

Research Article

Invasion Potential, Impact and Population Structure of Non-native Fish Species, *Cyprinus carpio* (Linnaeus, 1758) from the Tributary of the Ganga River, Central India

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Abstract

Fish population is a subject to natural control processes in respect of resource and a renewable resource if they are exploited in a systematic and planned manner. Random fish samples of *Cyprinus carpio* were collected. A total of 548 fish specimens in size ranges between 97 to 687 mm and age classes of 0+ to 9+ were used in present study. Invasion potential and population structure of *C. carpio* was studied during February 2019 to January 2020 from Sirsa fish landing centre at Prayagraj, Uttar Pradesh, Central India. *C. carpio* is of great socioeconomic importance for the region and keeps active a population of about 100 to 150 fishermen communities in Sirsa at Prayagraj, Uttar Pradesh. The age classes (0+ to 9+) indicated that the *C. carpio* was powerfully invaded in the Tons river. In total stock, male population comprised 49.63% and female population 50.36% of the total catches. In the pooled samples, 1+ age group was most dominated with 24.09%. Stock of this age group was most abundant in the Tons river. The mesh size of the nets and length of net was also more harvested this age group compared to other age groups. The 7+, 8+ and 9+ age groups were shared minute proportion with 2.19%, 0.91% and 0.55%, respectively. These age groups considered as old age groups. In case of pooled samples, 0+, 2+, 3+, 4+, 5+ and 6+ age groups contributed as 6.35%, 21.35%, 18.61%, 13.87%, 7.85% and 3.83%, respectively.

Keywords: Population structure, Invasion potential, *Cyprinus carpio*, stock health, Tons river, Ganga basin, Riverine ecosystem

Introduction

The non-native fish impact assessment and native fish stock management in respect of ecosystem function, biodiversity, recruitment pattern and fish stock, presently disputing both environmental executives (e.g. policy maker/government) and scientific communities especially in riverine sector and other large water bodies in developing countries [1-4]. Non-native species may become invasive and are capable of decreasing biodiversity through competition, spreading exotic diseases, predation and habitat degradation, genetic deterioration of wild populations through hybridization and gene introgression in short or long course of time [5-8]. Non-native fish species are also responsible for reduction of fish length, damage breeding ground and change food web structure and population structure of indigenous fish species and also earlier introduced fish species [9-13].

Fish stocks are altering, damaging and invading by human activities like as domestic, business, ornamental or trial purposes [14-18]. The Indian riverine fisheries are mostly disturbed by various stressors as like invasion of fishes (example alien species), overexploitation, domestic and industrial effluents [19-22]. Alien or exotic fish species have the great capacity to cause considerable ecological consequences in introducing or receiving ecosystems especially rivers, streams and reservoirs [23-25].

Cyprinus carpio is commonly called as common carp is non-native fish species or an exotic major carp for India. *C. carpio* forms a capture fishery of great value in the Ganga river system and other major riverine system and large water bodies of the country, apart from being one of the important species in the culture fishery of the country due to high consumer preference and higher production with Indian major carp (*Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*) [3,16,25,26]. It is widely distributed in the inland water in India [27,28]. The present study was thus undertaken to estimate invasion potential and population structure of *C. carpio* from the Tons river at Prayagraj, Uttar Pradesh, Central India. This study will help in enhancing the productivity of the river and formulating the fishery management policies of *C. carpio* from the Tons river in respect of Indian major carp.

Material and Methods

The fish samples of *Cyprinus carpio* were collected from Sirsa fish landing centre at Prayagraj, Uttar Pradesh, India during February 2019 to January 2020 (Map 1). Samples of the key scales from 548 fish specimens in the length ranges between 97 to 687 mm were examined for determination of age group and population structure. The key scales were removed from the row above lateral line and below dorsal fin region [17,29]. The scales were cleaned in 5% KOH solution to remove adhering tissues and finally washed in distilled water. The



Map 1: Tons river map with Allahabad district now Prayagraj district. The sampling site Sirsa is confluence of Tons river from the Ganga river at Prayagraj, Uttar Pradesh.

scales were then pressed between two glass plates while drying in order to avoid their curling. The total length (mm) from the tip of snout to the end of largest caudal fin rays was measured and key scales were taken from below the dorsal fin (3 or 4 rows) and above the lateral line. The annulus or annuli formation was determined according to the criterion suggested by [30,31]. A percentage frequency table was prepared on the basis of age and to compute in different sexes (male and female). Population structures of male and female fish were determined on the basis of age group.

Result and Discussion

Cyprinus carpio is one of the most desirable fish species for food and commercial purposes by majority consumers in this region (Tons river basin). The population structure of the male and female *C. carpio* was varied from 85 to 472 mm (total length) and 0+ to 9+ age groups. This species is of great socioeconomic importance for the

region and keeps active a population of about 100 to 150 fishermen communities at Sirsa at Prayagraj, Uttar Pradesh. In stock, male population comprised 49.63% and female population 50.36% of the total catches (Table 1 and Figure 1). In general, female fishes are more active compared to male in breeding season. Female population was higher due to twice or thrice breeding season.

