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Review Paper

Overviews on Diversity of Fish

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Abstract

Fish have great diversity and hence they can be classified in different categories. "Fish" generally refer to several aquatic animals but actually all of them are not fish, such as starfish, shellfish, cuttlefish, jellyfish and crayfish. Jawlesh fish are the most primitive fish. In deed, the ancestors of cartilaginous fish (having a cartilaginous skeleton) were the bony animals and they developed paired fins firstly. Bony fish are categorized into the lobe finned and ray finned fish. Teleost fish are the most 'modern' (advance). As regard to size, Paedocypris progenetica is the smallest fish. Gobies have the shortest life span and they are small coral reef-dwelling fish. Only 58% of extant fish are salt water, while a disproportionate 41% are fresh water fish and remaining 1% is anadromous fish. Groupers are protogynous hermaphrodites, who school in harems of 3 to 15 females. Fish adopt a variety of strategy for nurturing their brood, e.g., shark differently adopts three protocols with brood. Many fishes are food opportunists or generalists as they eat whatever they get easily. Fishes with four eyes have eyes above the top of head which are divided in two different parts, so that the fish can see below and above the water surface simultaneously. Seahorses are the slowest-moving fishes. So called the 'toxic fishes' are able to produce strong toxins in their bodies. Moreover, there are commercial food fish, recreational sport fish, decorative aquarium fish and tourism fish. As the most vertebrate species have brain-to-body weight ratios, fish also have the relative brain weights of vertebrates.

Keywords: Fish, fish diversities/categories, fish species.

Introduction

"Fish" denotes any non-tetrapod craniate (an animal with a skull and mostly with a backbone) that has gills, and whose limbs (if any) are fin-shaped[1]. Unlike mammals or birds, fish are not a clade but they are a paraphylectic collection of taxa, including jawless, skeletal and cartilaginous types (e.g., hagfish, lampreys, sharks and rays, ray-finned fish, coelacanths and lungfish)[2-3]. The lungfish and coelacanths are closer relatives of tetrapods (e.g., mammals, birds, amphibians) than the other fish (e.g., ray-finned fish or sharks). So, the last common ancestor of all fish is also an ancestor to tetrapods. However, the paraphyletic groups are no more in modern systematic biology, so the term "fish" as a biological group must not be used.

"Fish" generally refer to several aquatic animals but actually all of them are not fish, such as starfish, shellfish, cuttlefish, jellyfish and crayfish. During 16th century, though the biologists did not make a distinction, the natural historians classified also seals, whales, amphibians, crocodiles, even hippopotamuses and a host of aquatic invertebrates, as the 'fish'. But as per the definition of "fish", all the mammals, including Cetaceans (e.g., whales and dolphins) are not fish. Particularly in aquaculture, the true fish are called "finfish" (or fin fish) to differentiate them from other animals. An ecothermic fish has a streamlined body for rapid swimming that extracts oxygen from water by using gills or that uses an accessory breathing organ to breathe oxygen. This fish has two sets of paired fins, usually one or two (rarely three) dorsal fins, an anal fin and a tail fin. This also bears jaws and skin (that is usually covered with scales), and lays eggs. There is exception in each of these criteria. For example, tuna, swordfish and some species of shark show some warm-blooded adaptations. They can heat their bodies significantly, and their streamlining and swimming performance varies from fish (e.g., tuna, salmon and jacks that can cover 10-20 body-lengths/second) to species (e.g., eels and rays that swim not more than 0.5 body-lengths/second)[1]. Several groups of freshwater fish take oxygen from air and water with the help of different structures in them. The lungfish have paired lungs like those of tetrapods, and gouramis have 'labyrinth organ' that do similar functions; however, many catfish (e.g., *Corydoras*) take oxygen through the stomach or intestine[4].

