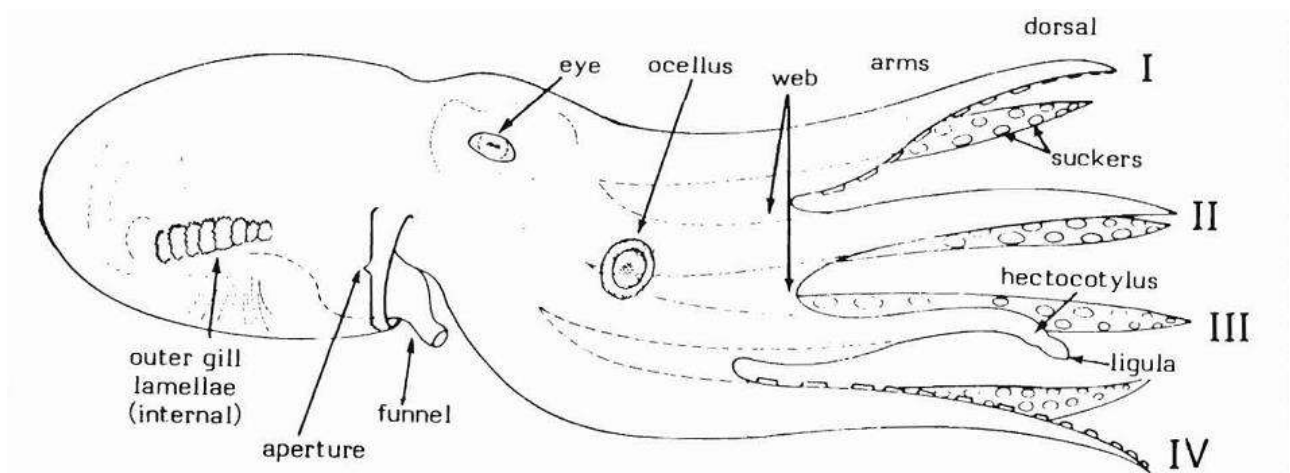
1. Shell thick, rugose; inequivalve,
2. Left (lower) valve convex, often forming a deep bowl and frequently overlapping the right valve, usually cemented to the substratum when small, right valve flat or slightly concave.
3. Inequilateral, umboes anterior to midline.
4. Juveniles with small taxodont teeth on each side of the umbones, absent in adults.
5. Ligament internal, thick; inner surface nacreous, with a single adductor scar, elliptical, distinct, and often recessed.

Hence, Family – Ostreidae

1. Abductor muscle round, bean-shaped.
2. Pigmentation of the mantle pronounced on the edge of the outer and inner lobes.
3. Mantle pigmented black.
4. Anal portion of the rectum 1 to 2 mm in length, markedly directed outwards.
5. Anal tip is simple, slightly funnel shaped.
6. Anal opening situated at the corner of the posterior and ventral margins of abductor muscle.

Hence, the Specimen – *Crassostrea gryphoides*

Specimen – 10



Systematic Position:

Kingdom: Animalia

Phylum: Mollusca

Class: Cephalopoda

Superorder: Octopodiformes

Order: Octopoda

Family: Octopodidae

Genus: *Octopus*Specimen: *Octopus* sp.

Identification:

1. Presence of a mantle with a significant cavity used for breathing and excretion,
2. Radula present.
3. This has a single, "limpet-like" shell on top, which is made of proteins and chitin reinforced with calcium carbonate, and is secreted by a mantle covering the whole upper surface.
4. The underside of the animal consists of a single muscular "foot".

Hence, Phylum – Mollusca

1. Exclusively marine animals are characterized by bilateral body symmetry,
2. Presence of a prominent head, and a set of arms or tentacles (muscular hydrostats) modified from the primitive molluscan foot.

Hence, Class – Cephalopoda

1. Octopods have rather short, compact bodies and only eight arms;
2. No trace of the missing second arm pair remains even during embryonic development.
3. Many species are benthic (bottom-living) and crawl over the ocean floor with the mouth facing the substratum.

Hence, Order – Octopoda

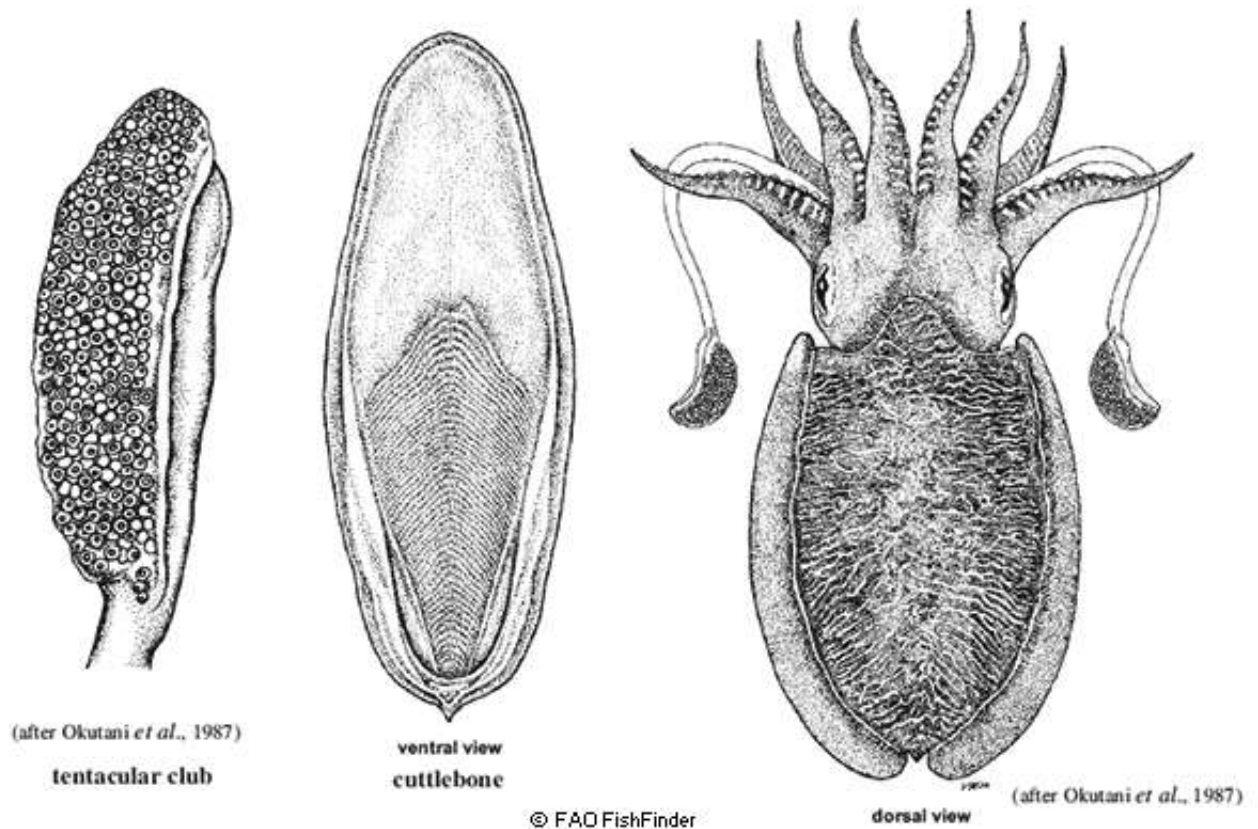
1. Presence of eight circumoral arms.
2. Absence of tentacles.
3. Arm sucker arranged in two rows, without horny rings and stalks.
4. Third arm tip of male spoon shaped.

Hence, Family – Octopodidae.

1. Octopuses are characterized by their eight arms, usually bearing suction cups.
2. They have neither a protective outer shell like the nautilus, nor any vestige of an internal shell or bones, like cuttlefish or squid.
3. The beak, similar in shape to a parrot's beak, and made of chitin, is the only hard part of their bodies.
4. The octopuses in the less-familiar Cirrina suborder have two fins and an internal shell, generally reducing their ability to squeeze into small spaces.
5. Octopuses have three hearts. Two branchial hearts pump blood through each of the two gills, while the third is a systemic heart that pumps blood through the body.

Hence, the Specimen – Octopus sp.

Specimen – 11



Systematic Position:

Phylum - Mollusca

Class - Cephalopoda

Order - Sepioidea

Family - Sepiidae

Genus - *Sepia*Species - *Sepia officinalis*

Identification:

1. Presence of a mantle with a significant cavity used for breathing and excretion,
2. Radula present.
3. This has a single, "limpet-like" shell on top, which is made of proteins and chitin reinforced with calcium carbonate, and is secreted by a mantle covering the whole upper surface.
4. The underside of the animal consists of a single muscular "foot".

Hence, Phylum – Mollusca

1. Exclusively marine animals are characterized by bilateral body symmetry,
2. Presence of a prominent head, and a set of arms or tentacles (muscular hydrostats) modified from the primitive molluscan foot.

Hence, Class – Cephalopoda

1. This order of species have eggs that attach to a substrate separately or in unorganized groups.
2. They also have two eyelids, and the suckers on their arms are encircled with muscle

Hence, Order – Sepioidea

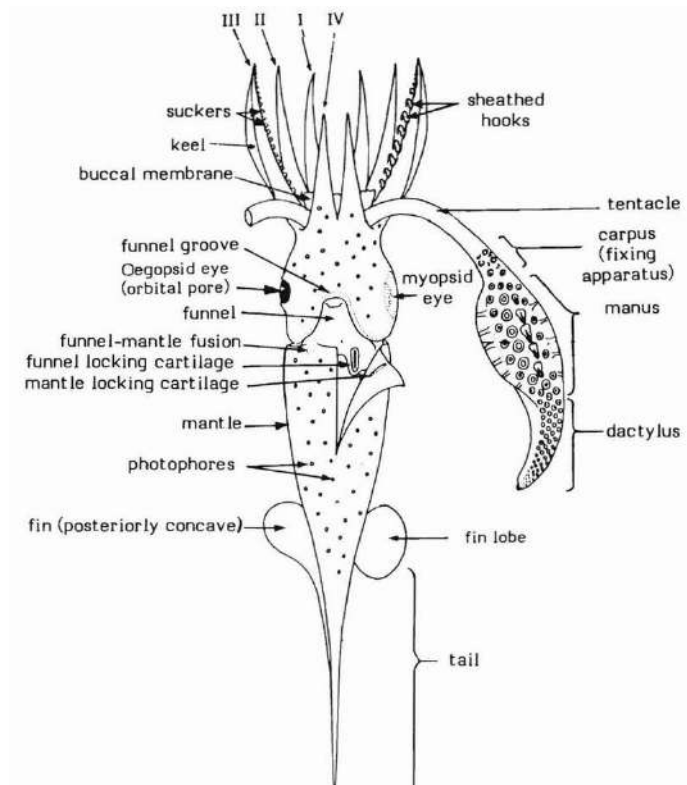
1. These animals have flattened arms, tentacles that can retract into a pocket of the body,
2. An eye pore inside of a ventral eyelid, narrow fins, and the shell of a cuttlebone.

Hence, Family – Sepiidae

1. These cephalopods do not have a pore at the posterior end of their mantle and their cuttlebone is about the same length as their mantle.
2. This species has an oval body and can only grow to a maximum length of 40 cm.
3. In English, the word Sepia refers to a "rich brown pigment prepared from the ink of cuttlefishes". The word officinalis is a Latin word that means "used in medicine".

Hence, the Specimen is *Sepia officinalis*

Specimen – 12

**Systematic Position:**

Phylum - Mollusca

Class - Cephalopoda

Order - Teuthida

Family - Loliginidae

Genus - *Loligo*Species – *Loligo vulgaris***Identification:**

1. Presence of a mantle with a significant cavity used for breathing and excretion,
2. Radula present.

3. This has a single, "limpet-like" shell on top, which is made of proteins and chitin reinforced with calcium carbonate, and is secreted by a mantle covering the whole upper surface.
4. The underside of the animal consists of a single muscular "foot".

Hence, Phylum – Mollusca

1. Exclusively marine animals are characterized by bilateral body symmetry,
2. Presence of a prominent head, and a set of arms or tentacles (muscular hydrostats) modified from the primitive molluscan foot.

Hence, Class – Cephalopoda

1. The main body mass is enclosed in the mantle, which has a swimming fin along each side. These fins, unlike in other marine organisms, are not the main source of locomotion in most species.
2. The skin is covered in chromatophores, which enable the squid to change color to suit its surroundings, making it practically invisible. The underside is also almost always lighter than the topside, to provide camouflage from both prey and predator.
3. Under the body are openings to the mantle cavity, which contains the gills (ctenidia) and openings to the excretory and reproductive systems. At the front of the mantle cavity lies the siphon, which the squid uses for locomotion via precise jet propulsion.

