



# 1. TAXONOMY AND DISTRIBUTION OF FISHES

## 1.a. FISH, STATUS IN HUMAN DIET-IMPORTANCE

The food value of fish has been recognized all over the world. Proteins have a key role in human diet for proper growth and other vital activities. Fish is regarded as an excellent source of protein for human diet. As compared to other sources of animal protein, the fish provides highly digestible protein which has also much growth promoting value for humans. Recent studies have proved that fish proteins are superior to that of milk, beef and egg albumen regarding digestibility which is in the order of 96% for fish. These proteins comprise all the essential amino acids in required concentration in human diet namely, lysine, arginine, histidine, leucine, isoleucine, valine, threonine, methionine, phenylalanine and tryptophane. This makes the biological value of fish much higher. Fish, therefore, is also an effective supplementary diet for people whose diet is principally of plant origin that is deficient in lysine and methionine.

In addition to about 20% proteins fish also contains phosphorus, iron, calcium, iodine, vitamin A, vitamin D, vitamin B/vitamin B<sub>2</sub> and niacin for supplementation of human diet. Flesh of fish is white and has a food value of 300 to 600 calories in one pound of fish. Fish is also highly nutritious as child food and is easily digested by infants. In short, the nutritional value of fish is higher than that of beef, lamb, sheep and poultry. Above all, it cooks easily, possesses an agreeable taste and flavour and is easily digestible. In recent studies, it has also been recorded that fish meat in the human diet reduces the risks of heart problems by reducing the formation of cholesterol as it possesses highly unsaturated fatty acids in it.

## 1.b. FISH TAXONOMIC STATUS

Pakistan is bestowed with immense aquatic resources both marine and freshwater. The marine fauna is not discussed here and focus is made on freshwater fauna only. The freshwater fisheries resources include rivers, canals, lakes, streams, huge reservoirs emerging by construction of dams and barrages. Fish is the most abundant and successful of all vertebrates encountered in water. The reason probably is that about 3/4<sup>th</sup> of the globe (Earth) is ocean and the remaining 1/4<sup>th</sup> also includes rivers, canals, drains, lakes, pools and rapids. According to an estimate more than 20,000 fish species are recorded in the world. However, the number of freshwater fish species recorded so far in Pakistan is 186.

The animals are classified on the basis of similarities and differences amongst them that form the basis of relationships between them. Animals most closely associated are placed in similar groups.

The fish (an exclusively aquatic organism) belongs to the Phylum Chordata of the Kingdom Animalia. They are placed in Sub Phylum Vertebrata which comprises two Super Classes Agnatha (jawless vertebrates) and Gnathostomata (jawed vertebrates) which is further subdivided into six classes namely Class Elasmobranchiomorphii (cartilaginous fishes), Teleostomi (bony fishes), Amphibia, Reptilia, Aves and Mammalia.

All the freshwater fish species found in Pakistan belong to the Class Teleostomi.

The classification of these species alongwith diagnostic features is as follows:

Kingdom: Animalia

Phylum: Chordata Sub-

Phylum: Vertebrata

Super Class: Gnathostomata (jawed vertebrates)

Class: Teleostomi (bony fishes)

Sub-Class: Actinopterygii (ray finned fishes)

Infra Class: Teleostei

The animals are named following the International Code of Zoological Nomenclature. According to the provisions of this code the generic name and names of all the preceding levels must begin with capital alphabets whereas the specific and sub specific names must always commence with small alphabets.

The freshwater fish fauna of Pakistan belongs to the following 9 orders and 20 families.

<b>Order</b>	<b>Family</b>
1. Clupeiformes	Clupeidae (palla, palri)
2. Osteoglossiformes	Notopteridae (featherbacks)
3. Salmoniformes	Salmonidae (trouts, salmon, white fishes & graylings)
4. Cypriniformes	Cyprinidae (minnows & carps) Bagaridae (bagrid catfishes) Siluridae (Eurasian catfishes) Schilbeidae (schilbeid catfishes) Heteropneustidae (stinging catfishes)
5. Beloniformes	Belonidae (needle fishes)
6. Cyprinodontiformes	Cyprinodontidae (killi fishes) Poeciliidae (livebearers)
7. Perciformes	Centropomidae (snooks) Nandidae (leaf fishes) Cichlidae (cichlids) Gobiidae (gobies) Channidae (snakeheads) Anabantidae (climbing perches)
8. Mastacembeliformes	Mastacembelidae (mastacembelid eels)
9. Synbranchiformes	Amphipnoidae (cuchia)

The details of species belonging to each family may be seen at page 129.

### **1.c. FISH, ECOLOGICAL STATUS**

The abundance and distribution of fishes in the waters of the earth are the products of interaction among fishes and their chemical, physical and biological surroundings. The study of relationships between an organism and its environment is the subject matter of ecology. All the communities in these habitats are continually changing.

In order to support/sustain any ecosystem the energy and nutrients are the basic requirements. In aquatic ecosystems the main source of energy is the light, only a fraction of which in aquatic ecosystems appears in the form of fish flesh as this energy is first harnessed by aquatic plants (producers) through photosynthesis that is followed by consumers i.e., animals including fishes. The key nutrients namely Carbon, Nitrogen and Phosphorus available for synthesis into protoplasm in the hydrosphere are circulated in biogeochemical cycles.

The environment of fishes is composed of many factors in addition to nutrients that may limit populations or influence geographic distribution. Any of these

factors may be limiting when it is present in quantities which are either too little or too large.