The fins have very variable body shape and arrangement, showing un-fishlike forms of anglerfish, gulpers, pufferfish and seahorses. Similarly, the fish skin surface can be naked (as seen in moray eel) or it may be covered with scales known as placoid (typical of shark and ray), ganoid (different fossil fish but also living gars and bichirs), cosmoid (fossil lungfish and coelacanths), cycloid and ctenoid (last two are found on most bony fish). Many fish still live on land. The mudskippers feed and interact with one another on mudflats, and go underwater to hide in their burrows[1]. *Phreatobius cisternarum* (catfish) lives underground, and in phreatic habitats, and its relative lives in waterlogged leaf litter[5-6]. Furthermore, there are many different shapes and sizes of fish. The whale shark may have the large

size of about 17 m (52 ft), while the stout infant fish may have the tiny size of about 8 mm (0.3 inch)[1].

Fish have great diversity and hence they can be classified in different categories. Though fish species have been discovered, about 250 new ones are still discovered every year. As per the data of FishBase, 32,100 fish species had been described by September, 2011. This is more than the combined total of all other vertebrates, i.e., mammals, birds, amphibians and reptiles[1]. Now a days, the documentation of biodiversity has become very important aspect of science due to various environmental influences. Fish diversity of any regime has great significance in assessment of that zone reference to environment and pollution, as well as it contributes to the necessary information for fisheries. Many fish species may be the bio-indicators as well[7]. The fish diversity of Mahanadi river suggests that this river is endowed with a variety of endemic fish species. Number of these fish species are significantly considered ornamental species. The economic potential of these ornamental fishes may be used for the domestic market in the first place for aquarium purpose[8]. Now, there is a great need to adopt rational methods and new technology in the fishing towards the conservation of fish diversity of several rivers like Mahanadi. A few effective measures have been suggested for this purpose. The management measures aimed at conserving freshwater fishes should be part of fishery policies of Governments. The broodstock maintenance centres and hatcheries should be established exclusively for endangered and critically endangered indigenous fishes for their *in situ* conservation. Investigation of invasive nature of exotic fish species in the natural habitats should be done to establish the nature of their natural breeding populations and the extent to which their feed habits overlap with endemic population of fish[8-11].

Diversity of Fish

According to Species:

Jawless fish: They are the most primitive fish. There is debate whether they are really fish or not. The jawless fish have no jaw, no scales, no paired fins and no bony skeleton. Their skin is smooth and soft to touch, and they are very flexible. They possess an oral sucker instead of jaw. They use oral sucker to fasten on to other fish and then use their rasp-like teeth to grind through their host's skin into the viscera. The jawless fish inhabit both fresh and salt water environments. Some are anadromous, moving between both fresh and salt water habitats[1]. The extant jawless fish are either hagfish or lamprey. The juvenile lamprey feed by sucking up mud containing microorganisms and organic debris. The lamprey has well developed eyes, while the hagfish has only primitive eyespots. The hagfish coats itself and carcasses it finds with noxious slime to deter predators and periodically ties itself into a knot to scrape the slime off. The hagfish is the only invertebrate fish and the only animal which has a skull but no vertebral column[5]. It has two brains, four hearts and a paddle-like tail[6].

Cartilaginous fish: They have a cartilaginous skeleton; however, their ancestors were bony animals and were the first fish to develop paired fins. The cartilaginous fish do not have swim bladders. Their skin is covered in placoid scales (dermal denticles) which are as rough sandpaper. Because cartilaginous fish do not have bone marrow, the spleen and special tissues around the gonads produces red blood cells (RBCs). Their tails can be asymmetric, with the upper lobe longer than the lower lobe. Some cartilaginous fishes possess an organ called "Leydig's organ", which also produces RBCs. There are over 980 species of cartilaginous fishes. They are sharks, rays and chimaera[1].

Bony fish: They include the lobe finned and ray finned fishes. The lobe finned fish is the class of fleshy finned fish, consisting of lungfish and coelacanths. They are bony fish with fleshy, lobed paired fins, which are joined to the body by a single bone. These fins evolved into the legs of the first tetrapod land vertebrates, amphibians. Ray finned fish is so-called because it possesses lepidotrichia or 'fin rays'; its fins being webs of the skin supported by bony or horny spines ('rays'). There are three types of ray finned fish: chondrosteans, holosteans and teleosts. The chondrosteans and holosteans are primitive fishes sharing a mixture of characteristics of teleosts and sharks. The holosteans are closer to teleosts and further from sharks in comparison with the other chondrosteans[1].

