



EXOTIC FISH SPECIES IN AQUACULTURE AND AQUATIC ECOSYSTEM IN TELANGANA STATE, INDIA

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Abstract: A number of invasions of freshwater exotic fishes have taken place into India over the past decade, adversely affecting the indigenous fish biodiversity. The collected information on alien fish species revealed the presence of 31 fish species introduced in India for aquaculture purpose, of which eight exotic fish species have been introduced in Telangana state. Many of them were illegally introduced and their historical information was not available. Telangana is abundant in water sources such as rivers, reservoirs, canals and irrigational tanks and exotic fish species escaped from confinement may pose challenges to ecology of the water bodies. The paper presents data on over-all scenario of various exotic fish species in the state, their distribution, dispersal and invasiveness and their impacts on the riverine fish diversity and ecosystem. Presence of exotic fish species such as *Oreochromis niloticus*, *O. mossambicus*, *Clarias gariepinus* etc. have impacted the populations of indigenous species and contributed towards the decline in the fishery of native cyprinid fish species in several natural aquatic bodies of the Telangana state. The mitigation of the negative impacts of exotic fish species will require continued co-operation of government, academia and private sector organizations.

Key words: Alien fish, Fish biodiversity, Invasion, Aquatic ecosystem, environmental impact

INTRODUCTION

Over the past two decades, many alien fish species have been clandestinely brought into India by private aqua-culturists, entrepreneurs and aqua-industrialists for immediate gains. Such unauthorized activities are causing indiscriminate spreading of alien species, with potentially adverse ecological consequences (Biju Kumar, 2000; Singh and Lakra, 2006; Lakra *et al.*, 2008). In spite of an already rich and diverse fish genetic resource of India, more than 300 alien / exotic species have been introduced into the country so far. While a vast majority of them are ornamental fishes, which remain, more or less, confined to the aquaria, some others have been introduced in aquaculture and open water systems with varying degrees of success.

However, unauthorized culture of alien species and their unintentional or deliberate spread is emerging as one of the greatest threats to the biodiversity of aquatic ecosystems. The impacts are typically greater in systems already affected by human activity (Vaughn, 2010). Increased

appearance of alien species particularly in degraded aquatic environments has further significantly aggravated threats to biodiversity (Lakra *et al.*, 2008).

Telangana is situated on the Deccan Plateau, in the central stretch of the eastern seaboard of the Indian Peninsula and covers 114,840 square kilometres. Two major rivers of South India, *viz.*, the Godavari and the Krishna River with their several tributaries form the chief perennial river systems of this state. There are a large number of medium and small sized rivers in addition to several man-made reservoirs, backwaters and tanks in this state.

AQUACULTURE OF EXOTIC FISH

While there are about 31 alien fish species recorded from aquaculture systems in India (Singh and Lakra, 2011), culture of some fish species such as *Pangasianodon hypophthalmus*, *Oreochromis niloticus*, *Piaractus brachypomus*, *Aristichthys nobilis* and *Clarias gariepinus* picked up during recent years (Table 1).

Table 1. Exotic fish species in aquaculture & its status in Telangana

Sl. No.	Common name	Scientific name	Present status
1	Common carp	<i>Cyprinus carpio</i>	Aquaculture
2	Grass carp	<i>Ctenopharyngodon idella</i>	Aquaculture
3	Silver carp	<i>Hypophthalmichthys molitrix</i>	Limited culture
4	Pangas	<i>Pangasianodon hypophthalmus</i>	Aquaculture
5	Big head carp	<i>Aristichthys nobilis</i>	Limited culture
6	African catfish	<i>Clarius gariepinus</i>	Limited culture
7	Red-bellied Pacu	<i>Piaractus brachipomus</i>	Limited culture
8	GIFT tilapia	<i>Oreochromis niloticus</i>	Limited culture

Bangkok strain of the common carp was brought into the country with the objectives of broadening the species spectrum in aquaculture and increasing yields through better utilization of vacant trophic niches. Of the alien carps, the common carp (*C. carpio*) is now widely cultured all over the country including Telangana in ponds and tanks.

Both silver carp (*H. molitrix*) and grass carp (*C. idella*) were introduced in 1959 for a specific purpose and have led to the development of a high yielding technology, 'Composite Fish Culture', after several years of experimentation. The grass carp (*C. idella*) was introduced mainly to control weeds in natural water bodies. It is an important species used in 'composite fish culture' and is widely cultured throughout India, including Telangana.

