
EXOTIC ORNAMENTAL FISH TRADE: A POTENTIAL THREAT TO BIODIVERSITY

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Abstract: Ornamental fish keeping is the second largest hobby of the world and its trade is multi-million dollar industry. Large number of small scale farmers and women entrepreneurs are involved in this industry and many people consider this as an additional source of income. Majority of the ornamental fishes are exotic species. Indian ornamental fish trade industry is dominated with presence of more than 500 exotic fishes. Introduction and invasion of these exotic fishes to our common water bodies adversely affect our rich diverse ecosystems. Multiplication of these exotic species will cause the removal of our native endemic species. They also introduce exotic parasites and diseases, interbreed with native fauna and manipulate the gene pool. They alter the food web and community structure. Some of them alter the habitat and make it unsuitable for the breeding and larval rearing of native fauna. All these changes adversely affect our indigenous species and ultimately lead to the elimination of key stone varieties. Majority of the people associated with this industry are unaware about the adverse effects caused by the exotic species. In local markets these fishes kept without any quarantine facilities. In this contest this paper discusses the major exotic ornamental varieties in Indian markets, reasons for its invasion to common water bodies, threat to biodiversity and remedies.

Keywords: Bio-Diversity, Exotic Fishes, Ornamental, Threat.

Introduction: Ornamental fish keeping is the second largest hobby of the world and its trade is multi-million dollar industry. Large number of small scale farmers and women entrepreneurs are involved in this industry and many people considered this as an additional source of income. Introduction of exotic species is considered as one among the five major reasons for the removal of biodiversity [1]. The major reasons for the introduction of exotic fishes in India can be categorized in to five. They are Sport Fishing, Aquaculture, Vector control, Accidental and Ornamental fish Trade. More than 30% of world's aquatic invasions are related to ornamental fish keeping [2]. Studies [3] says that one billion ornamental fishes are traded internationally each year, it contain 4000 freshwater and 1400 marine species. 26% of exotic freshwater fishes that invaded and established in the natural waters of USA has been introduced mainly through aquarium fish trade [4]. Out of the total 100 introduced species in North American fresh water ecosystems, 40 species have established via aquarium fish trade [5].

Common Exotic Aquarium Fishes in Indian Markets And Their Impacts On indigenous fauna : Most of the ornamental fishes Gold fish, Angel, Platy, Tetra, Gourami, Guppy and Mosquito fish found in our surrounding are exotic species. There are only 35 exotic ornamental varieties are approved by the Government for trade and culture [6]. But Indian ornamental fish trade industry is dominated with presence of more than 500 exotic fishes [7]. Banned fishes like *Aequidens rivulatus* (Green terror), *Astronotus ocellatus* (oscar), *Osteoglossum bicirrhossum* (Arowana), *Labeo chrysophycon* (black shark minnow), *Leptobarbus hoeveni* (maroon shark) [6], and Carnivoros fishes like Piranha (*Serrasalmus* sp.), Alligator gar (*Lepisosteus* sp.) [8], and pacu are very common in our internal markets. Any documentation regarding exotic introduction and trade are not available. 291 exotic ornamental species and 3 larvicidal fishes were reported [7] in Indian waters. 212 species of exotic ornamental fishes are reported to be imported to India [9]. 73 different varieties of 33 exotic ornamental fishes that bred and marketed in India [10].

Poecilia reticulata (Guppy) is one of the world's most widely distributed tropical fish, and one of the most popular freshwater aquarium fish species introduced in India for mosquito control as a part of Malarial eradication programme in 1908 [11]. Now this fish is a common member of fresh water aquariums. They have high reproductive rate and ability to tolerate wide range of ecological conditions [11] and capable of entering the micro habitats of native fishes. It act as the predator of egg and young ones of native fishes [12]. This fish is reported from the rivers of different states of India including Kerala [13], Western Ghat [14] and North east states [15]. The mosquito fish *Gambusia affinis* introduced in Indian waters for the same purpose from S. Africa in 1929 [16]. Now this fish is present in all most every states and rivers like Ganga and Yamuna [17]. The presence of this fish adversely affects the native cyprinodont populations in Europe and N. America [18], [19]. This fish is called as fish destroyer by famous fish biologist Myers [20] due to its impacts. Both of guppy and mosquito fish are prolific breeders and able to establish populations in natural waters and compete with native fauna. And also it is very difficult to eradicate them if they introduce once in a system.

Carassius carassius (gold fish) first brought to India from Europe in 1874 and introduced in Ooty lake. It also reported in various parts including Kerala, Tamil Nadu, Andhra, Himachal Pradesh [21] and in River Yamuna [22]. It have a worldwide distribution of about 32 countries [23].

