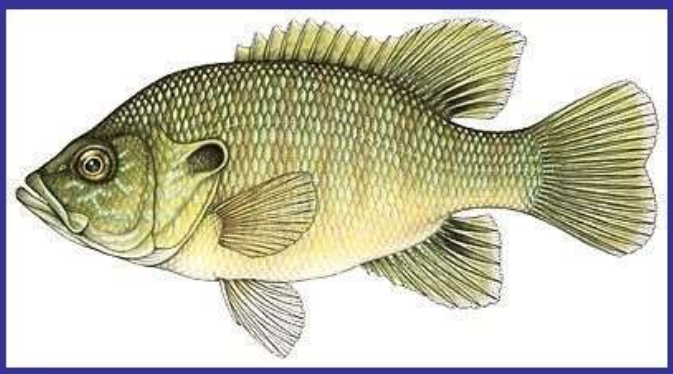
Fish Biology

Fish biology and anatomy

What is fish?

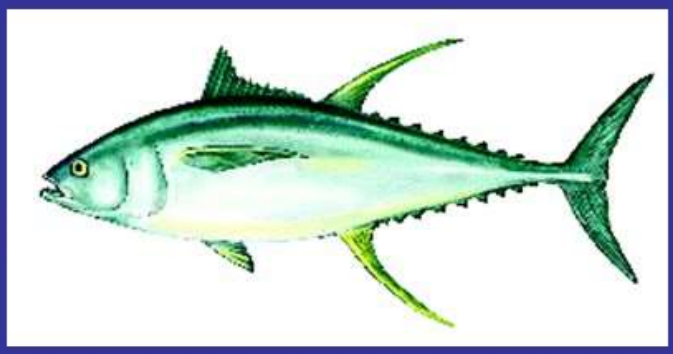
- Fish belong to the group of animals
- **Cold blooded**.
- While fish share many traits with animals from other groups they have a few specialized features.
- The first would be the **presence and use of gills**.
- Gills are the breathing organs of most aquatic animals, including mollusks and crustaceans.

Body shapes of Fish



Compressiform – fish that are laterally compressed; tall, thin body shape that allows fish to enter vertical crevices; allows for quick bursts of speed and quick turns.

Fusiform: streamlined with pointed ends - shaped like a plane; helps to lower frictional resistance, and allows them to move through the water extremely fast.



Body shapes of Fish

Anguilliform – fish that are long and skinny; these fish slither like snakes; allows them to maneuver into narrow openings and resist the force of current.

Globiform – these fish are almost round or globe-shaped.

Taeniform – thin ribbon like shape; good for hiding in crevices and cracks.

Integumentary system

Fins

Fins are supported by rays which are connected to the musculoskeletal system.

1. Unpaired Fins:

- **Dorsal**: 1 or more. In higher fish the anterior portion (or first dorsal) is supported by spines. The dorsal fin (s) are used for rapid changes of direction.
- **Caudal**: Primary fin used for locomotion; shape varies with motion type used by species.
- **Anal**: located posterior to the anal opening.

2. Paired Fins:

Pectorals:

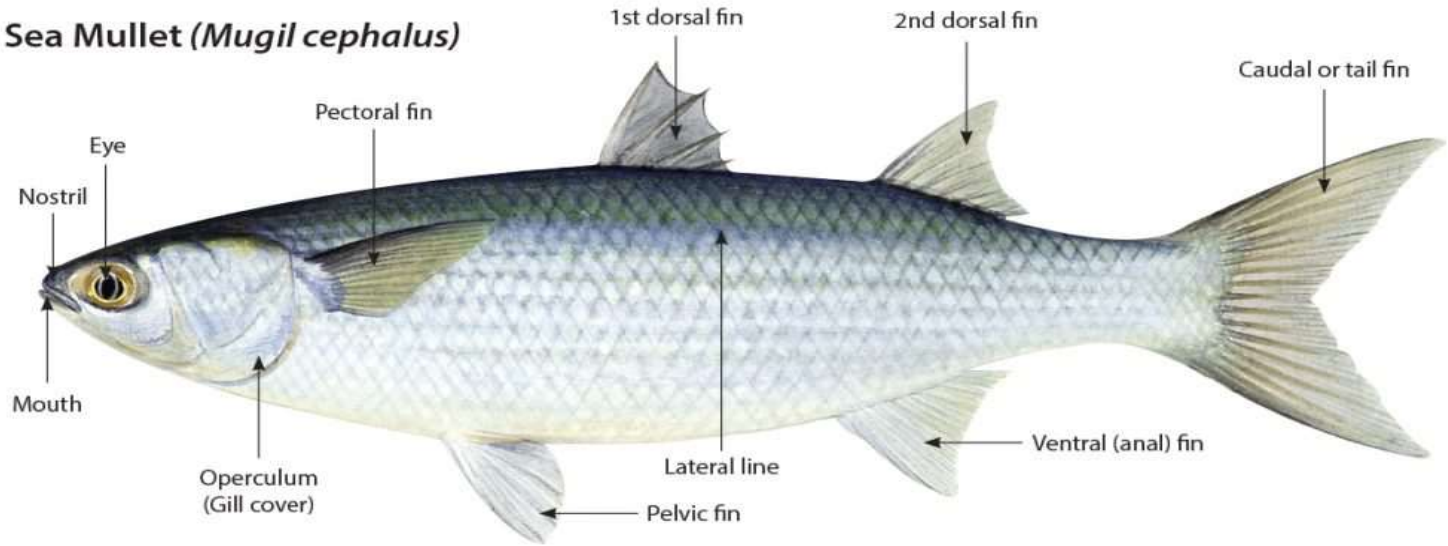
- Soft rayed only.
- They are attached to the pectoral girdle at the posterior border of the gill cavity.
- They are used to stabilize and change direction.

