



## **Fish Production: Technique and Management**



## **Introduction:**

Fish are the earliest known vertebrates and flourished during the Devonian period, about 400 million years ago. They form a highly successful group of animals comprising more than 40,000 species inhabiting all seas, rivers, lakes, canals, dams, muddy water, brackish water, estuaries and all places where water is available. They differ from each other in shape, size and habits, ranging from less than 2 cm to 18 meters. A very wide distribution of fish into a variety of habitats has resulted in numerous adaptations in their morphology, physiology and behavior.

The finfish and shellfish have always reserved a place of pride in the food basket of the country. From nutritional point of view, fish are valuable food due to presence of high quality proteins, in addition to vitamins and minerals like calcium, phosphorous, iron and sodium contents. All the essential amino acids and many poly unsaturated fatty acids (PUFAs) available in fish products are generally not found in land based food products and are absent in vegetables as well. Apart from these, the fish are particularly rich in B group of vitamins namely thiamine, riboflavin, niacin and pantothenic acid. With the change in life style in urban population, the consumption of processed fish and shell fish products has increased considerably all over the world. Therefore, products belonging to this class are in great demand in domestic as well as in global market.

Thus, increasing demand of fish for delicious food products and for other household products and ornamental items opens great opportunity for its trade and entrepreneurship particularly in rural areas. Sound knowledge on fish production techniques and management may be harnessed not only to set a business for one's own livelihood but also may create employment for others.

## **What is Ichthyology?**

Ichthyology is the branch of science which deals with the study of fish, including bony fish (Osteichthyes), cartilaginous fish (Chondrichthyes) and jawless fish (Agnatha) with all related aspects like ecology, morphology, anatomy, physiology, behavior, etc.



## **What is fishery science?**

Fishery Science is a multidisciplinary science which deals with the biological study of life, habit and breeding of various species of fish. This discipline manages and understands fisheries involving aspects like farming and husbandry of fishes and aquatic organisms in various water forms, i.e. fresh water, marine and brackish water. As fish export has a considerable share in the economy growth, this field is of importance from the traditional times. With increasing development of fishery sector, not only the traditional fishermen are dependent on these resources, but also the skilled personnel are required on regular basis.

## **Scope of career in Fishery Science in today's global context:**

With an increase in the taste buds of the people and in the urge to relish quality and to discover cuisines across the boundaries, there comes an increase in demand of fresh and quality seafood and fishes. Not only this, as the end customer now wants a detailed and cost worthy products for which they are ready to spend anything that the product demands, there comes an increase in not only the employment opportunities for the aspirants who are skilled and dynamic, but also the demand of quality fishery products for those who have their own business enterprises.

The Indian coastline is vast and country also has huge inland water bodies. So, the subject area to study and to work in this field is also large in our country. Thus, the aspirants who have dynamic entrepreneurial skills can excel in this expansive sector.

## **General Characters of Fish:**

Fish exhibit following common characters, most of which are related to their permanently aquatic mode of life.

1. Fish are cold blooded vertebrates, usually have a streamlined body; however, some are snake like and few are dorso-ventrally flattened.

2. Exoskeleton: body is covered with scales but some are naked without any exoskeleton. Integument with mucous glands and chromatophores - Endoskeleton: is bony or cartilaginous and less massive in comparison to land vertebrate.
3. Respiration by gills, accessory respiratory organs may also be present, gills open outside by gill slits and covered by operculum in osteichthyes (4 pairs) but absent in chondrichthyes (usually 5 pairs but never more than 7 pairs)
4. Lateral line system is present that contains neuromast organs (Rheoceptors), sensitive to water current and changes in pressure and vibrations (Echo-location).
5. Only internal ear is present
6. Eye lids and tear glands and fleshy muscular tongue is absent
7. Visceral skeleton is well developed (skeleton of pharyngeal wall associated with the gills)
8. Locomotion by muscular contraction assisted by paired and unpaired fins which are supported by fin rays of dermal origin
9. Paired visceral arches are present, first pair forms the upper and lower jaws, the second pair forms the suspensorium and remaining support the gills
10. Kidney is mesonephric in adults
11. There are 20 pairs of cranial nerves
12. Gonads possess true gonoducts
13. Development direct, unisexual, amnion and allantois are absent in the embryonic stage
14. Cerebrum is primarily an olfactory centre
15. Heart is venous, one pair nostrils, not for respiration only for olfaction.