Teleosts: They are the most advanced or 'modern' fishes. They are overwhelmingly the dominant class of fishes with nearly 30,000 species, covering about 96% of all extant fish species. They are ubiquitous throughout the freshwater and marine environments from deep sea to the highest mountain streams. They include nearly all the important commercial and recreational fishes. Teleosts have a movable maxilla and premaxilla, and corresponding modifications in the jaw musculature. These modifications make it possible for teleosts to protrude their jaws outwards from the mouth. The caudal fin is homocercal, meaning the upper and lower lobes are about equal in size. The spine ends at the caudal peduncle, distinguishing this group from those in which the spine extends into the upper lobe of the caudal fin[12]. Rosefish, swordfish, eel and seahorse are the some examples of the teleost fish[1].

According to Size: *Paedocypris progenetica* is the smallest fish species. This is a type of minnow that lives in the dark-coloured peat swamps of the Indonesian island of Sumatra. The females of this species have a standard length of 7.9 mm (0.31 inch) at maturity[13]. Until recently, this was the smallest of all known vertebrates. However, a minute Papua New Guinea frog, *Paedophryne amauensis*, with a standard length of 7.7 mm (0.30 inch) has been found. The slender Indonesian fish may still be the smallest vertebrate by weight. The male individuals of the anglerfish species *Photocorynus spiniceps* are 6.2 to 7.3 mm long at maturity, and thus could be claimed as an even smaller species. However, these males do not survive on their own merits but only by sexual parasitism on the larger female.

Another very small fish is the stout infant fish, a type of goby. As per the Guinness Book of World Records, the sinarapan (also a goby) is the world's smallest commercially harvested fish[14]. This is found in Philippines and has an average length of 12.5 mm (0.49 inch). This is threatened by overfishing. The largest fish is the whale shark. It is a slow moving filter feeding shark with a maximum published length of 20 m (66 ft) and a maximum weight of 34 tonnes. The whale sharks can live up to 70 years. The heaviest bony fish is the ocean sunfish. It can weigh up to 2,300 kg (5,100 lb). It is found in all warm and temperate oceans. The longest bony fish is the king of herrings. Its total length may be 11 m (36 ft), and it can weigh up to 272 kg (600 lb). It is a rarely seen oarfish found in all the world's oceans, and is present at the depths of 20 m (66 ft) to 1,000 m (3,300 ft)[1].

According to Life Span: The gobies are some of the shortest-lived species. They are small coral reef-dwelling fish. However, the rockfish are some of the longest-lived[1]. The shortest lived fish is the seven-figure pygmy goby, that lives for at most 59 days. This is the shortest lifespan for any vertebrate[15]. The short lived fishes have particular value in genetic studies on aging. The ram cichlid is used in laboratory studies because of its ease of breeding and predictable aging pattern[16]. The longest-lived fish is the 205 years reported for the rougheye rockfish, *Sebastes aleutianus* (found offshore in the North Pacific at 25-900 meters). This fish exhibits negligible senescence[17]. The maximum reliably reported age for a goldfish is 41 years. The orange roughy may be the longest living commercial fish, with a maximum reported age of 149 years. The sport fish (Atlantic tarpon) is one of the longest living, with a maximum reported age of 55 years. Some of the longest living fishes are living fossils, e.g., green sturgeon. This species is among the longest living species found in freshwater, with a maximum reported age of 60 years. This is also among the largest fish species found in freshwater, with a maximum reported length of 2.5 meters (8.2 ft) and a maximum reported weight of 159 kg. Another living fossil is the Australian lungfish; the individual has lived in an aquarium for 75 years, and is the oldest fish in captivity. As per the fossil records, the Australian lungfish has hardly changed for 380 million years. Among the gobies, small coral reef-dwelling fish is some of the shortest lived fishes with the seven-figure pygmy goby living at most for 59 days. The rockfish is some of the longest living fish with the rough eye rockfish, living for 205 years. The oldest fish in captivity (at least 75 years) is an Australian lungfish. The commercial fish, orange roughy (longest living) may live for about 149 years[1].

