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FISHERY OF MOZAMBIQUE TILAPIA *OREOCHROMIS MOSSAMBICUS* (PETERS) IN PORINGALKUTHU RESERVOIR OF CHALAKUDY RIVER, KERALA, INDIA

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Abstract: Chalakudy River originating and flowing through Southern Western Ghats, a global biodiversity hotspot; is exceptionally rich in fish diversity representing nearly 98 species. The fish fauna of Chalakudy River is threatened by a range of factors like habitat alteration, over-exploitation, pollution and introduction of exotic species. Five exotic fish species have been recorded from the river system so far. Though several reports are available on the fish diversity from this river, no attempt has been made to quantify the catch of non-native *Oreochromis mossambicus*. The present study focused on the month wise exploitation of *O. mossambicus* from Poringalkuthu Reservoir located in the midstream of Chalakudy River. A detailed monthly survey was conducted at the reservoir to observe the abundance index and catch of the major fish fauna along with *O. mossambicus* for a period of June 2011 to May 2012. The data collection was based on landing centres since experimental fishing was legally prohibited in the study site and the fishing was allowed only to the local tribes. The monthly landing was estimated using standard methods and annual catch was calculated by summarizing the landings of all months. The total catch of the reservoir was found to be 8064 kg/year with a highest quantity recorded for *O mossambicus* (2592 kg/year). The highest abundance index was also recorded for *O. mossambicus* (31.71%) compared to other fish fauna. The regular encounter of mature and ripe females of *O. mossambicus* indicates the successful establishment of the species in wild. The uncontrolled population expansion of this potential exotic fish may be checked since the species may damage the native fauna of the reservoir in a near future.

Key words: Exotic fish, abundance index, catch, range expansion, threats

INTRODUCTION

Biological invasions are increasingly recognized as a primary threat to global biodiversity after habitat degradation. Invasions can bring out irreversible changes in an aquatic ecosystem that may eventually lead to species extinctions (Nyman, 1991). Fishes are the most introduced (624 species) and threatened group of aquatic animal worldwide. In India more than 300 fish species were introduced for various purposes such as increasing fish production, sport fishing, aquarium trade and bio-control of mosquito (Singh and Lakra, 2011). The Western Ghats extending along the west coast of India, covers an area of 180,000 km^2 (CEPF, 2007), is one of the 34 global biodiversity hotspots and one of the three on the Indian subcontinent (Raghavan *et al.,* 2011). The freshwater fish biodiversity within the Western Ghats region is highly diverse, unique and of immense importance to livelihoods and economics with a record of 290 species in which 189 are endemic to the region (Dahanukar *et al.,* 2011). River Chalakudy is the fifth longest river (144 km) in Kerala originates from Anaimalai and Nelliampathy hills of Southern Western Ghats. Chalakudy River is one of the richest river systems of Kerala with regard to freshwater fish diversity harbouring 98 fish species (Ajithkumar *et al*., 1999; Raghavan *et al.,* 2008 a). The fish fauna of the Chalakudy River is highly threatened as a result of habitat alteration and introduction of exotic species (Bachan, 2003; Raghavan *et al.,* 2008 b). Five species of exotic fishes: *Oreochromis mossambicus, Gambusia affinis, Osphronemus goramy, Xiphophorous maculatus* and *Poecilia*

reticulata have been recorded from this river system (Raghavan *et al.,* 2008 b). Even though studies on ichthyofaunal diversity have been reported from Chalakudy River; reports on the status of exotic fishes in Poringalkuthu Reservoir is scarce. The present study evaluates the status, abundance and catch of an exotic fish, *O. mossambicus* from Poringalkuthu Reservoir.

MATERIALS AND METHODS

Poringalkuthu Reservoir is located in the midstream of River Chalakudy ($10^0$10'0'' & $10^0$33'30'' N and $76^0$17'0" & $77^0$4'0" E). The reservoir has an area of 285 ha, mean depth of 9 m at maximum water level and an altitude of 290 m from the mean sea level. It was constructed in 1957 for a purpose of hydro power production and water activities by the state government of Kerala under Kerala State Electricity Board. A detailed monthly survey was conducted in the landing centres of the reservoir to observe the species composition in the fishery from June 2011 to May 2012. The data collection was purely based on landing centres since experimental fishing was prohibited in the study area where the fishing was allowed only to the local tribes. The fish samples were collected and identified following standard methods (Talwar and Jhingran 1991; Jayaram 1999, 2009). The abundance index of each fish species was calculated from: A = N/S, where 'N' is the total number of individuals of species and 'S' is the total number of fishes observed. Selection of fishing units was done following Alagaraja (1984) and Kurup *et al*. (1992). Daily landings from each type of gears and fishing methods were computed following Kurup *et al*. (1992):

$$W = (w/n) \times N$$

Where, W = total weight of fish, w = total weight of fish from gear sampled n = number of gear sampled, N = total number of similar gears operated.