**Classification:** fish constitute more than one half of all vertebrates comprising around 40,000 species.

**Berg's classification (Modified): Super-class:** Pisces, **Classes:** Placodermi, Chondrichthyes, Osteichthyes (Teleostomi) and Dipnoi.

## Major Carps

**Definition:** Cultivable species of the fish are called the major carps.

Cultivable species of fish may be of three types:

**(1) Indigenous fishes:** Native fresh water fish, **eg.** *Labeo*, *Catla*, *Cirrhinus*.

**(2) Exotic fishes:** Imported fishes. **eg.** *Cyprinus* (Common or mirror carp), *Ctenopharyngodon* (Grass carp), *Hypophthalmichthys* (Chinese carp), *Osphronemus*, *Tilapia* and Crucian carp.

**(3) Salt water fish:** Acclimatized to fresh water **eg.** *Chanos* (Milk fish), Mulletts.

### Qualities of major carps:

- They should have a fast growth rate.
- Ability to feed on natural and comparatively cheap artificial food.
- Should be able to tolerate adverse climatic conditions.
- Should be hardy and resistant to common fish diseases.
- Should be palatable.
- Should be of high nutritive value.
- Should be prolific breeder.
- Should consume small quantity of food for development and growth.
- Should live in ponds with other species of fishes without any disturbance.
- Should preferably be herbivorous in diet.
- Should be gentle and non-poisonous.
- Should be easily harvested.
- Should reproduce under confined conditions.
- Should have low bone to flesh ratio.
- Should support high fish density in ponds.
- Should be transportable from one place to other.



### Other qualities of major carps:

- Major carps feed on phyto and zooplankton, decaying weeds and debris and other available aquatic plants.
- Resistant to relatively high temperature and turbidity.
- They can tolerate certain oxygen variation in water.
- Growth rate is fast and may attain a reasonably large size in short in short duration.
- They breed profusely.
- Fecundity is high. Flesh is palatable and much nutritive. They can be handled and netted easily.

**Some Important Major Carps:** Large sized corpulent fishes, which breed in running water.

#### (1) *Catla catla*. Hemilton:

**Common names-** It is also known by other names like *Catla*, *Bhakur*, *Thail*, *Tambra*, *Tay lee*, *Bau*, *Botchee*, *Dheker*, etc.

**Distribution:** Widely distributed from north and south India, Pakistan, Bangladesh, Burma, Sri Lanka.

**Characters:** It is strong and broad fish. Reared in association with other major carps. One of the major carps, which gains weight very soon and develops faster than *Rohu*. It is surface feeder and feeds on plankton voraciously. Dorsal surface is more elevated than ventral surface. Color of dorsal and ventral surfaces vary slightly. Widened mouth is tilted upside. Lower lip rather thick with continuous transverse folds. Operculum is large. Eyes are large and black. Barbles absent. Dorsal fin advances of pelvic fins. Fins are black in color and fin rays are strong. Caudal fin well forked. Lateral line almost clear. Large regular cycloid scales. Maximum length about 180 cm. Suitable for cultivation in confined waters. Does not breed in ponds but spawning may take place under controlled conditions in special reservoirs. Breeds when length is 55-56 cm. Spawning period in north India is June to

Sept and in south India twice a year during monsoon. Eggs 02 mm in diameter. Hatching after 10-18 hours of fertilization. Adult characters are attained after six weeks. Larvae and fries are used for stocking in ponds and tanks. Attains length 38-45 cm and weight 900 gm in one year and in second year weight becomes 4.5 Kg. Fecundity 80 eggs/gm body weight. Annual production is about 1,100-2,200 Kg/ hectare.