According to Habitat: In the oceans, there is 10,000 times more saltwater than there is freshwater in the rivers and lakes. However, only58% of extant fish species are saltwater; 41% are freshwater fish; and remaining 1% is anadromous[18]. This diversity in freshwater species is not surprising as the thousands of separate lake habitats promote speciation. Fish can also be pelagic or demersal. The pelagic fish inhabit the water column away from the bottom, while the demersal fish live on or near the bottom of oceans and lakes. The habitats can also be vertically stratified. The epipelagic fishes occupy sunlit waters down to 200 meters; mesopelagic fishes occupy the deeper twilight waters down to 1,000 meters (3,300 ft); and bathypelagic fish inhabitat the cold and pitch black depths below[1]. Most oceanic species (78% or 44% of all fish species) live near the shoreline. These coastal fishes live on or above the relatively shallow continental shelf. Only 13% of all fish species live in the open ocean, off the shelf. Of these, 1% is epipelagic, 5% are pelagic and 7% are demersal fish[18]. The fish are found in nearly all natural aquatic environments. Most fish, whether by species count or abundance, live in warmer environments with relatively stable temperatures. However, some species survive temperatures up to 44.6°C (112.3°F), while others cope with colder waters. Of the Antarctic convergence, there are over 200 finfish species. Some fish species tolerate salinities over 10%. The world's deepest living fish, *Abyssobrotula galatheae* (a species of cusk eel) lives in the Puerto Rico Trench at a depth of 8,372 meters (27,467 ft). On the other side, the Tibetan stone loach lives at altitudes over 5,200 meters (17,100 ft) in the Himalayas. Some marine pelagic fish range over the vast areas like blue shark fish that lives in all oceans. Other fish are confined to single, small living spaces like bythitid vent fish (e.g., *Thermichthys hollisi*, living around theramal vents 2,400 meters down), or isolated cave fish (e.g., *Lucifuga* in the Bahamas and Cuba or equally isolated desert pupfish living in small desert spring systems in Mexico and the southwest USA)[1].

According to Breeding Behaviour: Groupers (protogynous hermaphrodites) school in harems of 3 to 15 females. When no male is available, the most aggressive and largest females shift sex to male, possibly as a result of behavioural triggers. In very deep water, it is not easy for a fish to find mate. There is no light, so some species depend on bioluminescence. Others are hermaphrodites, that doubles their chances of producing both eggs and sperm when an encounter does occur. The female anglerfish releases pheromones to attract the tiny males. When a male finds her, he bites on to her and never lets go. When a male of *Haplophryne mollis* (anglerfish) bites into the skin of a female, he releases an enzyme which digests the skin of his mouth and her body, fusing the pair to the point where two circulatory systems join up. The male then atrophies into nothing more than a pair of gonads. This extreme sexual dimorphism ensures that, when the female is ready to spawn, she has a mate immediately available. Some sharks like hammerheads are able to breed parthogenetically. The male toadfish 'sing' at up to 100 decibels with their swim bladders to attract mates. The female groupers change their sex to male if no male is available[1].

According to Brooding Behaviour: Fish adopt a variety of strategies for nurturing their brood. For example, the sharks variously follow three protocols with their brood. Many sharks (including lamniformes) are ovoviviparous, bearing their young after they nourish themselves after hatching and before birth, by consuming the remnants of yolk and other available nutrients.