Indian neighbors, Bangladesh and Nepal, culture a number of alien species (Barua *et al.*, 2001; Gurung, 2005). Many alien species, such as *Clarias gariepinus*, *Pangasianodon hypophthalmus*, *Aistichthys nobilis*, and *Piaractus brachypomus*, have been surreptitiously smuggled into India from there to other states including telugu states of Andhra Pradesh, Telangana and are being cultivated (Table 1). These unauthorized introductions have achieved popularity in aquaculture.

Andhra Pradesh is one of the states in the country for clandestine culture of alien fish species. Andhra farmers took ponds near reservoir or canal water available areas in Telangana state and started these alien fish species culture by importing seed from the coastal districts. Among the catfishes, the African catfish *Clarias gariepinus* was also clandestinely introduced into

the state of Andhra Pradesh (A.P) in early 1990s from Bangladesh through West Bengal (Ramakrishna *et al.*, 2012), later in Telangana area created severe environmental problems including pollution of water and air in the vicinity of farm ponds. Although its culture is unauthorized, these fishes have become popular among aquaculturists in the country including Telangana and Andhra Pradesh states (Laxmappa and Srinivas, 2016).

Among the popular alien fish species, pangas catfish (*P. hypophthalmus*) introduced in 2004 from West Bengal illegally. The Government of India permitted this species for aquaculture in 2009. Now its culture is common in ponds, yielding maximum production by using pellet feed. In some areas chicken waste is used as feed for these fishes. Red-bellied pacu (*P. brachypomus*) is also illegally introduced in 2012 for aquaculture in A.P and later in Telangana by Andhra farmers. In some areas of the state *P. brachypomus* culture is mixing with pangas species and in some other areas culturing separately. Due to low yield problems its culture area is very limited in the state of Telangana.

GIFT tilapia and pangas fish species culture started in cages on piolet basis of selected 5 reservoirs viz., Koilsagar, Ashoksagar, Lower Maner Dam (LMD), Kadam and Palair in Telangana state in 2015 and culture was successful.

OCCURRENCE OF EXOTIC FISH IN OPEN WATERS

In recent years, there has been an alarming increase in the number of alien fish species being detected in the rivers, lakes and reservoirs of India (Lakra *et al.*, 2008; Raghavan *et al.*, 2008). Most

escapee alien species were from unauthorized culture species and moved into open waters inadvertently or because farmers were unaware and/or lacked knowledge of the potential adverse effects.

Tilapia, *Oreochromis mossambicus*, was first introduced into pond ecosystems in 1952 and thereafter stocked in several reservoirs of south India for production enhancement (Sugunan, 1995). *Oreochromis niloticus* was introduced into India during 1987 for aquaculture purpose and now it contributes more than 7.17% in total inland fish production (Singh and Lakra, 2006). Both this species are now found abundantly in almost every environment particularly in almost all reservoirs, lakes and reservoir fed tanks/ponds in Telangana. In Krishna river ecosystem *O. niloticus* population was found to represent 48.82% of the fishery (Laxmappa *et al* 2015a) and in natural irrigational tanks its population found 13.38% to 84.47% (Laxmappa *et al*, 2015b; 2015c; Mahender *et al*, 2016). The indigenous fish species like carps, catfish, murrel etc., populations were declined significantly. However, there has been intensive aquaculture diversification using alien fish species. Many of the cultured alien species have been deliberately or inadvertently released and are now appearing in natural aquatic bodies (Singh, 2014). The invasion of alien fishes in aquatic systems such as rivers, lakes, reservoirs and wetlands have been recorded and is found to differ in various locations and fishery.

The Impact assessment studies of invasives were carried-out in the Yamuna, Ganga, Periyar rivers, back waters of Kerala, Jaiselmer lake (Rajasthan), Ramgarhlake (Uttar Pradesh) Kolleru lake (Andhra Pradesh) and Krishna river & tanks (Telangana). Ecological impact assessment of *Oreochromis mossambicus*, *O. niloticus*, *Pangasianodon hypophthalmus*, *Clarias gariepinus*, *Cyprinus carpio*, *Hypophthalmichthys molitrix*, *Ctenopharyngodon idella*, *Aristichthys nobilis* and *Piaractus brachypomus* commonly occurring in aquaculture and breeding was attempted.

The collected information on alien fish species reveals the presence of twelve species introduced for aquaculture in the country. Many of them are illegally introduced and their historical information such as the source, place and period of their introduction is unknown. Some of these introduced fishes are now found in different inland water bodies. During the study few live specimens of African catfish *Clarias gariepinus* and pacu *Pygocentrus brachypomus* were collected from Krishna and Godavary rivers respectively. Recently invasive fish species *Pterygoplichthys pardalis* were also caught in large number in tanks of Nalgonda district in the state. The detailed information on the present distribution of exotic fish species in natural waters of Telangana state is presented in Table 2.

