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Factors Posing Threat to the Endangered Catfish *Clarias magur* (Hamilton 1822) and Strategies for Conservation

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Abstract The *Clarias magur*, commonly known as magur, is one of the widely preferred fish species because of less spine, high nutritional value and flesh quality. Recently, the IUCN (International Union for Conservation of Nature and Natural Resources) has declared *C. magur* as an endangered species. Several known and unknown factors are responsible for its population decline, over-exploitation in wild being one among them. Here, we have critically discussed the factors responsible for its declining population and possible strategies to conserve and revive the fishery. It is worth mentioning that, the culture of *C. magur* is more profitable than several other fish species cultured in India due to its unique characteristics of less water and oxygen utilization. Thus, conservation and propagation through aquaculture is very much essential to revitalize the population of *C. magur* so that the biodiversity and ecological balance in nature could be maintained.

Keywords *Clarias mugur*, Catfish, Endangered fish, Conservation, Propagation.

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Introduction

The facultative air breathing catfish *Clarias magur* is a preferred fish due to its nutritional value and taste of the flesh. The *C. magur* is widely distributed in the Ganges and Brahmaputra river basins in Northern and northeastern India, Nepal, Bhutan and Bangladesh (Ng and Kottelat 2008). The species is commonly found in ponds, rivers, ditches, streams, canals and derelict and swampy waters characterized with low-oxygen content. This fish attains sexual maturity within the first year and spawn during the monsoon season, when rivers rise and fish are able to excavate nests in submerged mud banks and dykes of flooded rice fields. It breeds in shallow marginal waters of ponds, ditches and natural depressions, and inundated paddy-fields during monsoon season and attains a maximum length of 35 cm and a weight of 250 g (Vishwanath 2010). The recent reports have revealed

that the population of *Clarias magur* has declined throughout its range and become endangered, at present. This is attributed to various factors such as constantly drying up of wetlands, increasing pesticide pollution of water bodies where the species breeds, introduction of exotic species like the African catfish (*Clarias gariepinus*) that compete with *C. magur* for food and habitat (Vishwanath 2010).

Factors responsible for declining of *Clarias magur* population

Habitat loss and degradation

Deforestation

Reduction in forest coverage area is often caused by natural calamities and human-induced activities. Nevertheless, irrespective of the causes for deforestation, it severely affects the natural habitat of fish species. One of the recent reports suggest that destruction of the riparian forests along the course of the rivers and river mouths should be completely avoided as deforestation in these area increases the turbidity and temperature of the water bodies (Angsuman 2017) which ultimately affects the existence and spawning of many fish species, including *C. magur*.

Construction of dam on river systems

Various reports have suggested migration of fishes from lower to upper riches or vice versa are greatly affected by construction of dams across the rivers (Catherine et al. 2012). It is worth mentioning that practically all the riverine fishes are migratory in nature moving up and down stream of the river for food and reproduction. Consequently, construction of dams affects their normal behavior and movement; thereby pose restriction to their feeding and spawning habitats. According to Catherine et al. (2012), construction of dams across the rivers entirely changes the ecosystem of the river and causes irreversible damage to its aquatic organisms, particularly the indigenous fishes. In addition to this, dams themselves create serious consequences leading to siltation on one side and the growth of aquatic weed on the other side (Angsuman 2017). It is, therefore imperative that impact assessment should be critically evaluated before allowing construction of the dams. Farakka Barrage in the river Ganga in the Mursidabad district and Kansaboti Dam in Bankura district on the River Kansaboti are two examples where the riverine fishes are obstructed in their normal migratory route (Angsuman 2017).

Conversion of wetlands

The wetlands are preferred breeding ground for *C. magur* as they provide a congenial environment. Destruction of wetlands greatly affects the natural population of fish species. We are of the opinion that, these water bodies should be properly protected and conserved. This will ultimately results in protection of various fish species, including *C. magur* and other aquatic animals. Often, observed that, the connection between the river and the wetland are blocked due to agricultural and allied activities. Undoubtedly, this severely affects the migration of fishes from river to wetlands for spawning. Thus, such connections should be maintained properly without placing any obstruction in-between.

Industrialization

Industrialization, probably, one of the major threats to the existence of indigenous fishes in the flowing water bodies. It also greatly affects the natural habitat that harbor spawning of fishes, including catfishes. It has been reported that, increasing industrialization has created pollution by discharge of the industrial waste materials in the different river systems or the water bodies in the country (Bukola et al. 2015). This has caused an unfavorable condition for breeding, consequently making their life threatened.