Some such hammerheads are viviparous, bearing their young after nourishing hatchlings internally, analogously to mammalian gestation. Finally, the catsharks and others are oviparous, laying their eggs to hatch in the water. Some animals (predominantly fish like cardinalfish) practice mouthbrooding, caring for their offspring by holding them in the mouth of a parent for extended periods. The mouthbrooding has evolved independently in many different fish families. Others (e.g., seahorse males) practice pouch-brooding, analogous to Australia's kangaroos, nourishing their offspring in a pouch in which the female lays them. The *Cyphotilapia frontosa* female mouthbrooding fry can be seen looking out her mouth. The chain catshark (an oviparous) is laying its eggs to hatch in the water. The great white shark (an ovoviviparous) is gestating eggs in the uterus for 11 months before giving birth. The scalloped hammerhead (a viviparous) bears its young after nourishing hatchlings internally[1].

According to Feeding Behaviour: By three basic methods, the food is accumulated into the mouths of fish i. by suction feeding, ii. by ram feeding and iii. by manipulation or biting. Approximately, all fish species use one of these styles and most use two[1]. Early fish lineages had inflexible jaws limited to little more than opening and closing. The modern teleosts have evolved protusible jaws that can reach out to engulf prey[19]. For example, the protusible jaw of slingjaw wrasse extends into a tube half as long as its body, and with a strong suction it catches prey. The equipment tucks away under its body when it is not in use. In practice, feeding modes lie on a spectrum, with suction and ram feeding at the extremes. Many fish capture their prey using both suction pressures combined with a forward motion of the body or jaw[1]. The cookiecutter shark is a small dogfish which derives its name from the way it removes small circular plugs, looking as though cut with a cookie cutter, from the flesh and skin of cetaceans and larger fish, including other sharks. The cookiecutter attaches to its larger prey with its suctorial lips, and then protrudes its teeth to remove a symmetrical scoop of flesh[20]. Most fishes are food opportunists, or generalists. They eat whatever is most easily available, e.g., the blue shark feeds on dead whales and nearly everything else that wriggles other fishes like cephalopds, gastropods, ascidians and crustaceans. The ocean sunfish prefers jellyfish. Other fishes have developed extreme specializations. Silver arowana (monkey fish) can leap two meters out of the water to capture prey. They usually swim near the surface of water waiting for potential prey. Their main diet consists of crustaceans, insects, smaller fishes and other animals that float on the water surface, for which their draw-bridge-like mouth is exclusively adapted for feeding. The remainings of the small birds, bats and snakes have also been found in their stomachs. The archerfish preys on land-based insects and other small animals by literally shooting them down with the water droplets from their specialized mouths. These fishes are remarkably accurate and the adults almost always hit the target on the first shot. They can bring down insects like grasshoppers, butterflies and spiders on a branch of an overhanging tree, 3 m above the water's surface. This is partially because of the good eyesight, but also due to the ability to compensate for the light refraction when aiming. The triggerfish also uses jets of water to uncover the sand dollars buried in the sand or overturn the sea urchins. The doctorfish (nibble fish) lives and breeds in the outdoor pools of some Turkish spas, where it feeds on the psoriasis affected skin of the patients. This fish is like the cleaner fish in that it only consumes the affected and dead areas of the skin (eat parasites of other fish), leaving the healthy skin for recovery[1].