Hence, Order – Teuthida

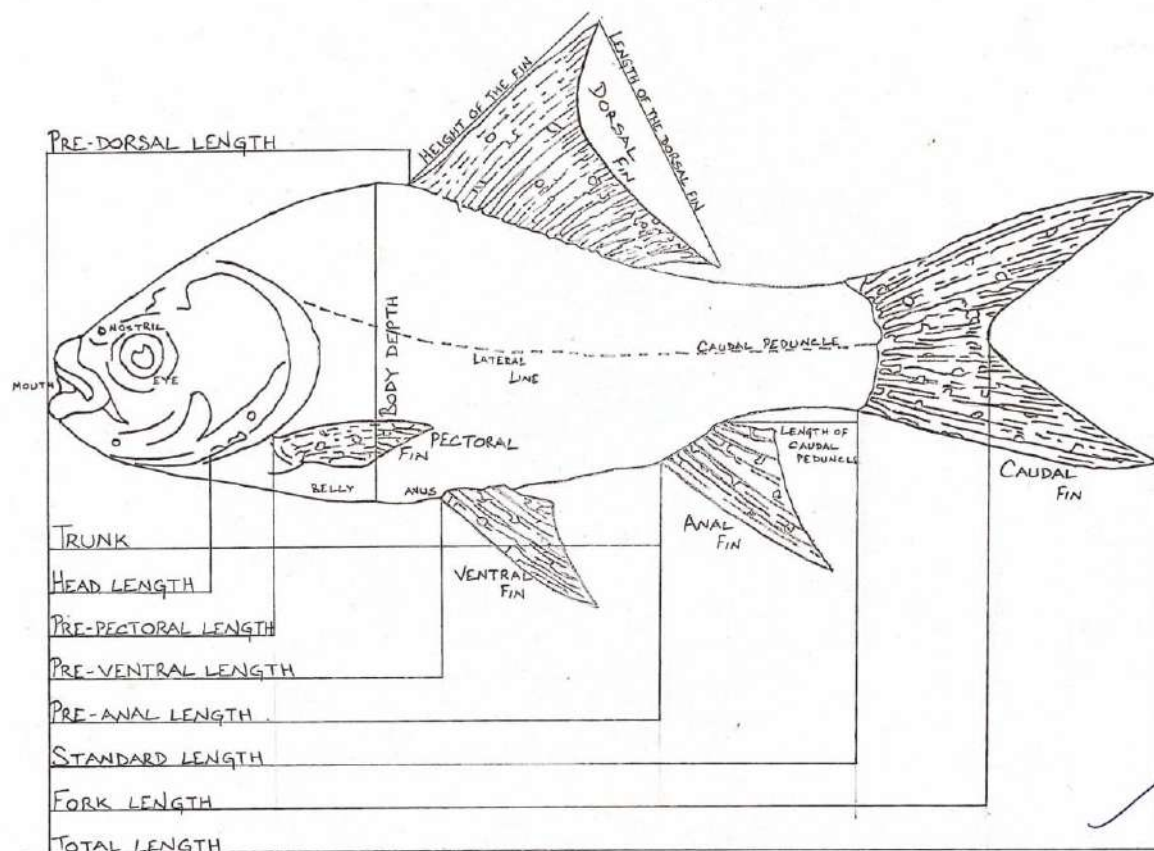
1. Very muscular body with 3 – 100 mm in size.
2. All member of the family have a cornea that covers the lens of each eye.
3. Presence of a gladius that extends the full length of the mantle and a gill that has a branchial canal.

Hence, Family – Loliginidae

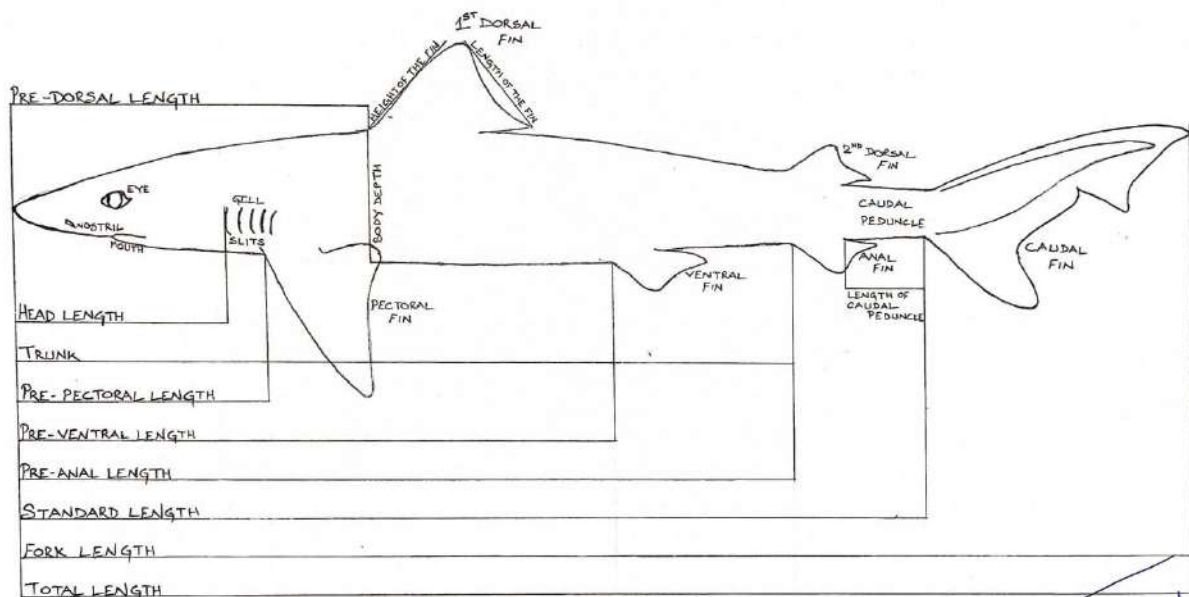
1. Long, moderately slender and cylindrical body. Rhomboid fins comprise two-thirds of the mantle length, though locomotion is via jet propulsion.
2. The posterior border is slightly concave.
3. The head is relatively small and has large eyes which are covered with a transparent membrane.
4. Like almost all squid, this species has ten limbs surrounding the mouth and beak: eight are relatively short arms, and two, which form the tentacles, are long, as they are used to catch prey.
5. The fourth left arm of males is a hectocotylus. The European squid can grow up to 30–40 cm in the mantle length, but more usually they are 15–25 cm long.
6. The males are generally bigger than the females and exhibit more rapid rates of growth.

Hence, the species - *Loligo vulgaris*

Anatomy of a Typical Freshwater Fish



Anatomy of a Typical Elasmobranch



MORPHOMETRIC MEASUREMENTS OF Tilapia mossambica

1. Standard length	—	15 cm
2. Total length	—	19 cm
3. Fork length	—	15.5 cm
4. Snout length	—	1 cm
5. Post orbital length	—	1.8 cm
6. Length of the upper jaw	—	1.5 cm
7. Length of the lower jaw	—	1.2 cm
8. Pre dorsal length	—	7 cm
9. Girth length	—	3.5 cm
10. Pre pectoral length	—	4 cm
11. Pre anal length	—	11.8 cm
12. Length of caudal peduncle	—	2 cm
13. Isthmus	—	1.7 cm

MORPHOMETRIC MEASUREMENTS OF Cirrhinus mrigala

1. Standard length	- 13.6 cm
2. Total length	- 16.5 cm
3. Fork length	- 15.0 cm
4. Snout length	- 1.5 cm
5. Post orbital length	- 1.7 cm
6. Length of the upper jaw	- 0.5 cm
7. Length of the lower jaw	- 0.9 cm
8. Pre dorsal length	- 6.1 cm
9. Girth length	- 3.5 cm
10. Pre pectoral length	- 3.2 cm
11. Pre anal length	- 10.5 cm
12. Length of caudal peduncle	- 2.5 cm
13. Isthmus	- 1.1 cm

STUDY OF BUCCOPHARYNX, GUT CONTENT, FEEDING HABIT & RELATIVE GUT LENGTH OF FISH

INTRODUCTION—In order to study the feeding habits of fishes the study of buccopharynx and alimentary canal is very important. The structural pattern of buccal mass and pharynx varies from fish to fish depending upon different feeding habits along with structural variants of alimentary canal.

OBJECTIVE—To manipulate the production in water body, the knowledge about feeding habits of fish is necessary. In fish culture it must be known whether the fish is carnivorous, herbivorous or omnivorous to occupy the possible ecological niches by minimising the complication among themselves.

PROCEDURE—The fish is dissected and the buccopharynx and entire viscera is exposed after noting the weight of the fish and the total length of the fish. After that the length of the intestine, body-weight relationship, condition factor G.S.I., G.O.S.I. etc are studied. The content of the stomach is observed under the microscope and from these observations the feeding habits of the fish will be known to us.

COMMENT—The following features are important from which the following remarks may be made.

i) **TEETH**: When teeth are present in the jaw it indicates the fish is carnivorous in feeding habit. The teeth helps in grasping of food, also indicates that the food is large and able to escape. When the teeth is present on pharynx or plate palate then it helps in crushing of food.

ii) **GILL RAKERS**: Well developed gill rakers indicate that the fish is plankton feeder.

iii) **INTESTINE**: Long intestine indicates generally herbivorous type while the short intestine indicates that the fish is carnivorous. Many folds of the intestine shows increased efficiency of digestion.

iv) **STOMACH**: Well developed stomach indicates further crushing of food.

v) **CONDITION FACTOR**: $K = \frac{W}{L^3} \times 100$

K = Condition factor

W = Body weight of the fish

L = Total length of the fish

$$\text{G.S.I.} = \frac{\text{Total length of gut}}{\text{Total length of body}} \times 100$$

$$\text{R.L.G.} = \frac{\text{Gut length}}{\text{Body length}}$$

STUDY OF BUCCOPHARYNX, GUT CONTENT, FEEDING HABIT & RELATIVE GUT LENGTH OF Oreochromis mossambica

MOUTH—
Superior

BUCCOPHARYNX—

- i] Pharyngeal teeth present
- ii] Double rays of gill filaments with spiny rakers.

ALIMENTARY CANAL—

- i] Stomach bulbous and thin walled.
- ii] Intestine much larger in size.

Body Length	Gut Length	RLG
16.5cm	161.5cm	0.012

GUT CONTENT—

Analysis shows presence of high quantities of diatoms, blue-green algae etc.

DISCUSSION—

- i] Mouth: superior— It seems to be surface feeder.
- ii] Stomach thin walled and bulbous— It seems to be herbivore.
- iii] R.L.G. greater than 1— It seems to be herbivore
- iv] Presence of algae, diatoms and rotifers— It seems to be omnivore.

COMMENT—

From the above discussion it may be concluded that it is a surface feeder to omnivore in nature as both characteristics of herbivore and carnivore is present in this fish.

STUDY OF BUCCOPHARYNX, GUT CONTENT, FEEDING HABIT & RELATIVE GUT LENGTH OF Channa punctatus

MOUTH—
Terminal

BUCCOPHARYNX—

- i] Pharyngeal teeth present
- ii] Gill rakers are short and stout.

ALIMENTARY CANAL—

- i] Stomach thick walled, sac like, somewhat 'U' shaped.
- ii] Intestine is very short.

Body length	Gut Length	RLG
15.5 cm	7 cm	2.214

GUT CONTENT—

Most of the food is digested or undigested.

DISCUSSION—

- i] Pharyngeal teeth present—It seems to be carnivore.
- ii] Stomach thick walled—It seems to be carnivore.
- iii] R.L.G. less than 1—It seems to be carnivore.

REMARK—

From the above discussion it may be concluded that the fish is carnivorous in feeding habit.

STUDY OF BUCCOPHARYNX, GUT CONTENT, FEEDING HABIT & RELATIVE GUT LENGTH OF Cirrhinus mrigala

MOUTH—

Broad and Transverse.

BUCCOPHARYNX—

- i] No Pharyngeal teeth present.
- ii] Presence of 4 pairs of gills with gill filaments.
- iii] Gill rakers moderate in size and filamentous.

ALIMENTARY CANAL—

Behind the Oesophagus posterior part of the intestine is swallowed, slightly form a tube like stomach with thin wall, intestine is much long and coiled.

