Classroom

In this section of Resonance, we invite readers to pose questions likely to be raised in a classroom situation. We may suggest strategies for dealing with them, or invite responses, or both. "Classroom" is equally a forum for raising broader issues and sharing personal experiences and viewpoints on matters related to teaching and learning science.

Project Lifescape
6. Freshwater Fishes: Catfishes

Project Lifescape aims to make available user-friendly accounts of a set of about 1500 species and higher taxonomic categories of target taxa to nurture the study of living organisms as a part of teaching biology and other related subjects in India. These accounts would be in a standardised format to promote studies whose results would be comparable and could eventually feed into a nationwide programme of monitoring a range of taxa of conservation and economic significance. This part includes a few such accounts on catfishes. These accounts are expected to be as non-technical as possible, the technical terms unavoidably used would be in bold letters and all of these are explained in a glossary with or without illustrations. Some examples of such terms are provided in the margins.

Catfishes

Fishes like frogs and turtles are cold-blooded vertebrates, systematically placed in the class Pisces. Nearly 22,000 species of fishes are known to science. Of these 40% (around 9000 species) are inhabitants of fresh and inland waters. A majority of these non-marine fishes are found in the tropical waters. For

Previous parts of the article appeared in
instance, it has been estimated that the river Amazon and its tributaries may together harbour 3000 or more species of fishes. The astounding diversity of tropical freshwater fishes has been for long realised and exploited worldwide.

Indian water provide habitats for a little more than a tenth of the world’s fishes (2500 species). Of these, interestingly, 930 species (about 10% of the world’s 9000 non-marine species) are considered as freshwater/inland fishes (henceforth treated as freshwater fishes). Freshwater fishes in India are distributed amongst approximately 20 orders, 100 families and 300 genera.

As much as 75% of all species of Indian freshwater fishes are in just 3 orders viz., Perciformes (perches, scats, cichlids, etc), Cypriniformes (carps, barbs, loaches, etc) and Siluriformes (catfishes). Of these, catfishes are of great significance, especially so since with the exception of cypriniform fishes, they are the most diverse in Indian freshwaters. They are often large and fleshy. Many are exploited by humans as food.

Catfishes are remarkable. They get their name after the cat-like whiskers that adorn their mouth region. Whereas barbels, whiskers and beards are not entirely unique to catfishes, all species of Indian catfishes are easily identified by the presence of an adipose or fatty fin near their caudal or tail fin. Additionally, most species of catfishes bear spines in their back or dorsal and/ or shoulder or pectoral fins that can inflict very painful stabs when handled. A few species are adapted to breathe air with the
aid of special internal organs and thus can survive outside water for 4-5 hours if they are not exposed to direct heat or desiccation.

While many are utilized as food, a few are popular with aquarists. In size they range from tiny ones of 2.5 cm to huge 200 cm giants weighing as much as 45 kg. Examples of India’s tiny catfishes are *Hara hara* (2.5 cm) inhabiting the waters of north and east India, *Laguvia shawi* (3.0 cm), *Horaglanis krishnai* (4.2 cm), *Akysis pictus* (4.5 cm) and *Nangra nangra* (5.0 cm). Interestingly, *H. krishnai* is blind, endemic to Kerala and inhabits wells.

Amongst our huge catfishes are *Wallagu attu*, which is also one of the largest of Indian freshwater fishes (some *mahseers* or *Tor* species being larger and heavier), followed by a few others in the genera *Aorichthys*, *Pangasius* and *Plotosus* that attain as much as 150 cm length. Thirteen families of catfishes are found in Indian freshwaters. These include about 50 genera, (the most diverse being *Glyptothorax*) and around 150 species. Of these, four species representing family Bagridae (*Mystus*-2 species), Clariidae (*Clarias*-1 species) and Heteropneustidae (*Heteropneustes*-1 species) are described here.

**Long-whiskered Catfish**

*Mystus gulio*: Bagridae

A gregarious catfish, often found in muddy waters, including salt water. The dark colouration contrasting against the almost white underside and a stocky build with extended belly identifies the species. Generally feeds along the bottom digging and turning over debris. Wriggles entire body while clumsily swimming.

**Morphological Characters**: A medium sized catfish attaining a length of 40 cm. The species bears four pairs of barbels. One of the two pairs of barbels on upper lip is very long and extends till end of pelvic fins. These barbels are black. Dorsal fin fairly high, with a strong spine. Caudal fin deeply divided. All fins are tipped black, especially contrasting in younger and smaller individuals. Adipose fin well developed and rounded.
The catfish is observed to often rest at the bottom between rocks and debris. Young ones tend to school. Like most catfishes, the species is very active at night. The long-whiskered catfish is known to scavenge for food even in sewage-filled and dark waters. It is also known to gorge itself on human feces.