**Fin formula** : D 18-19(3/15-16), P 19, V 9, A 8, C 19, LL 43, Ltr. 7 ½,



**Images of *Catla catla***



**(2) *Labeo rohita*. Hamilton:**

**Common name:** It is also known by other names like *Rohu*, *Ruee*, *Ruhu*, *Rohee*, *Rohit*, *Roe*, *Tenbda*, *Massa*, *Tapra*, *Dhambra*, *Dumbra*, etc.

**Distribution:** It is widely distributed in north India, Pakistan, Burma, Chennai, Andaman & Nikobar islands, Sri Lanka.

**Characters:** Most popular and valuable carp distributed throughout Indian plains except southern region. It develops comparatively faster. Generally body is elongated and abdomen is rounded. It is column feeder and feeds upon vegetation and planktons. Dorsal profile is slightly convex. Mouth is sub-terminal, semi-oval with continuous muscular lips and snout is projected forward. Operculum is comparatively smaller. One pair of small maxillary barbules are present. Fins are concave and well developed and dark grey in color. Dorsal fin originates between the midway of snout and base of caudal fin. Usually a red mark is present on the small sized scales. Lateral line is clear. Confined water is suitable for cultivation but does not breed in stagnant water. Reproduce at 51-75 cm of length (1.5-7.6 Kg). The average number of eggs are about 1,258/gm body weight. Spawning period in North India is June to September. Fry and fingerlings are collected for stock. In one year, it measures about 35-45 cm (675 gm) and attains maximum length of about 90 cm in about 03 years. Cultivated in association with other carps and production may be increased from 1,100 to 2000 Kg/hect./year.

**Fin Formula :** D 16(3/13); P 17; V 9; A 7(2/5); C 19; LL 40-41, L Tr. 6 ½- 7 ½ /9, Barbules 1 pair.







**Images of *Labeo rohita***

**(3) *Cirrhinus mrigala*. Hamilton:**

**Common name:** Mrigala, Mirka, Naini, Mirkali, Mirrga, Mori, Naraini, Morkha, etc.

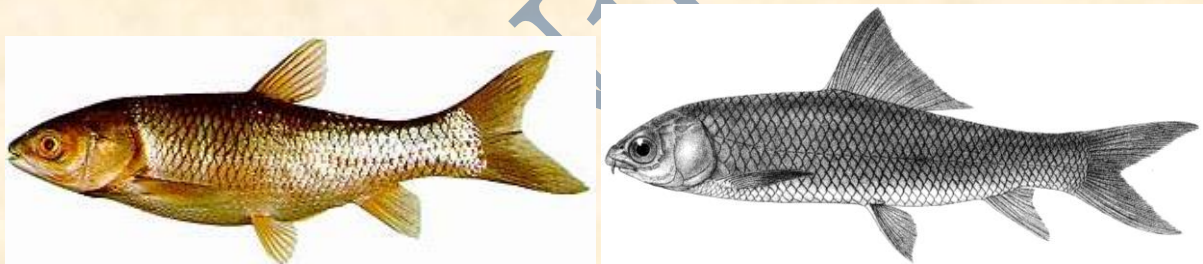
**Distribution:** North India, Madras, Assam, East Pakistan, Bangladesh and Burma.

**Characters:** It develops faster in the ponds, rich in organic matter. The width of the head is equal to its length behind the eyes which are located in the anterior half of the head. Mouth is slightly sub-terminal, small and wide. Lips are thin and fringed. One pair of short barbels are present. Dorsal fin is strong and its origin is nearer to snout than the base of the caudal fin. Cycloid scales are of moderate size. Belly scales are of bright orange colored. Lateral line is clear. Caudal fin is deeply forked. Pectoral, ventral and anal fins are tinged with black. Eyes are golden; hence, local name is Naini or Nain. Suitable for cultivation in confined water. Breeds in flooded rivers but does not breed in ponds; however, sometimes breeds in reservoir. Larvae and fry are collected for stocks. It attains sexual maturity in one year. Spawning period in North India is June to September. Egg is about 1.5 mm in diameter, hatching after 16-19 hours. Yolk sac is prolonged posteriorly. Adult features appear after 24 days. It is bottom feeders and suited for

cultivation in association with middle or surface feeders. It feeds on submerged plants and herbs.

