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Session 8

RIVERINE FISHERIES IN INDIA



ECOLOGY, CLASSIFICATION AND FISH PRODUCTION POTENTIAL OF RIVERS IN INDIA

INTRODUCTION

- Rivers are linear systems which show a gradient of characters along their length. Ideally the longitudinal profile of a river is concave with a steep upper portion near the source, giving way to reaches of progressively less gradient as the mouth is approached.
 - ▣ The **steep and torrential upper course** is called **“RHITHRON”**
 - ▣ The **flat, slow-flowing lower course** is called **“POTAMON”**.

RHITHRON ZONES- Characteristics

- They tend to show an alternation between
 - (i) steep, narrow and shallow riffles or rapids and
 - (ii) flatter, wider and deeper reaches, termed pools

- **Riffles** have high, turbulent flow, coarse bottoms of boulders, rocks or pebbles and limited attached vegetation.

- **Pools** have lower flow, bottoms of somewhat finer material and some rooted vegetation.

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- This zone is characterized by turbulent flow and relatively low temperatures.
 - Generally, the water is highly oxygenated, but at low water the pool and riffle system may break up into a series of pools, whose waters may become completely depleted of oxygen.



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Adaptations of fishes of rhithron zones

- The resident fish species in rhithron zones are entirely **rheophilic** and fall into two main groups.
 1. Those species which live on or among the rocks and vegetation of the bottom and are distributed mainly in the riffles.

These are of **small size and are adapted to grip or cling to the substrate**. Such adaptations include **mouth suckers**, for instance *Chiloglanis*, **ventral friction pads** as in *Astroblephus* or **pectoral fin spines adapted as hooks** as in *Glyptothorax*. Other species such as *Mastacembelus* have **long sinuous shapes that enable them to twine among the holes** in the rocky bottom.



Chiloglanis



Glyptothorax

Mastacembelus



2. Those species such as *Barbus* or *Salmo* which are **adapted to swim sufficiently fast as to resist the current and even move against it.**

This they cannot do on a sustained basis, however, and frequently take advantage of cover provided by the slack water of the pools and by snags, overhangs and other features which disrupt the current. Because of the severity of the habitat diversity of resident species tends to be low.



Salmo

POTAMON ZONES- Characteristics

- Potamon reaches are with wide, flat, meandering channels, mud bottoms and considerable rooted and floating vegetation.
- Zonation within the potamon is both longitudinal and lateral.
 - ▣ **Longitudinally**, there is a repetition of differing habitats associated with the meanders of the channel.
 - ▣ **Laterally**, there is the distinction between the main channel and its floodplain. The floodplain is normally an area of relatively flat land flanking the main channel.

- In exceptional cases, larger floodplain areas arise by geographic accident. The plain is usually higher near the river, where raised levels limit the main channel, and slopes downward toward the foot of the terrace confining the plain.
- Many bodies of water are found on the plain ranging from small temporary pools to large permanent lagoons and swamps.

- **The potamon is environmentally more complex than the rhithron.** There is usually a well defined series of river channels flanked by a floodplain.
- **Both running (lotic) and still (lentic) waters may be present.** The plain itself contains many types of water body, some of which retain water throughout the inter-flood period. Because of deposition of silt, such features show a succession from open lagoon, through vegetation-lined pools and heavily vegetated swamps to dry land.
- In the water bodies of the floodplain dissolved oxygen concentrations fall in the dry season, particularly in the smaller pools which may become completely depleted of oxygen.