**Related Taxa:** Many species of *Mystus* tend to resemble each other at a glance. Since colour often varies with the nature of water and age, confusion between species is very likely. *M. gulio* is probably most similar to *M. armatus* in overall colouration. However, *M. gulio* is much larger when adult and lacks the black blotch near the tail which the latter bears.

**Diversity:** The family Bagridae is widely distributed in the freshwaters of Asia and Africa. It comprises 27 genera. In India, 6 genera and 30 species represent the family Bagridae, of which 19 are in the genus *Mystus*. Sub-specific diversity in *Mystus gulio* is not known.

**Distribution:** An Oriental species, *Mystus gulio* is widely distributed in India, Pakistan, Bangladesh and Myanmar. It is generally found in the plains throughout India. The species is particularly common and widespread along the east coast.

**Habitat Preference:** One of the species of Indian catfishes with a greater preference for salt water, inhabiting estuaries, tidal swamps and even invading the sea. It spreads considerably during the rains upstream, entering stagnant pools. The species can be collected in rain puddles, which are muddy and quite unfit for most species of freshwater fish.

**Adult Behaviour:** Adults are not as gregarious as the young. They are often territorial. When kept inside well-lit aquariums, they are shy and hiding, moving about mostly in the dark. Both adults and young have an enormous appetite and feed on almost anything that they can gorge. As with many other species of catfishes, adults do not attack or fight with fishes belonging to other species when kept together in community tanks. Since this species of catfish generally inhabits muddy waters, such
observations in the wild are not easily possible.

**Life Cycle**: An egg-layer. It often spawns in temporary rainwater pools in coastal Tamilnadu.

**Human Significance**: Due to its size and abundance, *Mystus gulio* is often caught for food. Significant catches are reported from Gangetic estuary, Chilka Lake (Orissa) and Kerala backwaters. In Tamilnadu, however, due to its scavenging habits, especially of human feces, local people tend to abhor the fish and accept it only during lean season.

**Survey Method**: Cast nets and dragnets may be useful in shallow waters. Where quite abundant, hook and line can be used. Seasonal availability can be monitored at the local fish markets wherever the species is caught for food. Relative abundance in any given water body is best assessed by following fishermen and observing their catch.

**Suggested Student Projects**: The long-whiskered catfish can be easily maintained in captivity. Students may attempt keeping individuals in cement, glass or plastic tanks and observe their feeding and general behaviour. Live observations in the wild are more difficult due to the nature of habitat that the species inhabits.

It has been felt that the presence of the species in murky waters where other species are absent is a sort of bio-indication of the health of the habitat. Long-whiskered catfish is known to be a species tolerant of organic pollution. The levels of tolerance that the species exhibits can be locally monitored. Wherever the fish exists, water samples can be easily analysed for smell, colour/clarity, sediment load and presence of other microscopic plants and animals.

**Local Names**: Nuna-tengra (Bengali); Kala-tengra (Hindi); Vella-koorai and Kadakelethi (Malayalam); Singati (Marathi); Kontia (Oriya); Naikeluttee, Irunkeluttee, Kattai-keluttee and Uppang-keluttee (Tamil).
Striped Dwarf Catfish
*Mystus vittatus*: Bagridae

One of the most common of the smaller catfishes found in all sorts of freshwater habitats in India. The silvery colouration with clear fins identifies this catfish. Individuals occurring in muddy waters tend to appear golden when freshly caught.

**Morphological Characters:** A typical small catfish (21 cm) with forked tail distinguished from the former species by its sleeker build, longer barbels and more glassy appearance. The blue-black lateral bands, numbering about five that run along the sides of the catfish are often subdued and not striking in the adults. Some individuals have a black spot behind the gill covers. The species bears four pairs of barbels. One of the two pairs of barbels on upper lip extends well beyond the pelvic fins. Spines on the pectoral fins stronger than that on dorsal fin. Young are more strikingly coloured than adults.

When seen in clear water, the flashing silvery sides and the wriggling movement distinguish the catfish from other smaller species. It moves closer to the bottom. It is active at night.

**Related Taxa:** The species most similar in appearance to *Mystus vittatus* is *Mystus montanus*. However, the latter has fewer bands along the sides and a black spot near the tail in addition to the one behind gill covers.