Aquatic organisms including fishes, may be classified ecologically in several different ways. According to environmental tolerances, they may be grouped as either narrowly or broadly tolerant. The corresponding expression is prefixed respectively either by —Steno|| (narrow) or —Eury|| (broad). For temperature the classification is thus stenothermal or eurythermal, for salinity it is stenohaline or euryhaline, etc. Fishes may also be categorized on the basis of location in aquatic ecosystems i.e., benthic (bottom dwellers or ground fishes), pelagic (free swimming) or planktonic (depending on currents for their movements as do the larval young of many species). In lakes and ponds, littoral zone fishes are those of the inshore waters where light penetrates to the bottom and rooted green plants are often present. Limnetic zone fishes are those of offshore waters free of rooted plants, and extend downward to the light compensation level where illumination is inadequate for sustained life of phytoplankton, and profundal zone fishes are those in the darkened waters beneath the light compensation level. The foregoing categorizations illustrate stratification of communities in ecosystems. However, the species composition of the zone may be expected to vary geographically. In the flowing waters, the readiest division of the habitat and its occupants is into two rather subjective zones pools and riffles. The current of the riffles is generally fast enough to move sand and silt which is then deposited in pools and backwaters. The environmental forces that affect the lives of fishes are many, complex and interrelated in their effects e.g., temperature, light, current, dissolved oxygen, food, social factors, population density, population structure, succession, etc.

Freshwater occupied by fishes occurs both on the surface of the earth and in the subterranean waters of caves and underground stream channels.

The fresh surface waters of the earth are broadly separable into two groups of environments, standing or lentic and flowing or lotic. The lentic habitats include those of natural lakes and ponds along with many impoundments constructed by man. The lotic environment is that of river and streams. To these may be added the special conditions found in (a) springs, which may be sources of either lakes or streams, and (b) estuaries and heads of large impoundments where the lotic conditions of streams grade into lentic.

The Punjab Province has been bestowed with huge water resources wherein both types of ecosystems exist in the form of lotic and lentic waters. The total area of the lotic systems is 29,63,700ha. The major rivers of Pakistan are Indus, Ravi, Jhelum, Chenab and Sutlej that traverse huge distances. The running waters display typical characteristics with regard to temperature, turbidity, silting patterns, etc. The lentic waters are represented by natural lakes, man-made reservoirs, small dams, water-logged areas, ponds, etc.

On the basis of various regions the fishes in Pakistan have been grouped into 5 ichthyographic regions

#### **1.a.i. Northern Mountainous Region**

This region comprises the northern mountainous areas of Pakistan and Kashmir above 1,500m altitude. It includes the northern areas (Gilgit, Diamer and Skardu), upper parts of Chitral, Swat and Kaghan valleys. The fish fauna is predominantly high Asian (Central Asian) and mainly comprises the snow trouts (*Schizothoracinae*), loaches (*Noemacheilus*), and catfish genus of *Glyptosternum*.

Some south Asian forms belonging to genera *Labeo*, *Tor*, *Puntius*, *Garra*, *Ompok*, *Botia* and *Glyptothorax* have also been described.

#### **1.a.ii. Yaghistan Region**

This region was previously named as the north-western mountainous region. It is renamed as the Yaghistan region after the old tribal name of this area. This area is between 1000-1500m altitude. It is bordered by the Koh Sufaid range in the north, the Suleman range in the east, the Marri-Bugti hills in the south and the central Brohui range in the south-west. In the north-west, it extends upto Afghanistan areas drained by the rivers Kurram, Tochi, Gomal and their tributaries. The fish fauna is a mixture of south Asian, high Asian and west Asian forms but south Asian form predominates.

#### **1.a.iii. AbaSeen Region**

This includes the southern parts of the Malakand division, the vale of Peshawar, sub-mountainous Hazara, adjoining parts of the Punjab and Kashmir, north of the Safaid Koh and Kala Chitta ranges. It extends into south-eastern part of Afghanistan drained by the river Kabul and its tributaries. The fish fauna of this area is predominantly south Asian but some high Asian forms are, also found.

#### **1.a.iv. Mehran Region**

It was previously named as the Indus plain region. It comprises the Indus plain, adjoining hills i.e., Kohat hills, the Salt range and Potwar plateau in the north and Sind - Baluchistan hills in the south-west. The fauna of this region is south Asian except a few west Asian forms. Rarely, genus *Schizothorax* may also be found.

#### **1.a.v. Gedrosian Region**

This region comprises Baluchistan plateau, west of central Brohui and Hala ranges. The northern part of this range is drained by the rivers of Lora and Mashkel, which end into salt lakes of Hamun-i-Mashkel respectively. The southern part of the range is drained by the rivers Hingol, Dasht and their tributaries, which fall into Arabian Sea. The fish fauna is a mixture of west Asian (Lora drain) and south Asian form (rest).

Presently life in many of these regions is threatened due to human activities that have resulted in elevated pollution levels resulting from indiscriminate discharge of untreated industrial effluents and city sewage into these natural water bodies. This situation is further worsened due to drought that has caused lowering of ground water and sub soil water levels. This also has contributed to the higher concentration of pollutants in the aquatic environment. The construction of dams and barrages across major rivers aimed for irrigation and hydropower generation have also destroyed the fish habitat and breeding grounds. These structures have also hampered the migration of fish.

## **2. FISH SPECIES AND AQUATIC VEGETATION**

In addition to the knowledge about potential fishery resources it is essential that the fishery officers should have the knowledge of the fish-fauna and should be able to identify the early stages of the important culturable species of fishes. Unless they possess the requisite knowledge all efforts made may go in vain, or may even prove destructive. The scientific names of all the important freshwater species of fish fauna in Punjab Pakistan

with their local names are given. The scientific names will help the officers to study the literature on different species of fish published in India and elsewhere and the local names to help them to correctly identify them. Armed with this knowledge the officers will be able to stock the impoundments with right types of fish in correct proportion.

