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Impact of introduction of non- native fishes on indigenous fish fauna in freshwater reservoirs of Tamil Nadu

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Abstract

Culture based fisheries has been intensively practiced in Tamil Nadu freshwater reservoirs by stocking seeds of non-native fishes for more than 50 years. Indian major carps, Common carp and Tilapia are the most important fishes regularly being stocked to enhance the fish yield. It was justified that stocking with seeds of non-native fishes fills the vacant niche untapped by native fishes. Many reservoirs an abode of valuable indigenous fishes have lost their fishery wealth consequent to introduction of alien fishes. Survey on fish landings conducted by CIFRI in Mettur reservoir, Tamil Nadu alarmingly revealed the disappearance of precious Cauvery carps. The landings of unstocked fishes declined to 67276 kg in 2002-2003 from 148452 kg recorded in 1993-94. Similar marked decline of native fishes, *Wallago attu* and *Chela chela* in Vaigai, *Labeo calbasu* in Peechiparai and mullets in Krishnagiri reservoir has been observed in Tamil Nadu. An ecological imbalance created by the culture based fisheries system needs to be addressed urgently by taking appropriate measures and framing fishery policies to conserve the biodiversity of natural water bodies. A social entrepreneurship approach should be developed to exploit the fish production potential of reservoirs without destructing the populations of native fishes.

Keywords: Indigenous fishes, non- native fishes, reservoirs, Tamil Nadu

1. Introduction

Fisheries production from freshwater reservoirs has been gaining importance in developed countries. In India also, out of 3 million ha area of freshwater reservoirs, significant numbers of reservoirs are adopting culture based developmental strategy for fisheries production enhancement (Sugunan and Sinha, 2000) [1]. Fishery enhancement activities or exploitation for fishery resources are reported as an important threat to freshwater fish diversity in some developing countries Welcomme (1979 & 1985) [2, 3]. Many factors such as anthropogenic stress, damming, indiscriminate fishing, habitat loss, invasion of exotic species and intensive culture practices are posing pressure in the processes of fish production and conservation at the watersheds, rivers and reservoirs (Arthington *et al* 2004) [4]. Reservoirs modified as a lacustrine habitat by damming across the river have been reflecting their stress in their habitat as loss of aquatic resources. Since rivers and reservoirs are dispersed in nature, adequate fisheries data especially on catch details were not available. Nevertheless data available with fishery managers of Tamil Nadu reservoirs on fish stocking, fish catch, self-recruiting species and stocked fish species for a considerable period have given an insight on the favourable and adverse modifications taken place in fish faunal population of reservoir as well as the river obstructed. Reservoirs in Tamil Nadu are under intensive culture fishery practices for the past 50 years and over the years, stocked fishes, Indian Major Carps along with other exotic fishes, Chinese carps, common carp and tilapia have been gradually displacing the local indigenous fishes. This is very evident from the observations of fish composition recorded from the fish landings of various reservoirs in Tamil Nadu. In the present study it is evaluated from the fish landings data, the changes occurred in the fish composition of reservoirs and associated riverine habitats of Tamil Nadu.

2. Materials and Methods

2.1 Survey and characteristics of the reservoirs

About 20 reservoirs (Fig.1) were surveyed in Tamil Nadu to assess their ecology and fisheries from 1996 to 2006. Simultaneously fish landings data were collected from the fishery managers of respective reservoirs for the years available with them.

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These reservoirs can be broadly categorized as river valley projects with their catchment area lying in the Western Ghats. Their prime purpose of construction is power generation. Majority of the reservoirs are perennial and deep, located at the headwater of the river. They harbor endemic species in rich quantity. The second category encompassing the reservoirs in the rain shadow region, are shallow to medium depth. These are constructed for the dual purpose of irrigation and domestic use. The third category comprises reservoirs located in the plains which are highly seasonal and shallow in nature. Sandynulla, an upland reservoir in Nilgiris also dammed for flood control.