After six months, it attains about 340 gm weight and length about 24 cm and after one year, 1.5 Kg weight and 45-61 cm length. Annual production is about 1,100 Kg/Hectare/Year.

**Fin Formula :** D 16, P18, V 9, A 8, C 15, LL 42-44, Ltr. 6 ½, Barbles 1pair



**Images of *Cirrhinus mrigala***

#### **(4) *Cyprinus carpio*. Linnaeus:**

**Common name:** Common carp or European carp or German carp, Koi (Japan) and Li Yu (China).

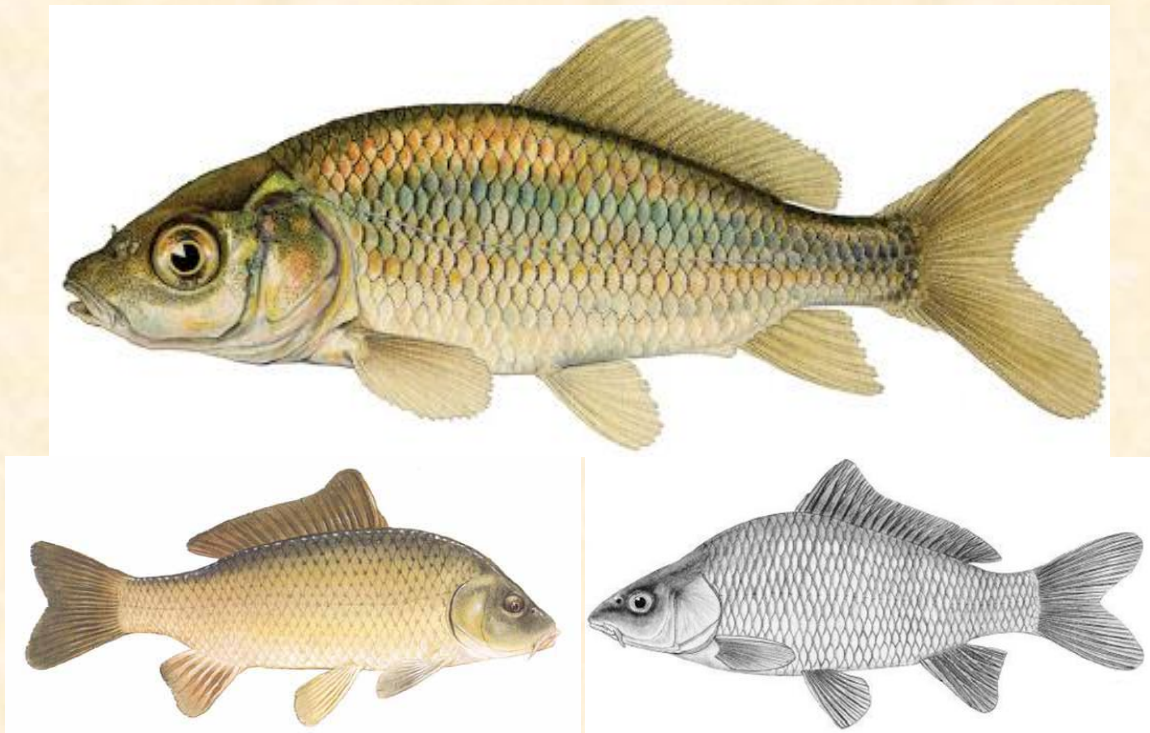
**Distribution:** India, China, Japan, Ceylon, Australia, cultivated in all parts of the world.