## 2. FISHES OF PUNJAB

<b>FAMILY NAME</b>	<b>SCIENTIFIC NAME</b>	<b>COMMON NAME</b>
<b>Bagridae</b>	<i>Sperata Sarwari</i>	Singhari
	<i>Batasio pakistanicus</i>	Batasio
	<i>Mystus bleekeri</i>	Bleekri
	<i>Mystus cavasius</i>	Teengara
	<i>Mystus horai</i>	Horaki Keengar
	<i>Mystus vittatus</i>	Keengar
	<i>Mystus tengara</i>	Teengara
	<i>Rita rita</i>	Khagga
<b>Chondiae</b>	<i>Parambasis baculis</i>	Baculis shisha
	<i>Chanda nama</i>	Nama shisha
	<i>Parambasis ranga</i>	Ranga shisha
<b>Channidae</b>	<i>Channa gachua</i>	Dauli
	<i>Channa marulius</i>	Saul
	<i>Channa punctatus</i>	Daula
	<i>Channa striatus</i>	Sauli
<b>Cobitidae</b>	<i>Botia birdi</i>	Botia
	<i>Botia lohachata</i>	Botia
	<i>Lepidocephaleus guntea</i>	Kanda Tori
	<i>Acanthocobitis botia</i>	Botia
	<i>Nema chailus corica</i>	Sundli
	<i>Schistura alepidota</i>	Schistura
	<i>Schisturoa horai</i>	Schistura
	<i>Schistura lepidocaulis</i>	Schistura
<b>Cyprinidae</b>	<i>Amblypharyngodon mola</i>	Makni
	<i>Aspidoparia morar</i>	Aam Chilwa
	<i>Systemus sarana</i>	Khurni
	<i>Barilius bendelisis</i>	Patha Chilwa

<b>Cyprinidae</b>	<b><i>Amblypharyngodon mola</i></b>	Amblypharyngodon mola
	<b><i>Barbodes sarana</i></b>	Khurni
	<b><i>Barilius bendelisis</i></b>	Patha Chilwa
	<b><i>Barilius naseeri</i></b>	Naseeri Chilwa
	<b><i>Barilius pakistanicus</i></b>	Pakistani Chilwa
	<b><i>Barilius vagra &amp; Barilius modestus</i></b>	Lahori Chilwa
	<b><i>Danio rerio</i></b>	Zebra Machli
	<b><i>Carassius auratus</i></b>	Sunehri machli
	<b><i>Gibelion catla</i></b>	Theila
	<b><i>Cirrhinus mrigala</i></b>	Mori
	<b><i>Cirrhinus reba</i></b>	Sunni
	<b><i>Chela cachus</i></b>	Cachus Biddah Morriah
	<b><i>Chela caubuca</i></b>	Laubuca Biddah
	<b><i>Barilius modestus</i></b>	Chilwa
	<b><i>Devario devario</i></b>	Patha Makhni
	<b><i>Rasbora daniconius</i></b>	Charl Machhli
	<b><i>Labeo angra</i></b>	Buttar
	<b><i>Lebeo bata</i></b>	Bata Machhli
	<b><i>Labeo caerleus</i></b>	Neeli rohie
	<b><i>Labeo diplostomus</i></b>	Giddah
	<b><i>Puntius terio</i></b>	Terio popra
	<b><i>Puntius ticto</i></b>	Ticto popra
	<b><i>Puntius waagenii</i></b>	Waagenic popra
	<b><i>Systemus sarana</i></b>	Khirmi
	<b><i>Crossocheilus diplocheilus</i></b>	Dogra Machhli
	<b><i>Garra gotyla</i></b>	Patherchat Machhli
	<b><i>Ctenopharyngodon idella</i></b>	Grass carp
	<b><i>Hypophihal michthys</i></b>	Nobilis Big head carp
	<b><i>Cyprinion watsoni</i></b>	Watsoni sabzag
	<b><i>Cyprinus carpio</i></b>	Gulfam
	<b><i>Esomus danricus</i></b>	Soomara Machli
	<b><i>Hypophthalmichthys molitrix</i></b>	Silver carp
	<b><i>Labeo boga</i></b>	Bhangan
	<b><i>Labeo boggut</i></b>	Bhangana
	<b><i>Labeo calbasu</i></b>	Kalbans
	<b><i>Labeo dero</i></b>	Pahari rohu
	<b><i>Labeo dyocheilus pakistanicus</i></b>	Torki
	<b><i>Labeo gonius</i></b>	Sareeha
	<b><i>Labeo rohita</i></b>	Rohu
	<b><i>Osteobrama cotio</i></b>	Paliro

	<i>Puntius chola</i>	Kola popra
	<i>Puntius conchonijs</i>	Gulabi barb
	<i>Puntius gelius</i>	Gelius popra
	<i>Puntius punjabensis</i>	Punjabi popra
	<i>Puntius sophore</i>	Sophore popra
	<i>Racoma labiata</i>	Chun
	<i>Salmophasia bacaila</i>	Choti Chal
	<i>Salmophasia punjabensis</i>	Punjabi Chal
	<i>Securicula gora</i>	Bari Chal
	<i>Macrotepis putitora</i>	Mahseer
<b>Mastacembelidae</b>	<i>Mastacembelus armatus</i>	Bam
	<i>Mastacembelus pancalus</i>	Grooj
<b>Nandidae</b>	<i>Nandus nandus</i>	Patta
<b>Neomacheilidae</b>	<i>Schistura curtistigma</i>	Shistura
	<i>Schistura prashari</i>	Shistura
	<i>Schistura punjabensis</i>	Shistura
	<i>Schistura shadiwalensis</i>	Shistura
	<i>Schistura nalbanti</i>	Shistura
<b>Notopteridae</b>	<i>Gudusia chapra</i>	Palli
	<i>Notopterus chitala</i>	Cheetal Pari
	<i>Notopterus notopterus</i>	But Pari
<b>Osphranomidae</b>	<i>Colisa fasciata</i>	Bari kanghi
	<i>Colisa lalia</i>	Choti kanghi
	<i>Oreochromis mossambica</i>	Tilapia
<b>Salmonidae</b>	<i>Oncorhynchus mykiss</i>	Rainbow Trout
<b>Schilbeidae</b>	<i>Eutropiichthys vacha</i>	Jhalli
	<i>Pseudeutropius atherinoides</i>	Chaali
	<i>Clupisoma garua</i>	Bachwa
	<i>Clupisoma naziri</i>	Aahi
<b>Siluridae</b>	<i>Heteropneustes fossilis</i>	Singhi
	<i>Ompok bimaculatus</i>	Pafta
<b>Siluridae</b>	<i>Wallago attu</i>	Mullee
<b>Sisoridae</b>	<i>Bagarius bagarius</i>	Goonch, Fauji Khagga
	<i>Gagata cenia</i>	Gageeta
	<i>Glyptothorax cavia</i>	Kani tingara
	<i>Glyptothorax stocki</i>	Stocki pahari Khagga
	<i>Nangra nangra</i>	Nangra
	<i>Nangra robusta</i>	Nangra
<b>Synbranchidae</b>	<i>Monopterusuchia</i>	Cuchia
<b>Xenentodontidae</b>	<i>Aplocheilus panchax</i>	Lal jheengra
	<i>Xenentodon cancila</i>	Kaan