These multipurpose reservoirs built across the main river or their tributaries with their water resource in the Western Ghats are situated between latitudes of 8°29'N and 12°30'N and longitudes of 76°35'E and 79°41'E at an elevation ranging from 38 to 2143 m above MSL. Parambikulam, Thoonakadavu and Peruvipallam are built on the western slopes of the Western Ghats across the rivers flowing towards west. These dams diverted the water towards east benefitting Tamil Nadu and Kerala preventing a large amount of monsoon water hither to going waste into the Arabian Sea.

2.2 Culture based fishery system in reservoirs

Culture based fisheries are capture fisheries which are mostly or entirely monitored by the regular stocking of seed fish. Culture based fisheries rely entirely on the natural productivity of the water body for growth and on artificial stocking for recruitment (Lorenzen, 1995) [5]. In this system rigorous stocking and harvesting strategies combined with other scientific management measures significantly increased the average fish yield of 50 kg/ha/yr to more than 200 kg/ha/yr. Indian major carps (IMC) by virtue of their food and feeding habits and 78 fast growth are forming the mainstay of culture fisheries in these reservoirs. *Catla catla* being a surface feeder is well utilized to feed the phytoplankton in the surface strata. *Labeo rohita* form a part of the stocking to feed on the column foods, while *Cirrhinus mrigala* and the exotic carp *Cyprinus carpio* utilize the bottom niche. The intensive stocking practices in the Palar-Poranthalar reservoir by the lessee increased the IMC carps contribution to 99.4% during 1998-99.

2.3 Status of indigenous fishes

The catch details of stocked and unstocked fishes and recommendations for promoting fish production with due consideration for native fish conservation in Tamil Nadu reservoirs are elaborately discussed by Murugesan *et al.* (2003) [6] (Fig.2). The influence of external stocking of fish seeds on fish production of Indian major carps and exotic fishes such as tilapia, common carp and grass carp are vividly discussed by Sreenivasan (1984) [7]. Amaravathy reservoir supported a variety of indigenous ichthyofauna such as *Acrossocheilus hexagonolepis*, *Cirrhinus cirrhosus*, *C. reba*, *Puntius dubius*, *P. carnaticus*, *P. sarana*, *L. fimbriatus*, *L. calbasu*, *L. bata*, *L. kontius*, *T. khudree* and *T. putitora* in the initial years of its formation. However after introduction of *O. mossambicus* in 1957-58, the fish propagated rapidly forming a major fishery of 79.8 % of the total yield. These fishes reduced in size to 80-300 gm from the record growth of the beginning of 1.7- 4.0 kg. From 1982 onwards annual stocking of IMC carps begun and established a major fishery resource and tilapia dominated in the non-stocked self-recruiting fishes. In this reservoir *P. carnaticus* has recorded up to 8

tons during 1987-88 and subsequently it had not reflected in the landings (Sreenivasan, 1979) [8]. The other Cauvery carps have not accounted sizeable quantity in the landings and hence these fishes were not recorded for its individual contribution in this reservoir once noted for larger scale spawning and recruitment of these endangered species. In the absence of natural recruitment of Indian cultivable carps in the reservoirs studied, regular 103 stocking of farm produced fry and fingerlings of fast growing carps was done every year in all the reservoirs except Varattupallam. The contribution of indigenous fishes in Vaigai reservoir was substantial shared by *P. sarana* (38.6-61.6), *W. attu* (4.2 t), *Chela sp.* (0.8-2.3 t), *O. bimaculatus* (1.08-1.48 t) *R. corsula* and *Glossogobius sp* till 1997 and later on their percentage share decreased and some fishes have not recorded in the landings at all. The indigenous fishes *Puntius sp.*, *channa sp.*, *Mystus sp* and *Glossogobius giuris* in Vembakottai and *T. khudree*, *L. calbasu*, *H. molitrix*, *Channa sp* and *Glossogobius sp* and *P. sarana* in Manimuthar were appearing occasionally in the landings. *P. sarana*, *Rhinomugil corsula*, *Chela sp* and *Glossogobius sp.* were important till 2000 and later on they disappeared in Krishnagiri reservoir (Sreenivasan, 1995) [9]. Similar marked decline of native fishes, *Wallago attu* and *Chela chela* in Vaigai, *Labeo calbasu* in Peechiparai and mullets in Krishnagiri reservoir has been observed in Tamil Nadu.

