ISSN: 2634 - 8845

Journal of Earth and Environmental Science Research

SCIENTIFIC Research and Community

Research Article

Open Access

Invasive Potential of Nile Tilapia, *Oreochromis Niloticus* (Linnaeus, 1758) From the Tributary of the Ganga River, Central India

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ABSTRACT

The natural fishery or wild stock of fishes especially fresh water in India is significantly declining due to manmade stressors. The invasion of fishes and size composition are an essential component of stream, river and other large water bodies ecosystem and represents an evident of structure, function, depth and health of stream/river. During study period 683 specimens of *Oreochromis niloticus* were collected from February 2019 to January 2020 in Sirsa fish landing centre from the lower stretch of the Tons river at Prayagraj, Uttar Pradesh, India. Size composition of fishes was varied from 82 to 463 mm (total length). The maximum total length of *O. niloticus* in the catches indicated that its increasing colonisation success in the river Tons. Size composition of fishes was also indicated that the stock of *O. niloticus* in the Tons river was in healthy condition. The 231-260 mm size group was most dominated (15.67%) compared to 261-290 mm (12.44%) and 291-320 mm (11.71%) in the total exploited stock. The middle size group was maximum exploited with 51.24% from the Tons river at Prayagraj. Higher size group contributed sizeable proportion with 25.04% in the exploited stock. The exploitation pattern was unsystematic in higher size group due to contribution of higher proportion. Current exploitation pattern is unsystematic but *O. niloticus* is powerfully invaded from the lower stretch of the Tons river at Prayagraj.

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Received: June 14, 2021; **Accepted:** June 22, 2021; **Published:** June 30, 2021

Keywords: *Oreochromis Niloticus*, Size Composition, Invasive Potential, Exploitation, Tons River

Introduction

Fishes are significant to providing a high-value protein source with omega-3 fatty acid and important micronutrients for much of the globe [1]. The human activities have powerfully altered size, age, sex ratio, fecundity, feeding nature, exploitation and biodiversity of fishes especially from the freshwater ecosystems over the world [2-9]. In general, *Oreochromis niloticus* (Nile tilapia) is eminent for their plasticity in survival, feeding nature, fast growth, tolerance, ease of breeding and size-at first maturity that not only compose them the ability to invasion in any fresh water ecosystem and become established in non-native ecosystem or introduced ecosystem (example habitats, environments) but also allow them an excellent aquaculture species (Example due to its ability to tolerate a wide range of environmental conditions and ability to feed at different trophic levels) with other carps [10-16]. It is naturally distributed in the Nile River as well as most parts of African rivers, reservoirs and lakes while it is exotic fish species for India [17-20]. It is a great economical importance species and significant role in the tropical and sub-tropical aquatic ecosystems [21-23]. Many researchers have reported that the invasive cichlids (Example *Oreochromis niloticus*) reducing growth and reproduction especially fecundity and survival of spawn of native species [24-28].

In 20th century, *O. niloticus* has been intentionally dispersed worldwide, in particular for aquaculture, restocking programs and higher production [17,18,29-33]. As production from capture fisheries (Example riverine sector) decreasing day by day but invasion of *Oreochromis niloticus* (Nile tilapia) and Cyprinus carpio (Common carp) it increased from the Ganga river system [34-36]. It is commercially and economically exploited from the Ganga river with 14.56% in 2015-2016 and Yamuna river with 24.36% in 2011-2012 at Allahabad (now Prayagraj) [19,37]. Therefore, knowledge of size composition and exploitation pattern of *O. niloticus* is essential to better understand its stock status, impact and to design optimal management strategies. Presently, the Tons river (lower stretch) fishery is very healthy in respect of landing, and size composition and exploitation pattern investigations are timely as the data are needed to improved management of *O. niloticus* stock and impact in the fishery of Indian major carp (Catla catla, Labeo rohita, Cirrhinus mrigala) and large size carp and catfishes (Labeo calbasu, Sperata aor, S. seenghala, Wallago attu).