### 3. AQUATIC VEGETATION

<u>LOCAL NAME</u>	<u>SCIENTIFIC NAME</u>
1. Alligator weed	<i>Alternanthera aspersa</i>
2. Bladder wort	<i>Utricularia flexuosa</i>
3. Common contail	<i>Ceratophyllum demersum</i>
4. Common reed	<i>Phragmites communis</i>
5. Curly leaf pond weed	<i>Potamogeton crispus</i>
6. Duck weed	<i>Lemna paucicostata</i>
7. Eel grass (cock screw)	<i>Vallisneria spiralis</i>
8. Eurasian water milfoil	<i>Myriophyllum spicatum</i>
9. Gulbakauli (water Hyacinth)	<i>Eichhornia crassipes</i>
10. Horned pond weed	<i>Zannichellia palustris</i>
11. Hydrilla	<i>Hydrilla verticillata</i>
12. Kanwal or Lotus	<i>Nelumbium nelumbo</i>
13. Naiad	<i>Najas graminea</i>
14. Pan (cat tail)	<i>Typha angustata</i>
15. Water chestnut (Singhara)	<i>Trapa bispinosa</i>
16. Water lettuce	<i>Pistia stratiotes</i>
17. Water lily (Nilofar)	<i>Nymphaea lotus</i>

### 4. PLANKTON

The plankton community is a mixed group of tiny plants and animals floating, drifting or feebly swimming in the water mass. The freshwater plankton lacks many elements that are abundant in the sea, where nearly every phylum is represented.

The individual plant, animal or bacterium in the plankton community is called a plankton. The plant plankton comprise the phytoplankton and the animal plankton are the zooplankton.

The plankton play a prominent role in providing the fishes with food. Nearly all marine life or even freshwater animals are ultimately dependent upon planktonic life for existence. They have been the subject of many studies on adaptations for flotation. Oil droplets, gas bubbles, gelatinous envelopes and water filled and saccoid bodies are adaptations for reducing weight or specific gravity. Horns, spines, setae and elongated stick like bodies are some of the structures that increase total surface area and resistance to sinking.

They have been classified on the basis of their sizes. The commonly encountered plankton in freshwaters of Punjab are Scenedesmus, Daphnia, Sphaerocystis, diatoms, flagellates, Dinobryon, Hydrodictyon, Peridinium, Volvox, Nitella, etc.

## 5. COMMONLY FOUND FISHES

### 5.i. CARNIVOROUS FISHES 5.1.a.

#### *Channa marulius* (Saul)



This belongs to snakehead group of freshwater fishes inhabiting large lakes and rivers. It prefers deep stretches of water with sandy or rocky bottom. It is locally called as Saul and is highly valued for its flesh

#### **Geographical Distribution**

This fish is commonly found in Pakistan, Nepal, Bangladesh, Burma, Thailand, China, Kampuchea and Sri Lanka.

#### **Distinguishing Characters**

A large fish, body elongate and sub-cylindrical, head and mouth large, lower jaw with 7-18 canines, dorsal fin extends from head to the caudal region, caudal fin rounded. Plate like scales on the head. Pectoral fins about half head length. 56-70 scales on lateral line. Since these fishes inhabit a variety of environments, their color differs accordingly. Usually above lateral line reddish with 5 or 6 dark oval blotches on flanks; below lateral line between blotches pale yellow, distinct white spots scattered on body. Juveniles with an orange band running from eye to middle of caudal fin

#### **Feeding**

It usually feeds on fishes, frogs, snails and other small aquatic animals. As such, it takes live bait well, particularly frog.

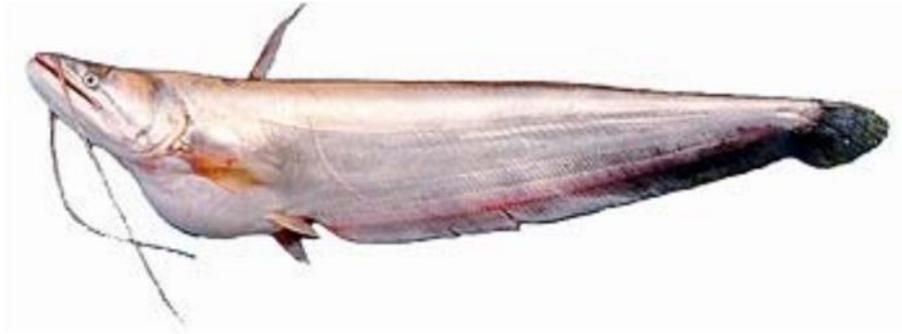
#### **Breeding**

Its spawning period extends from April to June. During this period the pairs of this fish form floating nests. The eggs are yellowish red with 2mm dia. Nests are guarded both by male & female. Eggs are hatched within 30- 54 hours and the fry remains guarded by the parents for about six weeks. It attains length of more than 120 cm.

#### **Prospects in Aquaculture**

In view of its popularity for taste and compactness of flesh, the Department of Fisheries Punjab is considering this fish for aquaculture after conducting detailed studies on its biology and adaption to controlled conditions.

### 5.i.b. *Wallago attu* (Mullee)



It is a freshwater river and Lake Fish found in Indus Plains and adjoining hilly areas in Pakistan. Moreover it is common in India, Nepal, Bangladesh, Burma, Thailand, Vietnam, Kampuchea, the Malay Peninsula, Sumatra and Java. Its local name is Mullee.