**Characters:** It is introduced from Sri Lanka in 1839. It attains a length of about 03 feet. It is a cold water fish but now adapted to warm water. It is cultivated most extensively and worldwide. It was first stalked in Nilgiri hills



in Chennai. Mouth is protractile with smooth simple lips. Three rows of teeth are present in the throat. Barbles are two pairs but one pair sometimes rudimentary. The dorsal fin is long with last simple ray, ossified and serrated behind and it originates opposite to the ventral fin. Can be cultivated up to altitude of 1000 m above sea level but growth is retarded below 150 m and above 600 m. The optimal water temperature ranges between 20-25°C. Attain a weight of 1.0 Kg in first year - Attain sexual maturity at the end of first year and grows 40-50 cm in length and 2-3 pounds in weight. -Breeds 4 or 5 times in a year.

**Fin Formula :** D 18-22, P 14-17, V 8-9, A 4-6, C 19, LL 35-38, Ltr. 7 ½



**Images of *Cyprinus carpio***

**5. *Channa punctatus* (Bl.)** : Ophiocephaliformes, Family : Ophiocephalidae  
-Commonly known as Saur, body covered with scales, 55-60 cm in length, dark black on dorsal and white or yellowish with brown or black spots or striations on the ventral side, slow moving fish, feeds upon manure, mud and rotten substances present in the bottom of the pond, reservoir or even in the well also, lateral line is well marked, head dorso-ventrally flattened, mouth wide, lips of unequal size, head covered with skin, eyes small,

operculum short, barbules absent, pectoral and ventral fins small, dorsal fin along with entire length of the body separated from the caudal by a notch, anal fin long and free, caudal fin is not forked, teeth present.

**Fin Formula :** D 29-30, P 16-17, V 6, A 20-22, C 12, LL 35-37, Ltr. 4-5/7.



**Image of *Channa punctatus***

**6. *Wallago attu* (Schn.) :** Cypriniformes, Family : Siluridae

-Supposed to be freshwater shark as it feeds upon young fingerlings, small fishes, frogs, insects and others.

-Develops faster, laterally compressed body, eyes are rounded and bigger, mouth wide and armed with teeth, lower jaw slightly longer than upper jaw, barbules 2 pairs and very big, pectoral fin small, dorsal fin rays strong, anal fin long and congruent, caudal fin forked, upper lobe pointed and big, color yellow to yellowish green.