Table 2. Existence of Exotic fish species status in open water ecosystem in Telangana

SI.No.	Common name	Scientific name	In open water status
1	Common carp	<i>Cyprinus carpio</i>	Limited
2	Grass carp	<i>Ctenopharyngodon idella</i>	Limited
3	African catfish	<i>Clarius gariepinus</i>	Limited
4	Pangas	<i>Pangasianodon hypophthalmus</i>	Rare
5	Red-bellied Pacu	<i>Piaractus brachipomus</i>	Rare
6	Nile tilapia	<i>Oreochromis niloticus</i>	Abundant
7	Mosambique tilapia	<i>Oreochromis mossambicus</i>	Common
8	Mosquito fish	<i>Gambusia affinis</i>	common
9	Guppy	<i>Lebistes reticulatus</i>	Limited
10	Giant gouramy	<i>Osphronemus goray</i>	Rare
11	Sail-fin catfish	<i>Pterygoplichthys pardalis</i>	Limited



Fig. 1. *Oreochromis mosambicus* caught from open waters



Fig. 2. *Oreochromis niloticus* caught from open waters



Fig. 3. *Clarius gariepinus* caught from open waters



Fig. 4. *Piaractus brachipomus* fish caught from open waters



Fig. 5. Grass carp caught from open waters



Fig. 6. Cultured GIFT tilapia



Fig. 7. Cultured pangas catfish from the pond



Fig. 8. Harvest of cultured Pangas catfish and Pacu fish



Fig. 9. Mosombique tilapia caught from open waters



Fig. 10. Nile tilapia caught from open waters



Fig. 11. Sail-fin catfish caught from open waters



Fig. 12. Cultured grass carp



Fig. 13. Cultured common carp



Fig. 14. Pangas catfish harvesting from Cage culture

IMPACT OF EXOTIC FISH SPECIES

The use of exotic species for fisheries and aquaculture diversification has been practiced since the middle of the 19th century. Although many such introductions have been successful, others have resulted in highly publicized failure, generating controversy over protection of native biodiversity, spread of pathogens and disease. However, the introduction and transfer of exotic species and breeds for aquaculture of exotic species and breeds for aquaculture purposes may be done with extreme caution as it can change or impoverish the biodiversity and genetic resources through interbreeding, competition for food, habitat destruction and through transmission of diseases.

The little or no management measures taken by farmers especially in preventing escape of pond reared individuals has now resulted in the species being distributed in many natural water bodies of the state. *C. gariepinus* is now being increasingly caught from Srisaillam backwaters and PJP canal fed irrigational tanks in the state (Laxmappa *et al.*, 2015b; Mahender *et al.*, 2015). African catfish escaped from rearing ponds in the area and got established in the larger village tanks also subsequently wiping out the indigenous species like snakeheads (murrels), local catfishes, etc.

Since last decade, the State Departmental officials have been conducting raids, destroying the African catfish stocks and filing the cases against culturists. But still some of the farmers

doing this illegal activity secretly and exporting this produce to neighboring states in the country. Carps culturists are also getting these African cat fish species in their tanks at the time of harvesting. However, farmers are unaware of the adverse implications of this catfish on the ecology.

CONCLUSIONS

Although aquaculture of *C. gariepinus* is banned in Andhra Pradesh and Telangana, vide GO. Ms. No: 54, Animal Husbandry, Dairy Development and Fisheries (Fish-II) Dept. dated 04.10.2005, some aqua-culturists have taken little consideration for such bans and continue rearing this catfish. It is widely believed that the popularity for African cat fish aquaculture is due to the simplicity in their rearing, fast growth and acceptability of cheap feed, such as slaughterhouse and chicken waste. The low operational costs and high profits derived from African catfish farming have led to intensification of production.

Low culture management practice, tolerance of a harsh environment, acceptability of a variety of feed, including slaughterhouse wastes, and fast growth mean that farmers have begun to culture it in small pits and cement cisterns as well as in large ponds in India. Considering the threats posed by African catfish, the Ministry of Agriculture, Government of India, ordered killing of this alien catfish *en masse* and has imposed a ban on its culture. However, it is still bred and

cultured even today in different parts of the country.

In view of the adverse environmental, socioeconomic and biodiversity impacts, there is an urgent need to regulate the illegal entry of alien species into the states including India. There is a pressing need to follow scientifically sound methods and approaches in the field of risk assessment for alien species so as to pick only safe and profitable species of aquaculture.

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