Monthly catch was estimated by multiplying daily catch with total number of fishing days in a month. The annual exploited quantity was calculated by summarizing the landings of all months.

RESULTS AND DISCUSSION

Reservoir fisheries has tremendous economic importance in terms of its vast resources, employment opportunities and as a source of animal protein in human diet. Even though reservoir fisheries hold immense fisheries potential, they are not contributing significantly to the inland fish production. The average fish yield from the reservoirs of India has been extremely low due to the unscientific management practices resulting from inadequate knowledge of the ecology and production biology of the reservoir (Jhingran, 1989).

The diversity of fish catches from Poringalkuthu Reservoir comprised of both indigenous and introduced species representing a total of 11 fish species belonging to 3 orders and 4 families. The main indigenous fishes exploited from the reservoir were *Tor khudree, Barbodes carnaticus* and *Hypselobarbus kolus* while, the non-native fishes contributed to the local fishery comprised of *Oreochromis mossambicus, Cyprinus carpio, Gibelion catla, Labeo rohita* and *Cirrhinus mrigala*. The total catch of the reservoir was found to be 8064 kg/year. The highest catch was recorded in November (949.8 kg) and lowest in January (372 kg).

The highest abundance index was recorded for *O. mossambicus* (31.71%) compared to other fish fauna (Fig.1). The second and third dominant species encountered were *T. khudree* (17.81%) and *D. filamentosa* (17.61%). The abundance index of *C. carpio, G. catla, L. rohita* and *C. mrigala* were comparatively low in the reservoir. Also, documenting the quantity of total exploration, *O. mossambicus* contributed the maximum in all the months of observation with an annual catch 2592 kg/year. Monthly variations in the catch of *O. mossambcius* and other fish species were shown in Fig 2. The catch per unit of effort (CPUE) of *O. mossambicus* varies between 0.30/kg/hr (March) to 1.86/kg/hr (July) (Fig 3).

O. mossambicus, commonly called as Mozambique tilapia is a salt-tolerant, mouthbrooding cichlid native to Africa (Skelton, 1993) having immense aquaculture potential. It is listed as one of the top 100 worst invasive species across the globe (Global Invasive Species Database, 2004) and has successfully established in more than 90 countries or territories on 5 continents (Russel *et al.,* 2012). Mozambique Tilapia was first introduced into a pond ecosystem in India during 1952 and thereafter stocked in the reservoirs of South India for production enhancement (Sugunan,

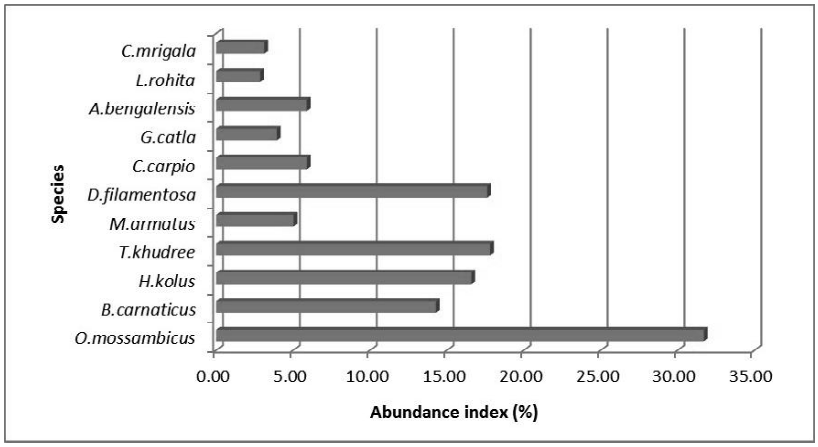

Fig. 1. Comparison of abundance index of fish species from Poringalkuthu Reservoir