**Diversity:** The family Bagridae is widely distributed in the freshwaters of Asia and Africa. It comprises 27 genera. In India, 6 genera and 30 species represent the family Bagridae, of which 19 are in the genus *Mystus*. Sub-specific diversity in *Mystus gulio* is not known.

**Distribution:** An oriental species. Occurs in India, Pakistan, Bangladesh, Nepal, Sri Lanka, Myanmar and Thailand. The species is common and widespread in India.

**Habitat Preference:** The striped dwarf catfish inhabits flowing and stagnant freshwater including those which are tidal.
Commonly caught in channels along rice fields.

**Adult Behaviour:** Adults are not gregarious and can be seen in clear waters moving about solitarily. Easily caught on hook and line in muddy waters. The catfish is generally of mild temperament and can be easily maintained in small sized aquariums with other species of smaller fish. Being a bottom dweller, it generally moves towards the surface along the sides or rocks.

**Life Cycle:** An egg-layer that spawns in shallow water and rainwater pools.

**Human Significance:** Being common and abundant, it is caught in large numbers as food. The species is listed as one of fishery value though small in size.

**Survey Method:** As with the other catfishes described already. In clear shallow water, the catfish can be observed using a light at night. The patterns of foraging and territoriality are often easily seen.

**Suggested Student Projects:** The patterns of distribution and breeding can be studied by students. Breeding is best observed in glass aquariums when affordable. Students can also document the variation in colour exhibited by the species with age and habitat.

**Local names:** Singorah and Tengara (Assamese); Tengra (Bengali); Kuggur and Palwa (Hindi); Chillan, Kallencoori and Ettachulli (Malayalam); Kontia (Oriya); Kabakander (Punjabi); Nattakeluthi, Keluthi, Auppan-keluthi, Sonan-keluthi and Kilaru (Tamil); Euku jella and Erra jella (Telugu).

**Magur**

*Clarias batrachus*: Clariidae.

A medium-sized air-breathing catfish (46 cm) with a rather cylindrical body quite resembling the common Indian snakeheads (*Channa* sp) in overall appearance. The presence of long barbels identifies the catfish.
**Morphological Characters:** Distinguished from most other species of freshwater catfishes by the dorsal and anal fins extending up to the tail. The caudal fin is distinct and rounded. Four pairs of *barbels* are present. Spines are found on the pectoral fins.

Overall colouration is brown with a bluish or greenish gloss, especially on the dorsal surface. Underside pale pinkish brown. White spots on sides are distinct. Fins greenish. The dorsal and anal fins bear red margins.

**Related Taxa:** All species of *Clarias* tend to resemble each other considerably. *C. batrachus* can be distinguished from the other two Indian species by the greater distance between the end of the head and anterior end of dorsal fin. *C. dayi* is known only from Kerala and is much smaller (17.5 cm). *C. dussumieri*, widespread in peninsular India, is also smaller (25 cm).

**Diversity:** The family Clariidae consists of 15 genera. Two genera including *Horaglanis* are found in India. Thirty two species are known under the genus *Clarias* of which 3 are found in India. The genus *Horaglanis* is unique consisting of just one species of blind catfish and endemic to Kerala.

**Distribution:** An oriental species known from India, Pakistan, Nepal, Bangladesh and all the way to the Philippines. Widespread in India.

**Habitat Preference:** Both fresh and brackish waters. This catfish has a preference for swamps and canals lined with aquatic plants bordering rice fields. Being an air-breathing catfish, the species can survive in fairly muddy, shallow and sewage waters.

**Adult Behaviour:** A catfish which stays buried in debris and mud and not easily seen. Wriggling, serpentine movement enables the species to move even on ground for short distances. When handled, it lashes aggressively and can easily inflict painful stabs using its pectoral spines. Larger individuals are difficult to handle being both aggressive and slimy.
Life Cycle: An egg-layer known to spawn in July-August during the rains. It breeds in ponds, tanks and inundated rice fields. It also migrates locally during the rains in search of appropriate spawning grounds. Maturity is attained after a year. The species is regularly cultured for fisheries and often artificially induced to breed.

Human Significance: A catfish commercially exploited as food. Cultured individuals are stocked at fairly high densities of 2500–100,000 per hectare. The flesh is highly priced for its nourishing qualities and medicinal value (enables quick recovery from prolonged illness). It has been used in laboratories for a number of hormonal studies also.

Survey Method: As with other catfishes. Since the species is more of a bottom-dweller, dragnets and hook and line will be best suited. In Kerala, individuals that shelter amongst reeds and aquatic plants bordering rice fields are sometimes dug up while the channels are widened.