Body Length	Gut Length	RLG
16 cm	234 cm	0.068

GUT CONTENT—

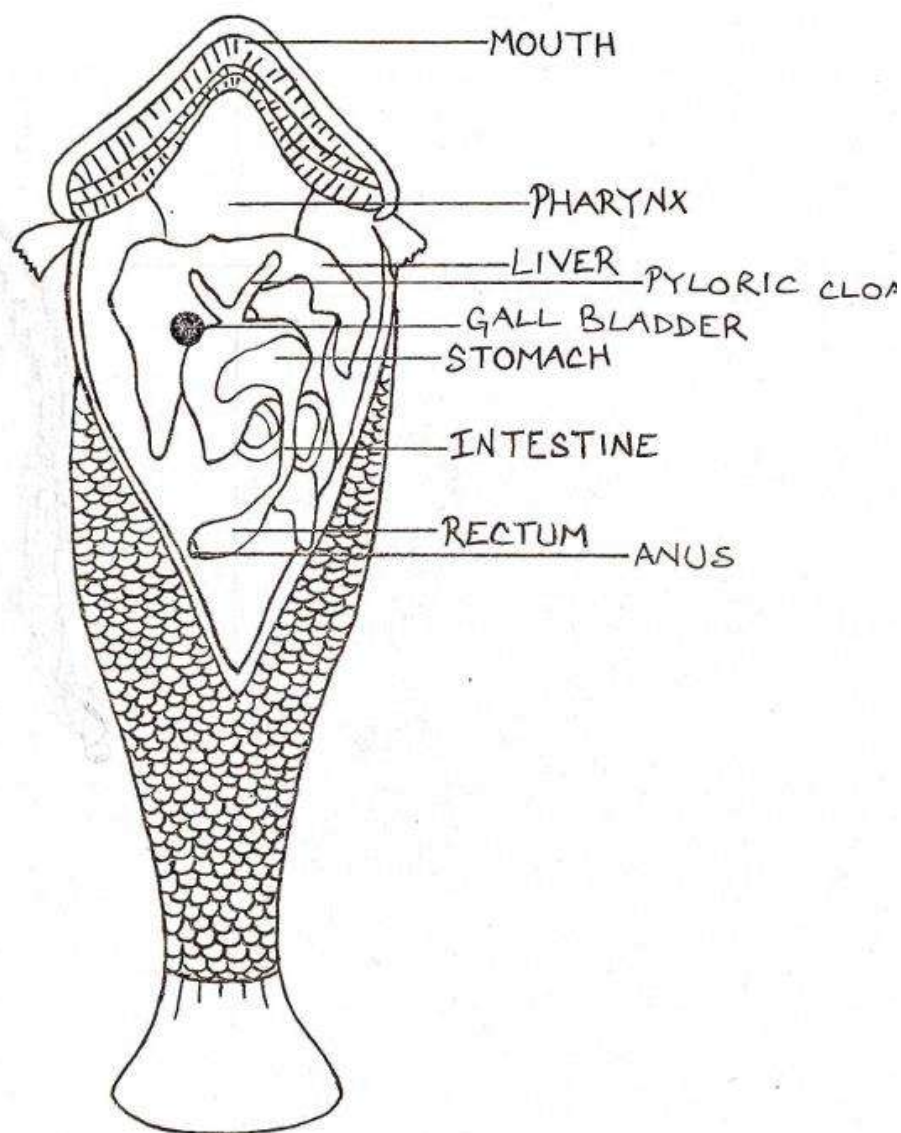
Gut content shows algae, decaying plants and animal matter, detritus and mud.

DISCUSSION—

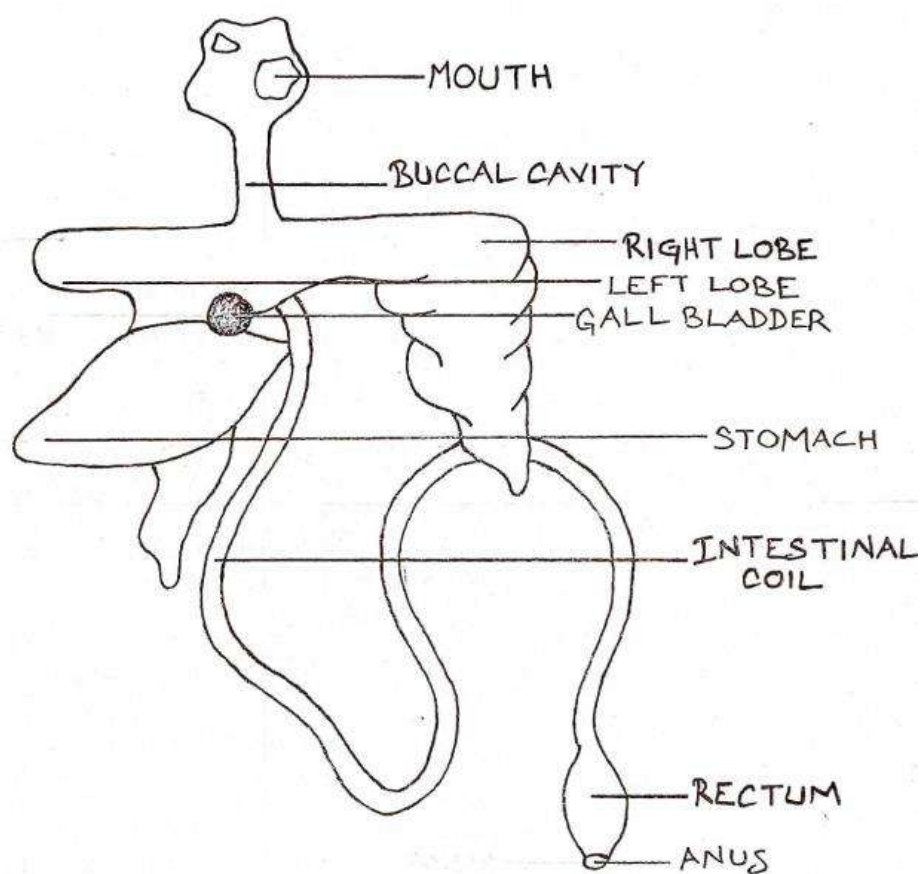
- i] Mouth broad and transverse—It seems to be bottom feeder.
- ii] No pharyngeal teeth, filamentous gills with gill rakers present—It seems to be plankton feeder.
- iii] RLG greater than 1—It seems to be herbivorous
- iv] Stomach thin, tubular and long—It seems to be herbivorous.
- v] Digested material algae—It seems to be herbivorous.

REMARK—

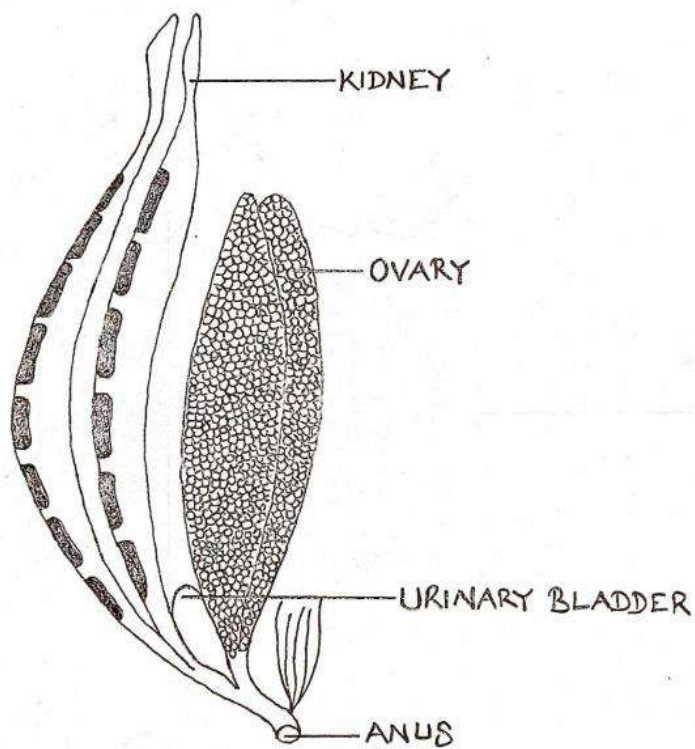
From the above discussion it can be concluded the fish is herbivorous in feeding habit.



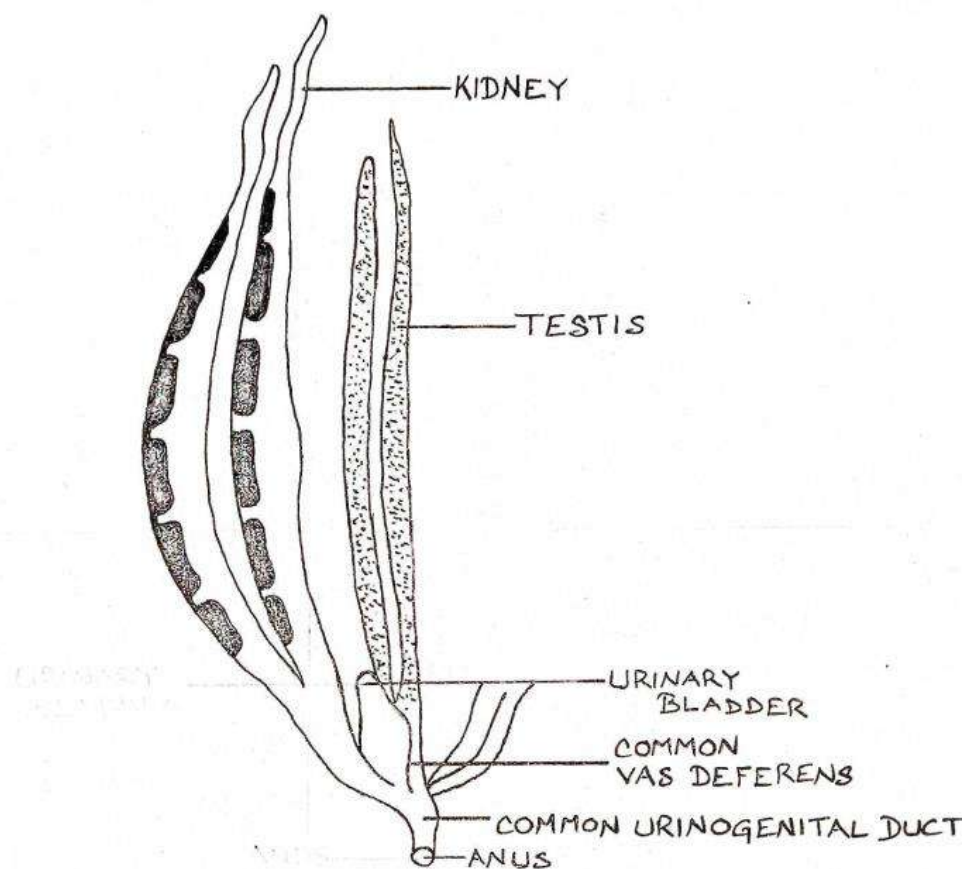
Digestive system of Channa punctatus



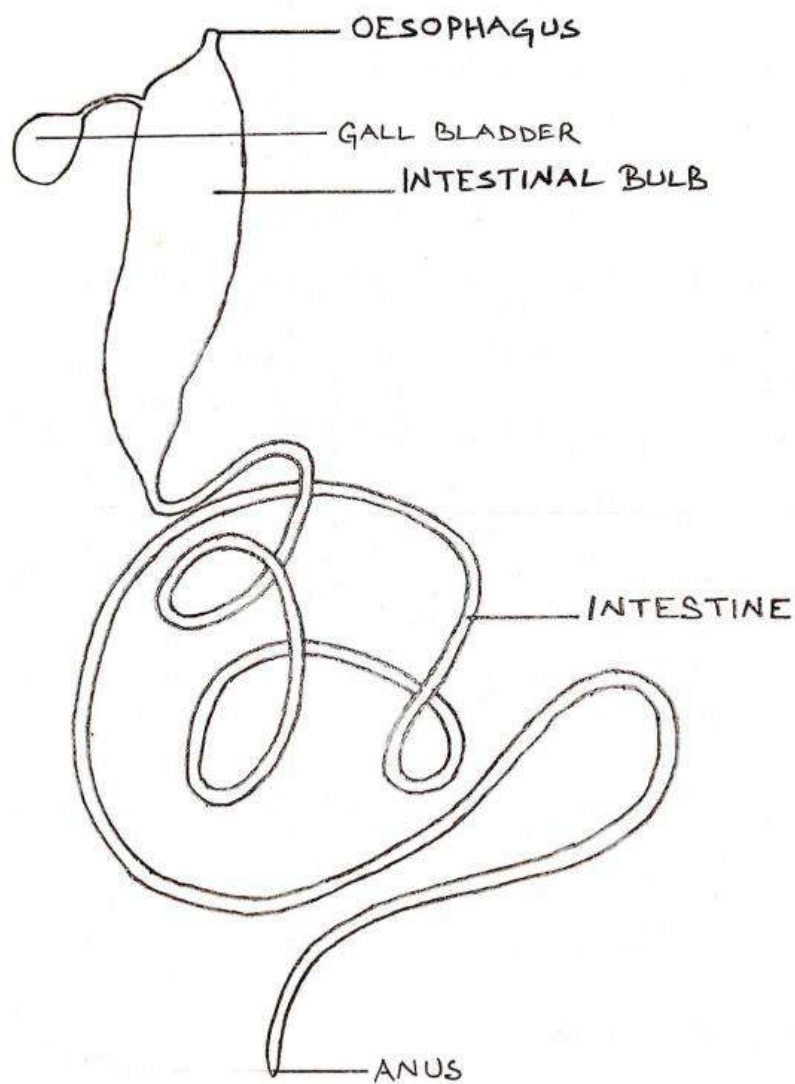
Digestive system of *Tilapia mossambica*



