International Journal of Global Science Research
Vol. 6, Issue. 1, April 2019, pp. 909-915
Available Online at www.ijgsr.com

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v6.i1.2019.118

Review

On the impact of Tilapia (*Oreochromis mossambicus* Peters, 1852) on the Icthyodiversity: A Review

Yati Sood, Prahlad Dube, Jyoti Sharma and Arjumand Quershi*
Department of Zoology, Government College, Kota, Rajasthan, India.
*Government College, Jhalawar, Rajasthan, India.
Email: dube.prahlad@gmail.com

Received: 05/03/2019
Revised: 12/03/2019
Accepted: 29/03/2019

Abstract: Tilapia (O*reochromis mossambicus)* is African mouth-brooder cichlid fish. It is native to the eastward flowing rivers of central and southern Africa. Morphological features are quite distinctive such as laterally compressed body, approx 35cm in length and up to 1.13 kg in weight. It are omnivorous. In India it was brought from Sri Lanka for the first time.It's invasion is problematic for native diversity in many countries. It is listed in Global Invasive Species Database (2006). It is creating threat to local fish fauna in India and other countries. Therefore, it is very important to understand the impact of it's presence in Indian waters. Rajasthan is known for his great Thar desert but south eastern part is blessed with many perennial and emprical rivers and lentic water bodies. Very less work is carried out regarding impact of tilapia on biodiversity of south eastern part of Rajasthan. Present paper tries to review the available literature on this area of study which would be a great help to conserve the native fish diversity.
Key words: fish diversity, tilapia, invasive species, morphological features.

INTRODUCTION:

Tilapia is the common name for nearly a hundred species of cichlid fish from the tilapiine cichlid tribe. Tilapia are mainly freshwater fish inhabiting shallow streams, ponds, rivers and lakes and less commonly found living in brackish water. Historically, they have been of major importance in artisan fishing in Africa and the Middle East, and they are of increasing importance in aquaculture and aquaponics. Tilapia can become problematic invasive species in new warm-water habitats such as Australia, whether deliberately or accidentally introduced, but generally not in temperate climates due to their inability to survive in cold water.

The native Mozambique tilapia is laterally compressed, and has a deep body with long dorsal fins, the front part of which has spines. Native coloration is a dull greenish or yellowish, and there may be weak banding. Adults reach approximately 35 centimetres (14 in) in length and up to 1.13 kilograms (2.5 lb). Size and coloration may vary in captive and naturalized populations due to environmental and breeding pressures. It lives for up to 11 years.

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v6.i1.2019.118

Mozambique tilapia are omnivorous. They can consume detrital material, diatoms, invertebrates, small fry and vegetation ranging from macro-algae to rooted plants. This broad diet helps the species thrive in diverse locations

The African mouth-brooder cichlid, the Mozambique tilapia, *Oreochromis mossambicus* Peters 1852, is native to the eastward flowing rivers of central and southern Africa (Philippart and Ruwet, 1982; Trewavas, 1982). Due to their perceived utility as an aquaculture species, *Oreochromis mossambicus* are now widely distributed around the world (Arthington et al., 1984; Philippart and Ruwet, 1982). However, *Oreochromis mossambicus* have now not liked as a preferred aquaculture species because of their propensity to 'stunt' and their general poor quality due to the small size of founder stocks (Pullin, 1988). Invasive populations are now causing environmental and ecological problems in many countries (Canonico et al., 2005) and as such, *Oreochromis mossambicus* is listed in the Global Invasive Species Database (2006) as being in the top 100 invasive alien species on the planet.

The species has been described as a 'model invader' due to a number of key biological characteristics including tolerance to wide ranging ecological conditions, generalist dietary requirements, rapid reproduction with maternal care, and the ability to successfully compete with native fish through aggressive behavior (Pe´rez et al., 2006b). Therefore, given suitable environmental conditions, *Oreochromis mossambicus* have become successfully established in almost every region in which they have been cultured or imported (Costa-Pierce, 2003; Cucherousset and Olden, 2011; Diana, 2009; Strecker et al., 2011). Official records show that *Oreochromis mossambicus* was first introduced to India from Sri Lanka in 1952 and thereafter stocked in several reservoirs of southern India for production enhancement (Sugunan, 1995). Tilapia now forms a part of fish fauna in the Godavari, Krishna, Cauvery, Yamuna and Ganga Rivers (Lakra et al., 2008).