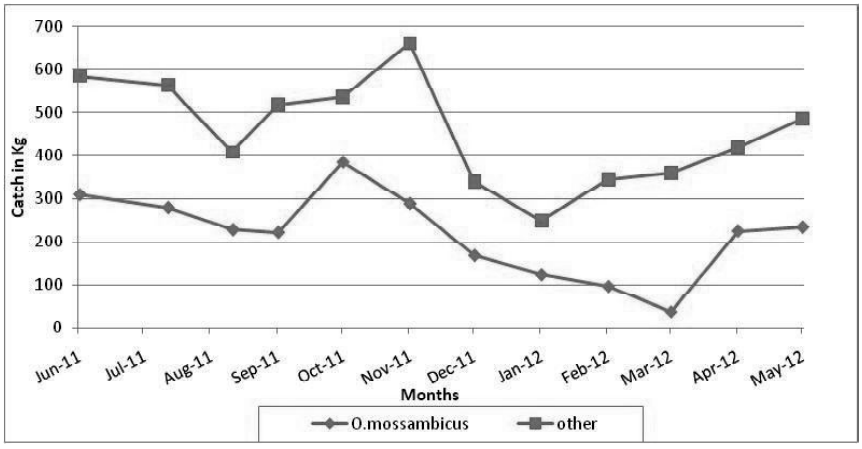

Fig. 2. Monthly variations in the catch of *O. mossambicus* and other fish species from Poringalkuthu Reservoirs

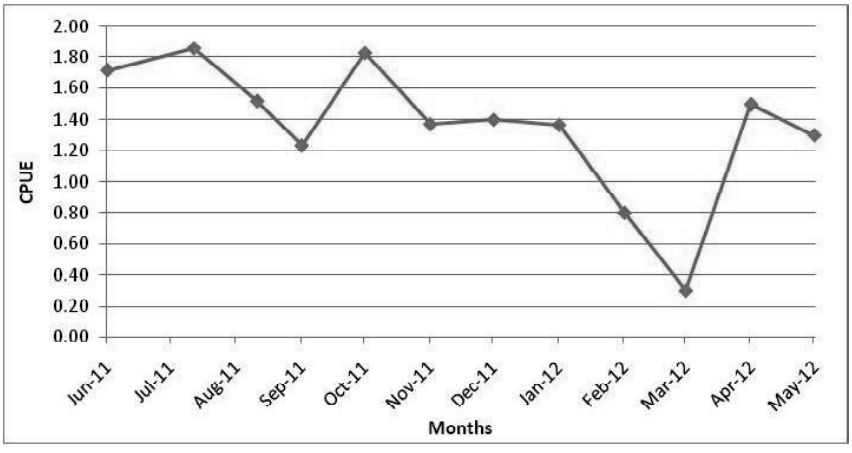

Fig. 3. Monthly variations in CPUE of *O. mossambicus* from Poringalkuthu Reservoir

1995). Later the fish formed its natural breeding population in almost all reservoirs of Tamil Nadu, Kerala, Andhra Pradesh and Karnataka (Sugunan, 1995; Lakra *et al.,* 2008). The possible invasion path of the fish into the Poringakuthu Reservoir could be deliberate stocking for production enhancement.