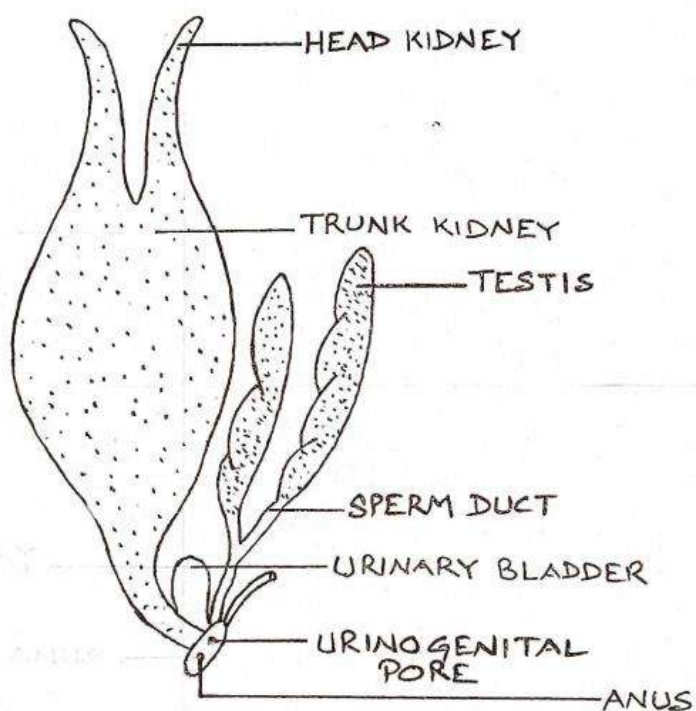
Urinogenital system of Tilapia mossambica



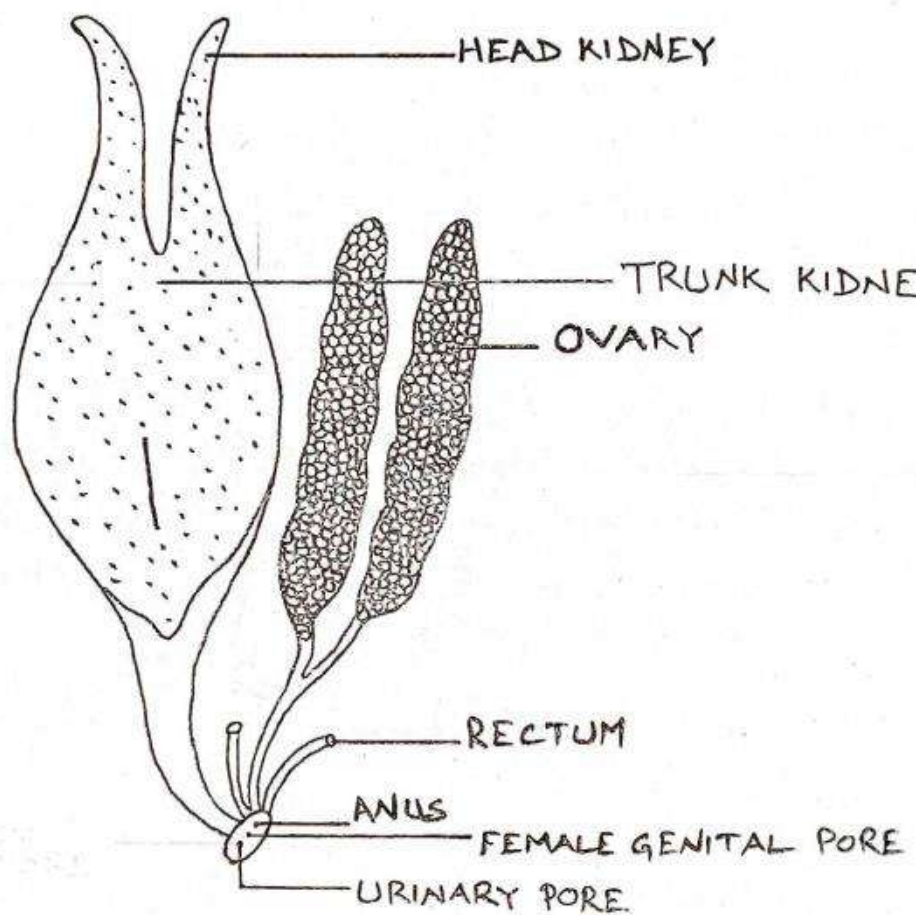
Urinogenital system of *Tilapia mossambica*



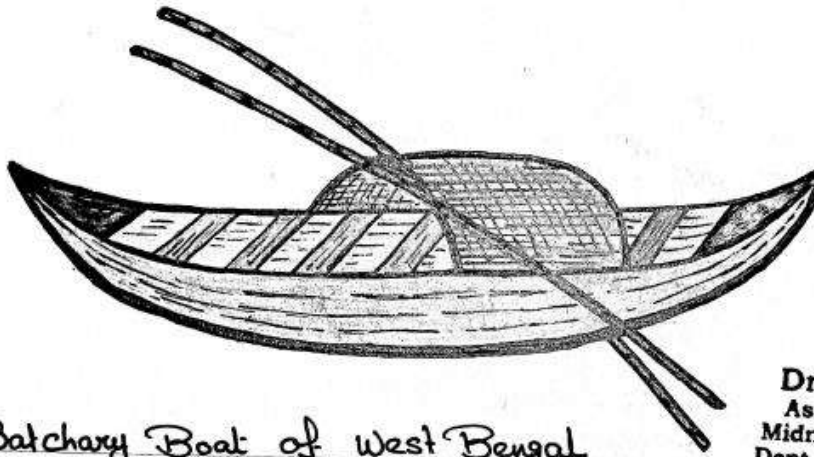
Digestive system of *Cirrhinus mrigala*



Urinogenital system of *Cirrhinus mrigala*



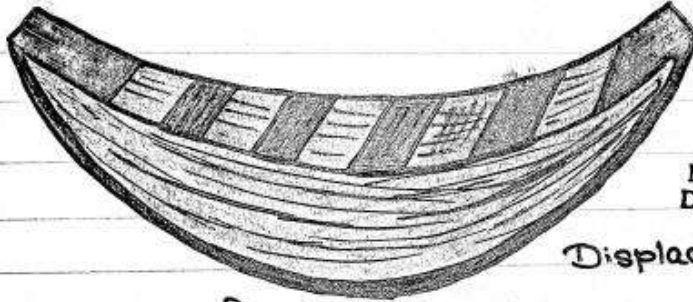
Urinogenital system of *Cirrhinus mrigala*

P-2: FISHING CRAFTS AND GEARS IDENTIFICATION

Batchary Boat of West Bengal

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- ① Size : 8.4-20.4 m OAL
- ② Most common dimensions are : 13.05 x 1.3 x 10.48 m.
- ③ The stern is as high as bow
- ④ Carvel built boat with planks butted together by staples.
- ⑤ Used for operation of drift net, bag net & dip nets.

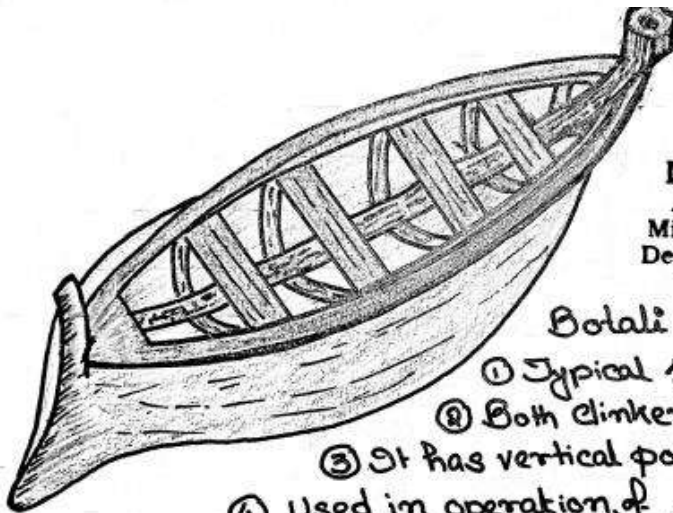


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Displacement: 3 tons

Chot Boat of West Bengal

- ① Short overhangs & high free board.
- ② Typical boat measures: 10.2 m x 2.55 m x 1.1 m.
- ③ Used for operation of seine net & bag net.

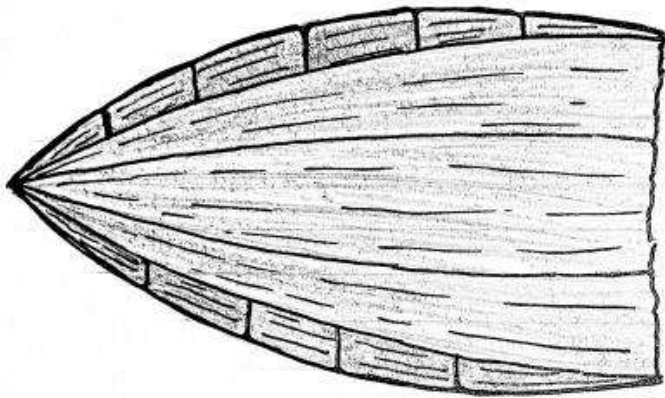


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Botali (Dingi) of Orissa

- ① Typical size: 3.5 x 0.45 x 0.45 m.
- ② Both clinker & carvel boats are present.
- ③ It has vertical pointed stem & stern.
- ④ Used in operation of gill nets to catch hilsa & Pomfrets.

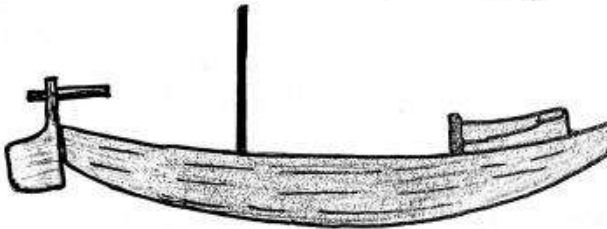
Clinker built boat is known as Pattiya.



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Calamaram of Orissa.
Also known as Ganjam type
Calamaram with distinctive
features.

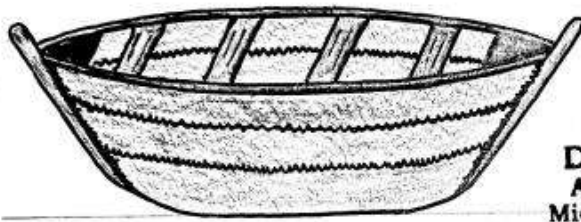
- ① The boat is made of 5 logs, which are pegged.
- ② Logs are narrowed to a point in the forward where 2 pieces fitted to give sharp beak point.
- ③ At the aft, the craft abruptly truncated.
- ④ 3 medium logs are full length pieces while sides are made of old logs and pegged to give require shape.
- ⑤ used to operate gill nets from beaches.



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Naua of Orissa & Andhra Pradesh

- ① Narrow round bottom boat without any keel.
- ② Heavily framed, Carvel/Planked built with short fore deck & longer outer aft deck.
- ③ Size: 10.5 x 1.95 x 0.68 m, displacement 4 tonnes.
- ④ Carries one mast & latten sail.
- ⑤ Mainly used for gill nets, Shore Seines, boat seines & long lines.



