International Journal of Zoology and Applied Biosciences
Volume 1, Issue 6, pp: 244-247, 2016
https://doi.org/10.5281/zenodo.1310758

ISSN: 2455-9571

http://www.ijzab.com

Research Article

INVASIVE ALIEN FISHES AND THEIR THREATS TO THE INLAND FISH CULTURE SYSTEM

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Article History: Received 31st October 2016; Revised 6th November 2016; Accepted 11th November 2016; Published 14th December 2016

ABSTRACT

Invasive alien fishes are considered as one of the significant reasons for destruction of the native fish biodiversity in freshwater ecosystems; many indigenous fishes become critically declined. The study was made to assess the species diversity and composition of introduced fishes in the freshwater systems of Cuddalore district, Tamilnadu, India. Total numbers of 15 families were identified. Prevention and early detection are necessary to control the spread of invasive alien species. Further, risk assessment is very important and should be made mandatory to manage the intentional introductions.

Keywords: Fresh water system, Indigenous fishes, Invasive alien fishes, Threats.

INTRODUCTION

In the middle of the 19th century, worldwide transfer of fish species, especially for the provision of supplementary food supply increased rapidly, later to the Second world war the number of introductions of alien fish species increased still further (Rajan and Sreeraj, 2014). Invasive alien fishes (IAF) are considered as one of the significant reasons for destruction of the native fish biodiversity in freshwater ecosystems (Garcia-Berthou, 2007; Singh and Lakra 2011; Lakra *et al.*, 2008; De Silva *et al.*, 2009; Pimentel, 2000). IAF made the endemic species defenseless, uncompetitive and may result in the world's ecosystem dominated by few ultra-competitive, "super species" (Mandal and Nandi, 2009). In India, over 300 alien fish species, including 291 ornamental species, 31 aquaculture species and 3 larvicidal fishes are recorded (Singh and Lakra, 2011). Most of the intentional introductions are aimed to bring benefits to fishery management, aquaculture and fishpond production or in the case of natural ecosystems, by a need to fill vacant niches, to increase production and to provide new objects for sport fishing and ornamental fish (Singh and Lakra, 2011; Lakra *et al.*, 2008).

In recent years, fresh water ecosystems in India have been suffering from heavy human interference, resulting in habitat loss and declining of indigenous species (Sinha, 2006; Vass *et al.*, 2010; Sarkar *et al.*, 2012) in general increased incidences of alien invasive species is specific (Singh and Lakra, 2011; Copp *et al.*, 2005). In the past, there was scanty effort made to the risk assessment of the introductions either intentional or unauthorized. However, the latter was not thoroughly premeditated, often because the negative impacts of the alien fish species became apparent only some time after the alien species were introduced and established in the ecosystem. Escaped invasive alien species from inadvertent releases can interact negatively with native ones by altering availability or quality of nutrients, competing for food and physical resources, changing habit structure and affecting gene flow species diversity (Laprieur *et al.*, 2008; Xu *et al.*, 2006). It is now widely recognized that invasion of alien species is one of the most important factors endangering fish biodiversity and breaking down geographical barriers (Laprieur *et al.*, 2008; Xu *et al.*, 2006). In outlook of the above documented facts, the objective of this study was to generate data about the spread of alien invasive fishes in the fresh water systems of Cuddalore district, Tamilnadu, India.

MATERIAL AND METHODS

The study was done from July 2015 to June 2016, to assess the species diversity and composition of introduced freshwater fishes in the ponds, freshwater streams and lakes

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including culture ponds of Cuddalore district, Tamilnadu, India. Cast nets and hand line were used for fish sampling, which was done from 6.00 a.m. to 10.00 a.m. in addition to this bamboo trap were used during the night to collect freshwater eels. Netted and trapped fishes were then stored by species in water-filled buckets. The majority of the fishes after sampling were released in the ponds and streams. Species specific counts were done and measurements of the fishes were made by the scale board method and weighed using an electronic balance.

RESULTS

The fishes collected from various sampling points showed a total number of 26 fish species which belonged to 15 families, Out of 26 recorded species, 17 were identified as native and 9 alien invasive fish species (Table 1). The recorded data showed the dominance of the family Cyprinidae followed by the other families such as Cichlidae, Channidae, Clariidae, Anabantidae, Gobiidae, Notopteridae, Poeciliidae, Heteropneustidae, Siluridae, Pangasiidae, Loricariidae, Anguillidae, Serrasalmidae and Latidae.

Table 1. Fish diversity of inland water systems of Cuddalore district, Tamilnadu, India.