According to Vision: The four-eyed fishes have eyes raised above the top of head and divided in two parts, so that they can see simultaneously below and above the water surface. These fishes in fact have only two eyes, but their eyes are especially adapted for their surface-dwelling lifestyle. The eyes are positioned on the top of the head, and the fish float at the water surface with only the lower half of each eye under water. The two halves are divided by a band of tissue, and the eye has two pupils connected by part of the iris. The upper half of the eye is adapted for vision in air, the lower half for vision in the water. The lens of the eye also changes in thickness top to bottom to account for the difference in the refractive indices of air versus water. These fishes spend their most time at the surface of water. Their diet mostly consists of the terrestrial insects which are available at the surface. Many species of fish can see the ultraviolet end of the spectrum beyond the violet[1]. The two stripe damselfish, *Dascyllus reticulatus*, has ultraviolet-reflecting colouration which it appear to use as an alarm signal to other fishes of its species[21]. The predatory species can not see this if their vision is not sensitive to ultraviolet. There is further evidence that some fishes use ultraviolet as a 'high-fidelity secret communication channel hidden from the predators, while yet other species use ultraviolet to make social or sexual signals[22]. The mesopelagic fishes live in deeper waters, in the twilight zone down to depths of 1000 meters, where the amount of sunlight available is not sufficient to support the photosynthesis. These fish are adapted for an active life under low light conditions. The barreleyes are a family of small, unusual-looking mesopelagic fishes, named for their barrel-shaped, tubular eyes which are usually directed upwards to detect the silhouettes of available prey. The barreleyes have large, telescoping eyes which dominate and protrude from the skull. These eyes generally gaze upwards, but can also be swivelled forwards in some species. Their eyes have a large lens and a retina with an exceptional number of rod cells, and a high density of rhodopsin (the 'visual purple' pigment); there are no cone cells[23]. Barreleye species, *Macropinna microstoma*, has a transparent protective dome over the top of its head, somewhat like the dome over an airplane cockpit, through which the lenses of its eyes can be seen. The dome is tough and flexible, and presumably protects the eyes from the nematocysts (stinging cells) of the siphonophores from which it is believed the barreleye steals food[23]. The four-eyed fishes feed at the surface of water with eyes that allow it to see both above and below the surface at the same time. The two stripe damselfish can signal secret alarms by reflecting ultraviolet to other fishes of its

species. The barreleye has barrel-shaped, telescopic eyes which are directed upwards, but can also be swiveled forward. The flashlight fish (mesopelagic fish) use a retroreflector behind the retina with photophores to detect the eyeshine in other fishes[1].

According to Locomotion: Seahorses are the slowest-moving fishes. The slowest of these, i.e., dwarf seahorse attains about 5 ft/hour. Among the fasted sprinters are the Indo-Pacific sailfish and black marlin. Both these have been found in a burst at over 110 km/hour (68 mph). For sailfish, that is equivalent to 12 to 15 times their own length per second. The wahoo is perhaps the fastest fish for its size, attaining a speed of 19 lengths/second, reaching 78 km/hour (48 mph). The shortfin mako sharks are fast enough and agile enough to chase down and kill an adult swordfish, but they do not always win. Sometimes in the struggle with a shark, a swordfish can kill it by ramming it in the gills or belly. The shortfin mako's speed has been recorded at 50 km/hour (31 mph) and it can achieve bursts of up to 74 km/hour (46 mph). It can jump up to 9 meters (30 ft) in the air. Due to its speed and agility, this high-leaping fish is sought as game worldwide. This shark is highly migratory. Its exothermic constitution partly accounts for its relatively great speed. The Atlantic bluefin tuna is capable of sustained high speed cruising, and maintains high muscle temperatures so it can cruise in relatively cold waters. A number of species jump while swimming near the surface, skimming the water. The flying fishes have unusually large pectoral fins, which enable the fish to take short gliding flights above the surface of water, in order to escape from the predators. Their glides are typically around 50 meters (160 ft), but they can use updrafts at the leading edge of waves to cover distances of at least 400 meters (1,300 ft). The flying fish was able to stay aloft for 42 seconds by beating the surface of water with its caudal (tail) fin. The mudskipper is a type of walking fish. The walking fishes are often amphibious and can travel over land for extended periods of time. They are able to spend longer times out of water. These fishes may use a number of means of locomotion, including springing, snake-like lateral undulation and tripod-like walking. The mudskipper is probably the best land-adapted of contemporary fish, and is able to spend days moving about out of water and can even climb mangroves, although to only modest heights. Some fish species can walk along the sea floor but not on land, e.g., flying gurnard fish[1].