2.4 Fisheries of Mettur reservoir

The important commercial native fishery of Mettur reservoir during the period 1943-65 comprised fishes such as *P. dubius*, *P. carnaticus*, *P. sarana*, *P. micropogon*, *Cirrhinus cirrhosus*, *C. reba*, *T. kudree*, *T. mussullah*, *Acrossocheilus hexagonolepis*, *Bagarius bagarius*, *Silondia silondia*, *S. childreni*, *Pangasius pangasius*, *Mystus aor*, *M. punctatus*, *M. seenghala*, *Wallago attu*, *Labeo kontius*, *L. calbasu*, *L. fimbriatus*, *L. portail*, *L. porcellus* and *Labeo ariza*. Among these many species such as *P. dubius*, *Cirrhinus cirrhosus*, *Silondia silondia*, *Acrossocheilus hexagonolepis* is imperiled by various causes particularly due to habitat change. The landings of unstocked fishes declined to 67276 kg in 2002-2003 from 148452 kg recorded in 1993-94. Harrison and Stiassny (1999) [10] estimated that 71 percent of extinctions were related to habitat alteration, 54 percent to exotic species, 26 percent to pollution and the rest to hybridization, parasites and diseases, or intentional eradication. Rani Palaniswamy and Manoharan (2003) [11] have reported that the fish landings of Mettur reservoir over the years from 93-94 to 2002-03 and the gradual reduction in the landings of unstocked fishes predominantly native fishes (Fig 3).

2.5 Self recruiting exotic fishes

Among the commercially important, consumers preferred self-recruiting exotic fishes, *Tilapia (Oreochromis mossambicus)* has been observed breeding in most of the reservoirs. Thousands of breeding pits were noted in the marginal areas of Uppar and Palar-Poranthalar. *Tilapia* since their introduction in freshwater reservoirs of Tamil Nadu were showing fluctuating trend in the landings. In the initial years, their performances were overwhelmingly good with commendable growth weighing more than 1 kg in Gunderipallam, Amaravathy and Palar-Poranthalar reservoir. In the later periods stunted growth and poor landings observed probably due to inbreeding and intensive culture based practices with heavy seed stocking. In Amaravathy

reservoir with the increasing production of stocked species, tilapia production concomitantly declined (Srinivasan, 1995)^[9]. The upsurge is observed in certain years in Krishnagiri, Uppar and Palar-Poranthalar reservoirs when the stocking density decreases. Recently it is noted that the invasion of

African catfish in Mettur reservoir offsets the proliferation of Tilapia by preying upon their eggs and damaging the nests. Schools of advanced fingerlings of Mahseer were located in Thoonakadavu reservoirs in 2000 but it is also recorded poorly in the later years.

