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Loss of Diversification of fish species in Meerut region: A Threat to natural fauna

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Abstract: *The freshwater aquatic biodiversity is depleting alarmingly due to introduction of exotic species, diseases, habitat loss, pollution, overexploitation and other anthropogenic activities. Loss of biodiversity is severe in freshwater ecosystem which represents a meager of 0.1 percent of earth's water wealth, yet they harbor 40 percent of the fish species so far recorded. Nearly 20 percent of the world's freshwater fish fauna is already extinct or is on the urge of extinction. The potential risks not only affect the biodiversity but also the socioeconomic aspects of the human community that depend on aquatic ecosystems for their sustenance. The paper reviews the loss of diversification of Fish species and their current availability status in the market.*
Key words: *Diversity, Freshwater ecosystem, Threat.*

I. Introduction

Ichthyodiversity refers to variety of fish species; depending on context and scale, it could refer to alleles or genotypes within piscian population. Biodiversity is also essential for stabilization of ecosystems and for protection of overall environmental quality. India is one of the megadiversity countries in the world and occupies the ninth position in terms of freshwater megabiodiversity (Mittermeir & Mittermier, 1997). The Indian fish population represents 11.72% of species, 23.96% of genera, 57% of families and 80% of the global fishes. Out of 2200 species so far listed, 73 (3.32%) belong to the cold freshwater regime, 544 (24.73%) to the warm fresh waters domain, 143 (6.50%) to the brackish waters and 1440 (65.45%) to the marine ecosystem.

Aquaculture has been an important vector in the introduction, transfer and spread of aquatic diseases and parasites. The high risk of disease transmission and parasite infestation among species has increased the level of uncertainity which farm managers have to contend with to develop the industry. Three major reasons for the loss of diversification and loss to aquacultural practices:

- Parasite infestations
- Bacterial, Viral, Fungal and Protozoan diseases
- Introduction of Exotic species

Fishes are source of good quality protein that we can easily and completely digest. In addition, fishes are also excellent sources of polyunsaturated fatty acids. The status of health depends on the fish's genetic composition, prior history and the quality of the present environment for both, the fish and the pathogen. Environmental factors that are stressful to fish may actually provide a more optimal environment for pathogenic organisms and consequently increase their virulence. Disease can also be particularly problematic when pathogens and parasites carried by introduced species affect native species. An introduced species may find invading easier if potential predators and competitors have been decimated by disease.

The parasitic fauna, its composition, the incidence and intensity of infestations it produces, are largely determined by the host's mode of life and type of food. Thus the environmental conditions determine the general characters of the parasitic fauna and the health of host fishes.

Fish diseases due to helminth parasite are one of the important problems in fish culture and fish farming. The importance of fish parasites is related directly to the importance of the fish they may affect. Parasites can influence the health of their hosts either directly or making them less resistant to environmental stresses. Some are capable of regulating host populations and they can influence community structure through their effects on different components which can decrease market value of their fish host, while other are of public health significance. Parasites also can be used as biological tags in population studies of fish. A lot of parasites cause severe physiological disturbances and pathological conditions in the host fishes. A majority of freshwater fishes carry heavy infections of parasites which cause deterioration in the food value of fish and may even result in their mortality. Besides these, there are a number of helminth parasites which are transmitted to human beings only through fish.

Parasites are extremely abundant and diverse in nature, representing a substantial portion of global biodiversity. At least 50% of the species living on earth are parasites of some form, considering all viruses and some bacteria

and the eukaryotic species most commonly associated with parasitology, including agents of diseases affecting not only humans, but also livestock, crops, and wildlife (Brooks & Hoberg, 2006). Interestingly, only a small fraction of the existing species is of medical or veterinary importance (Price, 1980; Poulin & Morand, 2004). There are many reasons to include parasites in any biodiversity survey, and indeed to study parasite diversity on its own. For example, parasites have been mentioned several times as elegant and sophisticated biological markers and as contemporary probes of biodiversity (Gardner & Campbell, 1992). Additionally, parasite diversity provides insights into the history and biogeography of other organisms, into the structure of ecosystems, and into the processes behind the diversification of life (Brooks & Hoberg, 2000; Poulin & Morand, 2000, 2004). In this context, parasites have, a dual and conflicting significance because they may regulate host populations, playing a central role in maintenance of genetic diversity and structuring host communities Brooks & Hoberg (2006), and at the same time, they represent treats to human health, agriculture, natural systems, conservation practices, and the global economy (Horwitz & Wilcox, 2005).