Ornamental fishes like *Pterygoplichthys multiradiatus* [24], *Trichogaster trichopterus* [25] and *Xiphophorus maculatus* [26] are reported in the inland waters of Kerala and Tamil Nadu [27], [28]. Several ornamental fishes such as *Barbus tetrazona* (tiger barb), *Betta splendens* (Siamese fighter), *Epalzeorhynchus frenatus* (rainbow shark), *Hyphessobrycon eques* (serpae tetra), *Labeotropheus fuelleborni* (Fuelleborn's cichlid), *Oreochromis niloticus* (Nile tilapia), *Phractocephalus hypophthalmus* (iridescent), *Poecilia latipinna* (sailfin molly) and *Pterygoplichthys pardalis* (tank cleaner) have been reported in freshwater ecosystems of Uttar Pradesh [29] and W. Bengal [7] with high invasion potential. *Pterygoplichthys pardalis* and *P.dijunctivus* reported from W. Bengal, Bihar and UP. Live specimens of *Pygocentrus nattereri* and *P. brachypomus* are reported from Periyar river Kerala, Dimbhe reservoir Pune [7], waters of Assam and Northern India [30].

P. multiradiatus is a South American cat fish with omnivorous feeding, able to with stand wide range of environmental conditions, attain big size and negatively affect the bottom spawning and periphyton feeding fishes [31]. It adversely affects many native fishes like *Etroplus suratensis* and several other insect populations by altering the habitat and overgrazing of algae [32]. *T.trichopterus* is a fish with opportunistic carnivorous nature and also shows territorial and aggressive behaviour [33]. This will affect the native species such as *Pseudosphronemus cupanus* and *Apolocheilus lineatus*. *Xiphophorus maculatus* is an insectivore and compete to many natives like *Puntius fasciatus*, *P.ticto*, *Devario malabaricus* for food.

Threats to Biodiversity: The presence of exotic species in a water body adversely affects the local fauna in various ways. Generally the exotic species are with wide range of feeding habit and able to survive in adverse environmental conditions. The absence of natural predators and parasites will also help them to establish in these water bodies. But at the same time the natural fauna which are found in this water bodies are strictly adapted to that ecosystem. The habitat alterations made by the exotic species affect the feeding and breeding behaviour of indigenous fauna. They also introduce exotic parasites and compete with the indigenous fauna for food and space. The interbreeding of exotic with indigenous manipulates the gene pool and cause genetic degradation. As a subtropical country, each water bodies of our country are rich in unique and endemic indigenous varieties. So presence of invasive species in these water bodies results in the removal of these species.

Major Reasons: The nature of human being to collect and own the varieties and to keep the favourable along with them while travelling play a major role in the international introductions. Even though ornamental fish culture is a multimillion dollar industry, it is not organised even in the developed countries, so it is very difficult to observe and impose strict rules and regulations. Every person related to aquarium keeping like hobbyist, fish cultures, traders, and officials have their own role in the spreading of exotic species. If a hobbyist fed up with his fishes, they empty their tanks to nearest water body and fill their tank with new more fascinating varieties [34]. In case of live or prolific breeders tanks are overcrowded after breeding. In such situations most of the aquarium keepers select the nearest water body as their stocking pool. [35]. The same happen in the case of bigger fish, which grow and are unable to be held by the small aquarium. In the case of ornamental fish cultures, exotic species are selected because it fetches high prize and demand in the market than the indigenous variety. For the breeding purposes they introduce these fishes in to natural pond. Chances

for this fish to spread to other waterbodies are also higher. Because of the ideal climatic conditions and good transportation facility, the major cities of our country transformed as breeding stations for exotic species for international trade [28]. One of the other common reason is the insufficient quarantine facility given to this type of fishes in the local market [27]. In such situations their way to escape is very easy during rains and flood. Accidental escapes from the culture ponds during natural calamities are also one reason for exotic spreading. Online trade and development of world market through globalisations are also play major roles in the spreading of exotic species. A total of 65 genera of freshwater exotic fishes are available in India for online trade [27]. Implementation of the existing laws is also very difficult for the officials because of its highly unorganised structure.

Remedies: The presence and invasion of exotic ornamental species in the natural water bodies are already confirmed. But at the same time the aquarium industry is spreading fast. Majority of people and people related to aquarium industry are unaware about the adverse effect of exotic introduction. As a remedy its necessary to develop awareness among the public. Conversion of ornamental fish trade industry in to an organized sector is difficult, but otherwise Prevention by laws are not effective . Still the implementation of stringent laws helps to control the intentional introductions up to certain level. A detailed study regarding the available exotic species in the domestic markets, their sources and existing quarantine facilities are essential to understand the present scenario of markets and making policies. Field investigations to study the level of invasion of the exotic fish species should be carried out and efforts are needed to remove and eradicate the existing exotic from water bodies. A detailed study for finding out the suitable indigenous varieties for replacing the exotic species, development and standardisation of their breeding technique , Promoting the culture and trade of these endemic varieties are some of the possible remedies for this problem.

Conclusion: Our country India is diverse not only in culture, tradition and geography but also in biodiversity. Indian fish fauna is rich in diversity with 80% of the global fishes. Biodiversity is essential for stabilization of ecosystems, protection of overall environmental quality, for understanding intrinsic worth of all species on the earth. As a major source of exotic fish introduction, ornamental fish trade became a potential threat to our biodiversity. We want to change this situation and protect our biodiversity. A combined and dedicated movement of the public, researchers, authorities, aquariums traders, hobbist are the one and only solution for prevent the new invasions in to our waters and thus to hold our rich diversity.

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