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Masula Boat / Bare Boat of Orissa & Andhra Coast

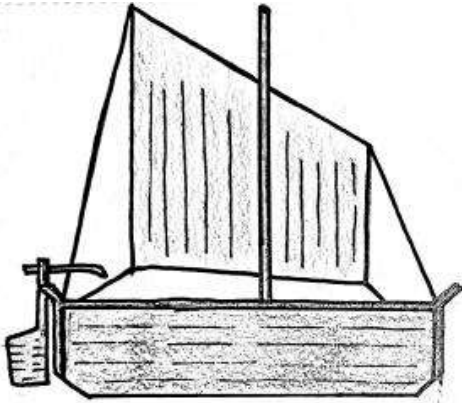
- ① Non rigid, clumsy open boat without ribs.
- ② Average size of the boat 8.4m x 2.4m x 1.2 m.
- ③ Planks made of mango wood & stitched with palmmyrah leave fibres, keeping continuous rope in between the ~~stems~~ seams.
- ④ Triangular sails used from bamboo mast.
- ⑤ Used in operation of gill nets, lines & boat seines.



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Boat Catamaran of Tamil Nadu Coast

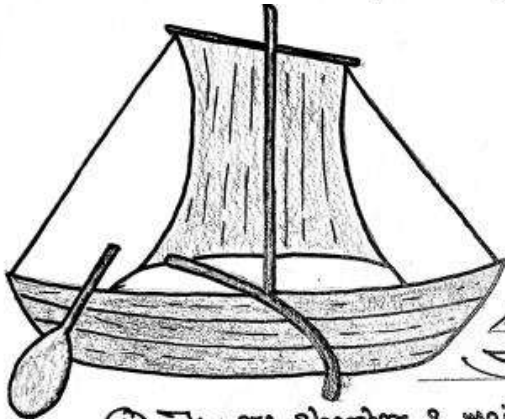
- ① The catamaran is made of 2-5 logs.
- ② The size of the catamaran varies from 6.15m to 6.9m.
- ③ A small triangular sail is used to carry the craft to the fishing ground.
- ④ They are normally worked in a pair to operate Madivalai, a boat seine.



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Tuticorin Boat of Jamil Nadu Coast

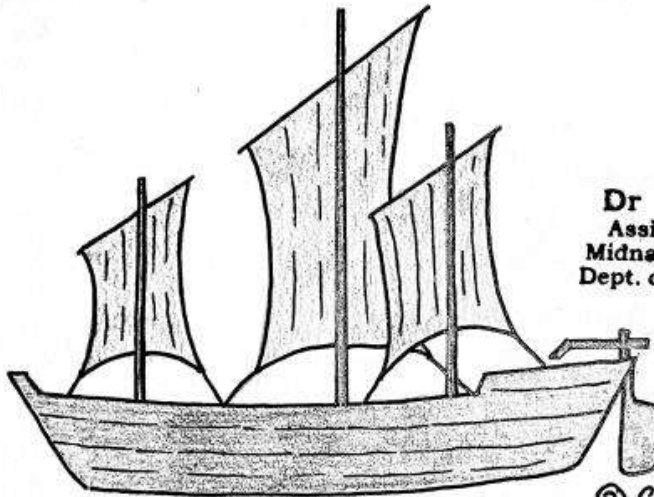
- ① Long relatively narrow, nearly vertical stems & sterns.
- ② Sheer line is almost straight.
- ③ One mast with lug hull & sail.
- ④ Typical boat measures $8.7 \times 1.8 \times 0.6-0.33$ m.
- ⑤ The boat is indigenous but mechanised with few modifications to operate gill & seine nets.



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Adirampatnam Fishing Canoe of Jamil Nadu Coast.

- ① They are shorter & majority of them are dugouts with wash strokes.
- ② Usually employ one mast, occasionally 3 masts are used.
- ③ The balance board locally known as Kadisu is exceptionally long & permanently fixed.
- ④ The boat is very common & used to operate gill nets, seine nets, bagnets, hooks & lines.



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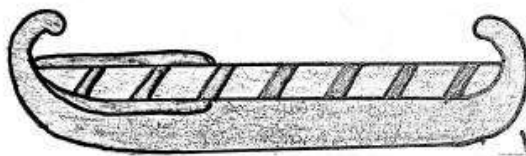
Kala Dhoni of Jamil Nade.

① Heavy transom stern.

② Carries largest & heaviest
balance board.

③ Rigged with 3 masts & lug sails.

④ The fastest traditional fishing boat.



Dugout Canoe

Kerala is the home of dugout,

though the boat is found along the

Gujarat coast, Maharashtra, Karnataka & some extent in Jamil Nade.

① The boat is made by scooping out material from single large trunks of trees like mango, aini.

② Keel portion is thicker than the sides.

③ Propulsion by sails or paddles.

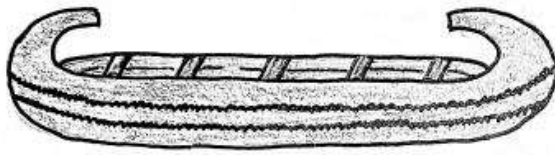
④ 3 different dugouts differ in size and use.

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a) Larger - (9.6 x 10.5 x 0.9 x 0.75 m) commonly known as odoms. displacement 3 tonnes used in pair to operate boat seine.

b) Medium (Thonies) (7.2 x 0.9 x 0.6 m) displacement - 2 tonnes, used to operate beach seines, gill nets & lines.

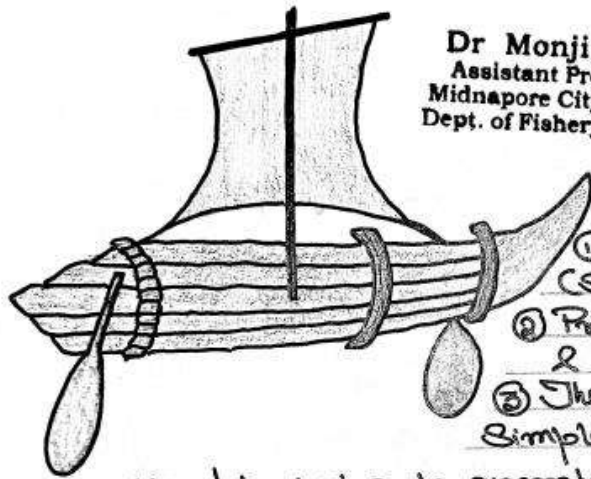
c) Small (Beputhoni) 6.9-7.8 m used to operate gill nets & lines.



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Plank Built Canoes of Kerala Coast.

- ① Built with planks in the shape of dugout. Locally known as Chumboke or Tonna Vellam.
- ② Wooden planks are sewen with coir ropes. A layer of black pitch is applied inside & outside to make water-tight.
- ③ Use paddle for propulsion, occasionally sails.
- ④ Size: Larger one 11-12m x 1-1.5m x 0.8m (displacement: 5t)
Smaller one 6-7m x 0.9m x 0.6m (displacement: 3-4t)
Used for Shore Seines & Gill nets.

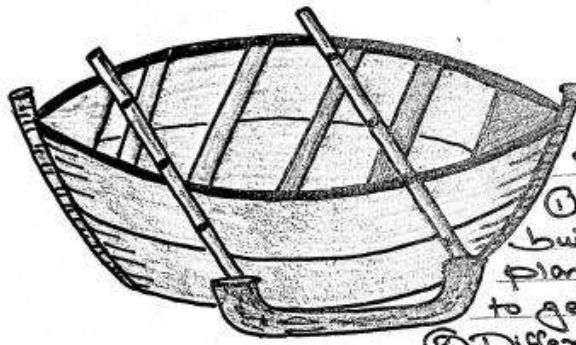


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Raft Catamaran of Kerala Locally known as Chalekthadi.

- ① The raft is made of 3-5 logs (soft wood) & tied with coir ropes.
- ② Propulsion with split bamboo oars & sails.
- ③ The raft is very traditional & simple, used over 10,000 years.

Used in pairs to operate boat seines & individually to operate long lines in deeper waters.



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Rampami Boat of Maharashtra

① Long deep, widely spread built up canoes. In some cases planks are built over the dugouts to get wider beam.

② Differ from normal built up canoe

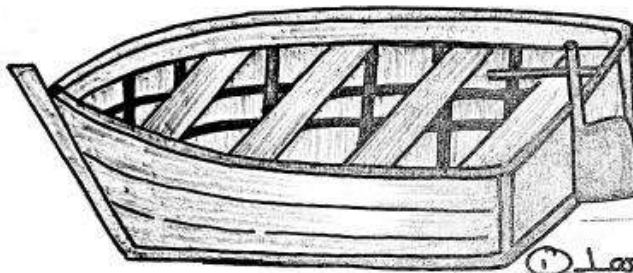
Without riggers to give stability.

③ Narrow keel, stem & stern look alike.

④ No mast is carried.

⑤ Typical boat measures 15.0 x 1.80 x 2.70 m

The boat is used to operate a seine net (Beach seine) locally known as 'Rampami'.



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Machwa Type Waham of Gujarat Coasts.

① Large deep sea vessel.

② Average Size: 9.6 m - 10.2 m x 2.86 m (Beam)

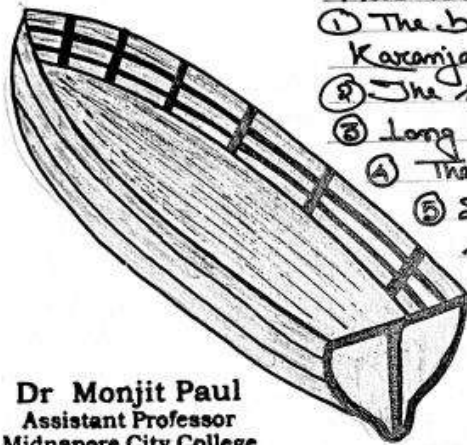
③ Raked Stern, square Stern.

④ Decked fore & aft.

⑤ Rudder is large & heavy.

⑥ Single mast with lateen sail.

Used for operation of Doll nets & Gill nets. 4-45 shots of gill nets are operated from each boat with 7-8 crew.

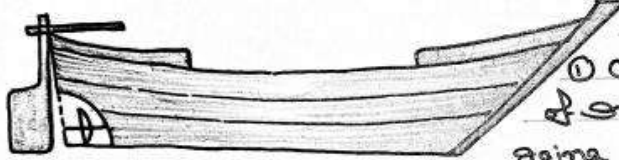


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Machwa of Kutch (Gujarat Coast)

- ① The boat is commonly known as Karamja Boat.
- ② The size of the boat 14.1m x 3.3m x 0.9m.
- ③ Long overhanging bow with raked stem.
- ④ The keel is short in relation to length.
- ⑤ 2 mast (Raked forward) with lateen sails.

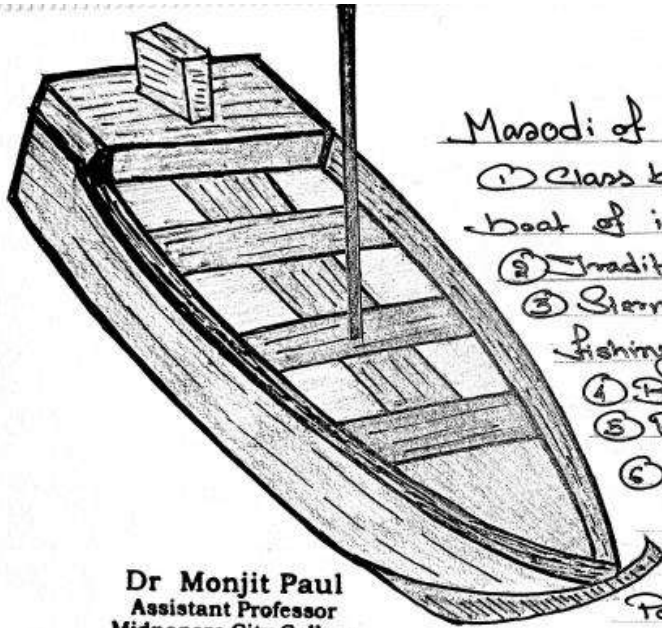
The boat is used to operate gill nets, dol nets & seine nets.