#### **Distinguishing Characters**

Body elongate and compressed, snout round, mouth wide, its gape extends posteriorly beyond eyes. Two broad bands of conical teeth. Barbells two pairs; Maxillary pair long, extends beyond origin of anal fin, the mandibular pair much shorter. Dorsal fin short inserted slightly in advance of pelvic fins. Pectoral spine weak. Caudal fin deeply forked, its upper lobe longer. Skin is scaleless. Color of body is silvery or sometimes olive.

#### **Feeding**

It is extremely carnivorous and feeds on all types of aquatic animals as well as on dead bodies. As such, it is also called "Freshwater Shark".

#### **Breeding**

It breeds during July and August. The eggs are yellowish with a diameter ranging from 1.2 -1.5 mm. It grows to about 2m and weighs more than 40 kg.

#### **Prospects in Aquaculture**

Although it is included in the game fishes of Pakistan, its taste and meat is not liked very much due to its feeding on dead bodies. Moreover, due to its carnivorous habits and low market value it is not used in aquaculture practices.

### 5.i.c. *Sperata sarwari* (Singharee)



It is a common giant catfish of freshwater rivers, lakes, channels and reservoirs. It is locally called as —Singharee", "Seengh" and "Singhara".

#### **Geographical Distribution**

It is a well-known fish of Indo-Pak Subcontinent. Moreover, in Pakistan, this fish has been reported in the rivers, streams and also stagnant waters.

#### **Distinguishing Characters**

Body stout and compressed Snout broad and specthulate. Mouth subterminal, barbels four pairs which extend posteriorly to pelvic fin. Dorsal spine weakly serrated on its posterior edge; adipose fin base short about as long as rayed dorsal fin base. Scaleless skin. It is brownish gray on back, silvery on flanks and belly.

#### **Feeding**

It feeds on different aquatic animals including crustaceans, molluscs, frogs and small fishes.

#### **Breeding**

It breeds during May, June & July and attains a length of more than one m. This fish is very much liked for its flesh (with nominal intramuscular bones), taste and sport. It comes easily both on dead and live baits.

#### **Prospects in Aquaculture**

Although it is a carnivorous fish yet keeping in view its other qualities pertaining to its popularity for taste, flesh, easy dressing and filleting, the Department of Fisheries, Punjab is considering it for its monoculture. As such, the detailed biological studies along with its artificial/induced breeding are included in the future plan.

### 5.i.d. *Rita rita* (Khagga)



It is one of the famous catfishes of freshwater esteemed as a food and game fish. *Rita rita* is locally called as "Khagga" and "Tirkanda". The anglers enjoy the way this fish plays during angling.

#### **Geographical Distribution**

This fish inhabits freshwaters of most of the South Asian countries including Pakistan, India, Nepal, Bangladesh and Burma. In Pakistan, it is common in Indus plain and most of the freshwater streams, nallahs and ponds.

#### **Distinguishing Characters**

Body is elongate. Head somewhat depressed. Mouth transverse, provided with small teeth arranged in bands. Barbels three pairs. Dorsal and pectoral spines are stout and strong. Body is scaleless. Lateral line straight. The color is greenish brown on the back and on flanks, dull white on abdomen.

#### **Feeding**

It mostly feeds on insects, young fishes, mollusks and also on carrion. It comes very easily on live baits like worms and small fishes as well as other baits.

#### **Breeding**

This fish attains maturity at 380mm stage. It breeds during May to September with peak during July to August. It attains a maximum length of one meter or even more but commonly it is found in small sizes.

#### **Prospects in Aquaculture**

*Rita rita* is a meaty and stout fish and is very much esteemed as food. As such, some preliminary studies on its culture have also been undertaken. However, due to small size, slow growth and carnivorous habit it is not used in fish culture practices.

### 5.i.d. *Notopterus spp.* (Pari)



This fish belongs to family Notopteridae. The fish of this family predominantly inhabit tropical freshwaters and brackish water. These fish have diverse body form and size. Genus *Notopterus* is represented by two species namely, *N. notopterus* and *N. chitala* in Pakistan. These fishes are often seen at the surface, splashing and exposing their silvery flanks. *N. chitala* attains a maximum length up to 122cm, whereas *N. notopterus* is a small fish and attains a maximum length of 60cm. Presence of 15-silvery bars on back and a hump in *N. chitala* can easily distinguish it from *N. notopterus*

#### **Geographical Distribution**

These fishes inhabit particularly larger rivers and flood plains. These are also found in stagnant backwaters. Three genera are found in tropical Africa and East Asia, whereas one namely *Notopterus* in India and Pakistan, Bangladesh, Burma, Thailand, Malaya and Indonesia.

#### **Distinguishing Characters**

A very long anal fin which begins just behind the head and extends along the under surface of the body to tip of the caudal fin. Caudal fin confluent with anal fin. On the dorsal side in the center is a small slender dorsal fin from which the fish derives the name — Feather-back. Pelvic fins rudimentary, scales small, lateral line complete. These fishes are dull on the back and silvery on the sides.

#### **Feeding**

It feeds on live foods, aquatic insects, snails and surface swimming fishes. It mostly feeds during night time, therefore, it is also called nocturnal predator.

#### **Breeding**

During the rainy season, the sexually mature specimens migrate to flooded swamps. The eggs are laid on aquatic plants, fallen trees and branches in the water. They are guarded by the male who fans the spawn to keep them aerated. After production of fry they return to the main streams along with their fry.

#### **Prospects in Aquaculture**

Although it is regarded as a good game fish yet due to its carnivorous habits, slow growth and presence of a large number of intra-muscular bones in its flesh, it is not used as a culturable species of fish for aquaculture practices.