Mozambique Tilapia could pose serious ecological impacts to many native fish stocks in natural water bodies (Canonico *et al*., 2005; Lakra *et al*., 2008). Its prolific breeding habit and parental care help it to multiply every 3 weeks, caused space overlap with local species in Godavari, Krishna, Cauvery, Yamuna, Sharavathi, Ganga, Bharathapuzha and Chalakudy Rivers (Bijukumar, 2000; Bhat, 2003; Lakra *et al*., 2008; Raghavan *et al.,* 2008 b ; Sarkar *et al.,* 2010). *O. mossambicus* replaced all fish species including major carps and has contributed 99% of the total catch in the Vaigai Reservoir of Tamil Nadu (Sreenivasan and Sundarajan, 1967).The population of *Labeo kontius* in Vaigai Reservoir and *Puntius dubius* in Amaravathy Reservoir have been severely affected by the establishment of *O. mossambicus* (Natarajan and Menon, 1989). The growth of *Chanos chanos* was reduced in many aquatic habitats in Tamil Nadu where tilapia was introduced (Singh and Lakra, 2011). Introduction of tilapia has resulted in competitive displacement of Indian major carps in Jaisamund Lake (Rajasthan) (Lakra *et al.,* 2008). In Ayakulam pond the growth rates of *G. catla, Labeo fimbriatus* and *C. mrigala* were adversely affected by tilapia population (Sreenivasan, 1996). Tilapia has adversely affected the indigenous *Cirrhinus reba* and decrease to the catch of *C. reba* from 70% to 20% in Kabini Reservoir (Murthy *et al*., 1986). The presence of well-established population of tilapia may cause negative effects on orange chromide, *Pseudetroplus maculatus* in the Chalakudy River because both share more or less the similar ecological resources (Raghavan *et al.,* 2008b). *O. mossambicus* contributed 15% of fish landing in Periyar Lake and it may cause threat to *Tor khudree* since 78% of their food were similar (Kurup *et al.,* 2006; Renjithkumar, 2014). In Malampuzha reservoir of Kerala *O. mossambicus* contributed 70% of the catch after the ranching done in 1960's (Mahanta *et al.*, 2003). From the study it is evident that *O. mossambicus* is the most abundantly distributed fish species in Poringalkuthu Reservoir. A year round the availability of the fish and the regular encounter of mature and ripe females of *O. mossambicus* indicates the successful establishment of its population in the reservoir which may pose a threat to the indigenous fishes, especially *T. khudree*.

The uncontrolled population expansion of this potential exotic fish may be checked since the species may damage the native fauna of the reservoir in a near future. A regular monitoring of the population and a detailed investigation on the bionomical characteristics of *O. mossambicus* in the reservoir is to be engaged to generate a database which will enable for the complete or partial irradiation of tilapia with a view to protect the endemic and threatened fish fauna.

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REFERENCES

Ajithkumar, C.R., Remadevi, K., Thomas, R. and Biju, C.R. 1999. Fish fauna, abundance and distribution in Chalakudy river system, Kerala. *J. Bombay Nat. Hist. Soc*., 96 (2): 244-251.

Alagaraja, K. 1984. Simple methods for estimation of parameter for assessing exploited fish stocks. *Indian J. Fish.,* 31(2): 177-195.

Bachan, A.K.H. 2003. Riparian vegetation along the middle and lower zones of the Chalakudy river, Kerala, India. Report. Kerala Research Program on Local Level development. Trivandrum, Kerala.

Bhat, A. 2003. Diversity and composition of freshwater fishes in streams of Central western Ghats, India. *Env. Bio. Fish*., 68: 25-38.

Bijukumar, A. 2000. Exotic fishes and freshwater fish diversity. *Zoos' print Journal*, 15:363-367.

Canonico, G.C., Arthington, A., McCrary, J.K. and Thieme, M.L. 2005. The effects of introduced tilapias on native biodiversity. *Aquatic Conservation: Marine & Freshwater Ecosystems.*,15: 463-483.

CEPF, 2007. Ecosystem profile: Western Ghats and Sri

Lanka Biodiversity Hot spot- Western Ghats Region .Critical Ecosystem Partnership fund. 95 pp.

Darwall, IUCN, Cambridge, UK and Gland, Switzerland and Zoo Outreach Organisation. Coimbatore, India. 116 pp.

Dahanukar, N., Raghavan, R., Ali, A., Abraham, R. and Shaji, C.P. 2011. The status and distribution of freshwater fishes of the Western Ghats. In The Status and Distribution of Freshwater Biodiversity in the Western Ghats, India. S. Molur., K.G. Smith., B.A Daniel. W.R.T Darwall, IUCN, Cambridge, UK and Gland, Switzerland and Zoo Outreach Organisation. Coimbatore, India. 116 pp

Global Invasive Species Database. 2004. 100 of the World's Worst Invasive Alien Species. (Accessed on 20/04/2016).

Jayaram, K.C. 1999. The freshwater fishes of the Indian region. Narendra publishing house, New Delhi, 551 pp.

Jayaram, K.C. 2009. The freshwater fishes of the Indian region, Revised 2nd Edition. Narendra Publishing House, New Delhi, 614 pp.

Jhingran, A.G. 1989. Limnology and production biology of two man-made lakes in Rajasthan (India), with management strategies for their fish yield optimization. Final report, IDA assisted Pilot project on reservoir fisheries management in Rajasthan, Central Inland Fisheries Research Institute, Barrackpore, India, 63 pp.

