Population structure of exotic fish tilapia (Oreochromis mossambicus, Peters 1852) from the lower stretch of Tapi River (weir-cum-causeway), Surat (Gujarat)

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Abstract:

Fish population structure is important to elucidate the fish exploitation pattern and it is directly related to fish productivity in the aquatic resources. In present study, determine the population structure of the exotic fish (Oreochromis mossambicus, Peters 1852) from the lower stretch of Tapi River (Causeway), Surat (Gujarat). The morphometric measurements including total length and weight were measured from the randomly collected 569 fish specimens during November 2025 to March 2026. The length of studied fish was ranged varied from 15.000-37.400 cm and weight was 50.00 -990.00 g whereas the mean values of length and weight was 26.130 ± 0.165 cm and 373.222 ± 7.139 g from weir-cum-causeway of Tapi river. The findings of length-based group distribution depicted 5 length groups in that length group C was containing 233.000 numbers and dominated (40.949 %) followed by length group B 216.000 (37.961 %), D 90.000 (15.817 %), A 20.000 (3.515 %) and E 10.000 (1.757 %) in the studied fish population. Findings of the present study is very useful for planning for sustainable fishery of studied fish in the water bodies.

Introduction:

Tilapia (Oreochromis mossambicus, Peters 1852) is an exotic fish which belongs to the Cichlidae family and is known as mud bream. It originated from Africa and introduced in large number into tropical and sub-tropical waters of the world (Fryer & Iles, 1972) for improving local fishery potential and for broadening species diversity in aquaculture programs, sport fishing, aquarium keeping, controlling of unwanted organisms (mosquitoes, aquatic weed etc.). After introduction tilapia became the second most farmed finfish after carp in the world and they are the mainstay of many resource-poor fish farmers (Eknath et al., 1993) and major protein source in many of the developing countries. Tilapia is the most important aquaculture species of 21st century (Shelton, 2002) and represents the fifth position of the world in total fish production (Sugunan 1997). The tolerance of variable environmental conditions (Trewavas, 1983) support to survival of tilapia and its total world production reached 3.6 million tons in 2008 (FAO, 2010). Tilapia are trophic generalists (Traxler and Murphy, 1995) and reproductive biology of it is characterized by short generation time and extended breeding seasons (Naylor et al., 2000; Coward and Little, 2001; Stickney, 2002). In fact, population of exotic fish tilapia in non-native and become numerically dominant in various habitats (Faunce and Paperno, 1999; Pathak et al. 2011; Ujjania et al., 2020). It can mature in small size and at early stage under adversative environmental conditions of the water bodies that helps to increase the population (Ujjania et al., 2010; UnekeBilikis et al., 2021).

The population density considered as the number of fish specimens available in unit area of the water body (Ujjania and Sharma, 2023) while population represented as a fish ratio of different age classes or length groups at same time in the water body (Kajungiro et al., 2019; Gopesh et al., 2021). The population studies are the important aspect of fishery biology and the growth rate of fish can be computed from the age estimation and population structure, which gives important information about stock composition, age, maturity, life span, mortality, growth and production (Markert et al., 2010; Muhammad, 2013; Dwivedi et al., 2017). Thus, the aspects of present study is convenient for the management and conservation of fish populations (Haroon, 1999) and exploitation pattern of the population (Prashant et al., 2008) in natural water bodies. The determination of the population pattern of fishes is useful to tackle the problems of basic life history and essential for framing future policies and management of the fishery (Soni and Ujjania, 2018). Similar studies on population structure of tilapia were reported by Dwivedi and Jha (2013) from Ganga River, Dwivedi et al. (2017) from Ken River, Ujjania et al. (2024) from Ukai dam, Gujarat. Whereas, population structure of mrigal in Ghaghra river reported by Khan et al. (2017), common carp in Ghaghra river was reported by Khan (2017), mrigal in Ukai dam reported by Soni and Ujjania (2018), Gangetic Tengra in Ghaghra river reported by Khan (2019), major carp in Ukai dam reported by Ujjania and Soni (2020). Similarly, Khan et al. (2007) and Imran et al. (2015) studied size composition and exploitation pattern of C. mrigala and other Indian major carps.

The present study was conducted to determine the population structure of exotic fish tilapia (O. mossambicus) from the lower stretch of Tapi River (Causeway), Surat (Gujarat) which would be useful to develop the strategies for the conservation and management of aquatic ecosystems.

Materials and methods

The fish specimens (569) were randomly collected from the lower stretch of the Tapi River, specifically near the weir-cum-causeway at Morarji Desai Setu, Surat (21.17° N latitude and 72.83° E longitude) during the November 2025 to March 2026. The selected site is important due to its role in supporting fish diversity, including exotic species such as tilapia, and its exposure to varying water quality conditions, making it suitable for studying biological aspects and ecological adaptations of fish populations. The selected morphometric measurements i.e. total length (cm) and weight (g) were measured from these randomly collected fish specimens. The total length measured from the snot tip to caudal fin end of the fish by the measuring tape, whereas the body weight (WT) of the fish was measured with the help of a single pan balance. The length data was distributed in different five length groups (A,

B, C, D and E) on the basis of the length difference of 5.0 cm (Ujjania et al., 2014).The population structure of fishes was denoted by age pyramid which prepared by method of Odum (1971). The graphical presentation and data calculation were completed with the help of MS Excel 2010.

Result and Discussion

The total length and weight was minimum (15.00 cm and 50.00 g), maximum (37.400 cm and 990.00 g) and mean (26.130 ± 0.165 cm and 373.222 ± 7.139 g) respectively observed from the studied fish tilapia in weir-cum-causeway (Table 1) and 5 length groups were observed from the length-based group distribution (Table 1).

The length group distribution depicted that length group C containing 233.000 numbers and was dominated (40.949 %) followed by length group B, 216.000 (37.961 %), D, 90.000 (15.817 %), A, 20.000 (3.515 %) and E, 10.000 (1.757 %) in the fish catches during the study (Table 1). These findings help to conclude that the middle sized tilapia (length group B, C & D) contributed the maximum contribution in the tilapia catches compared to lower sized groups (A) and higher sized groups (E). In the present study the patterns of population structure was an 'urn shaped' shaped pyramid which resulted in harvested catch of studied fish juvenile fish was less compared to the larger and mature fishes. The 'urn shaped' population structure is obtained when the birth rate of fishes are reduced and these groups decline in proportion to the larger groups in the fish population (Odum, 1971). The exploitation pattern of fish population was an indicator of over exploitation (Khan et al., 2017). The findings of the present study are evidenced by the reports of the Jhingran (1959), Mayank and Tyagi (2013), Tripathi et al. (2015), Imran et al. (2015), Mayank and Dwivedi (2015), Dwivedi et al. (2016), Khan (2017), Soni and Ujjania (2018), Khan (2019) and Ujjania and Soni (2020).

Conclusion

The finding of present study concluded that studied exotic fish tilapia having normal growth and well survival with optimum morphometric variables (length and weight). It contains 5 length groups and in the fish catches, medium sized fishes (length group B, C & D) are dominated (97.727 %) compare to younger fishes (length group A, 3.515 %) and elder fishes (length group E, 1.757 %) that is not depicted worthy for natural stocking of the fishes in the weir-cum-cause way. The findings of the current study is useful for the planning of sustainable fishery in the studied fish water system.

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Conflicts of interest

"No conflict of interest" declared by the authors

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