Pelvic (ventral)

- Variable location, thoracic or abdominal.
- Higher fish have thoracic pelvic fins.

They are used to stabilize and brake

Fish Fins


Sea Mullet (Mugil cephalus)
1st dorsal fin
2nd dorsal fin
Caudal or tail fin
Pectoral fin
Eye
Nostril
Mouth
Operculum
(Gill cover)
Lateral line
Ventral (anal) fin
Pelvic fin

Fins also, can be

1) Soft rayed

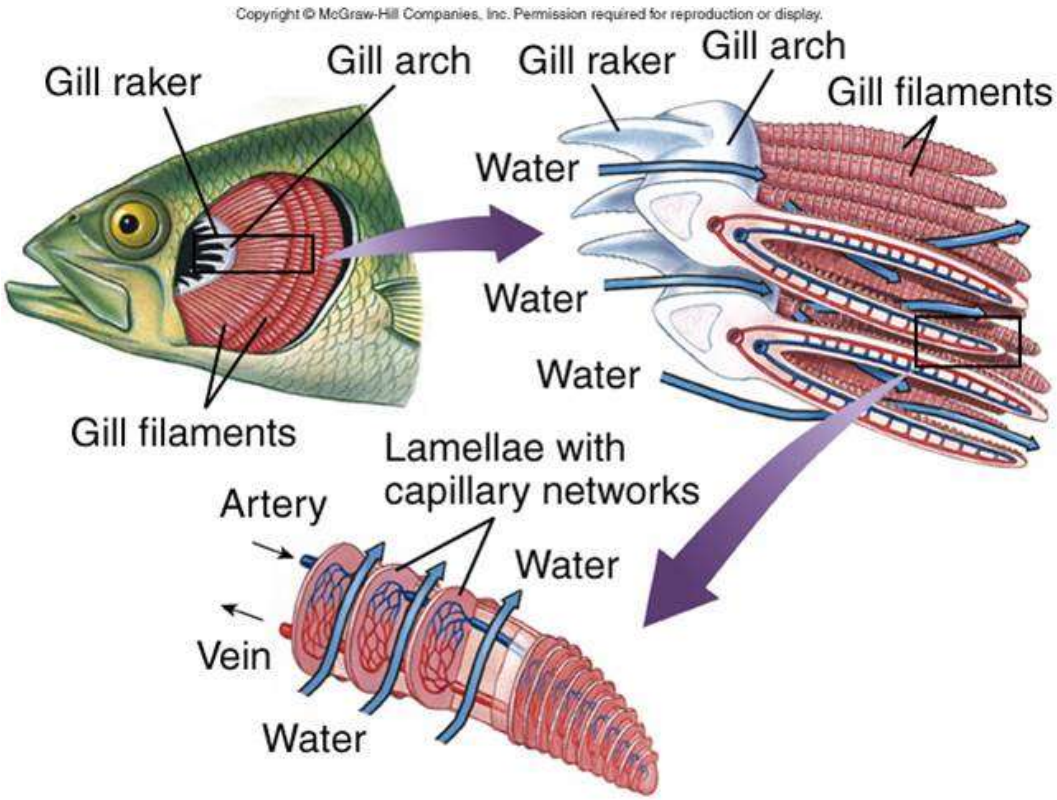
- Fins supported by soft rays.
- Cycloid scales (rounded, smooth).
- Pectoral fins caudal on body.
- **e.g. eels.**

2) Spiny rayed

- Some fins supported by bony spines such as:
- **Pectoral fins and Pelvic fins** more cranial than on soft rayed and can be below pectorals.
- e.g. angelfish flatfish, catfish, bluegill, crappie, bass.

Fish dissection

1. Respiratory system



Excretory system

1. Gills:

Gills are responsible for the excretion of CO_2 and ammonia, the primary nitrogenous product of fish.

2. Kidneys:

Fish kidneys are long, spanning the length of the abdominal cavity, and retroperitoneal against the vertebral column.

Each kidney consists of two sections;

- Head (anterior) kidney.
- Tail (posterior) kidney.

While all portions of the kidney have hemopoietic, reticuloendothelial, endocrine, and exocrine tissue, the head kidney is predominantly hemopoietic and the tail kidney is predominantly excretory.

OSMOREGULATION

Maintaining electrolyte balance in an aquatic environment depend on whether they are freshwater or saltwater species.

Freshwater:

Freshwater fish are **hypertonic** inn relation to their environment, thus water tends to diffuse in and ions tend to diffuse out (mainly via he gills).

Freshwater fish **drink very little and produce lots of dilute urine**.