Family	Species	Nativity	Status
Cyprinidae	*Catla catla*	India	*
Cyprinidae	*Cirrhinus mrigala*	India	*
Cyprinidae	*Ctenopharyngodon idella*	Eastern Asia	*
Cyprinidae	*Labeo rohita*	South Asia	*
Cyprinidae	*Hypophthalmichthys molitrix*	Asia	*
Cyprinidae	*Cyprinus carpio*	Europe	**
Cyprinidae	*Carassius arassius*	Europe	**
Channidae	*Channa punctatus*	Asia	*
Channidae	*Channa striatus*	Asia	*
Channidae	*Channa marulius*	South Asia	*
Anabantidae	*Anabas testudineus*	India	*
Cichlidae	*Oreochromis mossambica*	Southern Africa	**
Cichlidae	*Oreochromis niloticus*	Africa	**
Cichlidae	*Etroplus suratensis*	India	*
Gobiidae	*Glossogobius giuris*	India	*
Notopteridae	*Notopterus notopterus*	India	*
Poeciliidae	*Gambusia affinis*	Mexico	**
Clariidae	*Clarias gariepinus*	Africa	**
Clariidae	*Clarias batrachus*	Asia	*
Heteropneustidae	*Heteropneustes fossilis*	India	*
Siluridae	*Wallago attu*	South Asia	*
Pangasiidae	*Pangasiandon hypophthalmus*	Southeast Asia	**
Loricariidae	*Pterygoplichthys pardalis*	United States	**
Anguillidae	*Anguilla bengalensis*	India	*
Serrasalmidae	*Piaractus brachypomus*	S. America	**
Latidae	*Lates calcarifer*	South east Asia	*

Native *, Invasive**

DISCUSSION

The result showed the fish diversity of inland water system, including culture ponds of Cuddalore district, Tamilnadu, India, which indicates that there was an increasing trend of invasive alien fishes and decline of indigenous fishes. However, increased production of invasive alien fishes resulted in loss of biodiversity which was changing fast due to different degree of invasion and consequential habit loss on account of the invader alien invasive fish species (Garcia-Berthou, 2007; Singh and Lakra, 2011; De Silva *et al.*, 2006). Despite, the observed impacts of invasive alien fish species emphasized that the biodiversity was adversely affected. The risks associated with the invasion of alien fish species were growing with the increasingly

rapid diversification of aquaculture activities with alien invasive fish species and unregulated transportations (Xu *et al.*, 2006; Singh and Lakra, 2011). Alien invasive fish species claimed the losses of fishery of local species and genetic diversity as per the results of this study. Although increased spread of invasive alien fishes, there were declines in habitat quality and more invasions by alien fishes (Singh and Lakra 2011; Laprieur *et al.*, 2008; Clavero and Garcia-Berthou, 2005). Many local species, particularly Indian major carps were found to considerably decline. Loss of local fish resource availability was understood as a key factor that influenced the invasion success and processes (Davis, 2000; Prieur-Richard *et al.*, 2000). The process of species invasion appeared to happen in three successive stages which were initial dispersal due to increased human activities; establishment of self-sustaining population and spread along the river stretches. Tilapia, African catfish, silver carp, sucker mouth catfish, Red bellied piranha and Gambusia are unequivocally reported to prove the devastating impacts on aquatic ecosystems (Singh and Lakra, 2011). Alien species can cause severe changes in ecosystem's functioning and are currently recognized as principal agents of ecological changes (Pimentel *et al.*, 2005; Byrnes *et al.*, 2007; Zenetos *et al.*, 2010). Understanding the factors that influence the success of ecologically and economically damaging biological invasions is of prime importance. The results of this study documented that invasive populations typically exhibited potential of reducing fish genetic diversity, suggesting that invasions overweigh large confounding factors associated with loss of fish biodiversity (Garcia-Berthou, 2007; Singh and Lakra, 2011).

CONCLUSION

The intentional or inadvertent introduction of fish species other than native was recognized as a key part of the human impelled biodiversity crisis, harming indigenous species and disturbing ecosystems processes (Clavero and García-Berthou, 2005; Byrnes *et al.*, 2007). The greater the incidence of introduction of alien invasive fishes in a region, the higher the probability that some of them become invasive and will hence cause ecological or economic damage (Clavero and García-Berthou, 2005; Jeschke and Strayer, 2005; Pysek and Richardson, 2006). It is therefore, suggested that prevention and early detection are necessary to control the spread of invasive alien species. Further, risk assessment is very important and should be made mandatory to manage the intentional introductions.

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