In earlier studies, tilapia attracted the attention of scientific communities due to its mouth brooding behaviour (Perez et al., 2006; Russell et al., 2012). Tilapia has remained an objective of astonishment to ethnologists for years but its present behaviour, that is, prolific feeder and prolific breeder changed the scenario. Tilapia is now known for its invasion to the non-native water bodies and destruction of their flora and fauna.

REVIEW:

The Icthyodiversity and impact of invasive species on it has been a popular subject among the scientist all over the globe. The most widely dispersed tilapia species the Mozambique tilapia *(Oreochromis mossambique)* which was once known as the Java tilapia since most introduction of this fish originated from west Jawa, Indonesia, its first established local outside Africa (Hickling 1960). Due to the small size of founder stocks, by the mid -1970 the Mozambique tilapia deteriorated in many recipient environment and small sized, poor quality fish lost consumer acceptance [Pullin1988].

Allonson et al., (1971) suggested that *Tilapia mossambicus* to estuaries at the southern end of its distribution at the sourthen Africa related to the maintenance of near normal Na and Cl ion concentration at low temperature during winter water.

Moriarty (1973) reported that the cells of blue green algae are lysed by high concentration of acid (pH 1.9 – 1.4) in the stomach of *Tilapia nilotic.* After laysis, cell contain are digested in the intestine. Acid secretion follows diuranal cycle

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v6.i1.2019.118

related to feeding and thus there is a cycle from zero to maximum digestion each day.
Kutty and Sukumaran (1975) reported that *Tilapia mossambicus* to 30^0C in fresh water and forced to swim at current speeds 36, 66 and 82 cm/s in Blazka's activity apparatus failed to swim at 39.7, 38.4 and 37^0C respectively when temperature become increase lower critical temperature of swimming failure at the same three of ambient water was gradually increased from the acclimation temperature swimming speeds were 17.4, 10.8 and 19.8^0 C the pattern of swimming failure at the critical temperature was similar to that at critical ambient O_2 concentration.
Bruton et al., (1975) reported that *Tilapia mossambicus* inhabits the littoral and sub-littoral in the warm and transition period (Aug. Apri) but move into deep water in the cool season (May- July). Exposed and sheltered areas are utilized for different purpose by adult fishes, the former for nesting, and latter for feeding and mouth brooding.
Hwang (1987) reported that the development of leaky junctions and interdigitations in branchial chloride cells appear to correlate to seawater adaptation in *Oreochromis mossambicus*. These change of seawater-adapted chloride cells seem to be associated with the increase of ion permeability in the gills of teleosts adapted to seawater rather than those adapted to fresh water.
Pullin and Cupili (1987) reported the tilapia are cultured throughout the tropics and subtropics for genetics improvement. They also reported that largest tilapia culture industries are in Asia. The emphasis is on the most popular cultured species, *Oreochromis niloticus*
De Silva and Sirisena (1988) reported that *Oreochromis mossambicus* formed nest build in five manmade lake Sri Lanka. The nest always found generally located in or near cover in shallow water. The nests ranged from 11 to 110 cm in diameter, two size groups of nest recognizable small, with diameter 10-50 cm and large with diameter >50 cm. At any nesting site only one size group of nest was found.
Amarasinghe and de Silva (1992) have reported that the performance of *Oreochromis mossambicu*s in Kaudulla and Minneriya reservoirs was better than is other various geographical area. This may be due to very favorable environment for *Oreochromis mossambicus* in Sri Lanka reservoirs which provide variety of nutrition food source.
Yada et al., (1994) observed that the changes in GH (growth hormone) which occurred when tilapia were moved between fresh water and sea water are compatible with idea proposed by other for salmonids that GH may have important role for sea water.
Oliveira and Almada (1995) reported that sexual dimorphism in growth of conventional morphometric character was investigated in juvenile and young adult (size range 31 to 91 mm) of *Oreochromis mossambicus*. A closely associated set of traits was identified that shows sexually dimorphic growth which was positively allometric in the male. These traits correspond to two different morphological complexes. Jaw structure and anal /dorsal fins. The best sex discriminates among this set of traits were premaxilla width and fin height and snout. These finding may be explained in term of intra and inter sexual selection acting together and favouring males with strong and large mouth and high dorsal and anal fin, traits that are important in agonistic display (jaw and fins) fighting and nest digging (jaw).
Jayaprakas et al., (1996) observed that carnitine induced lipid catabolism leading to reduction in lipid content of cultured fish, using lipid as energy source while sparing protein for anabolic processes. Significantly high GSI, sperm cell concentration, motaility and percentage

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v6.i1.2019.118

viability of the spermatozoa in carnitine treated tilapia.