An introduced species (exotic) is any species intentionally or accidentally transported and released by man outside its present range (Kottelat and Whitten, 1996). Exotic species of fishes were introduced in many parts of the world for

- Aquarium Keeping
- Sport fishing
- Improving local fishery potential and for broadening species diversity and
- Controlling of unwanted organisms

The exotics are a competition to indigenous fishes for food and habitat. They may prey upon native fishes, introduce new diseases and parasites, resultings in the production of hybrids and cause genetic erosion of indigenous species and degradation of the physicochemical nature of aquatic ecosystems. All this will subsequently lead to loss of biodiversity (Nymann, 1991). During the last several decades over 300 species of exotic fishes have been brought into India for experimental aquaculture, sport fishing, mosquito control and aquarium keeping. A list of the important species introduced in Indian river systems are given in table. Although not many study has been carried out on the impacts of exotic fishes in Indian waters.

Exotic fishes transplanted in India

Species	Home Country	Purpose
A. Game Fishes		
Brown trout (*Salmo trutta fario*)	U.K.	For planting streams, lakes & reservoir
Rainbow Trout (*Salmo gairdneri*)	Srilanka &Germany	For planting streams, lakes & reservoir
Eastern Brook Trout (*Salvelinus fontinalis*)	U.K.	For planting streams, lakes & reservoir
Loch Leven Trout (*Salmo levensis*)	U.K.	For planting streams, lakes & reservoir
Sockeye Salmon (*Oncorhyncus nerka*)	Japan	For planting streams, lakes & reservoir
Atlantic Salmon (*Salmo salar*)	U.S.A	For planting streams, lakes & reservoir
B. Food Fishes		
Golden carp (*Carassius carassius*)	U.K.	Experimental culture
Tench *(Tinca tinca)*	U.K.	Experimental culture
Gourami (*Osphronemus goramy)*	Java & Mauritius	Experimental culture
Common carp *(Cyprinus carpio)*	Sri lanka	Experimental culture
Tilapia *(Oreochromis mossambicus)*	Africa	Experimental culture
Grass carp *(Ctenopharyngodon idella)*	Japan	Experimental culture
Silver carp *(Hypophthlmichthys molitrix)*	Hong Kong	Experimental culture
Tawes *(Puntius javanicus)*	Indonesia	Experimental culture
C. Larvicidal fishes		
Guppy *(Poecilia reticulate)*	South America	Mosquito control
Top Minnow *(Gambusia affinis)*	Italy	Mosquito control
D. Ornamental fishes		
Live bearers	From various countries	Aquarium keeping
Egg layers	From various countries	Aquarium Keeping
E. Unauthorised introduction		
Bighead carp *(Aristichthys nobilis*)	----------	Aquaculture
African catfish *(Clarias gariepinus)*	----------	Aquaculture
Nile Tilapia *(Oreochromis niloticus)*	----------	Aquaculture
Red Tilapia (*Oreochromis sp.)*	----------	Aquaculture
Red Piranha (*Serrasalmus nattereri*)	----------	Aquaculture

Table: Environmental impact of alien fish introductions.

Aquaculture Introduction	Environmental Impact	References
Oreochromis mossambicus	Displaced Gangatic carps, replaced *Puntius dubius* and *Labeo kontius* and now posing threat to *Etroplus suratensis*	Sreenivasan, 1967; Murthy *et al* 1986; Natrajan *et al* 1988; Jhingran, 1991
Osphronemus goramy	Naturalized but ecological implication is minimal	Shetty *et al* 1989
Aristichthys nobilis	Displacement of *Catla* and silver carp, hybridization with silver carp	Singh and Ponniah, 2001
Cyprinus carpio	Displacement of local spp. *Schizothorax, Osteobrama belangiri, Tor putitora* etc	Shetty *et al* 1989; Singh & Das 2006
O. niloticus	reduced catches of indigenous fish species	Mishra *et al* 2000; Sugunan, 2002; Fish Base 2004
Clarias gariepinus	Environmental problem, started appearing in wild posing threat to biodiversity. Risks of hybridization with native fishes, loss to local culturable fishes	Thakur, 1998; Barua *et al* 1999; Mishra et al 2000; Singh and Ponniah 2001 Singh and Mishra 2001a, b; Sugunan, 2002
Carassius auratus	Hybridization with common carp in nature	Shetty *et al* 1989; Sugunan,2002
Hypophthalmichthys molitrix	Naturalized in some reservoirs and displacement of *Catla*	Kaushal, 1991; Pandey, 1997, Singh 2004
Ctenopharyngodon idella	Not known	----
Oncorhynchus mykiss	Unknown	----
Salmo trutta fario	Eradication of local spp.	Sehgal, 1989