They actively reabsorb ions in the kidneys and across the gills.

Saltwater:

Saltwater fish are **hypotonic** in relation to their environment, thus water tends to diffuse out and ions tend to diffuse in (mainly via the gills).

Marine fish **drink a lot and produce small amounts of concentrated urine.**

They excrete ions in the kidneys, gills and the gut.

SWIM BLADDER

The swim bladder (or air bladder) is a gas filled organ used for maintaining buoyancy.

The volume of the organ is adjusted to control buoyancy.

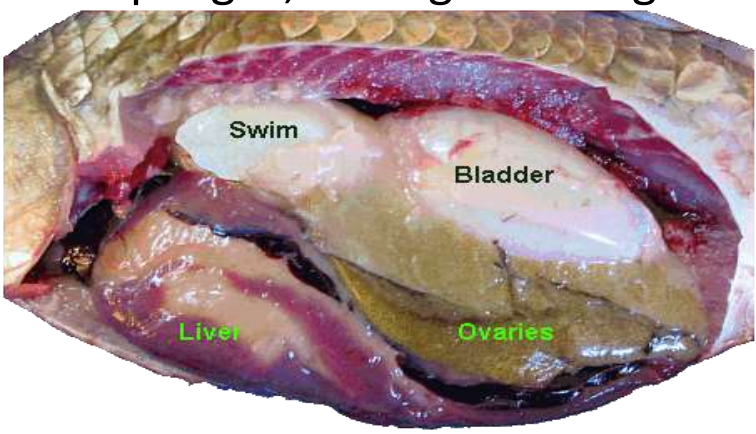
In bottom dwellers or fast swimming fish the swim bladder may be reduced or absent.

It originates embrologically as an alimentary canal outgrowth.

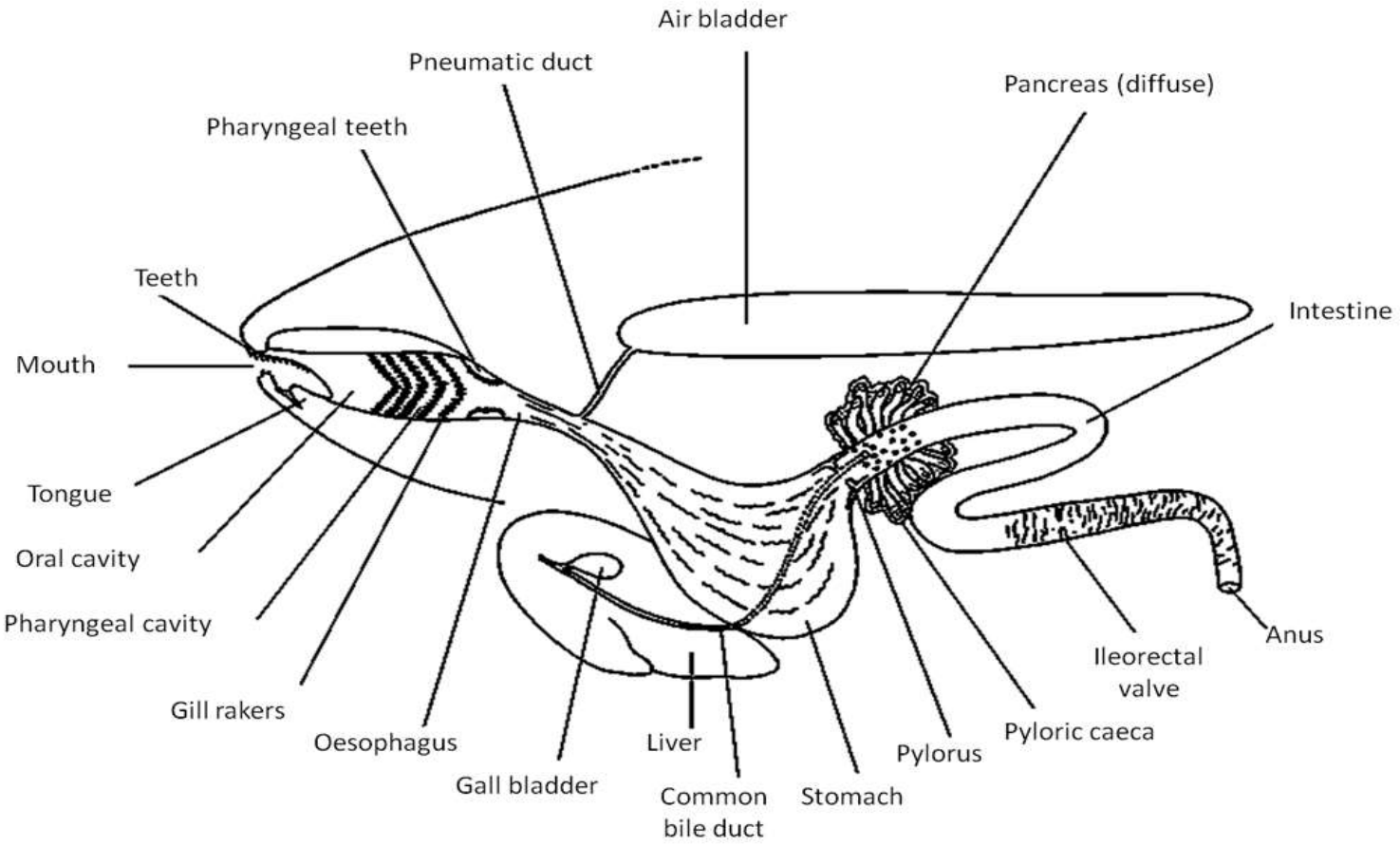
Physoclistic fish (such as the spiny-rayed fish) have no connection between the esophagus and the swim bladder. Gas must enter and exit the organ via a capillary network on its cranioventral wall.