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Satpadi of Maharashtra

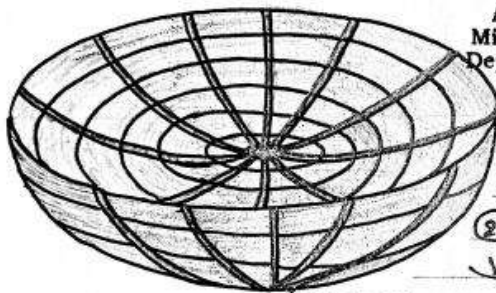
- ① One of the best fishing boat of India with excellent sea going qualities.
 - ② Mechanised easily without great changes.
 - ③ OAL - 9-13.5m
 - ④ Planking is laid carvel fashion but seams are rabbated.
 - ⑤ Medium gundeale & transom stern.
- Popularly known as Gal Boat, used along the coast of Maharashtra to operate gill nets.



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Masodi of Lakshadweep Islands.

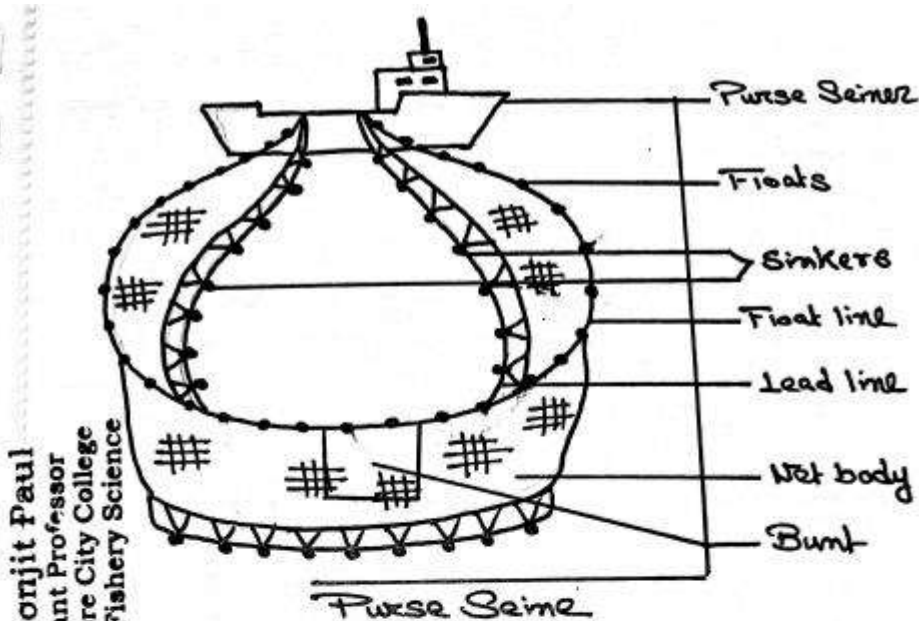
- ① Class by itself, superior than any boat of inland.
 - ② Traditional sailing cum rowing boat.
 - ③ Stern is broader provided better fishing platform.
 - ④ Boat carries two lateral sails.
 - ⑤ Boat Measures : 12.5 x 8.0 m.
 - ⑥ Suitable for mechanisation.
- The boat is used in Minicoy island for Tuna Pole & Line Fishing.



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Coracles

- ① The Coracles are dominant craft of South Indian Reservoirs.
 - ② Large Wide mouth flat bottom baskets made of split bamboo.
 - ③ The common size is 8.6 m dia. at mouth.
 - ④ Manned by one-to two fishermen.
- All types of fishing gears including gill nets, seine nets, long lines, cast nets are operated from each coracle.



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Structure of Purse Seine

Design, Shape, Size of the purse seine vary greatly with operation, target species, depth etc.

A typical purse seine could consist following parts:-

- ① Bunt: This is the section of net where catch is concentrated prior to its removal. The netting of bunt should be stronger & made of thicker twines.
- ② Main Body: Largest part of the net extending from bunt to facilitate surrounding the shoal of the fish.
- ③ Selvages - Consists of a few rows of meshes & thicker twines to protect the net from damages.
- ④ Float & Lead line - The upper selvages are attached with float line & lower selvege to the lead line.

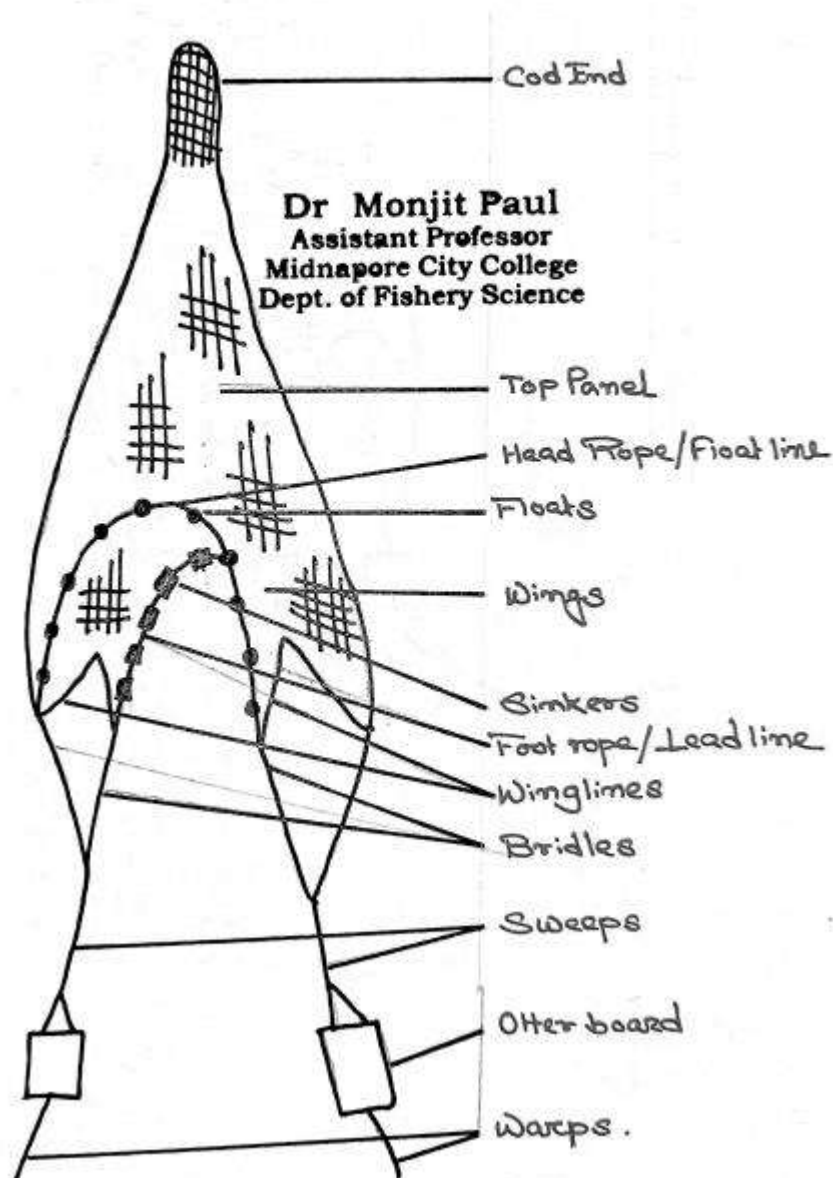
Bridles & tow line: Bridles are ropes attached to the float line & lead line on either end and are connected a tow line of sufficient length to facilitate setting & hauling operations.

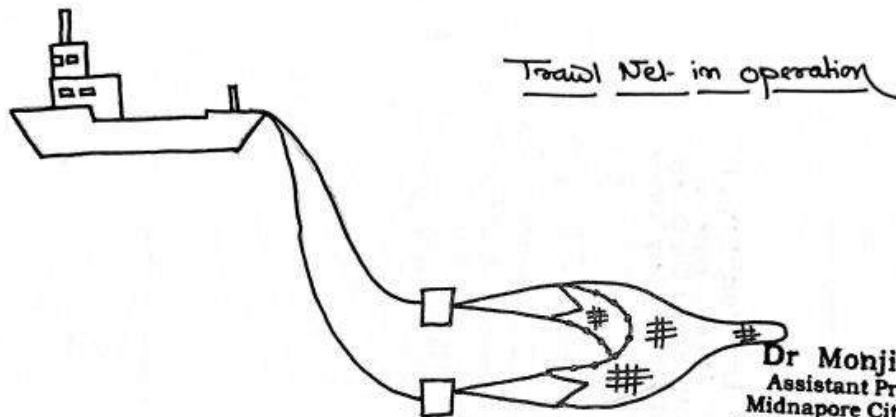
Floats & Sinkers: Sinkers are attached to the lead line to attain 1-3 kg/m to 8 kg/m weight. Floats are used to maintain the total buoyancy 1.5 to 3.5 times of total underwater weight. Higher buoyancy is maintained in the bunt area of the net.

Operation of Seine Net:

Seine fishing is the method of fishing that employs the surrounding of net, called a seine, that hangs vertically in water with its bottom edge held down by weights & its top edge buoyed by floats. Seine nets can be operated from the shore (Shore/Beach Seine) or from the boat (Boat Seine).

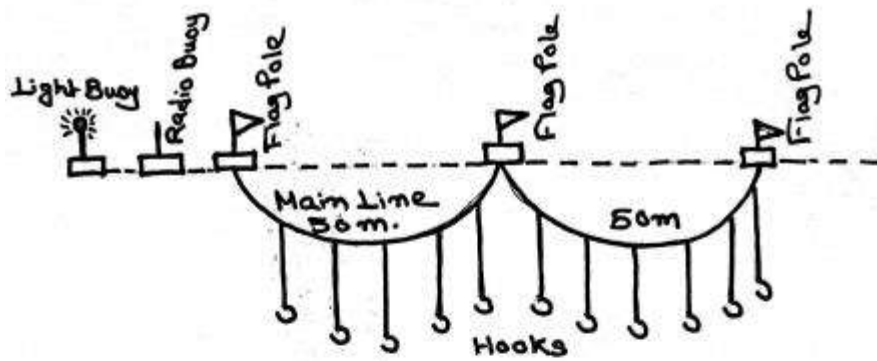
A typical diagram of Trawl Net





Trawling is a method of fishing that involves pulling a fishing net through the water behind one or more boats. The net is used for trawling is called trawl. Trawling today is heavily regulated in some nations. Capture of undesirable species - turtle, sea lions is the main concern.

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A typical long Lines.

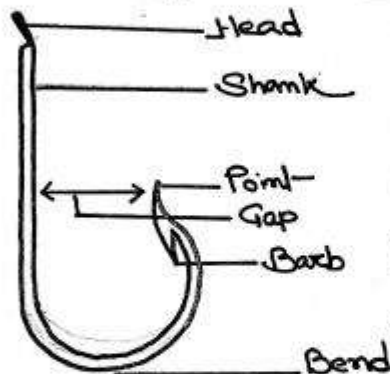


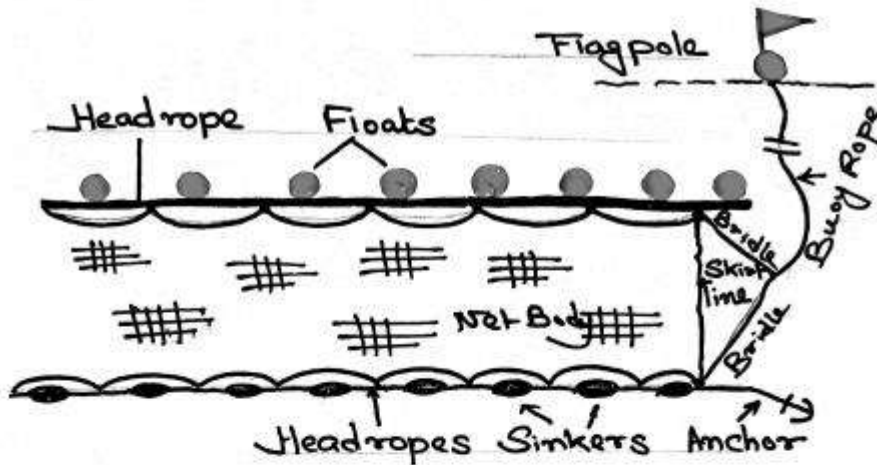
Diagram of a typical Hook

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Hooks & Lines are passive gear where fish is attracted by a natural or artificial bait (lures), placed on hook.

Hooks are metallic points, used to catch the fish by ripping them.

The fishing gear is generally operated in a very wide range of depths to catch large fishes like Tuna, Swordfish etc.