Adaptations of fishes of potamon zones

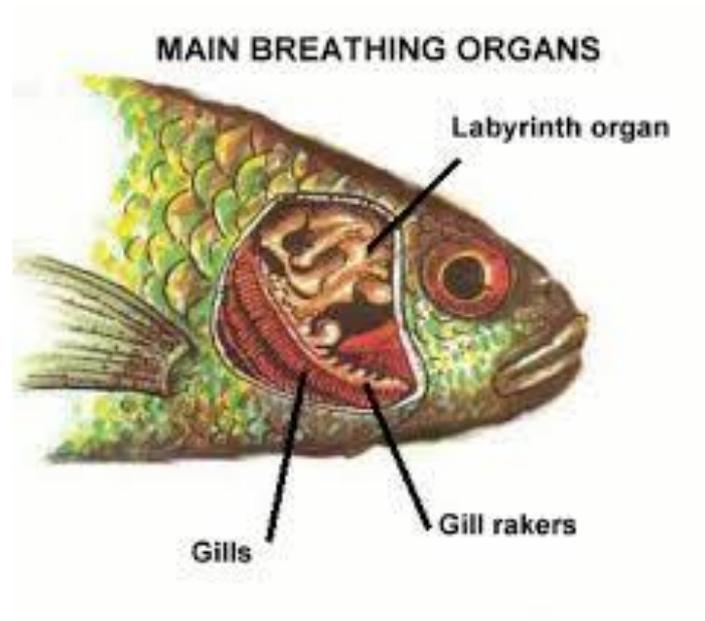
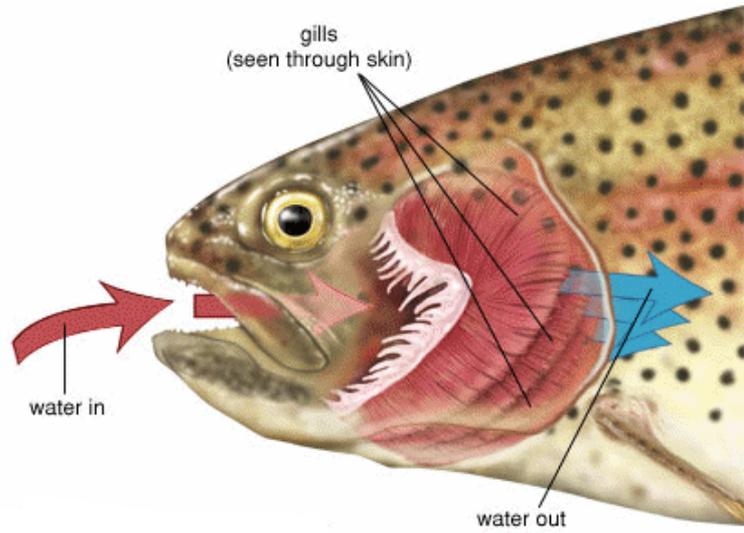
- There are two main adaptations which enable fish to survive the conditions during low waters.

1. Species which is specifically **adapted to resisting low dissolved oxygen concentration.**

The adaptations may be in the form of **auxiliary respiratory organs for using atmospheric oxygen** as in the case of such fishes as *Clarias* or *Notopterus*, or may be physiological as with *Carassius* or even behavioural as with many cyprinodonts.



The same species often have a capacity to support high temperatures. They generally have complex breeding habits with **multiple spawning**, a great degree of parental care, and only migrate laterally between the dry season habitat in the main river channel or the standing waters of the flood plain and the flood season habitat in the inundated area.

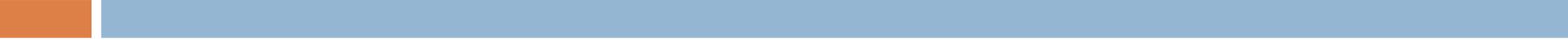




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2. Species which uses the rich habitat provided by the flood plain during the flood but escapes the severe dry season conditions by **lateral movement off the plain and longitudinal migration within the main river channel to an alternative habitat.**

This is usually located in the deeper regions of the main river channel, but may also be in the sea or some other large water body adjacent to the river system.



A certain proportion of these species move upriver, even as far as the rhithron zone. Such fishes show few adaptations other than a capacity for fast and sustained swimming.

Their breeding strategy is generally simple, relying on a single release of a large number of eggs, either on the flood plain or in the headwater streams. To accomplish this they may undertake migrations for very long distances up-and down-river

CLASSIFICATION OF RIVERS OF INDIA

- The rivers of India play an important role in the lives of the Indian people. The riverine system of the country comprises four groups of rivers viz. **major rivers, medium rivers, minor rivers and desert rivers.**
- **Most of the rivers pour their waters into the Bay of Bengal.**
- Some of the rivers whose courses take them through the western part of the country empty into the Arabian Sea.
- Parts of Ladakh, northern parts of the Aravalli range and the arid parts of the Thar Desert have inland drainage.

Major rivers

- The rivers with a **catchment area of 20,000 km² and above** are called major rivers. There are 14 such major rivers in India.

- The major rivers of India can be classified into Himalayan rivers and Peninsular rivers on the basis of origin. All major rivers of India originate from one of the **three main watersheds**.
 - 1) **The Himalaya and the Karakoram ranges**
 - 2) **Vindhya and Satpura ranges and Chota nagpur Plateau in central India**
 - 3) **Sahyadri or Western Ghats in western India**



These **major rivers are broadly grouped into five systems** that include the followings:

- 1) The Ganga riverine system (Himalayan rivers)
- 2) The Brahmaputra riverine system (Himalayan rivers)
- 3) The Indus riverine system (Himalayan rivers)
- 4) The East coast riverine system (Peninsular rivers)
- 5) The West coast riverine system (Peninsular rivers)

Major river basins of the country

Sl. No.	Name of the river	Origin	Length (Km.)	Catchment Area (Sq. Km.)
1.	Indus	Mansarovar (Tibet)	1114+	321289+
2.	a) Ganga	Gangotri Glacier (Uttarkhand)	2525+	861452+
	b) Brahmaputra	Kailash Range(Tibet)	916+	194413+
	c) Barak & other rivers flowing into Meghna, like Gomti, Muhari, Fenny etc,			41723+
3.	Sabarmati	Aravalli Hills (Rajasthan)	371	21674
4.	Mahi	Dhar(Madhya Pradesh)	583	34842
5.	Narmada	Amarkantak (Madhya Pradesh)	1312	98796