Over-exploitation

Over the years, over-exploitation of water bodies for fishing has caused decline in population of many indigenous fish species and *C. magur* is no exception to that. Over-exploitation generally affects the fishes that are difficult to breed in captivity and have a great consumer preference for food and recreation. Such fishes are rampantly caught from the wild, irrespective of their age and size. This practice has turned

many fish species in to endangered list. The *C. magur*, for which there are no commercial seed production units and very few farmers do the culture based on the seed obtained from the wild, have been continuously caught from the wild to meet the consumer demand.

Introduction of
exotic species

The introduction of African catfish (*Clarias gariepinus*) has caused considerable damage to the indigenous fishes including *C. magur* in the country. It is highly carnivorous fish and is known for faster growth rate. It can attain a weight of 60 kg in eight years and can thrive in extreme environmental condition (Angsuman 2017). Wherever, this species has been introduced it has caused serious damage to the indigenous fish species (Gulab et al. 2014). Similarly, introduction of Common carp (*Cyprinus carpio carpio*) has been observed to pose threat for existence of some indigenous carp such as *Cirrhinus mrigala* and *Cirrhinus reba* with which Common carp shares the ecological niche at the bottom (Angsuman 2017).

Strategies for conservation

According to the IUCN (International Union for Conservation of Nature and Natural Resources 2008) Red List of all life forms; 16,928 species are threatened globally, and of these 1,275 species are fishes. In Asia 6,106 organisms are threatened of which 688 are fin fishes (Lakra et al. 2011). These figures implies, grossly all aquatic environments are experiencing serious threats to both biodiversity and ecosystem stability. Several strategies and priorities could be adopted to conserve these valuable germplasm.

In-situ conservation

In-situ conservation is defined as the conservation of ecosystems and natural habitats and the maintenance and recovery of viable population of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties (Jena and Gopalakrishnan 2011). This conservation method works through the integration of knowledge on fish and habitat diversity, habitat utilization, life history traits as well as human interference and other socio-economic issues (Jena et al. 2011).

Ex-situ conservation

In this rechnique the species are conserved outside their natural habitats either perpetuating the population in genetic resource center or in the form of gene pools, gamete storage and germplasm banks (Jena and Gopalakrishnan 2011). As in the case of a variety of animals, rapid freezing of gametes to ultralow temperatures found successful in the case of fishes. Storage of fish milt, eggs, and embryos without loss of viability is of considerable value in conservation as well as in the sustaining of aquaculture. The very advantages of cryopreservation includes, i) Development of gene bank for conservation of endangered fish genetic resources ii) Availability of gametes all the year round for seasonal brooders iii) Facilitates easy transportation of germplasm over a geographical area iv) Helps in selection and hybridization program (Jena and Gopalakrishnan 2011). Inadequate milt production or asynchronization in maturity of two sexes being an issue for induced breeding in several cultivable species, cryopreserved sperm can be effectively utilized to overcome from such milt related problems.

Live gene banks

Live gene banks contribute to delisting of threatened species by captive breeding and restocking in species-specific recovery programs. Various organizations have adopted this approach and created necessary infrastructure to cater to the needs. For example, National Bureau of Fish Genetic Resources, Lucknow has established a live gene bank holding species of high conservation significance and with the objectives of a) Collection of threatened, endangered, and rare fish species and management of their stocks under farm conditions. b) Study of growth, maturity, survival, and adaptability of these species in controlled conditions, and c) Study of the life history traits of the threatened species as a tool for *in-situ* and *ex-situ* conservation (Lakra and Sarkar 2011).

Tissue banking

This is a speedy mode of storing the biological material for longer durations, it does not require any species-specific protocols and can be used to retrieve genetic information and genetic manipulation studies later. As per NBFGR data, nearly 13000 tissue accessions of fresh water and marine fish species collected from mainland and inland ecosystems are maintained in the tissue bank (Jena et al. 2011).

Captive breeding

This program has become the major tool to replenish the declining populations of threatened species in their natural habitat and simultaneously to supplement as well as enhance yields of wild species (Jena et al. 2011).

Ranching

This technique is developed for enhancemet of resources by stocking open waters with seeds derived from target fish species and providing them with appropriate artificial shelters for enabling the animal to guard themselves against natural hazards, so that they could reach a size where predation and juvenile mortality are much reduced (Rout et al. 2007).

Biomass conservation

This implies the preservation of entire population. This can be achieved by demarcating some areas as protected areas. Probably, this type of conservation will be extremely important in slowing the rate of species extinction (Rout et al. 2007).

Concept of state fish

An innovative approach to fish conservation by declaring a state fish for each of the states was adopted for the first time in the country by NBFGR in 2006 (Jena et al. 2011). In compliance with this concept, 16 states of the country became partners with NBFGR in developing strategies for conservation and enhancement of their selected state fish in order to achieve the real time conservation success (Table 1). These states have been provided with an action plan and technical backstopping for improved management of state fish (Lakra and Sarkar 2011).

Table 1. List of state fishes (Courtesy: ICAR-National Bureau of Fish Genetic Resources).