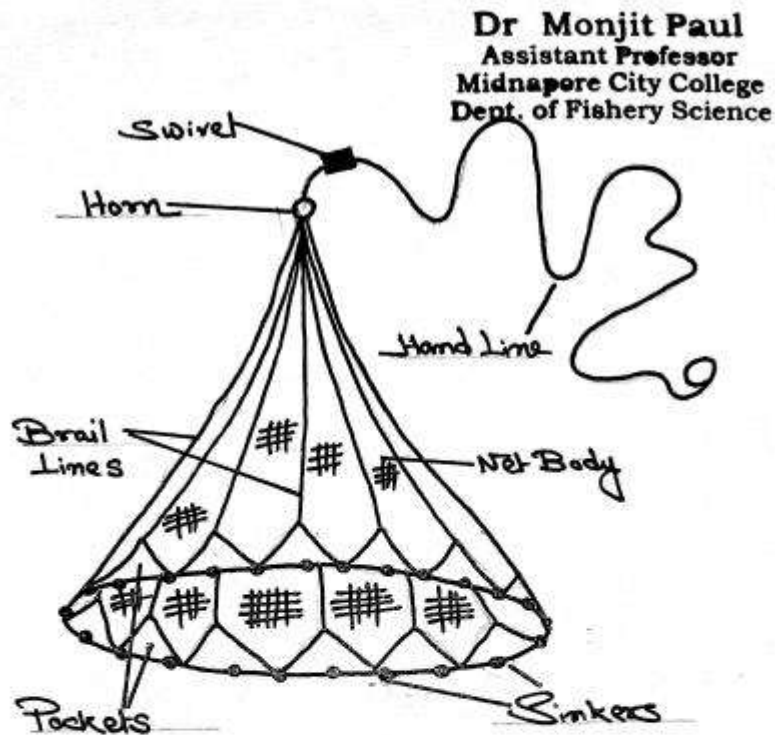
A typical diagram of Gill Net

Gillnetting is a fishing method (passive) uses gill nets - a vertical panel of netting that hang from the line with regularly placed floats.

Fishes are caught by gill nets in three ways -

- ① Wedged - held by the mesh around the body
- ② Gilled - held by the mesh slipping behind the opercula.
- ③ Jangled - held by teeth, spines, maxillaries or other protrusions of the body

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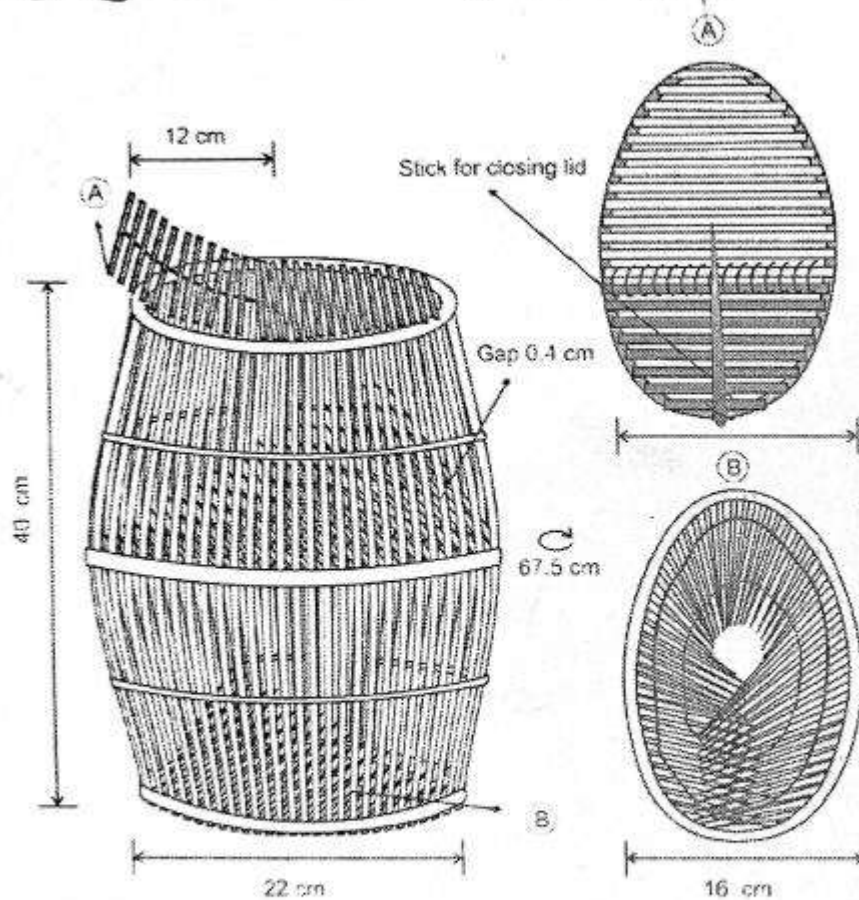
Cast Net

A cast net is also known as throw net. It is a circular net with small weights distributed around its edges.

The net is cast or thrown by hand in such manner that spreads out while it is in air, before it sinks into the water. The net is effective to catch fishes from lakes, reservoirs.

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① Cylindrical Trap (Kaita)



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① Cylindrical Trap (Kaita)

Size : 32x20 c.m (Bamboo Made)

Area of operation : Shallow water bodies

Target Species : Small prawns, Mastacembelus spp., Puntius spp., Channa spp., Anabas spp.

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② Cylindrical Trap (Dingora/Bmdh Dingora)

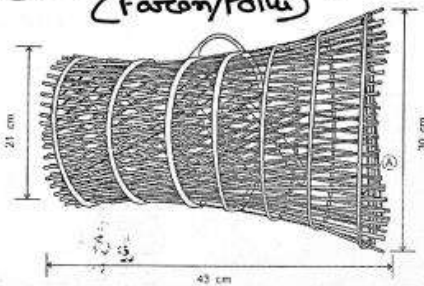
Size : 65x23 cm (Made of Bamboo)

Area of operation : Paddy fields

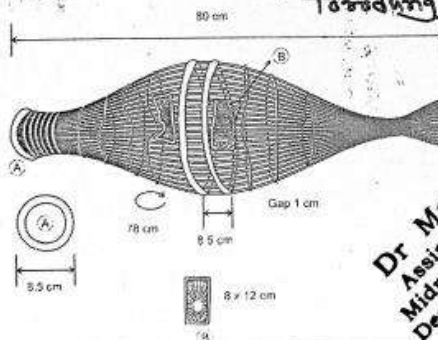
Target Species : Mystus spp., Wallago spp.,
Heteropneustes spp., Clarias sp., Puntius spp.,
Channa spp., Anabas spp.,

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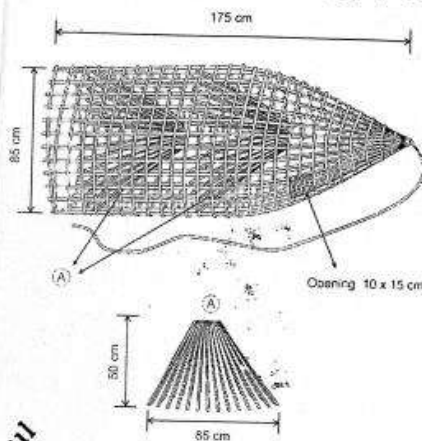
③ Cylindrical Trap (Farcon/Polui)



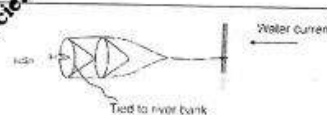
⑤ Spindle Trap (Seppa/Torodung)



④ Cylindrical Trap (Dui Hukhi/Poori)



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③ Cylindrical Trap (Farcom/Palui)

Size: 43X21 cm

Made of Chopped bamboo.

Area of operation: Paddy Fields

Target Species: Small prawns, *Mystus* spp., *Puntius* spp., *Betta* spp., *Channa* spp., *Anabas* spp.

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④ Cylindrical Trap (Dui Mukhi Paori)

Size: 210X88 cm/175X85 cm

Made of Chopped bamboo.

Area of operation: River & Beels.

Target Species: *Notopetern* spp., *Channa* spp.

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⑤ Spindle Trap (Sapa/Tordung)

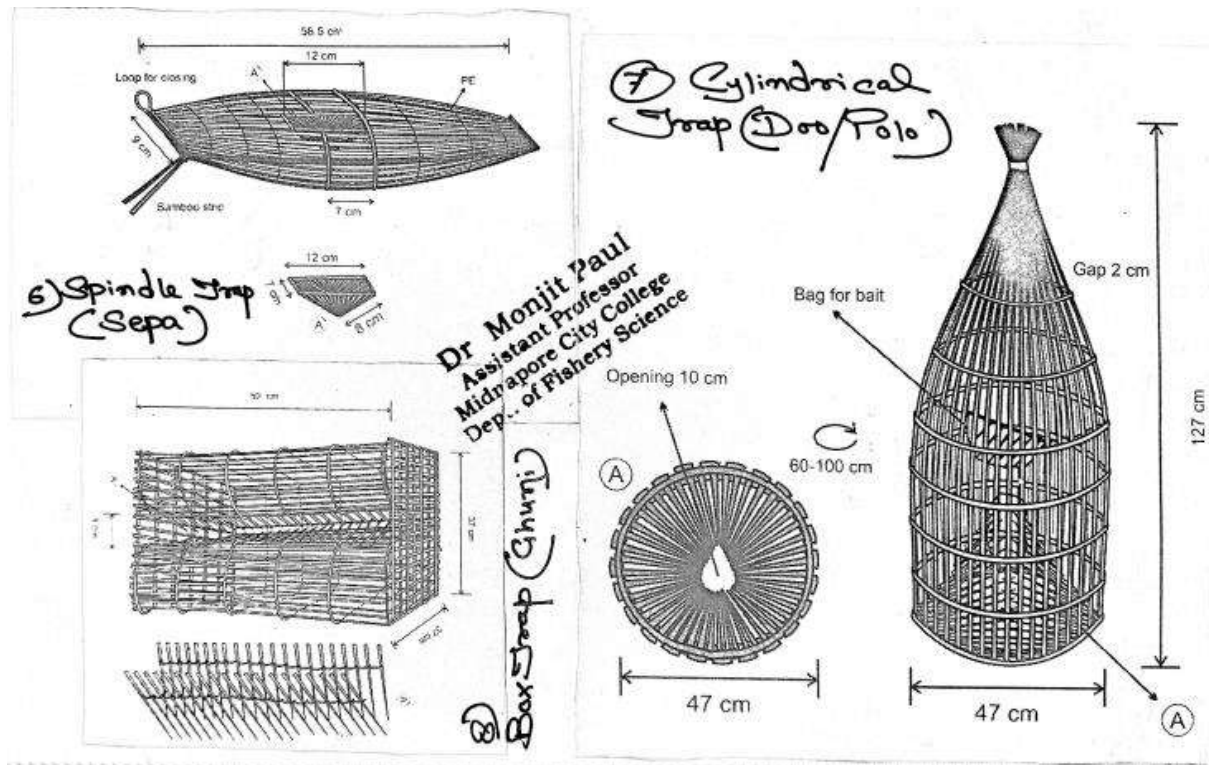
Size: 80X8.5X86 cm

Made of Chopped Bamboo.

Area of operation: River & Beels.

Target Species: Prawn & miscellaneous fishes.

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⑥ Spindle Trap (Sopa)

Size: 58.5 x 30 x 15 cm

Made of Chopped bamboo.

Area of operation: ~~Transect~~ River & Beels

Target Species: Prawns & Small fishes.

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⑦ Cylindrical Trap (Doo/Polo)

Size: 60-100 cm Dia

Made of chopped bamboo.