### 5.i.e. *Bagarius bagarius* (Fauji Khagga)



This fish belongs to family Sisoridae. It is an exclusively Asian family of bottom dwelling catfishes. Most with more or less thickened leathery skins. The genus *Bagarius* of this family has head and body covered by heavily keratinised skin superficially differentiated into un-calciferous plaques or tubercles. *Bagarius bagarius* is the well known member of this genus found in Pakistan. It is locally called "Fauji Khagga" or "Gonch".

#### **Geographical distribution**

These fishes are mainly inhabitants of rapid and rocky pools. *Bagarius bagarius* is found in Punjab, Sind, N.W.F.P in Pakistan and other Asian countries including India, Nepal, Bangladesh, Burma, Thailand, Malaysia and Indonesia.

#### **Distinguishing characters**

The body of this fish is rather elongate, head depressed. Mouth is inferior and crescentic, barbels four pairs. Dorsal fin inserted near to adipose fin than to snout tip. Pelvic fins inserted anterior to a ventral line through base of last dorsal fin ray. Abdominal vertebrae 17 to 20. Body is green or olivaceous to rich green tan or brown, with darkly pigmented bands or blotches. Caudal fin light yellowish grey; paired fins with black spots.

#### **Feeding**

*B. bagarius* is a strongly carnivorous and voracious fish. It preys on a variety of fishes and other live food. It also feeds on carrion.

#### **Breeding**

Its breeding season starts prior to the commencement of the monsoon rains.

#### **Prospectus in aquaculture**

This is one of the largest Asian catfish and so far the largest member of sisoridae.

It grows to 120 kg in weight and 2 m in length. The flesh is not much relished being very stiff and fibrous. This fish is also called freshwater shark because of its strong voracious and carnivorous feeding habits. Due to these demerits it has not been included in the list of culturable species of fishes.

## 5.ii. HERBIVOROUS FISHES

### 5.ii.a. *Labeo calbasu* (Kalbans)



#### **Geographical Distribution**

This fish is commonly found in Pakistan, India, Nepal, Bangladesh, Burma, Thailand, China and Sri Lanka.

#### **Morphological Characters**

Its body is deep and well built. The mouth is narrow, depressed and obtuse in frontal region. Four barbels are present along the sides of the mouth. Lips are thick and fringed. Colour of the body greyish, dusky and darkish. The eyes are reddish in color. There are pores on upper lip and snout.

#### **Feeding**

It feeds on decayed or bottom vegetation like other culturable species. The fry usually feed on unicellular algae and zooplankton. The adult fish also feeds on molluscs.

#### **Breeding**

Its spawning period extends from April to late July. The pattern of breeding is similar to that of rohu and thaila. In captivity, it can not be bred except through induced spawning. Pairing occur during the period of spawning. The spawning temperature is 20-26°C. Fecundity rate is about 70,000 eggs/kg body weight.

#### **Prospects in Aquaculture**

It is very delicious fish. Its growth rate is poor compared to other culturable species, due to this reason it is not preferred to culture. However, Department of Fisheries has launched a project to study the breeding habits and its adaptation in prevailing culture system.

### 5.ii.b. *Labeo gonius* (Sariha)



#### **Geographical Distribution**

This fish is commonly found in Pakistan, India, Nepal, Bangladesh, Burma, Thailand and China.

#### **Morphological Characters**

It is similar to rohu and kalbans. The number and size of scales are more than rohu and kalbans. The body is deep and well built. The mouth is narrow, depressed and obtuse in frontal region. Four barbels along the sides of the mouth. Lips are thick and fringed. Colour of the body greyish, dusky and darkish.

#### **Feeding**

It is an omnivorous fish and eat plankton (both zoo & phytoplankton), insects and crustaceans. The fry usually feed on unicellular algae and zooplankton.

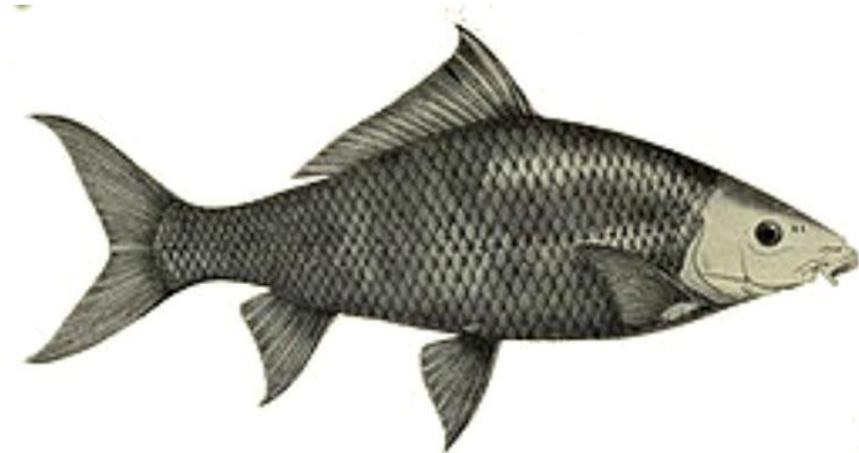
#### **Breeding**

Its spawning period extends from April to late July. The pattern of breeding is similar to that of rohu and thaila. In captivity, it can not be bred except through induced spawning. Pairing occur during the period of spawning. There is external fertilization and no parental care. The spawning temperature is 20-26 °C. Fecundity rate is about 70,000 eggs/kg body weight.

#### **Prospects in Aquaculture**

It is very delicious fish. Its growth rate is poor compared to other culturable species, due to this reason it is not preferred to culture.

### 5.ii.c. *Labeo dero* (Pahari Rohu)



#### **Geographical Distribution**

Pakistan, India, Nepal, Bangladesh, Burma, Thailand, China and Sri Lanka.

#### **Morphological Characters**

Its body well built and sub-cylindrical. Its head is small and 20 % of the whole body. The depth of body is deep and equal to the length of head. The dorsal side of the snout has deep groove. Many small pits are present on snout. There is no lobe on lateral side of snout. The mouth is big and inferior. The lower lip bears a number of dorsal papillae. The lower jaw bears a horny layer. Only two small maxillary barbels are present on the sides of the mouth. The eyes are located in the posterior half of the head. The diameter of the eye is 25 % of head length. The dorsal fin originate between snout and base of tail. The dorsal fin is somewhat elevated than the head and bears 13 rays. The pectoral and pelvic fins are small and carry 18 and 09 rays respectively. Anal fin is also small and has 8 rays. The caudal fin is forked and is longer than head.