Material and methods

Climate and Characteristics of the River

The climate of this region (Tons river basin) is marked by mild cold during winter and intensive heat during summer. The monsoon season is July to September month. Sometimes winter rainfall is also recorded. The Tons river is essentially a hilly stream arising in the Kaimur hills of the Vindhyan range, Madhya Pradesh, India. The

Tons river drain the Bundelkhand geographic region of central India. Bundelkhand lies between the Indo-Gangetic Plain to the north and the Vindhya Range to the south. It is a tributary of the Ganga, which forms confluence at Sirsa near Meja in the Prayagraj district. Tons river lies between latitude 24o 0' to 25o 16' 54" North and longitude 80o 26' 45" to 82o 04' 57" East. It banks are lined by deep ravines and the bed is rocky. Agriculture and human settlements were the major land use category in its catchment.

During study period 683 specimens of *Oreochromis niloticus* were collected from February 2019 to January 2020 in Sirsa fish landing centre from the lower stretch of the Tons river at Prayagraj, Uttar Pradesh, India. Size composition (total length) varied from 82 to 483 mm. Drag net, cast net, gill net and hook and line were used by fishers/fishermen to catch the fishes in the Tons river. A total of 683 fish samples (male and female) were collected and analyzed. The total length (mm) from the tip of snout to the end of largest caudal fin rays was measured by measuring scale. The obtained data from the river was classified into a series of size groups of 30 mm intervals. The number of samples calculated according to size group then converted into percentage.

Result and discussion

The size composition of *O. niloticus* was varied from 82 mm to 463 mm (total length) from the lower stretch of the Tons river at Prayagraj, Uttar Pradesh, India. The maximum fish exploitation was recorded in 231 to 260 mm size group in case of male, female and pooled samples. This size group of fishes is more attracted to the fishers (Example due to market value, cost of fishing) and consumers also (Example taste, structure of bone in fish body) both. The maximum total length (463 mm) of *O. niloticus* in the catch indicated that its increasing colonisation success from the river Tons at Prayagraj, Uttar Pradesh, India.

Pooled samples

The maximum fish exploitation was recorded in 231 to 260 mm size group with 15.67% while minimum exploitation was observed with 1.17% in 441-460 mm size group. Fish exploitation is an economic activity governed by social needs and pressures. The middle size group was maximum exploited compared to lower and higher size groups from the lower stretch of the Tons river at Prayagraj. The experienced mature female fish stock was healthy in the river in monsoon season but very high fishing pressure we observed in this season. On the basis of data, it is observed that middle size group was maximum exploited with 51.24% at Prayagraj. Lower size group was exploited with 23.78%. Higher size group shared sizeable proportion with 25.04% in exploited population (Figure 1). The results also indicated that the exploitation was unsystematic in higher size group.

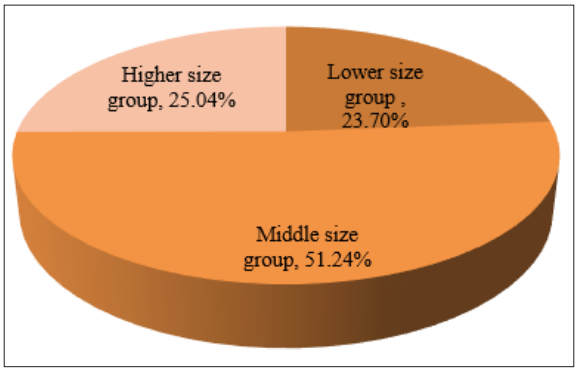

Figure 1: Exploitation structure (according to size group) of *Oreochromis niloticus* from the Tons river at Prayagraj, Uttar Pradesh

Lower size groups 81-110 mm, 111-140 mm 141-170 mm and 171-200 mm were contributed in the exploited stock with 2.34%, 5.41%, 7.17% and 8.78%, respectively (Table 1). Middle size groups 201-230 mm, 231-260 mm 261-290 mm and 291-320 mm were shared in the exploitation 11.42%, 15.67%, 12.44% and 3.28%, respectively. Higher size groups 321-350 mm, 351-580 mm, 381-410 mm, 411-440 and 441-470 mm were contributed in the exploitation with 10.54%, 7.03%, 4.54%, 1.76% and 1.17%, respectively (Table 1, Figure 2).