Vanzyl et al., (1997) reported that 24 *Oreochromis mossambicus* from the Hardapdam, Namibia were introduced during 1986, into salt pans at Swakopmund on the Namibia coast. The salt concentration of the salt pans is higher than of sea water. The *Oreochromis mossambicus* adapted well to the condition, breed successfully and maintained a healthy population.

Nakano et al., (1998) suggested that glucose is an important energy source for osmoregulation during the acclimation to hyperosmotic environments in *Oreochromis mossambicus.*

Kumar (2000) reported that exotic species and other anthropogenic activities the exotics compete with the indigenous species for food, habitat and may even prey open them, introduced new parasites and diseases. *Oreochromis mossambicus* in India has been claimed as a success story by expect. He found that tilapia now dominates indigenous icthyofaunal in many water bodies of India.

Canonica et al., (2005) has reported that tilapia species are highly invasive and exist under feral condition in every nation in which they have been introduced. They also found that tilapia damage to native fish species and biodiversity.

Raghavan et al., (2007) reported that five exotic found Chalakudy river in Kerala, India. *Oreochromis mossambicus* was ubiquitous in occurrence with large shoals being encountered at all sampling sites along the downstream upstream gradient of the river.

Marjani et al., (2009) observed that 17-alpha Methyl Testosterone [MT] receiving treatment showed a significantly higher male proportion than the control experiment of *Oreochromis mossambicus.* Dose rate of 75 mg/kg MT of feed resulted in maximum male population [98.09%] with 1.91% sterilized fish. The dose rate of 75 mg/kg MT gave the maximum gain in body weight i.e., 11.8g which is 1.2 time greater than the control.

Singh and Lakara (2011) have reported that in India over 300 alien species are present 291 invasive species, for example *Cyprinus carpio, Oreochromis niloticus, Aristichthys nobilis, Pygocentrus natereri* and *Pterygolichthys sps*. They reduce the availability of local species and establish in natural water bodies becoming invasive and consequently adversely affecting fish biodiversity and aquatic ecosystem.

Adriana et al., (2011) reported that Nile and mozambique tilapia harbour a number of different species of Gyrodactylus, with *Gyrodactylus cichlidarum* being the most frequently encountered and being associated with mortalities of juvenile *Oreochromis niloticus niloticus*.

Russell et al., (2012) reported that two invasive tilapia species, *Oreochromis mossambicus* and *Tilapia mariae* in fresh water habitat in north-eastern Australia was investigated *Oreochromis mossambicus* length and age considerably depending on habitat male and *Oreochromis mossambicus* in a large impoundment were considerably greater than for those resident in small coastal drain.

Singh (2014) reported that number of invasion of fresh water exotic fishes have taken place into India over the past decade and adversely affected the fish biodiversity. Many more change are predictable to occur with the expected climate invading near area and ecosystem. The estimated annual average production of alien species fit for human consumption amount to around 18.2 to 34.5% of the annual average production of marketable fish culture in India. A significant negative impact of the introduced species on native icthyo fauna has been ascertiained as regard to its ecological, biological characteristic biodiversity and health. Concidered a typical invasive alien

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v6.i1.2019.118

species, *Oreochromis mossambicus, Oreochromis niloticus* and *Cyprinus carpis* heavily depressed the occurrence and numbers of Indigenous population and also contributed to the declined fishery of native cyprinid fish in several natural aquatic body of the country.

Ujjania et al., (2015)has reported that during 1990-90 in Jaisamand IMC (37%), Minor carp (59%) and Cat fishes (9%) total production 287 metric ton but due to invasion of tilapia where only IMC (11%), Minor carp (3%), Cat fish (4%) and Tilapia is dominating 82% out of total production 119 Meteric ton.(2012-13)

Sakhare and Jetithor(2016) reported that 80 specimens of *Oreochromis mossambicus* collected from Borna Reservoir of Maharashtra, India revealed that the food of juvenile mainly is rotifer(35%), copepode(30%), chlorophyceae(20%), bacillariophyceae(10%) and aquatic insect(5%). While in adult gut chlorophycaea (40%), bacillariophyceae(30%), rotifer(15%) and aquatic insect(5%).Intense feeding was noticed during summer season and juvenile was the active feeder.