On lateral line, there are 41-43 scales. Colour of the dorsal side is brownish while rest of the body is silvery. On each scale, there is conspicuous red line. The eyes are reddish in colour. There are pores on upper lip and snout.

#### **Feeding**

Basically it is herbivorous fish and eat planktons and insects. It is the substitute of rohu in mountaineous area.

#### **Breeding**

It spawns during July to August. The pattern of breeding is similar to that of rohu and thaila. The temperature required for spawning is 20-26 °C. Fecundity rate is about 50,000 eggs/kg body weight.

#### **Prospects in Aquaculture**

Its growth rate is poor compared to other culturable species. Therefore, it is not commonly cultured in central and southern Punjab.

**5.ii.e. *Cirrhinus reba* (Sunni)**



**Geographical Distribution**

This fish is commonly found in Pakistan, India, Russia, Nepal, Bangladesh, Burma, Thailand and China.

**Morphological Characters**

It is similar to mrigal, but differ in color and size. Its body is stout and head is small. Mouth opens on ventral side. Its lips are thin there are two rostral barbels around the mouth. Dorsal fins contain 11-12 rays. Caudal fin is forked. The scales are hexagonal and are 35-37 on the lateral line. Its colour is silvery and the margin of scales are bluish. Eyes are golden.

**Feeding**

It is mainly herbivorous fish and usually feeds on small insects and crustaceans.

**Breeding**

Its spawning period extends from April to late July. Breeding start during rainy season in nature. The optimal temperature for spawning is 17-27 °C. Fecundity rate is about 80,000 eggs/kg body weight.

**Prospects in Aquaculture**

It attains maximum length of 60 cm. It contains a number of intramuscular bones. As such, it has low market value and is not included in the culture system. Its growth rate is very slow.

#### 5.ii.f. *Tilapia mossambicus*



Tilapia is a hardy fish belonging to Cichlidae family. The fish is endemic to Africa but during the last five decades they have been introduced to many parts of the world. Tilapia is being successfully cultured in many countries both in fresh and saline waters. Tilapia are grouped on the basis of their feeding/ breeding habits and anatomical differences under the following genera:

- i) Tilapia
- ii) Sarotherodon
- iii) Oreochromis

These fishes are now well known in Indo-Pak due to their hardy nature and prolific breeding in open ponds.

#### **Geographical Distribution**

They are found in Java, Malaysia, Philippines, Thailand, Sri Lanka, Pakistan, India, Vietnam, Zair, Madagascar, Mozambique, Zimbabwe, Tanzania, & Uganda and other African countries. Since 1985 it is abundantly cultured in Pakistan, particularly in extreme climatic conditions. Tilapias were introduced in Pakistan due to their quality of growing equally well in saline and in brackish waters. Tilapia is presently growing well in Lal Sohanrah Bahawalpur, & Kallar Kahar lake Chakwal.

#### **Morphological Characters**

There are about 77 species of Tilapia in the world in which 20-25 are most important. They all have oblong body shapes with long dorsal fins, which have 23-31 fin rays. The nose has one nostril on each side. Head is upwardly concave.

Their colour ranges from olive grey to blackish brown and bright golden. Its size varies from 10 to 40cm.

#### **Feeding**

Tilapias are omnivorous fishes. Various species of Tilapia feed on variety of natural food items e.g., *S. galilaeus* are mainly herbivores, *S. mossambicus* & *T. rendalli* are phytoplankton eater where as *S. alcalicus* mostly feeds on dead phytoplankton deposits.

#### **Breeding**

They become sexually mature at an age of just 2-3 months. They breed in standing waters. In Pakistan Tilapia breeds three to four times a year. Their optimum temperature range is between 20-30 °C. They produce several hundred sticky eggs and breed the eggs and larvae in their mouth. These fishes breed frequently in the pond resulting in over population, which can be prevented through use of suitable systems.

### **Prospects in Aquaculture**

Now-a days UNDP, A.D.B and several other agencies are taking interest in cultivation of Tilapia due to its euryhaline nature which enable them to survive even in 30,000 ppm salinity & water-logged environment. In Pakistan every year 1.601 acres of land becomes useless either due to salinity or water logging. These areas can be used for Tilapia farming because of their hardy nature. As such, the detailed scientific studies and surveys are being made by the Department of Fisheries Punjab to undertake successful culturing of this fish in the said areas.

Although Tilapia has been introduced to many brackish natural water bodies but its prospects in Pakistani polyculture system are minimum. Efforts are made to restrict the species to few natural habitats.

Experiments for mono-sex culture through sex reversal and other techniques are underway to exploit aquaculture potential of the species.

### **5.iii. CULTURABLE FISHES**

#### **5.iii.a. *Labeo rohita* (Rohu)**



#### **Geographical Distribution**

This fish is commonly found in Pakistan, India, Nepal, Bangladesh, Burma, Thailand, China, Kampuchea and Sri Lanka.

#### **Morphological Characters**

Its body is deep and dorsal profile is more concave than abdomen. Snout is obtuse and compressed, projecting beyond the jaws. Lips are thick and fringed with distinct inner fold. Generally one pair of small maxillary barbels is present and sometimes a second rostral pair is present. Lateral line scales are 40-42. Color of the body is bluish or brownish along the back and silvery on the sides and beneath. Usually a red mark is present on each scale.

#### **Feeding**

Rohu is an omnivore fish and usually takes increasing quantities of decayed vegetation matter including higher plants, which might form more than half the bulk of its food. The fry usually feed on unicellular algae and zooplankton.