Physostomatous *fish* (such as the soft-rayed fish) have a pneumatic duct which connects the swim bladder to the esophagus, through which gas can enter or exit.

The swim bladder also has some secondary functions, including sound reception, sound production, and water pressure detection



Digestive system



Commonly farmed fish in Egypt

Tilapias

Popular Cultured Tilapias

Nile Tilapia

Mozambique Tilapia

Blue Tilapia

Red Tilapia

Oreochromis Niloticus

- ***Scientific name :*** **Oreochromis Niloticus.**
- ***Common name :*** **Nile tilapia.**
- ***Common local names:*** **Bolti.**
- **The most obvious identification mark for Nile tilapia is the parallel vertical bands on the tails fin.**
- **other tilapias just have scattered dots on the tails fins.**

i. **The body flattened, compressed by the sides and relatively short.**
ii. **The body is fully covered in scales.**
iii. **The body colour is silver whitish on the belly, darker on the back**
iv. **females being lighter than.**
v. **The males acquire bright pink colours on the flank, head and tail as it matures. The chest and chin get darker.**
vi. **The body tends to have darker vertical bands, especially when young.**
vii. **The most distinguishing marks are the clear vertical, parallel bands on the tail fin, which tends to pink.**

genus *Oreochromis*

- **All commercially important tilapia outside of Asia and Africa belong to the genus *Oreochromis*, of which there are three main species used for farming.**

1. **These are Nile tilapia* *(Oreochromis Niloticus)*,**
2. **Mozambique tilapia *(Oreochromis mossambicus)***
3. **and blue tilapia *(Oreochromis aureus)*.**

The Nile tilapia is the most popular farmed species.

- These species can be differentiated from each other by examining their **body colouration and fins.**
- **Nile tilapia** have **strong vertical bands on the caudal** fins whereas **Mozambique tilapia** have **weak or no bands on the caudal fins.**
- **Mature male Nile tilapia** have **grey or pink pigmentation in the throat region**, while **Mozambique tilapia have a more yellow colouration**.
- However, colouration is often an unreliable method of distinguishing *Oreochromis* tilapia species because environment, state of sexual maturity, and food source greatly influence colour intensity

Species	Body	Fins
O. Mossambicus	Dark colour	No bars on caudal fins
O. aureus	Bluish colour and anal fins	Red margins on dorsal, caudal
O. niloticus	Reddish to white	Prominent bars on caudal fins; white colour strips on dorsal and anal fins.

Mozambique tilapia

Nile tilapia

- **The scientific names of Nile tilapia have been revised several times in the last 30 years, which can create confusion for fish farmers.**
- **The scientific name has been previously given as *Tilapia nilotica, Sarotherodon niloticus* and is currently *Oreochromis niloticus*.**

Tilapia zillii

- **The yellow tilapia**
- ***Scientific name:*** **tilapia zillii**
- ***Common name:*** **Zillii**

- ***Description***

- **The body is golden yellow (so the name "yellow tilapia") with an iridescent blue sheen.**
- **The lips are bright green and chest pinkish.**
- **The flank/side has six or seven dark vertical bars, bars, of variable intensity.**
- **The dark "tilapia-mark", which is common to tilapia, persists in adult fishes.**
- **The colouration of breeding fishes is more intense than that of non-breeders.**

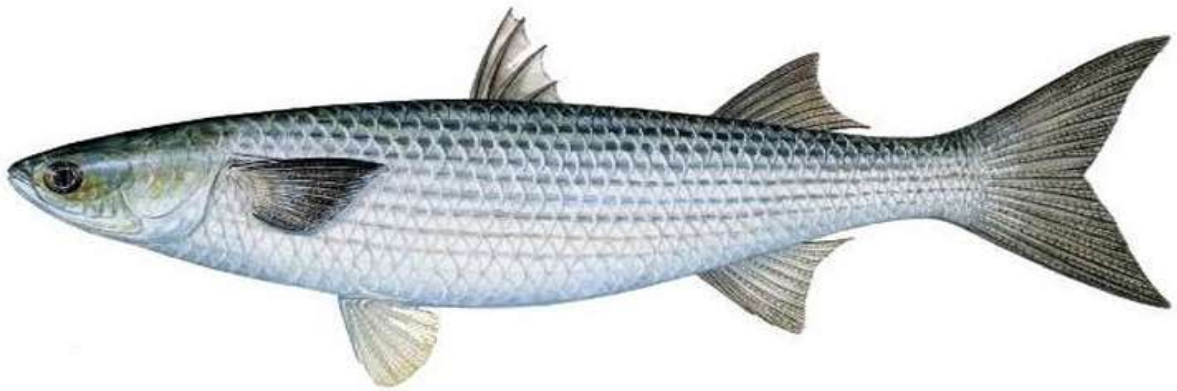
Mugil cephalus (Mugilidae)