Laxmappa (2016) reported that presence of exotic fishspecies such as *Oreochromis niloticus, Oreochromis mossambicus, Claris gariepinus* etc have impacted the population of indigenous species and contributed towards the decline in the fishery of native cyprinid fish species in several natural aquatic bodies of Telangana state.

Renjithkumar et al., (2016) reported that the contribution of non native species to the total fishery of Bharathapuzha River was estimated to be 13.93%. Indian major carp [*Gibelion catla, Labeo rohita, Cirrhinus mrigala*] and *Oreochromis mossambicus* were the non native species represented in the exploited fishery. *Gibelion catla*[3.98t], *Labeo rohita* [5.14t] and *Cirrhinus mrigala* [3.14t] were the transplanted species which together formed 11.43% in the total landing of the river. The size range of Catla Rohu, Mrigal in the catch were 240-720mm, 290-560mm and 190-360mm respectively. The exotic fish Oreochromis mossambicus accounted for 25% of the fishery

CONCLUSION:

Concluding the above account we can state that tilapia [*Oreochromis mossambicus*] are popular exotic fish in fresh water resources It's invasion harm full for other indigenous fishes species. Thus tilapia [*Oreochromis mossambicus*] study is very important for aquatic diversity.

REFERENCES:

Allanson B.R., Bok, A, and VanWyk, N.I. (1971) The Influence of Exposure to Low Temperature on Tilapia mossambica Peters (Cichlidea). Journal of Fish Biology, 3(2),181-185.

Amarasinghe U.S., and deSilva, S.S. (1992) Population Dynamics of Oreochromis mossambicus and Oreochromis niloticus (Cichlidae) in Two Reservoirs in Sri Lanka. Asian Fisheries Sciences 5(1),37-61

Arthington A.H., McKay, R.J., Russell, D.J., and Milton, D.A. (1984) Occurrence of the introduced cichlid Oreochromis mossambicus (Peters) in Queensland. Aust. J. Mar. Freshw. Res. 35(2), 267-272.

Bruton M.N., and Boltt R.E. (1975) Aspect of the biology of Tilapia mossambicus Peters (Pisces: Cichlidae) in a natural fresh water (Lake Sibaya , South Africa) Journal of Fish Biology 7(4), 423-445.

Canonica G.C., Arthington A. McCrary J.K. and Thieme M.L. (2005) The effect of introduced tilapias on native biodiversity.

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v6.i1.2019.118

Aquatic conservation marine and fresh water ecosystem 15(5), 463-483.

Costa-Pierce BA (2003) Rapid evolution of an established feral tilapia (Oreochromis spp.): the need to incorporate invasion science into regulatory structures. Biol. Invasions 5:71-84

Cucherousset J, Olden JD (2011) Ecological impacts of non-native freshwater fishes. Fisheries 36(5), 215–230.

de Silva S.S., and Sirisen H.K.G. (1988) Observations on the nesting habits of Oreochromis mossambicus (Peters) (Pices: cichlidae) in SriLanka reservoirs. Journal of Fish Biology, 33(5), 689-696.

Diana J. S. (2009) Aquaculture production and biodiversity conservation. Bioscience 59(1), 27–38.

Garcia–Vasquez A., Hansen H. Christison K.W. Bron J.E. and Shinn A.P. (2011). Description of three new species of Gyrodactylus von Nordmann, !832 (Monogenea) parasitising Oreochromis niloticus niloticus [L.] and Oreochromis mossambicus (Peters) (Cichlidae). Acta Parasitological 56(1), 20-33

Hwang P.P. (1987) Tolerance and ultrastructural response of branchial chloride cells to salinity changes in the euryhaline teleost Oreochromis mossambicus. Marine Biology 94(4):643-649.

Hickling C.F. (1960) The Malacca tilapia hybrid. Fish culture research station, Malacca. 57(1).

Jayaprakas V., Sambhu, Kumar, S. S. (1996) Effect of Dietary L-carnitine on Growth and Reproductive Performance of Male Oreochromis mossambicus (Peters). Fishery Technology, 33(2), 84-90

Kutty M.N., and Sukumaran, N. (1975) Influence of Upper and Lower Temperature Extremes on the Swimming Performance of Tilapia mossambica. Journal Transaction of the American Fishery Society 104(4), 755-761.

Kumar A.B., (2000). Exotic fishes and fresh water fish diversity. Zoos' Print Journal, 15(11), 363-367

Laxmappa B., (2016). Exotic fish species in aquaculture and aquatic Ecosystem in Telangana State, India. Journal of Aquatic Biology and Fisheries, 4:1-7

Lakra W.S., Singh, A.K., and Ayyappan, S. (eds.) (2008). Fish Introductions in India: Status, Potential and Challenges. Narendra Publishers, New Delhi, India.