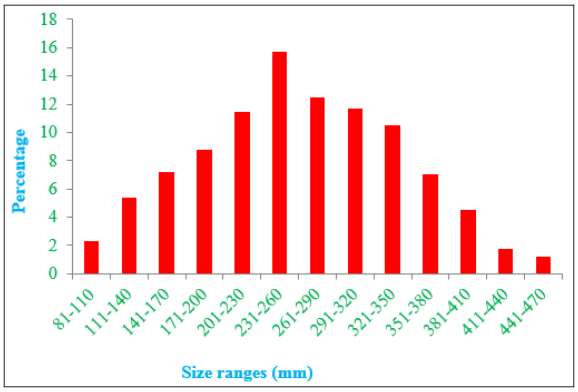

Figure 2: Size composition and exploitation structure of *Oreochromis niloticus* from the Tons river at Prayagraj, Uttar Pradesh (Pooled samples)

Male samples

In case of male samples, the maximum exploitation was recorded in 231 to 260 mm size group with 15.18% but minimum exploitation was observed with 1.49% in 441-460 mm size group (Table 1). Size group 261-290 mm was the second most exploited stock (Fig. 3). Size group 81-110 mm, 111-140 mm 141-170 mm and 171-200 mm, 201-230 mm, 291-320 mm, 321-350 mm, 321-350 mm, 351-380 mm, 381-410 mm and 411-440 mm were contributed in the exploitation with 2.68%, 5.95%, 7.73%, 9.23%, 11.01%, 11.61%, 10.12%, 6.84%, 4.17% and 2.08%, respectively (Figure 3).

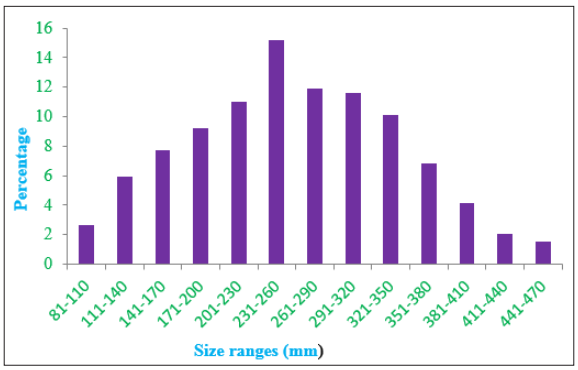

Figure 3: Size composition and exploitation structure of *Oreochromis niloticus* from the Tons river at Prayagraj, Uttar Pradesh (Male samples)

Female samples

In case of female samples, the maximum exploitation was recorded in 231 to 260 mm size group with 15.67% while minimum exploitation was observed with 1.17% in 441-460 mm size group (Table 1). Size group 261-290 mm was the second most exploited stock (Figure 4). Size group 81-110 mm, 111-140 mm 141-170 mm and 171-200 mm, 201-230 mm, 291-320 mm, 321-350 mm and 321-350 mm were shared in the exploitation with 2.68%, 5.95%, 7.73%, 9.23%, 11.01%, 11.61% and 10.12%, respectively (Fig. 4). 351-380 mm, 381-410 mm and 411-440 mm size group was contributed minute proportion with 6.84%, 4.17% and 2.08%,