Suggested Student Projects: If locally cultured, students may visit the facility and observe sexing and induced breeding. Field studies are difficult considering the kind of habitat the species lives in. Local fishermen can help in assessing distribution and abundance in the various habitats. Being an air-breathing catfish, the species may help in monitoring water quality wherever it occurs.

Local Names: Magur and Maghur (Assamese); Magur and Maghur (Bengali); Wagur, Manguri and Mangur (Hindi); Halimeena (Kannada); Yeri-vahlay, Musi and Muzhi (Malayalam); Magurah and Maguro (Oriya); Kugga (Punjabi); Masarai and Karupputhelai (Tamil); Marpoo and Marpulu (Telugu).

Stinging Catfish
Heteropneustes fossilis: Heteropneustidae

A small to medium sized (30 cm) freshwater catfish, readily
identified by its black colouration and eel-like appearance. **Barbels** are well developed. A species best known for its extremely painful stab.

**Morphological Characters:** Body cylindrical and long. The four pairs of **barbels** are almost equal in length. Dorsal fin is reduced and leaf-like. The species lacks the adipose fin giving the dorsal surface a fin-less appearance. Caudal fin small and rounded. Anal fin long and reaching the tail. Spines are present on the pectoral fins. Young are reddish or brown in overall colouration.

**Related Taxa:** The species can be easily identified. The nearest relative of the species that is known in India is *H. microps*. The latter is however distinguished by the anal fin being fused with the caudal fin.

**Diversity:** The family Heteropneustidae is represented by a single genus *Heteropneustes* and two species *H. fossilis* and *H. microps*.

**Distribution:** The family is Oriental extending till Laos in the east. *H. fossilis* is known from India (including Andaman and Nicobar Islands), Pakistan, Sri Lanka, Bangladesh, Myanmar, Thailand and Laos.

**Habitat Preference:** Freshwater ponds, lakes and rain pools. Occasionally also brackish water. Being an air-breather it can stay in almost any kind of water.

**Adult Behaviour:** The species is not aggressive moving about the bottom amongst other species. It is very active at night. It likes to hide amongst debris and cavities. Adults are capable of leaping out of water. Young are more active swimming amongst aquatic plants. In clear shallow waters, adults are easily observed with lights at night. It is known to occur in large shoals in appropriate habitats.

**Life Cycle:** An egg-layer, it spawns in pools during the rains. It prefers swamps for laying eggs. Individuals are sexually mature after a year and at a size between 5.5 cm (male) and 12 cm
Eggs are adhesive sticking to underwater surfaces. Induced breeding is also possible with the species. The stinging catfish is known to undergo long summer sleep within cracked soil during dry seasons.

**Human Significance:** The stinging catfish is a species highly valued as food and medicine. During summer, 90% of all fish that people in West Bengal consume are of this species. The catfish is regularly cultured and stocked by fishermen in many parts of the country.

**Survey Method:** As with the other catfishes. Most readily caught in nets. Survey of fish catches and local markets can be useful while assessing the availability of the species. In areas prone to flooding, floodwater brings with it large numbers of the species, both young and adults.

**Suggested Student Projects:** If cultured locally, students can observe sexing, induced breeding, spawning and development. In clear waters, adults can be observed at night with lights. Stinging catfishes are easily maintained in aquariums where they can be observed for feeding, territoriality and breeding.

**Local Names:** Singee and Sheenee (Assamese); Singhi (Bengali); Singhi (Gujarati); Kamachsinghi, Bitchu, Talia, Singhi (Hindi); Kappathede, Kappershode, Seruva and Sinimeen (Kannada); Kahree-meen, Kadu, Mooya and Kari (Malayalam); Bitchukamacki (Marathi); Singhi (Oriya); Lahoord and Nullie (Punjabi); Thaylee and Thalimeen (Tamil); Ingilayee, Mapujella and Marpu (Telugu).

Einstein's physics of the 1920s was not only an exercise in administration and the holding of professorships, however. It was also play. With Mühssam he measured the diameter of capillaries; with Goldschmidt he invented a hearing aid; and with Szilard several refrigerating devices. Jointly with a Dutch firm, the N V Nederlandsche Technische Handelsmaatschappy 'Giro', Einstein also held a patent for a gyrocompass (Deutsches Reichs Patent 394677) [M2]. He did the work on this device in the mid-1920s.

From: Abraham Pais – Subtle is the Lord.