- ***Scientific name:*** **Mugil cephalus.**
- ***Common English name:*** **Flathead grey mullet.**

• *Description*

- **Cylindrical body and broad head**
- **Adipose eyelid well developed, covering most of pupil.**
- **Upper lip thin, without papillae, labial teeth of upper jaw small, straight, dense, usually in several rows.**
- **Two dorsal fins; the first with 4 spines; the second with 8-9 soft rays.**
- **Anal fin with 8 soft finrays.**

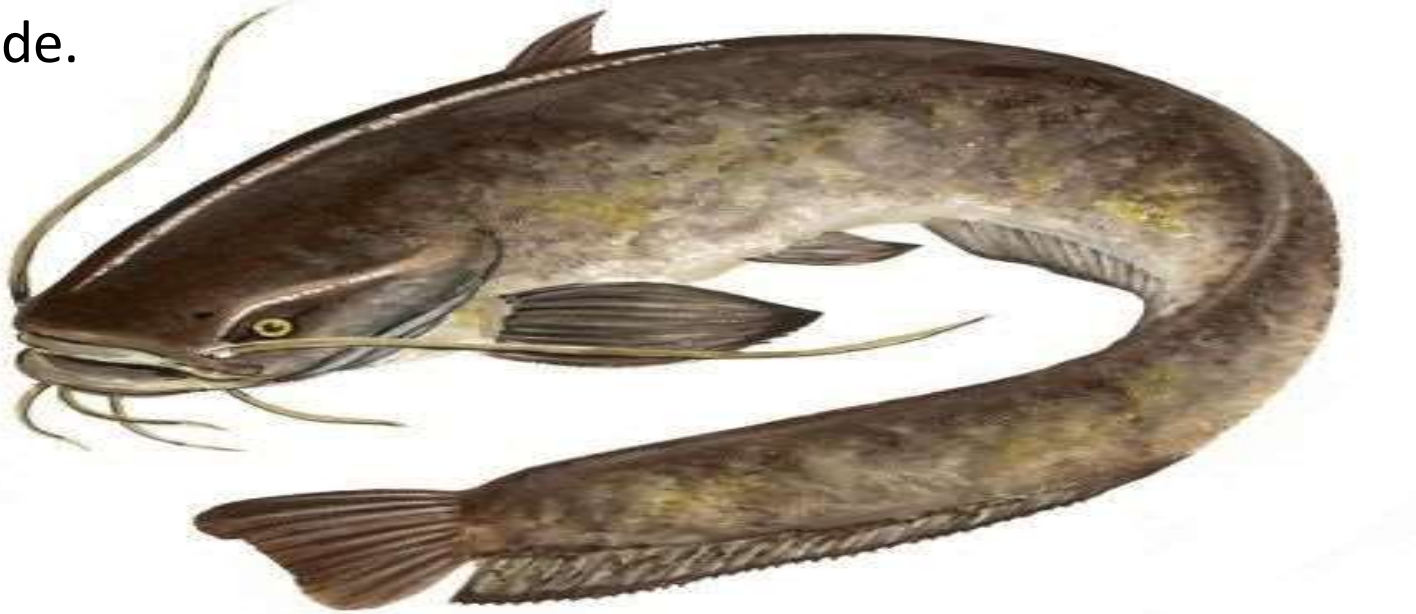
- **Pectoral fins with 16-19 rays**
- **Colour back blue/green, flank and belly pale or silvery; scales on back and flanks usually streaked to from longitudinal stripes.**



African Catfish

- *Scientific name:* Clarias gariepinus.
- *Common English name:* African Catfish.
- ***Description***
- A long, slender fish without covering the body.
- Generally dark grayish-black on the back and creamy-white on the belly.
- Colouration tends to vary to resemble the surrounding. Fishes kept in an aquarium with sand bottom are always very lightly colored while those in ponds with black mud tend to be darker.

- The Catfish is an elongated fish, being larger at the head and body tapering towards the tail.
- It has no scales and is very smooth and slippery.
- The head is dorsally compressed and flat with a wide mouth opening laterally sideways.
- The mouth contains numerous tiny teeth facing inside the mouth for gripping its prey and has a pair of barbs on either side.



Organs for breathing

- Its breathing apparatus is modified partly into normal gills of typical fish and partly into lung like structured that enable the fish to breathe dry.
- Because of the above, the Catfish is able to live in water of very poor quality with very low oxygen. It can also be stocked at very high densities (10 fish/m^2).