Sl. No.	Name of the river	Origin	Length (Km.)	Catchment Area (Sq. Km.)
6.	Tapti	Betul (Madhya Pradesh)	724	65145
7.	Brahmani	Ranchi (Jharkhand)	799	39033
8.	Mahanadi	Nazri Town (Chattisgarh)	851	141589
9.	Godavari	Nasik (Maharashtra)	1465	312812
10.	Krishna	Mahabaleshwar (Maharashtra)	1401	258948
11.	Pennar	Kolar(Karnataka)	597	55213
12.	Cauvery	Coorg (Karnataka)	800	81155

Medium rivers

- A river with a **catchment area between 2,000 and 20,000 km²** is categorized as Medium River.
- Forty four such rivers are in India with a total drainage area of 0.24 million km². Of these rivers, 9 rivers are interstate rivers as they flow through more than one state.
- Seventeen rivers flow towards west into the Arabian Sea and 23 towards east into the Bay of Bengal. Four rivers in north eastern states like Mizoram and Manipur flow into Bangladesh.

- Some of the west flowing rivers include Shetrunji Bhadra, Dhadhar, Vaitama, Kalinadi, Bedti, Sheravathi, Bharathapuzha, Periyar and the Pamba. The total drainage area of these rivers is about 63,500 km².
- Some of the east flowing rivers include Baitarni, Matai, Rushikulya canal, Thotapalli, Kortalaiyar, Palar, Ponnaniyar, Vellar, Vaigai, Tambraparani, Karanphsuli, Kaldan and the Imphal. The total drainage area of these rivers is about 1,793 km².

Minor rivers

- A river with a **catchment area of less than 2,000 km²** is categorized as minor River.
- These rivers are numerous and are mostly small streams, flowing from Western and Eastern Ghats into the sea. The total drainage area of these rivers is about 0.2 million km².

Desert rivers

- These rivers **flow for some distance and disappear in the deserts of Rajasthan.**
- These rivers include Luni, Machai, Rupen, Saraswati, Baner and Ghaggar.
- The major fishes found in these rivers are *Amblypharyngodon mola*, *Bari bendelansis*, *Botia geto*, *Labeo catla*, *Cirrhinus mrigala*, *C. reba*, *Labeo spp*, *Danio devario*, *D. rerio*, *Tor tor*, *Nemacheilus botia*, *Puntius spp*, *Rasbora daniconius*, *Mastacembelus armatus*, *Channa spp.*, *Trichogaster fasciatus*, *Clarias batrachus*, *Mystus spp*, *Heteropneustes fossilis*, *Wallago attu*, *Notopterus spp.*, etc.

Classification of riverine fishes

- Based on the migratory habits, fishes occurring in Indian rivers are classified as:

1. Resident species

2. Local migrants

3. Long distant migrants

□ Resident species

The fish species which prefer to remain confined within the local territories are termed resident species.

This type includes *Cyprinus carpio*, *Notopterus spp.*, *Channa spp.*, *Mastacembelus spp.*, *Garra spp*, *Osteobrama spp*, *Puntius spp*, *Labeo spp*, *Cirrhinus spp*, *Mystus spp*, *Clupisoma spp* etc.

□ **Local migrants**

The fish species which perform seasonal migrations within short distances for feeding, breeding etc., are called local migrants.

This type comprises of mahseer, Indian major carps, large and medium sized catfishes (like *Bagarius bagarius*), salmons, trouts etc.

□ Long distant migrants

The fish species which perform regular annual migrations for feeding or spawning or for both are called long distant migrants.

This type consists of Indian shad (*Hilsa ilisha*) - an anadromous fish, freshwater eel (*Anguilla* spp.) - a catadromous fish and catfish (*Pangasius pangasius* , migrate from river to estuary).



Three species of Hilsa shad (A- *Tenualosa ilisha* : B- *Tenualosa toli*: C -*Hilsa kelee*)



Anguilla bengalensis

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Production potential of rivers of India

- The country as a whole has a river length (including canals) of 1,95,210 km with a resource potential of 29,000 km. Different river systems of the country with a combined length of 29,000 km offer one of the richest fish genetic resources of the world.
- Their highly diverse natural fish fauna characterizes Indian rivers. All these water bodies have about 930 fish species belonging to 326 genera.

- Though **proper riverine production data are not available**, the data collected by **CIFRI, Barrackpore** on selected stretches of the rivers, Ganga, Brahmaputra, Narmada, Tapti, Godavari and Krishna shows that fish production from these rivers vary from 0.64 to 1.64 tonnes per km, with an average of 1 tonne per km.
- The riverine fisheries resources contribute significantly to the total inland capture fisheries production. **The riverine ecosystem witnessed marked alterations due to** water abstraction, dam construction, sedimentation and irrational fishing. These activities affected the natural riverine fish production showing continuous declining trend.