Area of operation: ~~in~~ Paddy fields &
other shallow water bodies

Target Species: Miscellaneous fishes

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⑧ Box Trap (Ghoni/Ghumi)

Size: 50 x 37 x 37 cm

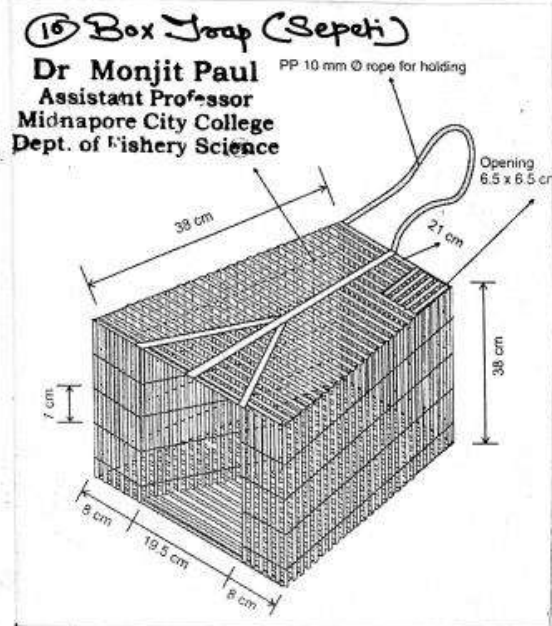
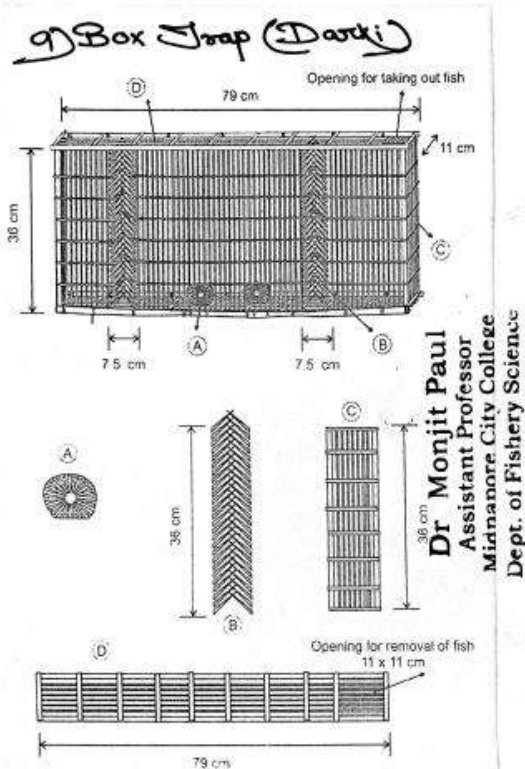
Made of chopped bamboo.

Area of operation: River, Beels, Canals

Target Species: Catfishes, Murres, Puntius

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9) Box Trap (Dorki)

Size: 79 x 36 cm

Made of Chopped bamboo.

Area of operation: Rivers, Canals, Bels.

Target Species: Prawns, Eel & other fishes

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10) Box Trap (Sepeti)

Size: 38 x 35 cm

Made of Chopped bamboo.

Area of operation: Canals, Rivers & Bels

Target Species: Catfishes & Miscellaneous

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Histological Slide Preparation of Fish Tissues (Paraffin Method).

1. Collection of the Sample:

- a. Live fishes are sacrificed to take the organs – heart, liver, kidney, testes, ovary intestine, stomach etc.

2. Fixation of the Sample:

- a. Fixation process must be started quickly as possible as the removal of selected organs.
- b. Take 3-5 mm thick tissue/organs for quick fixation in fixatives.
- c. Plastic sample jars for fixation are labelled with sample name, collection date etc.
- d. Fill the vials with 2/3 of fixatives.
- e. Organs and fixative volume must be 1:20.
- f. Place the organs into the separate vials with fixative.
- g. Store the vial to fix the tissue. Fixation time will depend on the type of fixatives used.
- h. Fixation time – Formalin: 10-12 hrs. Alcohol formalin 7-10 hrs. and Bouin's: 4-6 hrs. (At normal room temperature).

3. Dehydration of the Sample:

After proper fixation, the tissue must be dehydrated to remove the water from tissue block by following ways.

- | | |
|------------------|---------|
| - Alcohol (50%) | - 1 hr. |
| - Alcohol (70%) | - 1 hr. |
| - Alcohol (70%) | - 1 hr. |
| - Alcohol (85%) | - 1 hr. |
| - Alcohol (95%) | - 1 hr. |
| - Alcohol (100%) | - 1 hr. |

4. Cleaning:

After dehydration, the tissues are to be cleared with clearing agent to remove alcohol prior to paraffin embedding. The clearing agent should be miscible both in alcohol and paraffin. The commonly used cleaning agents are:

- Xylene = (3-4 mm thick tissue can be cleared in 30-60 minutes for two changes each)
- Chloroform = (Clearing time – Overnight, but less harmful than xylene for the tissue)
- Cedar wood oil (Histological GR) = (It is good for cleaning of delicate tissue).

5. Impregnation with paraffin:

- a. Paraffin are melted in hot air oven at 50-60 degree centigrade depending upon the melting point.
- b. Avoid to exceed the temperature 5 degree centigrade above the melting point as it can cause the tissue hardening or shrinkage. If the wax is over heated it can be crystallised and become useless.
- c. The tissue is transferred to molten wax. The amount of wax should be 25-30 times more than tissue volume.

- d. Impregnation must be with 2-3 changes in melting wax to complete removal of clearing agent.

6. **Embedding:**

It is the orientation of tissue in melted paraffin which after solidification can be used for tissue sectioning in microtome.

- a. Molten paraffin wax which is heated at temperature just 2-3 degree above the melting point is poured into the mould to an adequate depth so as to cover the thickest tissue block.
- b. The wax touching the mould will quickly form a semi solid layers. Now introduced the tissue with prewarmed forceps to prevent the wax to stick in it. The tissue is pressed to the semi solid block to orient it perfectly.
- c. As soon as possible, the mould are submerged into the cold water at 20 degree centigrade to avoid crystallization of paraffin. Ice water must be avoided as it may crack the paraffin.
- d. When the blocks are set hard they are removed from the mould.
- e. The tissue surface towards the mould base is the cutting surface.
- f. The processing schedule after dehydration is as follows:
 - Absolute alcohol + Xylol (equal parts) - 1 hr.
 - Cedar wood oil - 2 hr.
 - Cedar wood oil - 2 hr.
 - Cedar wood oil - 1 hr.
 - Paraffin wax (melted) - 2 hr.
 - Paraffin wax (melted) - 1 hr.
 - Paraffin wax (melted) - 1 hr.
 - Placing the tissue to paraffin mould.

7. **Cutting:**

- a. Fix the block in the block holder on the microtome knife in such a position that it will be clear of the knife when it is in position, block may be fixed directly or it may be fixed to a metal carrier which in turn is fixed to the microtome.
- b. Insert the appropriate knife in the knife holder and screw it tightly in position. Adjust if required. The clearance angle should be set at 3-4 degree and angle of slope should be set permanently at 90 degrees. It is important to tighten the knife clamp screw securely and block clamp screws must also be firm.
- c. Trimming of tissue block: Move the block forward so that the wax block is almost touching the knife. To trim away any surplus wax and to expose a suitable area of tissue for sectioning, the section thickness adjusters are set at 15 microns.
- d. On exposing a suitable area of tissue, the section thickness is set to the appropriate level for routine purposes to 4-6 microns.
- e. Apply ice to the surface of the block for a few seconds and wipe the surface of block free of water. This step is optional but makes sections cut easily.
- f. The whole surface of the block will move parallel to the edge of the knife in order to ensure a straight ribbon of sections.

- g. The microtome is now moved in an easy rhythm with right hand operating the microtome and left hand holding the sections away from the knife.
- h. The ribbon is formed due to the slight heat generated during cutting, which causes the edges of the sections to adhere. If difficulty is experienced in forming the ribbon it is sometimes overcome by rubbing one of the edges of the block with finger.
- i. During cutting the paraffin wax embedded sections become slightly compressed and creased. Before being attached to slides the creases must be removed and the section flattened. This is achieved by floating them on warm water at 45-degree C, with little trace of detergent. It is helpful to flatten the ribbon and can remove any shrinkage.
- j. The action in floating out must be smooth with the trailing end of ribbon making contact with water first to obtain flat sections with correct orientation, floating out with the shiny surface towards the water is essential. When the ribbon has come to rest on water the remaining wrinkles and folds are removed by teasing apart by using forceps or seeker.
- k. Picking up sections – The ribbon of sections floating on water is split into individual or groups of sections by use of forceps or seekers. Picking up a section on slide is achieved by immersing the slide lightly smeared with adhesive vertically to three fourths of its length bringing the section in contact with the slide. On lifting the slide vertically from the water, the section will flatten on to the slide. The sections are then blotted lightly with moistened blotting paper to remove excess water and to increase contact between section and slide. For delicate tissues or when several ribbons of sections are placed on the slide, omit the blotting instead keep the slide in upright position for several minutes to drain.
- l. Sections are collected from the very first cut that includes any tissue. Ribbons of ten - 1-10, 11-20, 11-20, 21-30 so on are picked up and mounted on the slides.
- m. Adhesive are placed on slide and rub over it before placing the section cutting.
- n. Drying of section: Sections are then kept in incubator with a temperature 5-6°C above the melting point of wax i.e. at 60°C for 20-60 minutes. It is better to overheat than underheat. If the sections are not well dried they may come off during staining. The sections should not be allowed to dry without a good contact with the slide, such sections will come off during staining.

8. **Staining:**

The process of staining in coplin jar with Haematoxylin and Eosin are as follows:

a. Cleaning and Rehydration –

- Xylol - 1 to 3 minutes.
- Xylol - 1 minute
- Xylol - 1 minute
- Alcohol (100%) - 30 sec.
- Alcohol (85%) - 30 sec.
- Alcohol (70%) - 30 sec.
- Tap water - 30 sec.

b. Staining –

- Haematoxylin - 2 minutes.
- Tap water - 30 sec.
- Tap water - 30 sec.
- Tap water - 30 sec.
- Alcohol (70%) - 1 minute
- Alcohol (95%) - 1 minute
- Eosin Y - 1 minute
- Alcohol (95%) - 2 minute
- Alcohol (95%) - 1 minute
- Alcohol (100%) - 2 minute
- Alcohol (100%) - 2 minute
- Alcohol (100%) - 2 minute
- Xylol - 1 minute
- Xylol - 1 minute
- Xylol - 1 minute

9. Mounting:

- a. The final step in this procedure is to permanently mount the sections under a coverslip. This is accomplished by covering the section in a medium that will harden and produce a clear binder between the slide and cover slip. The ideal mounting medium should not distort the stain colour, or yellow and become brittle with age. DPX or Canada balsam can be used as good mounting adhesive.
- b. Place 2-3 drops of resin over the slide carefully to avoid trapping any bubble inside it.
- c. To avoid entrapping air bubbles, lower the cover slip slowly from one side of the droplet.
- d. Place the slide on the slide warmer and carefully place a lead weight on top of the cover slip. There should be enough mounting medium to completely cover the bottom of the cover slide, and budge slightly around the edges.
- e. Leave slides on the warmer for at least 24 hours; excess medium can then be cut from edges of cover slip with a razor blade

Fixatives:

Formalin (v/v) (10%)

- | | |
|---------------------------------------|-----------|
| - Formaldehyde | = 10 ml |
| - Acid sodium phosphate (monohydrate) | = 0.4 gm |
| - Anhydrous disodium phosphate | = 0.65 gm |
| - Water to make the volume | = 100 ml |

Alcohol formalin (v/v) (10%)

- | | |
|---------------------|---------|
| - Formalin | = 10 ml |
| - Alcohol (70%-95%) | = 90 ml |

Bouin's Fluid

- | | |
|---------------------------------|---------|
| - Saturated aqueous picric acid | = 75 ml |
|---------------------------------|---------|

- Formalin = 25 ml
- Acetic acid = 05 ml

Section adhesive Mayer's Albumin –

- Fresh egg white = 50 ml.
- Glycerol = 10 ml.
- Sodium salicylate = 01 ml.

Stain:**Haematoxylin:**

- Haematoxylin powder (Harris haematoxylin) = 4 g.
 - Potash alum = 100 g.
 - Mercuric oxide = 2 g.
 - Ethanol (100%) = 60 ml.
 - Distilled water = 800 ml.
- a. Boil 800 ml. distilled water with potash alum (100 g.)
 - b. Add 4 g. Haematoxylin with 60 ml ethanol to dissolve in it.
 - c. When potash dissolve in water, add ethanol haematoxylin solution in it.
 - d. After adding Haematoxylin at low heat add mercuric oxide and heat the mixture again to dissolve Mercuric oxide completely. Now the colour of the solution become pinkish blue.
 - e. In working solution of Haematoxylin (100 ml.) 4 ml of glacial acetic acid can be added for good nuclear staining.

Eosin:

- Eosin = 2g.
 - Distilled water = 160 ml.
 - Alcohol (95%) = 640 ml.
 - Glacial acetic acid. = 0.8 ml.
- a. Add eosin to distilled water.
 - b. Add 95% alcohol in eosin + distilled water.
 - c. To final mixture add 0.8 ml glacial acetic acid.