Mirror carp (Cyprinidae)

- ***Scientific name:*** **Cyprinus carpio.**
- ***Common English name:*** **Mirror carp, common carp.**
- ***Description***
- **A short, rounded fish with fat belly.**
- **Light yellow in colour with soft, leathery skin and large shiny (mirror-like) scales.**
- **The scales often do not cover the whole body completely.**
- **The Mirror carp has a large, rounded funnel-like mouth that can be protruded forward and retracted back during feeding.**
- **A pair of barbs extends out from the edge of the mouth.**
- **Mature females are relatively shorter with more rounded bodies while the males are more slender.**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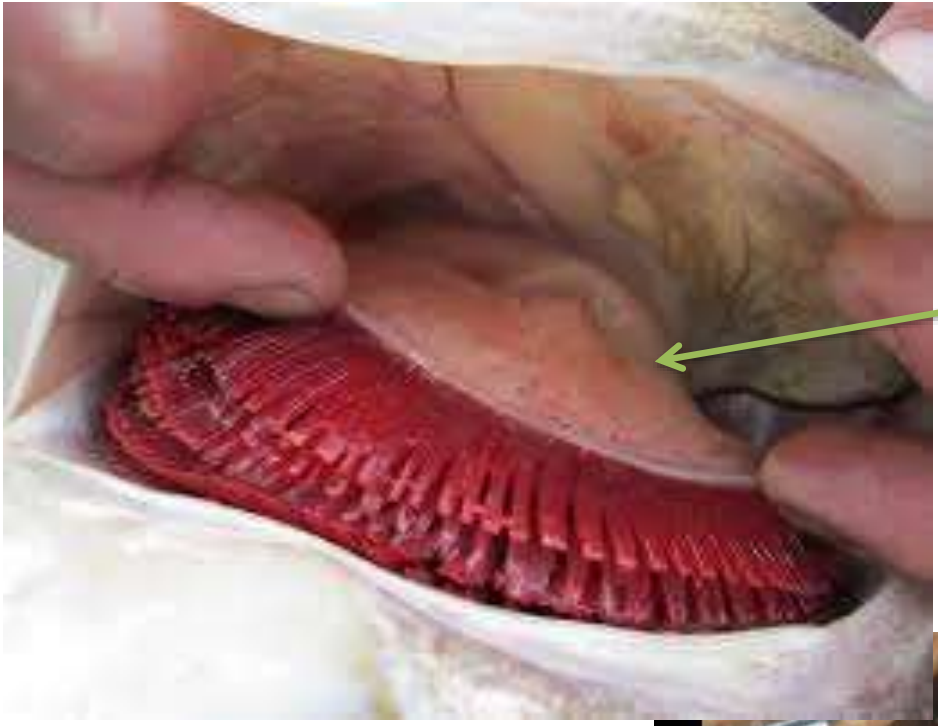
Silver carp

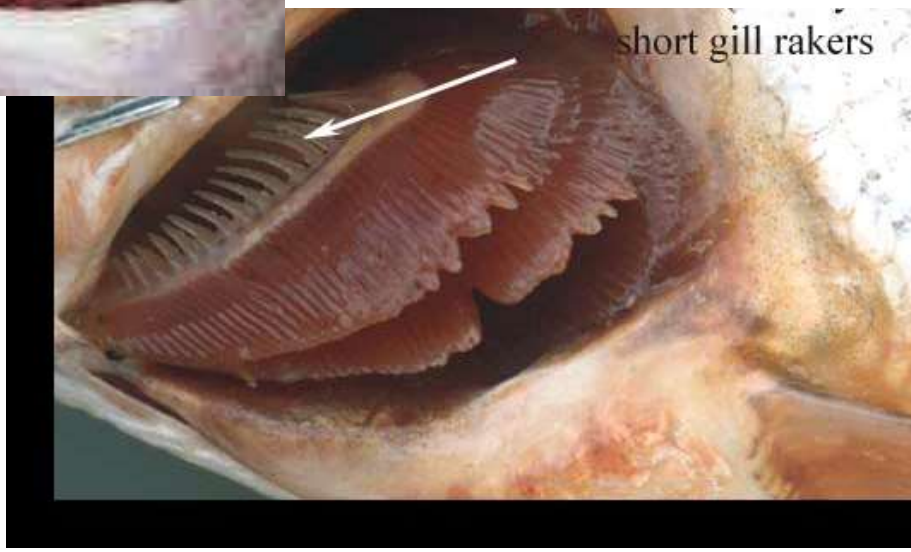
- *Scientific name:* *Hypophthalmichthys molitrix*.
- *Common English name:* Silver carp.