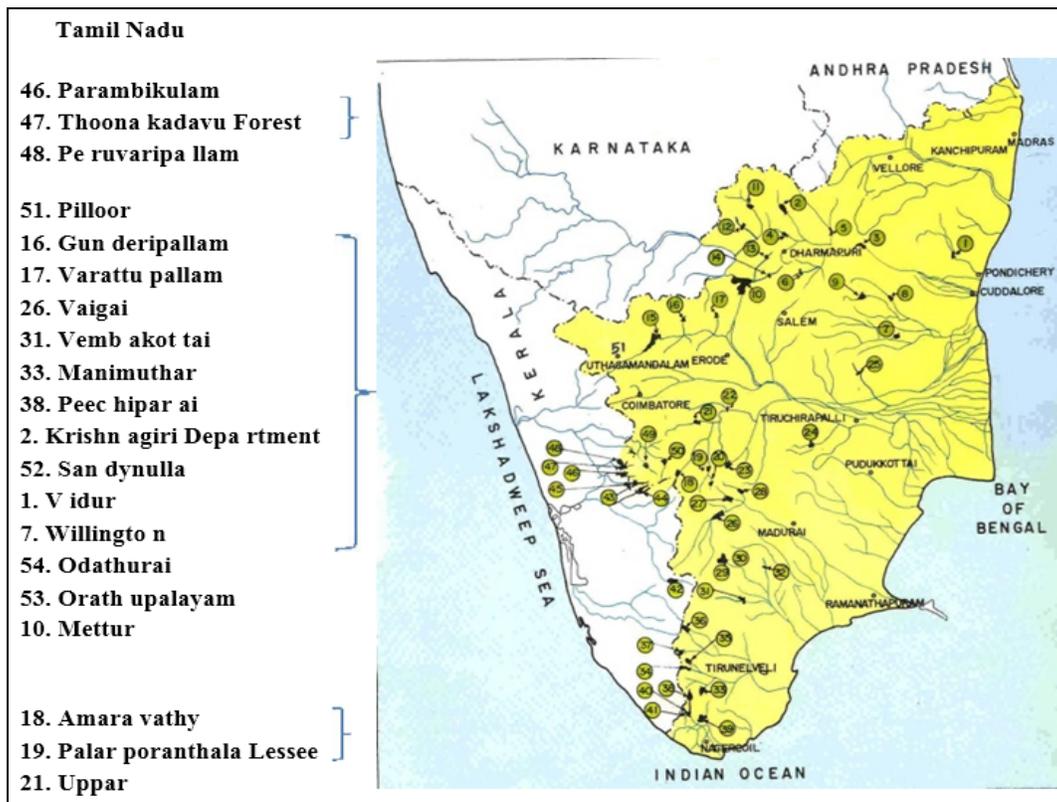


Fig 1: Reservoir map of Tamil Nadu

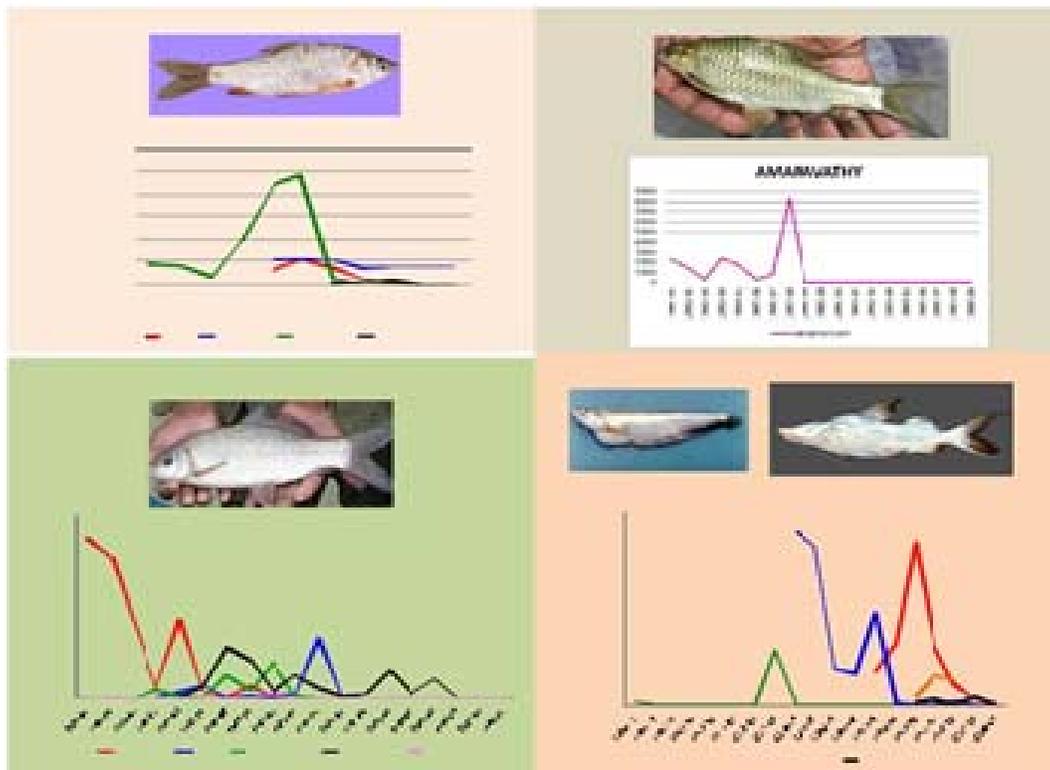


Fig 2: Decline of indigenous fish catch in few reservoirs

2.6 Fish Landings in Mettur Reservoir

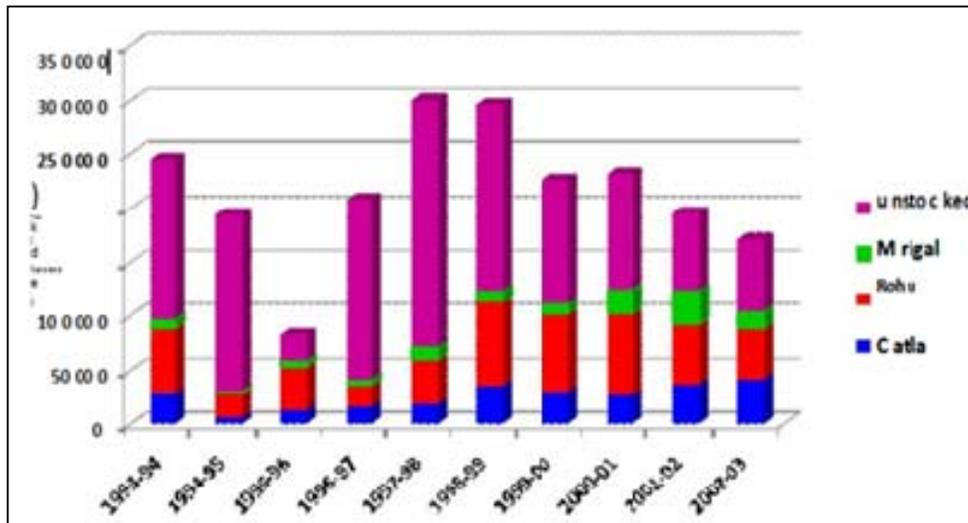


Fig 3: Fish landings in Mettur reservoir

3. Results and Discussion

In India the introduction of *Cyprinus carpio* into Dal Lake and Loktak Lake has been reported to affect the population of indigenous *Schizothorax* and *Osteobrama belangeri* respectively (Paliwal and Bhandarkar, 2014) [12]. Depletion of native population catla and Mahseer was observed in Govind Sagar reservoir after the introduction of silver carp (Menon, 1979, Molur and Walker, 1998) [13, 14]. Some of the major issues threatening the fishery and productivity of the reservoirs in India are loss of biodiversity, increased water demand from agriculture, industry, human habitation, habitat modifications, over and indiscriminate fishing, global warming, turbidity increase and alteration of breeding behavior of fishes which are of great concern warranting fishery managers attention. Reservoirs needs to be categorized on account of their suitability for culture based fisheries, conservation of brood stocks, eggs, larvae and fish fry, protection of breeding grounds. Matured fishes migrate towards upstream region during monsoon period for breeding. Such breeding ground need to be protected from sand mining activities. Ban on fishing brood fishes for sustainable fishery of indigenous fishes is to be followed by mesh size regulation. It is also necessary to standardize the fishery management protocols in culture based fisheries adopted reservoirs, giving space for native fish repopulation, either planting indigenous fishes or promoting the existing stock.

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