According to Toxicity: The strong poisons are produced in the bodies of 'toxic fishes'. Both the poisonous fish and venomous fish contain toxins, but deliver them differently. The venomous fishes bite, sting or stab, causing an envenomation. They do not necessarily cause poisoning if they are eaten, since the digestive system often destroys the venom. By contrast, the digestive system does not destroy poisonous fish toxins, making them poisonous to eat. The puffer fish is the most poisonous fish. This is the second most poisonous vertebrate after the golden dart frog. It paralyzes the diaphragm muscles of human victims, who can die from suffocation. In Japan, skilled chefs use parts of a closely related species, the blowfish to create a delicacy called "fugu", including just enough toxin for that 'special flavour'. The spotted trunkfish is a reef fish which secretes a colourless ciguatera toxin from the glands on its skin when touched. The toxin is only dangerous when ingested, so there is no immediate harm to divers. However, the predators as large as nurse sharks can die as a result of eating a trunkfish. The giant moray is a reef fish at the top of the food chain. Like many other apex reef fish, it is likely to cause ciguatera poisoning if eaten[1]. The outbreaks of ciguatera poisoning in the 11th to 15th centuries from large, carnivorous reef fish, caused by the harmful algal blooms, could be a reason why Polynesians migrated to Easter Island, Hawaii and New Zealand[24]. At least 1200 species of venomous fishes are prevalent, and more venomous fishes are found than the venomous snakes. In fact, there are more venomous fishes than the combined total of all other venomous vertebrates[25]. The venomous fishes are found in almost all habitats around the world, but mostly in the tropical waters. They wound over 50,000 people every year. They carry their venom in the venom glands and use various delivery systems like spines or sharp fins, barbs, spikes and fangs. The venomous fishes tend to be either very visible, using flamboyant colours to warn enemies, or skillfully camouflaged and may be buried in the sand. Apart from the defense or hunting value, the venom helps bottom dwelling fish by killing bacteria that try to invade their skin. The most known venomous fishes are the reef stonefish. They have remarkable ability to camouflage themselves amongst rocks. They are an ambush predators that sit on the bottom waiting for prey to approach. Instead of swimming away if disturbed, they erect 13 venomous spines along their back. For defense, they can shoot venom from each or all of these spines. Each spine is like a hypodermic needle, delivering the venom from two sacs attached to the spine. The stonefish has control over whether to shoot its venom, and does so when provoked or frightened. The venom results in severe pain, paralysis and tissue death, and can be fatal if not treated. Despite its formidable defenses, the stonefish has predators. Some bottom feeding is done by rays and sharks with crushing teeth feed on them, as does the Stokes' sea snake. The beautiful lionfish (a coral reef fish) is also venomous. Unlike stonefish, the lionfish can only release venom when something strikes its spines. Although not native to the USA coast, the lionfish has appeared around Florida, and have spread up the coast to New York. It is attractive aquarium fish, sometimes used to stock ponds, and may have been washed into the sea during a hurricane. The lionfish can aggressively dart at scuba divers and attempt to puncture their facemask with their venomous spines. The stargazer, *Uranoscopus sulphureus,* is also a venomous fish. The stargazer buries itself and can deliver electric shocks as well as venom. It is a delicacy in some cultures (cooking destroys the venom), and can be found for sale in some fish markets with the electric organ removed. They have been called 'the meanest things in creation'. The stingray envenomations can occur to people who wade in shallow water and tread on them. This can be avoided by shuffling through the sand or stamping on the bottom, as the rays detect this and swim away. The stinger usually breaks off in the wound. It is barbed, so it

can easily penetrate but not so easily be removed. The stinger causes local trauma from the cut itself, pain and swelling from the venom, and possible later infection from bacteria. Rarely, the arteries are severely damaged or death can result. The treatment for venom stings usually includes the application of heat, using water at temperatures of about 45°C (113°F), since heat breaks down most complex venom proteins[1].