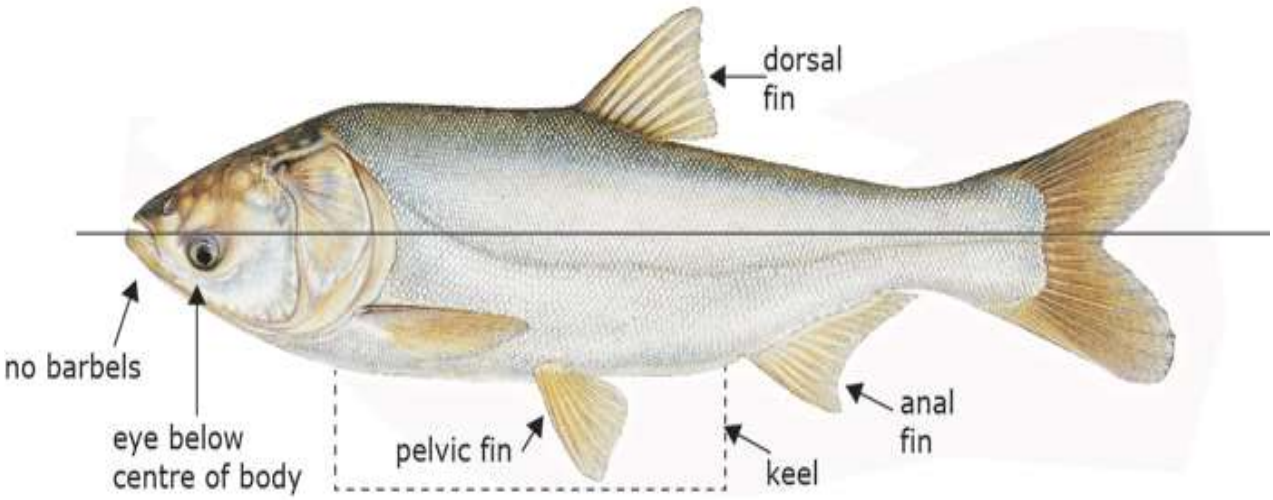
- ***Description***

- Body laterally compressed and deep with large head.
- Eye small, on ventral side, of head.
- Gill rakers sponge-like.
- Dorsal fin with 8 rays; no adipose fin. Anal fin with 13 to 15 rays.
- Lateral line with 83 to 125 scales.