**Fin Formula :** D 5, P 1/14, V 10, A86(4/820, C 17, Barbules 2pairs



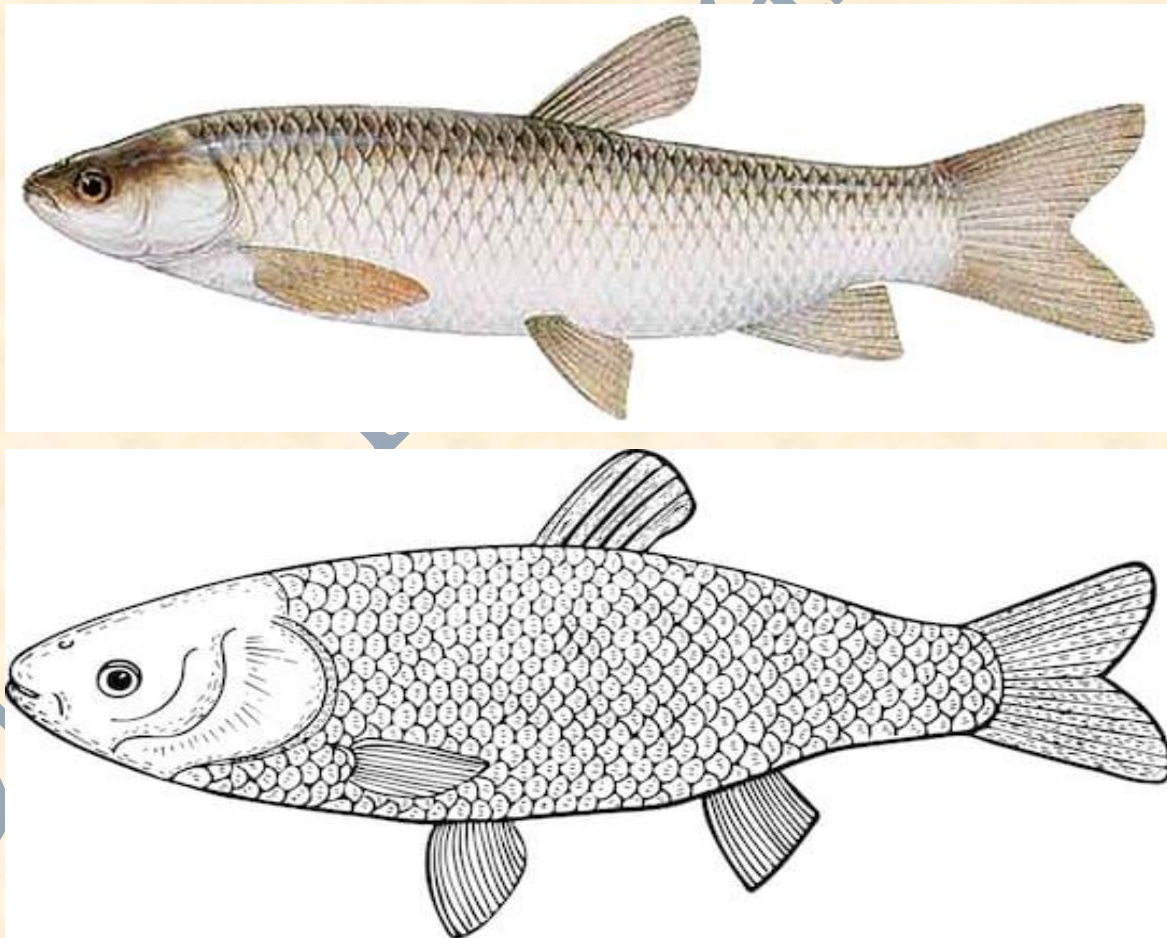
**Images of *Wallago attu***



**(7) *Ctenopharyngodon idella* (Grass carp):**

It is herbivorous fresh water fish. It is a native of Asia (China) and is commonly cultivated in China for food but was introduced in Europe and US for aquatic weed control and now it has been introduced in various countries, including India. It has wide degree of temperature tolerance and spawn at temperature of 20-30°C. It is elongated and torpedo shaped. Terminal mouth is slightly oblique with non-fleshy firm lips. Barbules are absent. Body color is dark olive, shading to brown-yellow on the sides. It grows very rapidly. It attains a maximum length of about 1.4 m and weight of about 40 kg. Life span is about 5-9 years. It eats up to three times of its own body weight daily. They feed on aquatic plants but may also take detritus, insects and other invertebrates.