respectively. Reported 41.3 to 400.0 mm (total length) size of fishes, *O. niloticus* in coastal Mississippi, USA [18]. Estimated that the total length 13.5 to 48.0 cm of *Oreochromis niloticus* from Lake Nasser, Egypt [38,39]. Rreported that the size composition of *O. niloticus* varied from 10.4 to 44.5 cm from the Yamuna river at Allahabad (now Prayagraj), Uttar Pradesh. She also stated that the aquatic environment of the Yamuna river at Allahabad was most favorable for *O. niloticus* due to fast growth increment, food supply and multiple breeding. Reported that the frequency of fishes of age group I are most dominant in the catch and constitute about 33.49%, 36.42% and 33.74% for *O. niloticus* males, females and sexes combined, respectively in El-Bahr El-Faraouny Canal, Al-Minufiya Province, Egypt [40].

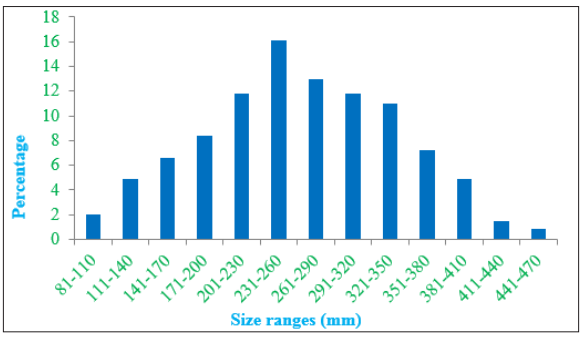

Figure 4: Size composition and exploitation structure of *Oreochromis niloticus* from the Tons river at Prayagraj, Uttar Pradesh (Female samples)

Fishing pressure changes the size composition, total length, biodiversity, density of fishes, growth rate, age composition, sex ratio, income of fishers/fishermen and maturation of fishes [41-47]. The size composition (Example maximum and minimum total length) of fishes is altering season to season and year to year due to large size fishes more active in breeding season [48-51]. The over exploitation and non-targeted fishing is the biggest problem of riverine fishery [52-53]. The fishing pressure, mesh size, size of nets and fishing technique (example degree) are responsible for increasing or decreasing of total length of fishes (example maximum total length) and recruitment in the lotic ecosystems [47, 54-57]. Non-native fishes are also changed selectivity of gear due to nature, dwelling behaviour and ecological condition [58-59]. The growth of fishes is slightly checked by heavy metals accumulation in the body of fishes [60-62].

Conclusion

It may be concluded that the research provides an important baseline study of this fish. Size composition of *O. niloticus* indicated that the stock from the Tons river was in healthy condition and exploitation was unsystematic. Overall, present condition of *O. niloticus* was recorded due to sustainable exploitation and multiple breeding of this species in the Tons river. Mostly large size and perennial rivers has large size of fishes in water bodies and maintain food supply, space, reproductive needs stated that the when sustainably harvested or farmed, inland fish can be considered part of the green food movement for more environmentally friendly sourcing of food [41, 53, 63-65].

Table 1: Size composition and exploitation of Nile tilapia, *Oreochromis niloticus* from the Tons river at Prayagraj, Uttar Pradesh, India

SN	Size groups (mm)	Male	%	Female	%	Pooled	%
1	81-110	09	2.68	07	2.02	16	2.34
2	111-140	20	5.95	17	4.90	37	5.41
3	141-170	26	7.73	23	6.63	49	7.17
4	171-200	31	9.23	29	8.36	60	8.78
5	201-230	37	11.01	41	11.81	78	11.42
6	231-260	51	15.18	56	16.14	107	15.67
7	261-290	40	11.90	45	12.97	85	12.44
8	291-320	39	11.61	41	11.81	80	11.71
9	321-350	34	10.12	38	10.95	72	10.54
10	351-380	23	6.84	25	7.20	48	7.03
11	381-410	14	4.17	17	4.90	31	4.54
12	411-440	07	2.08	05	1.44	12	1.76
13	441-470	05	1.49	03	0.86	08	1.17
	Total	336	49.19	347	50.80	683	

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