#### **Breeding**

Its spawning period extends from April to late July. In captivity, it can not be bred except through induced spawning. Pairing occur during the period of spawning. There is external fertilization and no parental care. The spawning temperature is 20-26°C. Fecundity rate is about 100,000 eggs per kilogram body weight.

#### **Prospects in Aquaculture**

It is very popular and considered an excellent food. Due to high demand and price in the market, it is commonly cultured in the province of Punjab along with other species.

### 5.iii.b. *Catla catla* (Thaila)



#### **Geographical Distribution**

Pakistan, India, Nepal, Bangladesh, Burma, Thailand, China, Kampuchea and Sri Lanka.

#### **Morphological Characters**

It possesses elongated body, curved on ventral and dorsal sides. There is pair of small barbels on upper jaw. Mouth is small. Body is scaled except mouth and head. Red spot on each scale. Dorsal side of body is bluish and silvery on the side.

#### **Feeding**

It is surface-feeder. Adult usually feeds on phytoplankton, zooplankton, small insects and crustacean. During fingerling stage, it feeds mostly on crustaceans and algae.

#### **Breeding**

Its spawning period extends from April to late July. In captivity, it can not be bred except through induced spawning. Pairing occur during the period of spawning. There is external fertilization and no parental care. The temperature required for reproduction is 20-26 °C. Fecundity rate is about 100,000 eggs per kg body weight. Eggs are hatched within 8-12 hours.

#### **Prospects in Aquaculture**

Due to reasonable price in the market, it is commonly cultured in the province of Punjab along with other species.

### 5.iii.c. *Cirrhinus mrigala* (Mrigal)



#### **Geographical Distribution**

This fish is commonly found in Pakistan, India, Russia, Nepal, Bangladesh, Burma, Thailand, China, Kampuchea and Sri Lanka.

#### **Morphological Characters**

A large fish, body oblong and moderately compressed. Width of head equal to length behind the eyes which is located in the anterior half of the head. One pair of barbels present. Scales of moderate size; lateral line scales 40 to 45. caudal fin deeply forked. Colour of the body is silvery, dark grey along the back, sometimes coppery. Pectoral, ventral and anal fins are tinged with black. Eyes are golden.

#### **Feeding**

It is bottom-feeder. It is usually feeds on phytoplankton, zooplankton and other small insects. It can be angled well with live and artificial bait.

#### **Breeding**

Its spawning period extends from April to late July. In captivity, it can be bred through induced spawning. Pairing occur during the period of spawning. Fertilization external and without parental care. The optimal temperature for reproduction is 20-26 °C. Fecundity rate is about 100,000 eggs/kg body weight. Eggs are hatched within 12-18 hours.

#### **Prospects in Aquaculture**

Due to reasonable price in the market, it is commonly cultured in the province of Punjab along with other species.

#### 5.iii.d. *Cyprinus carpio* (Common carp)



#### **Geographical Distribution**

This fish is inhabitant of China and Russia, transplanted in the middle ages to Europe and south east Asia.

#### **Morphological Characters**

Body oblong, moderately compressed. Protractile mouth with smooth simple lips. Three rows of teeth in throat. Two pairs of barbels, one pair is sometimes rudimentary. Long dorsal fin with last simple ray ossified and serrated behind. Origin of dorsal fin opposite to that of ventral. Height of body, development of fins and scales, color of body and size subject to great variation.

#### **Feeding**

It is an omnivorous fish. It is mud- strainer feeds on phytoplankton, zooplankton and other small insects. It collects food by taking bottom mud into the mouth, filtering out digestible particles and rejecting the rest. It can be angled well with live and artificial bait.

#### **Breeding**

Its spawning period extends from February to April. In captivity, it can be bred easily. Pairing occur during the period of spawning. Fertilization is external and exhibits no parental care. Reproduction temperature above 20 ° C. Fecundity rate is about 100,000 eggs/kg body weight. Eggs are hatched within 72 hours.

#### **Prospects in Aquaculture**

In view of its popularity for taste, it is often cultured with other species.

**5.iii.e. *Ctenopharyngodon idella* (Grass carp)**



**Geographical Distribution**

It is native of south, central and northern China and Russia, transplanted in Europe south Asia, south east Asia and Africa.

**Morphological Characters**

This fish has elongated and moderately compressed body, broad head with short and rounded snout. Upper jaw is slightly longer than the lower. Barbels are absent. There are two rows of compressed, comb-like teeth in throat. Scales on the body are of moderate size. The fish is dark grey above and silvery on the belly.

**Feeding**

It is a herbivorous and highly voracious fish. The adults have distinct preference for vegetable food such as leaves of tree, green fodder, weeds and other aquatic plants.

**Breeding**

Its spawning period extends from April to late July. In captivity, it can not be bred except through induced spawning. Pairing occur during the period of spawning. There is external fertilization and without parental care. The breeding temperature is 20-26 °C. Fecundity rate is about 100,000 eggs per kg body weight. Eggs are hatched within 12-18 hours.

**Prospects in Aquaculture**

Due to high price in the market, it is commonly cultured in the province of Punjab along with other species under prevailing polyculture system.

**5.iii.f. *Hypophthalmichthys molitrix* (Silver carp)**



**Geographical Distribution**

It is native of south, central and northern China and Russia, transplanted in Europe, south Asia, south east Asia and Africa.

**Morphological Characters**

This fish has elongated and moderately compressed body. Head is short and rounded snout. Upper jaw is slightly longer than the lower. Barbels are absent. Caudal is forked and lateral line is curved. Scales on the body are of moderate size. The colour of the body is silvery and fins are slightly blackish.

**Feeding**

It is a herbivorous fish. The adult has distinct preference for vegetable food such as plankton, leaves of tree, and crustaceans.

**Breeding**

Its spawning period extends from April to late July. In captivity, it can not be bred except through induced spawning. The breeding temperature is 20-26 °C. Fecundity rate is about 100,000 eggs per kg body weight. Eggs are hatched within 12-18 hours.

**Prospects in Aquaculture**

Due to fast growth, it is commonly cultured in the province of Punjab along with other species under prevailing polyculture system.