In the pooled samples, 1+ age group was most dominated with 24.09%. Stock of this age group was most abundant in the Tons river, Uttar Pradesh, Central India (Figure 2). The mesh size of the nets was also more harvested this age group compared to other age groups. The 7+, 8+ and 9+ age groups were shared small proportion with 2.19%, 0.91% and 0.55%, respectively. These age groups considered as old age groups. In case of pooled samples, 0+, 2+, 3+, 4+, 5+ and 6+ age groups contributed as 6.35%, 21.35%, 18.61%, 13.87%, 7.85% and 3.83%, respectively (Figure 2). The 9+ age group indicated that the ecological condition was most favorable for *C. carpio* from the Tons river. The age classes also indicated that the *C. carpio* was powerfully

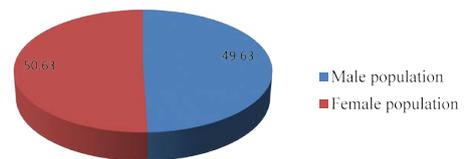


Figure 1: Population structure of male and female from the Tons river at Prayagraj, Uttar Pradesh, Central India.

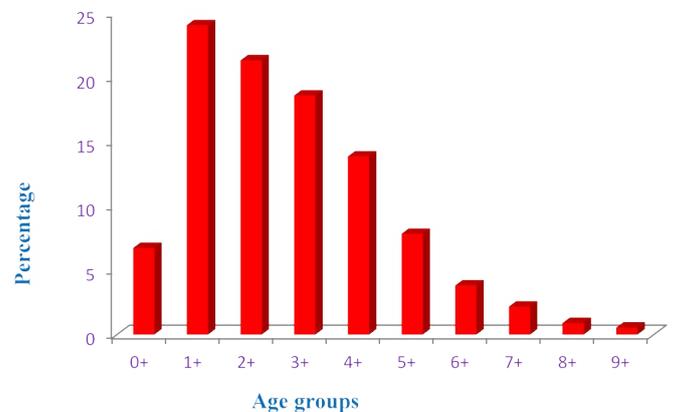


Figure 2: Population structure of stock fishes (Pooled samples) from the Tons river at Prayagraj, Uttar Pradesh, Central India.

Table 1: Population structure of Common carp (*Cyprinus carpio*) from the Tons river at Prayagraj, India.

Age classes	Number of male	Percentage	Number of female	Percentage	Pooled samples	Percentage
0+	20	7.35	17	6.16	37	6.75
1+	64	23.53	68	24.64	132	24.09
2+	57	20.95	60	21.74	117	21.35
3+	50	18.38	52	18.84	102	18.61
4+	37	13.60	39	14.13	76	13.87
5+	20	7.35	23	8.33	43	7.85
6+	12	4.41	9	3.26	21	3.83
7+	7	2.57	5	1.81	12	2.19
8+	3	1.11	2	0.72	5	0.91
9+	2	0.73	1	0.36	3	0.55
Total	272	49.63	276	50.36	548	

invaded in the Tons river. It is believed that this healthy stock (0+ to 9+ age groups) of *C. carpio* from the Tons river due to habitat degradation and water quality of the river. Overall, population distribution was systematic in the pooled samples. The 5+ age group probably remain unexploited. Distribution pattern indicated that the population of *C. carpio* in future will be increased (Figure 2).

According to the percentage occurrence 1+ age group was also most dominated with male (23.53%) and female (24.64%) of the total stocks (Table 1). Male population was contributed in 0+, 2+, 3+, 4+, 5+ and 6+ age groups with percentage shared as 7.35%, 20.95%, 18.38%, 13.60%, 7.35% and 4.41%, respectively (Table 1). The old age groups 7+, 8+ and 9+ were contributed minute proportion with 2.57%, 1.11% and 0.73%, respectively.

While female population was contributed in 0+, 2+, 3+, 4+, 5+ and 6+ age groups with percentage as 6.16%, 21.74%, 18.84%, 14.13%, 8.33% and 3.26%, respectively (Table 1). The old age groups 7+, 8+ and 9+ were contributed very minute proportion with 1.81%, 0.72% and 0.36%, respectively (Table 1). In the present study, *C. carpio* indicates that occurrences of males and females are difference in number; this is possibly caused by the incidence of fish pairs near to the nest area where females take care of their broods. It breeds twice or thrice per year. The frequency of the breeding is more suitable for the stabilization of the stocks in the river.

Present time, the ecological condition of Tons river at Prayagraj is most fitting (example age composition, population structure) for *C. carpio*. [32] reported that the population structure of *Labeo bata*, female was greater than male in the Ganga river at Allahabad. The age group 1+ of *C. carpio* was dominant (21.54%) and constituted nearly one fifth of the total population from the Ganga river at Allahabad [33]. [34] reported that the *O. niloticus* of males comprised 56.1% and females 43.9% of the catches in Barra reservoir, Brazil. [35] determined the population structure of the Himalayan Mahseer (*T. putitora*) in the foothill section of the Ganga river and reported that the samples comprised of 1+ to 9+ age groups individuals. Of these 2+ and 4+ age groups constituted 66.01%, while 1+ was nearly 8.07% of the total stock. Most wild fish stocks (example indigenous fish species) in Indian rivers have been over exploited or have reached their maximum sustainable yield but stock of exotic species increasing day by day [26,36,37]. *C. carpio* with a known capability to adjust to different environmental situation and its high prospective for aquaculture, can now be found in many rivers of India [38-41].

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