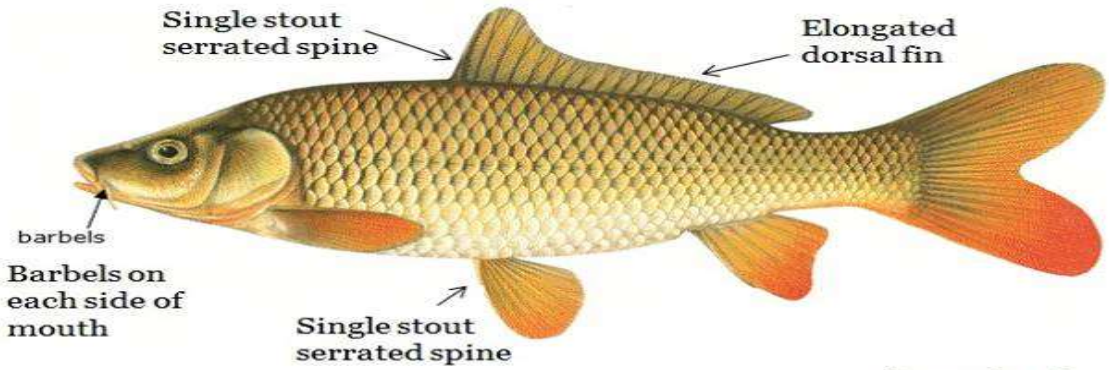


sponge like Gill Rakers of silver carp

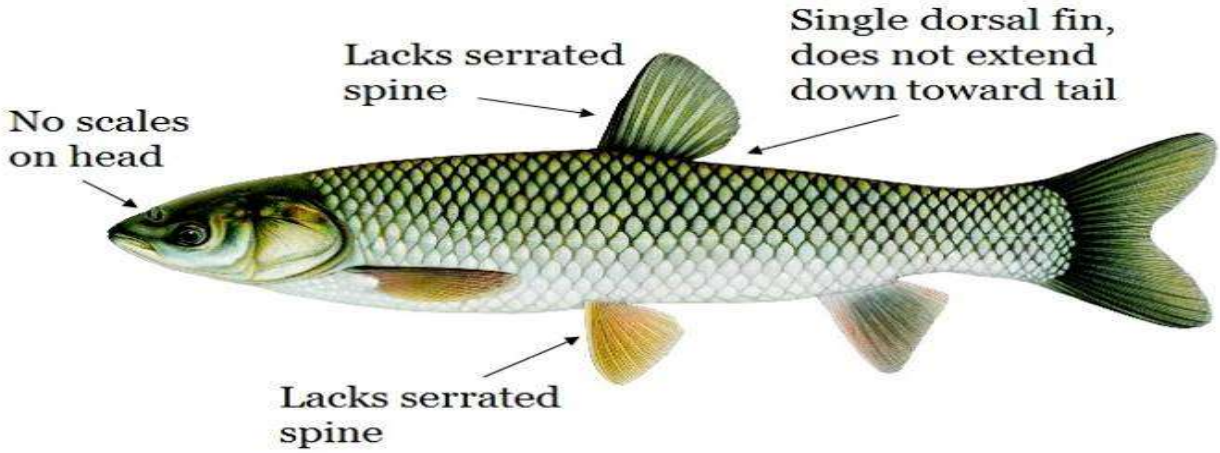



dorsal fin
no barbels
eye below centre of body
pelvic fin
keel
anal fin

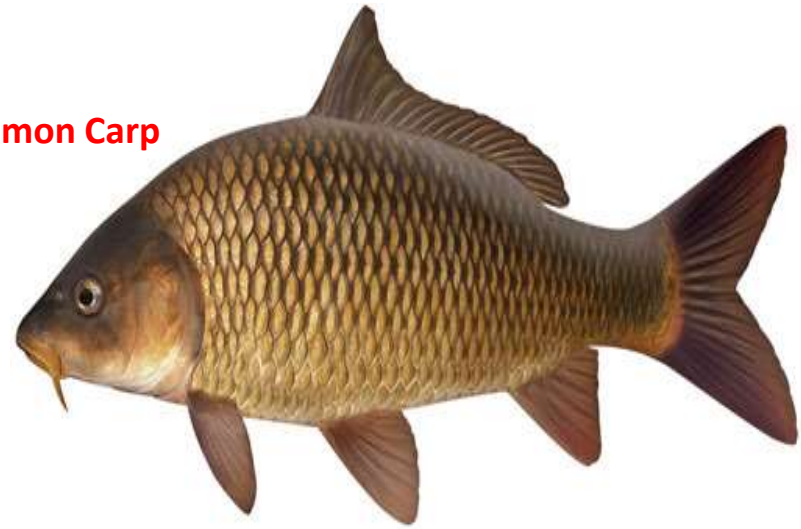
Common Carp



Grass Carp



Common Carp



• ***Feeding habits***

- The different fish types grown in aquaculture feed on different food types and have different feeding habits. The lack of this knowledge by some farmers has led into farmers giving the wrong feed to the fish they are farming. This has resulted in poor pond harvests.
-

Nile tilapia

- **The Nile tilapia naturally feeds on minute green plants called "algae". These plants are not visible by naked eyes except with the help of a microscope. Their presence in the water is indicated by the green colour of the water.**

- **Algae grow very well in water fertilized with organic manure or agricultural fertilizers.**

- **Nile tilapia feeds on the algae distributed in the water column. It does not feed on organisms and dead materials in the bottom mud.**

- **Nile tilapia finds it difficult to eat large plants or their parts. Their mouths are not adapted for that. However, feeding large plant leaves may not be totally useless because the un-eaten materials eventually rot and become fertilizer for growth of algae.**
- **Nile tilapia that has been kept in ponds has learnt to eat artificial foods and feeds**

Tilapia zillii

- Tilapia zillii is different from Nile tilapia in their feeding habits.
- i) Tilapia zillii is adapted to feeding on soft parts of large plants.
- The mouth structure is adapted for feeding large plant parts and not for the tiny plants (algae).
- Therefore, fertilizing a pond that contains only Tilapia zillii does not benefit the fish.
- However, when the pond contains both Tilapia zillii and Nile tilapia, it can both be fertilized and fed with soft plant materials. The fertilization benefits the Nile tilapia while Tilapia zillii feeds on the large plant parts.

Mugil cephalus (Mugilidae)

- **Flathead grey mullet is a diurnal feeder, consuming mainly zooplankton, dead plant matter, and detritus.**
- **Mullet have thick-walled gizzard-like segment in their stomach along with a long gastrointestinal tract that enables them to feed on detritus or wastes.**
- **Feeding by sucking up the top layer of sediments, flathead grey mullet remove detritus and microalgae.**

- **They also pick up some sediment which functions to grind food in the gizzard- like portion of the stomach.**
- **Mullet also graze on epiphytes and epifauna from seagrasses as well as ingest surface scum containing microalgae at the air-water interface.**
- **Larval flathead grey mullet feed primarily on micro crustaceans. Copepods, mosquito larvae, and plant debris have been found in the stomach contents of larvae under 35 mm in length.**
- **The amount of sand and detritus in the stomach contents increases with length, indicating that more food is ingested from the bottom substrate as the fish matures.**

African catfish

- **The Catfish lives and feeds predominantly at the bottom of the pond.**
- **Clarias is described as an omnivore and a scavenger, feeding on mixture of dead decaying plant (detritus) and animal materials at the bottom of ponds.**
- **It is a predator feeding on other animals, including, mollusks and fish.**
- **It is also a cannibal, feeding on its own young.**
- **Because of the differences in the feeding habits, the polyculture (mix of different fish species) of both Clarias and Tilapia produces better yield.**
- **However, if the two fish are to be stocked together, the tilapia fry should be larger than the Catfish fry or the Catfish fry is stocked two months after the tilapia was stocked. This is to avoid Catfish eating up the tilapia fry.**

Mirror carp

- **Carp predominantly lives and feeds from the bottom of ponds.**
- **It is described as omnivorous, feeing on a mixture of dead decaying plant and animal materials (detritus).**
- **It stays at pond bottom, stirring mud and sand while looking for food (filter feeding). In this way it makes the pond water constantly silty.**
- **The mirror carp does not feed on fresh plant materials or on algae and does not live in mid water.**
- **The above behavior makes the Carp suitable for its culture together with Nile tilapia in the same pond with minimum competition, where the Nile tilapia will feed on small plants mid water column, while Carp will be at the pond bottom feeding from mud.**

SILVER CARP

- **It is herbivorous and low in the food chain; feeds and fertilizers are therefore easily available at low cost.**
- **It can be polycultured with some other species, due to its specific habitat.**
- **Silver carp consume diatoms, dinoflagellates, chrysophytes, xanthophytes, some green algae and cyanobacteria (‘blue green algae’). In addition, detritus, bacteria and small crustaceans are other major components of their natural diet.**


THANK
YOU !