S.No	Traits of interest	Implications of aquaculture	Ecological risks
1	Tolerates harsh environment including low salinity, dissolved oxygen and temperature	Low management profile	can gravitate into new environments
2	Water requirement is low as compared to other local culturable species	Can be reared easily in small water bodies including shallow flood plains	Can easily escape in natural water systems especially during flooding
3	Fast growth under natural as well as farm conditions.	High production attracts farmers to adopt culture of this fish.	Out-competes other local species particularly *C.batrachus*
4	Readily accepts variety of cheap feed including slaughterhouse wastes.	Aquaculture in poor quality water and in derelict waters	High chance of disease outbreaks including Zonotic problems.
5	Easily breeds in ponds/tanks and also inundated fields.	Auto stocking is additional benefit to the farmers	Can easily form self-sustaining feral population
6	Brood fish can produce viable eggs and sperms throughout year.	Seed availability easy for aquaculture	Farmers have preference over local *Clarias batrachus* species.

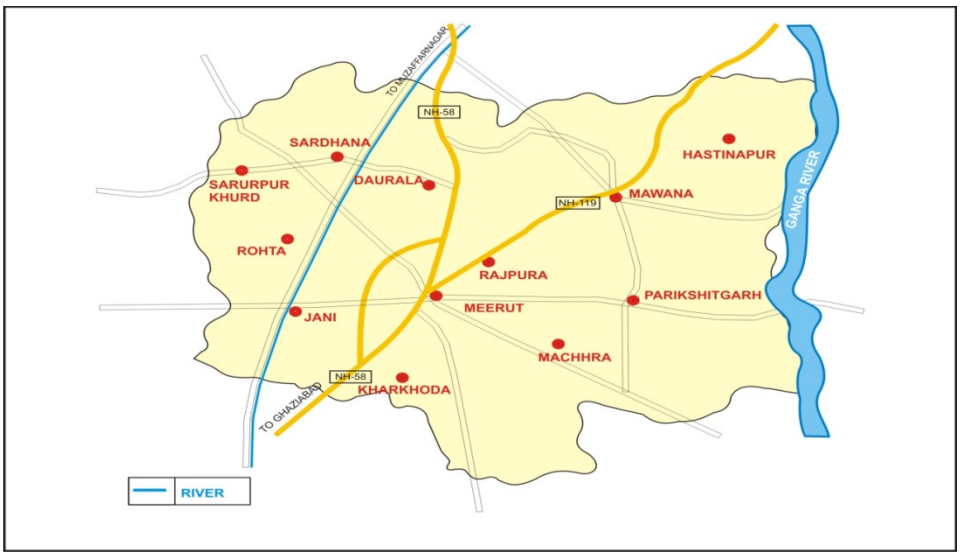

Fig: Map of Meerut showing 12 blocks which covers main fishery sources

Fishes found in Meerut region, their family and the type of diseases reported are given in the list:

FISHES	**FAMILY**	**DISEASES**
Amblypharyngodon mola	Cyprinidae	Protozoa
Amphipnous cuchia	Ophiocephalidae	Worms
Anabas testudineus	Anabantidae	Protozoa and Worms
Bagarius bagarius	Siluridae	Protozoa and Worms
Barilius bendelesis	Cyprinidae	Worms
Barilius bola	Cyprinidae	Worms
Catla catla	Cyprinidae	Protozoa and Worms
Chanda baculis	Centropomidae	Protozoa and Worms
Channa gachua	Ophiocephalidae	Protozoa, worms, bacterial, fungal and viral
Channa marulius	Ophiocephalidae	Protozoa, worms, bacterial, fungal and viral
Channa punctatus	Ophiocephalidae	Protozoa, worms, bacterial, fungal and viral
Channa striatus	Ophiocephalidae	Protozoa, worms, bacteria, fungal and viral
Cirrhinus chaudharyi	Cyprinidae	DD
Cirrhinus mrigala	Cyprinidae	DD
Cirrhinus reba	Cyprinidae	DD
Clarias hybrids	Clariidae	Protozoa,worms,bacterial and fungal
Clupisoma garua	Schilbeidae	Protozoa and Worms
Colisa fasciatus	Anabantidae	Protozoa, worms, bacterial and fungal
Crossocheilus latius	Cyprinidae	DD
Danio devario	Cyprinidae	Protozoa, Worms and Bacteria
Esomus danricus	Cyprinidae	DD
Eutropiichthys vacha	Schilbeidae	Protozoa and Worms
Glossogobius giuris	Gobiidae	Protozoa and Worms
Gudusia chapra	Clupeidae	DD
Hemiramphus gorakhpurensis	Hemiramphidae	DD
Heteropneustes fossilis	Saccobranchidae	Protozoa, Worms and bacterial
Hilsa tenulosa	Clupeidae	Protozoa and Worms
Labeo angra	Cyprinidae	Protozoa,worms,bacterial and fungal
Labeo bata	Cyprinidae	Protozoa,worms,bacterial and fungal
Labeo boga	Cyprinidae	Protozoa,worms,bacterial and fungal
Labeo calbasu	Cyprinidae	Protozoa,worms,bacterial and fungal
Labeo dero	Cyprinidae	Protozoa,worms,bacterial and fungal
Labeo gonius	Cyprinidae	Protozoa,worms,bacterial and fungal
Labeo pangusia	Cyprinidae	Protozoa,worms,bacterial and fungal
Labeo rohita	Cyprinidae	Protozoa,worms,bacterial and fungal
Macrognathus aculeatus	Mastacembelidae	Protozoa and Worms and bacterial
Mastacembalus armatus	Mastacembelidae	Protozoa and Worms and fungal
Mastacembalus pancalus	Mastacembelidae	Protozoa and Worms and fungal
Mystus aor	Siluridae	Protozoa and Worms and Fungal diseases
Mystus bleekeri	Siluridae	Protozoa and Worms and Fungal diseases
Mystus cavasius	Siluridae	Protozoa and Worms and Fungal diseases
Mystus singhala	Siluridae	Protozoa and Worms and Fungal diseases
Mystus tengara	Siluridae	Protozoa and Worms and Fungal diseases
Mystus vittatus	Siluridae	Protozoa and Worms and Fungal diseases
Nandus nandus	Nandidae	Protozoa and Worms and Fungal diseases
Notopterus chitala	Notopteridae	Protozoa and Worms
Notopterus notopterus	Notopteridae	Protozoa and Worms
Ompok bimeculatus	Siluridae	Protozoa and Worms
Osteobrama cotio	Cyprinidae	DD
Pangasius pangasius	Schilbeidae	Protozoa and Worms
Puntius conchonius	Cyprinidae	Protozoa,worms,bacterial ,fungal,viral and nutritional deficiency
Puntius muzaffarpurensis	Cyprinidae	Protozoa,worms,bacterial and fungal and nutritional deficiency
Puntius sarana	Cyprinidae	Protozoa,worms,bacterial and fungal and nutritional deficiency

Puntius sophore	Cyprinidae	Protozoa,worms,bacterial and fungal and nutritional deficiency
Puntius ticto	Cyprinidae	Protozoa,worms,bacterial and fungal and nutritional deficiency
Rasbora daniconius	Cyprinidae	DD
Wallago attu	Siluridae	Protozoa and Worms and viral diseases
Xenentodon cancila	Belonidae	Protozoa and Worms

DD- Data deficient
(List compiled from various published sources)

There are many fishes which were earlier found in Meerut very easily but now they are rarely seen in the market. As discussed above, reasons could be many but the problem is same i.e. the extinction of many species. A study was conducted for two years; the data was recorded and summarized in the form of table to show a list of fish species which are economically important to mankind but now hardly available in the region.

RARELY AVAILABLE FISHES

Fish	**Family**	**Economic Importance**
Gudusia	Clupeidae	Food
Hilsa tenulosa	Clupeidae	Food, Commercial, Experimental
Amblypharyngodon mola	Cyprinidae	Food
Aspidoparia	Cyprinidae	Food, minor commercial
Chagunius	Cyprinidae	Food, commercial, game fish
Chela	Cyprinidae	Food, aquarium
Rasbora	Cyprinidae	Food, aquarium, commercial
Botia	Cobitidae	Food, aquarium
Rita rita	Bagridae	Food, commercial
Bagarius	Sisoridae	Food
Chaca	Chacidae	Food
Ailia	Schlbeidae	Food, commercial
Silonia	Schlbeidae	Food, commercial, game fish
Clarias gariepinus	Clariidae	Food
Aplochielus	Cyprinodontidae	Food, aquarium, commercial
Rhinomugil	Muglidae	Food, commercial, aquaculture
Chanda	Centropomidae	Aquarium, food
Badis badis	Nandidae	Food, aquarium

II. Conclusion

A large number of diseases occur in fish due to nutritional deficiency, parasitic infestation, over harvesting or unhygienic condition of water. Current trends in intensive fish farming lay emphasis on the prevention rather than treatment of fish diseases. Therapy can be applied to fish in three ways: External treatment, Systemic treatment, Parenteral treatment. India is one of the mega diversity countries with respect to freshwater species. There are plenty of culturable species and further introduction of exotic species is not required. India has to develop baseline data on the natural population potential of the indigenous species. Extreme risk areas should be indentified the effective monitoring and conservation programmes. The water bodies harboring endangered fishes must be declared as fish sanctuaries or aquatic diversity management areas.

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