Marjani M., Jamili, S., Mostafwi, P.G., Ramin, M. and Mushiuchin, A. (2009). Influence of 17- Alpha Methyl Testosterone on Masculinization and Growth in Tilapia (Oreochromis mossambicus). Journal of Fisheries and Aquatic Science 4(1), 71-74.

Moriarty D.J.W.,(1973). The physiology of digestion of blue-green algae in the Cichlid fish, Tilapia nilotica. Journal of Zoology, 171(1), 25-39

Nakano K., Tagawa, M. Takemura, and A, Hirano, T. (1998). Temporal Change in Liver Carbohydrate metabolism Associated with Sea water transfer in Oreochromis mossambicus. CBP Part B: Biochemistry and Molecular Biology 119(4), 619-836

Oliveira R.F., and Almada, V.C. (1995). Sexual Dimorphism and Allometry of External Morphology in Oreochromis

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v6.i1.2019.118

mossambicus. Journal of Fish Biology 46(6), 1055-1064.

Philippart J.C. and Ruwet J.C. (1982). Ecology and distribution of tilapias. In: Pullin RSV, Lowe-McConnell RH (eds) Biology and culture of tilapias. International Center for Living Aquatic Resource Management, Manila. pp. 15-59.

Pe´rez J.E., Nirchio, M., Alfonsi, C., and Munoz C. (2006b). The biology of invasions: the genetic adaptation paradox. Biol. Invasions 8, 1115-1121

Pullin R.S.V.,(1988). Tilapia genetic resources for aquaculture. In: Pullin RSV (ed) International Center for living aquatic resources management conference proceedings, Manilla, ICLARM. pp. 108.

Raghavan, R., Prasad, G. Anvar-Ali, P.H. and Pereia, B. (2007). Exotic Fish in a Global biodiversity hotspot observation from river chalakndy, Part of western ghats , Kerala, India. Biological invasions (2008) 10(1), 37-40.

Renjithkumar C.R., Roshni, K. and Madhusoodam, K.B. (2016). Composition of Non Native Fishes in the Exploited Fishery of Bharathapuzha River, Kerala, India. Journal of Aquatic Biology and Fisheries 4, 99-104.

Russell D.J., Thuesen, P.A. and Thomson, F.E. (2012). Reproductive strategies of two invasive tilapia species Oreochromis mossambicus and Tilapia mariae in northen Australia. Journal of Fish Biology 80(6), 2176-2197

Sakhare V.B., and Jetithor, S.G. (2016). Food and feeding behavior of Mozambique tilapia (Oreochromis mossambicus Peters) from Borna Reservoir of Maharashtra, India . Journal of Fisheries, 4(3), 431-439.

Singh A.K. and Lakra, W.S. (2011). Risk and benefit assessment of alien species of the aquaculture and aquarium trade into India. Reviews in Aquaculture, 3(1):3-18.

Singh A.K., (2014). Emerging Alien Species in Indian Aquaculture: Prospect And Thereats. Journal of Aquatic Biology and Fisheries, 2(1):32-41

Strecker AL, Campbell PM, Olden JD (2011). The aquarium trade as an invasion pathway in the Pacific northwest. Fisheries 36(2), 74–85.

Suguan VV (1995). Exotic Fishes and their Role in Reservoir Fisheries in India. FAO Fisheries Technical Paper No. 345.

Trewavas E (1982). Tilapias: taxonomy and speciation. In: The biology and culture of Tilapias. London.

Ujjania N.C., Dubey, M., Sharma, L.L., Balai, V.K. and Srivastav, R.M. (2015). Bio-invasion of exotic fish tilapia (Oreochromis mossambicus Peters, 1852) in Lake Jaisamand, India. International Journal of fisheries and aquatic studies 3(2), 174-177.

Van Zyl B.J., Hay, C.J. and Steyn, G.J. (1997) The Successful Introduction of Oreochromis mossambicus in Salt Pans Along the Namib coast. Madoqua 19(2), 87-89.

Yada T., Hirano, and T. Grou, E.G. (1994) Changes in Plasma Levels of the Two Prolactins and Growth Hormones During Adaptation to Different Salinities in Euryhaline Tilapia, Oreochromis mossambicus. General and Comparative Endocrinology 93(2), 214-223.