According to Human Use: Fishes are sought by humans for their value as commercial food fish, recreational sport fish, decorative aquarium fish, and in tourism, attracting snorkelers and Scuba divers. Throughout human history, the important fisheries have been based on the forage fish. The forage fish are small fish which are eaten by larger predators. They usually school together for protection. The typical ocean forage fish feed near the bottom of the food chain on plankton, often by the filter feeding. They include the family Clupeidae (e.g., herring, sardine, menhaden, hilsa, shad and sprat fish), as well as anchovies, capelin and halfbeaks. The important herring fisheries have existed for centuries in the North Atlantic and North Sea. Likewise, the important traditional for anchovy and sardine fisheries have operated in the Pacific, Mediterranean and southeast Atlantic. The world annual catch of forage fish in recent years has been around 25 million tonnes, or one quarter of the world's total catch[1]. Higher in the food chain, Gadidae (e.g., cod, pollock, haddock, saithe, hake and whiting fish) also supports important fisheries. Concentrated initially in the North Sea, the Atlantic cod was one of the Europe's oldest fisheries, later extending to the Grand Banks[26], declining numbers led to international 'Cod Wars', and eventually the virtual abandonment of these fisheries. Now, the Alaska pollock supports an important fishery in the Bering Sea and North Pacific, yielding about 6 million tones; while the cod amounts to about 9 million tonnes. The yellowfin tuna are now being fished as a replacement for the depleted southern bluefin tuna. The Atlantic cod fisheries have collapsed. The koi and goldfish have been kept in decorative ponds for centuries in China and Japan. The food fish, oily fish, whitefish, farmed fish and the fish used for medicinal purposes are also consumed by the humans. The recreational and sport fishing are big business. The USA saltwater fishers spend about $30 billion annually and support 350,000 jobs. Some of the more popular recreational and sport fishes include bass, marlin, porgie, shad, mahi-mahi, smelt whiting, swordfish and walleye. The fish keeping is another popular pastime, and there is a large international trade for aquarium fish. Snorkeling and Scuba divings attract millions of people to beaches, coral reefs, lakes and other water bodies to view the fish and other marine lives[1].

Others: Fishes hold the records for relative brain weights of vertebrates. Most vertebrate species have similar brain-to-body weight ratios. The deep sea bathopelagic cusk-eel (*Acanthonus armatus*) has the smallest ratio of all known vertebrates. However, the elephantnose fish (an African freshwater fish) has the largest ratio of all known vertebrates. The *Sarpa salpa* (a species of bream) is recognizable by the golden stripes running the length of its body and can induce LSD-like hallucinations, if it is eaten. These widely distributed coastal fish became a recreational drug during the Roman Empire and are called 'the fish that make dreams' in Arabic. Other hallucinogenic fishes are *Siganus spinus* (fish that inebriates in Reunion Island) and *Mulloidichthys samoensis* (chief of ghosts in Hawaii)[1].

Conclusion

At present, the documentation of biodiversity has become very important aspect due to different environmental influences. The fish diversity of any regime has great significance in assessment of that zone reference to environment and pollution, as well as it contributes to the necessary information for fisheries. Many fishes may be the bio-indicators also. In deed, the fish have great diversity and so they are categorized in different ways. As per the data of FishBase, 32,100 fish species were described by September, 2011. This is more than the combined total of all other vertebrates, i.e., mammals, birds, amphibians and reptiles. The ancestors of cartilaginous fish were the bony animals and they developed paired fins firstly. Bony fish are categorized into the lobe finned and ray finned fish. Teleost fish are the most 'modern'. According to the size, *Paedocypris progenetica* is the smallest fish. Gobies have the shortest life span and are small coral reef-dwelling fish. Groupers are protogynous hermaphrodites, who school in harems. Fish adopt various strategies for nurturing their brood, e.g., shark differently adopts three protocols with brood. Many fishes are food opportunists or generalists as they eat whatever they get easily. Four-eyes fises have eyes above the top of head which are divided in two different parts, so that the fishes can see below and above the water surface simultaneously. Seahorses are the slowest-moving fishes. The 'toxic fishes' are able to produce strong toxins in their bodies. There are also fishes like commercial food, recreational sport, decorative aquarium and tourism fishes. The fish also have the relative brain weights of other vertebrates. Now, there is a great need to adopt rational methods and new technology in the fishing towards the conservation of fish diversity.

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