Kurup, B.M., Sebastain, M.J., Sankaran, T.M. and Rabindranath, P. 1992. Fishery and biology of Macrobranchium spp. of the Vembanad Lake. In; Silas, E. G.,1992 (Ed.), Freshwater Prawns, KAU, Trichur. p78-89.

Kurup, B.M., Radhakrishnan, K.V. and Manojkumar, T.G. 2006. Fish and fisheries of Periyar Lake, Kerala. *Indian J. Fish.*, 53(2): 153-166.

Lakra, W.S., Singh, A.K. and Ayyappan, S. 2008. Fish introductions in India: Status, potential and challenges. Narendra Publishers, New Delhi, India, 303pp.

Mahanta, P.C., Abidi, R. and Kapoor, D. 2003. Impact of introduction of exotic and genetically manipulated fishes in Indian reservoir. In workshop on Fisheries Management in the lentic water system: stocking of reservoir with fish fed, CIFRI Publication. p74-98.

Murthy, N.S., Gonda, S.S. and Murthy, V.A. 1986. Fishes of Kabini reservoir in Karnataka. *Fishing Chimes.,* 8:36-38.

Natarajan, A.V. and Menon, V.R. 1989. Introduction of exotic fishes in Tamil Nadu. Proceeding of Workshop on exotic aquatic species in India. Asian Fisheries Society, Indian branch, Mangalore, India. p 62-65.

Nyman, L.1991. Conservation of Freshwater Fish. Protection of biodiversity and genetic variability in aquatic ecosystems. Fisheries Development Series 56, Swedmar & WWF, Sweden, 38.

Raghavan, R., Prasad, G., Ali, A and Pereira, B. 2008 a. Fish fauna of Chalakudy river, part of Western Ghats biodiversity hotspot, Kerala, India: Patterns of distribution, threats and conservations needs. *Biodiversity and conservation.,* 17:3119-3131.

Raghavan, R., Prasad, G., Ali, A. and Pereira, B. 2008b. Exotic fish species in a global biodiversity hotspot: observations from river Chalakudy, part of Western Ghats, Kerala, India. *Biol Invasions*., 10:37–40

Raghavan, R., Ali, A., Dahanukar, N. and Rosser, A. 2011. Is the fishery for the Deccan Mahseer, *Tor khudree* (Sykes, 1839) in the Western Ghats Hotspot sustainable? A participatory approach to stock assessment. *Fish. Res.,* 110: 29–38.

Renjithkumar, C.R. 2014. Fish germplasm resources and exploited fisheries of rivers of Kerala and Bionomics of Red Canarese barb, *Hypselobarbus thomassi* (Day 1874). Thesis Submitted to Cochin University of Science & Technology, Cochin, 536 pp.

Russel, D.J, Thuesen, P.A and Thomson, F.E. 2012. A review of the biology, ecology, distribution and control of Mozambique tilapia, *Oreochromis mossambicus* (Peters 1852) (Pisces: Cichlidae) with particular emphasis on invasive Australian populations. *Rev. in Fish Bio. and Fisheries.*, 22(3): 533-554.

Sarkar, U.K., Gupta, B.K. and Lakra, W.S. 2010. Biodiversity, ecohydrology, threat status and conservation priority of the freshwater fishes of river Gomti, a tributary of river Ganga (India). *Environmentalist*., 30(4):306-316.

Singh, A.K. and Lakra, W.S. 2011. Risk and benefit assessment of alien fish species of the aquaculture and aquarium trade in to India. *Reviews in Aquaculture.*, 3:3-18.

Skelton, P.H. 1993. A complete guide to the freshwater fishes of southern Africa. Southern Book Publishers, Halfway House, South Africa.

Sreenivasan, A. 1996. Why exotic species? *Fishing Chimes*, 16(1): 09-10.

Sreenivasan, A. and Sundarajan, D. 1967. A note on the tilapia fishery of an impoundment in Madras State. *Science & Culture*., 33:145-146.

Suguan, V.V. 1995. Exotic fishes and their role in reservoir fisheries in India. FAO Fisheries Technical Paper No. 345.

Talwar, P. K. and Jhingran, V.G. 1991. Inland fishes of India and adjacent countries. Vol. I and II. Oxford and IBH Publishing Company. New Delhi, 536 pp.