Sl. No.	State	Common name	Scientific name
1	Andhra Pradesh	Snake head murrel	*Channa striatus*
2	Kerala	Karimeen	*Etroplus suratensis*
3	Karnataka	Carnatic carp	*Puntius carnaticus*
4	Orissa	Mahanadi mahaseer	*Tor mahanadicus*
5	West Bengal	Hilsa	*Tenulosa ilisha*
6	Arunachal Pradesh	Golden mahaseer	*Tor putitora*
7	Bihar	Magur	*Clarias batrachus*
8	Haryana	Kalbasu	*Labeo calbasu*
9	Himachal Pradesh	Golden mahaseer	*Tor putitora*
10	Jammu and Kashmir	Golden mahaseer	*Tor putitora*
11	Manipur	Pengba	*Osteobrama belangri*
12	Mizoram	Nghavang	*Semiplotus modestus*
13	Nagaland	Chocolate mahaseer	*Neolissocheilus hexagonolepis*
14	Tripura	Pabda	*Ompok bimaculatus*
15	Uttar Pradesh	Chital	*Chitala chitala*
16	Uttarakhand	Golden mahaseer	*Tor putitora*

Control of exotic fishes

Indiscriminate introduction of exotic fishes, without proper impact assessment, may exterminate the native fishes. While introducing an exotic species, it is imperative to screen the biology, genetics of the candidate species and its possible impact on native species in natural environment (Rout et al. 2007). This will not only ensure safety to the habitat but also help protecting the indigenous fish species.

Sustainable fish harvest

Exploitation of fisheries resources in traditional fishing grounds need to be appropriately regulated. Brood fishes and juveniles should be protected to maintain a sustainable stock. Net and mesh size regu-

lations have to be strictly enforced to safe guard the juveniles. Random killing of fishes by the use of dynamite, poisoning and other associated methods should be strictly banned (Rout et al. 2007).

Monsoon ban

The committee appointed by the Givernment of India has recommended a closed season for 47 days from 15th April to 31st May along the east coast and 15th June to 31st July along the west coast. However, a little advancement has been made to close the fishing operation during this period. We believe, all the state Government should follow the recommendation and strictly enforce the monsoonal ban (Paul et al. 2011).

Habitat restoration

Situation specific habitat restoration programs should be carried out based on the quantum of degradation. For example, in case of sedimentation or siltation, the deforestation activities should be immediately checked, coupled with intensive afforestation program in the erosion prone catchment areas. Pollution of water bodies should be immediately control pertaining to pollution control norms (Rout et al. 2007).

Mass awareness

Mass awareness holds the key to success of biodiversity conservation. Through intensive campaign people should be made aware of various ecological, socio-economical, nutritional, cultural, aesthetic, recreational, pharmaceutical and captive breeding technique so as to stop the further exploitation of endangered fish species. To retrieve the endangered species and to protect the dwindling diversity is responsibility of every citizen.

Implementation of Government acts for conservation

Indian Fisheries Act of 1897 (modified in 1956) is a land mark with regards to fisheries. To conserve and optimize utilization of its biological resources, India enacted the Biological Diversity Act (BDA) 2002. This encompasses guidelines to address a wide range of issues related to the utilization of biological resources and information within the country as well as by other countries. The objective is to put appropriate procedures in place so that biological resources are optimally utilized while maintaining sovereignty over them (Jena et al. 2011).

Indian Fisheries Act, 1897–This act highlights the conservation aspect and banned the use of explosives and poisoning of waters for the destruction of fish (Biradar and Ayyappan 2011).

Indian Wildlife (Protection) Act, 1972–This act relate to declaration of marine protected areas (marine national parks/sanctuaries/biosphere reserves) to safeguard and protect the aquatic ecosystems along with their resources.

Environmental (Protection) Act, 1986–It authorizes the central Government to protect and improve environmental quality, control and reduce pollution from all sources and prohibit or restrict the setting and or operation of any industrial facility on environmental grounds.

Biological Diversity Act, 2002–The main objective of this act is to protect the biological diversity of India. It provides for the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and related matters.

Conclusion

Generally fishes do not merely get endangered overnight. This is the consequences of many years of over exploitation without giving due attention for propagation. Each fish has its own role to play in the natural ecosystem and cannot be replaced with other species. With the introduction of exotic catfishes such as African catfish and Pangas, the much needed attention to *C. magur* has gone down. One of the prime reasons the *C. magur* fails to attract attention is that the former two species could be easily bred and culture whereas *C. magur* is comparatively difficult. In *C. magur*, the males have to be sacrificed to obtain the spermatozoa for breeding. Currently, researchers have reoriented their research to focus on *C. magur*

reproduction and to provide much needed approach to obtain the spermatozoa without killing the males.

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