**-Fin formula: D 3/7, P<sub>1</sub> 1/17, P<sub>2</sub> 1/8, A 3/7-8, C ,LL 40-50**

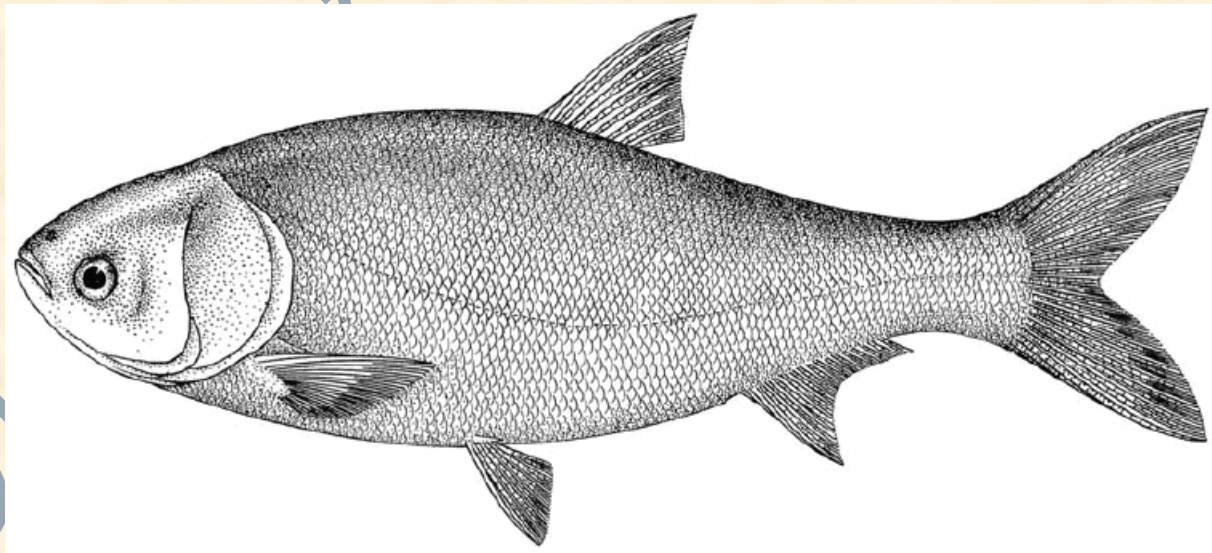
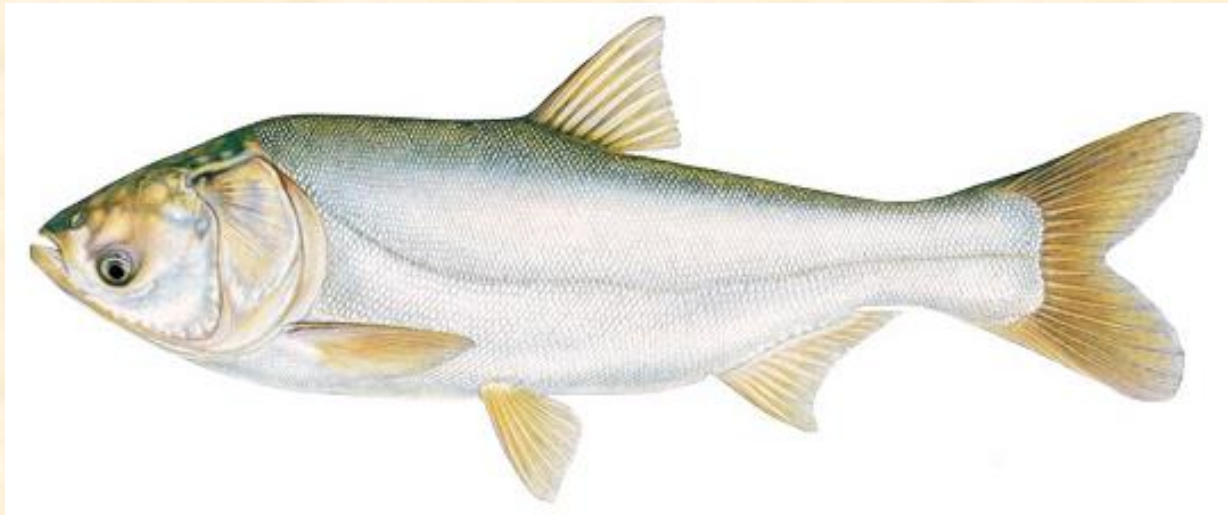


**Images of *Ctenopharyngodon idella***

**(8) *Hypophthalmichthys* (Silver carp):**

It is herbivorous fresh water fish and filter and plankton feeder. It is native of Asia (China). It is widely used in aquaculture. It enhances fisheries and control water quality. It attains a maximum length of about 140 cm and weight of about 45 kg. It is also known as the flying carp. It has olive green coloration above lateral line and on back and silver below lateral line. Body is laterally compressed. Gill rakers are thin and numerous for filter feeding. Smooth keel on abdomen. Dorsal fin originates from posterior to pelvic fin base.

**Fin formula: D 3/7, P<sub>1</sub> 1/17, P<sub>2</sub> 1/7, A 2-3/12-14**



**Images of *Hypophthalmichthys***