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Studies on age profile of Common carp, *Cyprinus Carpio* (Linnaeus, 1758) from the Tons River, India

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Abstract

Heavy fishing affects the population by the exploited section of the stock in riverine water bodies. *Cyprinus carpio* is very frequently cultured in the Ganga basin especially the middle and lower stretches of the river due to its plasticity nature (survival rate), fast growth rate, high market demand, consumer preference, and the very simple availability of seed (for example fry and fingerlings). *C. carpio* is highly adaptable to a suite of environmental conditions. Age composition, age, and growth of *C. carpio* were studied from February 2019 to 2020 January from a fish landing centre at Sirsa, Prayagraj, Uttar Pradesh, India. The hard part, key scales were studied for estimation of age and growth in the present study because of easy availability. A total of 548 specimens in length ranges between 97 to 687 mm and age classes of 0+ to 9+ were estimated in the river. The fish attained mean length of 203, 325, 413, 478, 529, 565, 594, 621 and 643 mm, respectively at the end of 1+ to 9+ years of the life cycle. The maximum growth was observed in first year with 203 mm of the life span. The result also indicated that the age composition and growth rate of *C. carpio* in the invaded waters of the Tons River is very appropriate to the fishes

Keywords: *heavy fishing; age and growth; age composition; tons river; cyprinus carpio; ganga basin*

Introduction

Cyprinus carpio (Linnaeus, 1758) was introduced in India in 1959 with the objective to enhance fish production from tanks, ponds, and reservoirs [1]. The Common carp, *Cyprinus carpio* is an exotic fish species, being one of the commercially and economically important species from the Tons River (Ganga River basin). It is one of the most broadly cultured and economically important freshwater fish species in the world due to its tolerance to variable environmental conditions [2-4]. It is the most frequently cultured freshwater fish in India with *Catla catla, Labeo rohita* , and *Cirrhinus mrigala* (Indian Major Carp) and this fish is economically significant in terms of local consumption and production potential [5-7]. Due to early maturity, feeding nature, and neglected fisheries policies, the population of this species has increased significantly in the open water system or lotic water system in India. In recent years, *C. carpio* has made accidental access to the many natural water bodies of India including streams, rivers and wetlands [8-9]. *C. carpio* is generally considered to be one of the most ecologically damaging fish species [10-14]. *C. carpio* is commonly called an ecological pest because it can change the ecological characteristics (For example feeding ground, food supply, and breeding ground) of aquatic ecosystems [15-18].

In natural water bodies, *C. carpio* can survive in very low water temperatures and it can tolerate low concentrations and supersaturation of dissolved oxygen [19-23]. It is preferred for larger and slow-moving water bodies with soft sediments [3, 24]. *C. carpio* is a tolerant and resilient fish that thrive in a wide variety of aquatic habitats [25-27]. There is a report of a *C. carpio* living an astounding 47 years,

probably in captivity. Other reports of 17 to 20 years are probably more typical [8, 25]. Their ability to reach high biomass [28-29]. Introductions of non-indigenous fishes can reduce diversity and modify local community dynamics in freshwater systems. It is dominating species from the Ganga River, Yamuna River and its tributaries in India [3, 11, 30-32]. The combination of feeding nature, fast growth, achieves early sexual maturity and high fertility rate features allows developing invasiveness potential of *C. carpio* [3-4]. *C. carpio* normally spawns in early summer and spring but it can also breed in all year round in the tropics [33-35].

Fish growth, measured in units of length, weight, or energy and defined as a change in size or amount of bodily material, is an important ecological characteristic of fish populations. Knowledge of fish age and growth is very important for the rational utilization of fish stocks and their sustainable production [36-37]. Age and growth increments are two features of the prime significance in assessing fish population and their response to various types of habitats. The fundamental studies on the age and growth of *C. carpio* are limited and fragmentary work has been conducted globally [38-43]. Accurate estimation of fish growth rate in natural systems is reliant on the ability to maintain constant time intervals over which growth is evaluated. The age and growth parameters of the fish in entirely different habitats would have different length distributions, age compositions, and growth rates. Therefore, the present study has been carried out to unravel the age composition, age, and growth of *C. carpio* from the Tons River, Uttar Pradesh, India, which is the entirely new home for the fish. The study would help the fishery managers and planners in the management of the riverine fisheries in respect of exotic species.

Material and methods

The Tons River is a right-bank tributary of the Ganga River which forms confluence at Sirsa near Meja in the Prayagraj district, Uttar Pradesh, India. 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. The Tons River is essentially a hilly stream arising in the Kaimur hills of the Vindhyan range 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. Fishes were caught from the Tons River at Prayagraj. The sample was collected during February 2019 to 2020 January from fish landing centre at Sirsa, Prayagraj, Uttar Pradesh, India. Common carp, *Cyprinus carpio* fish or specimens was selected for present study from the Tons River. Fishes were collected using a variety of methods including gill nets, drag nets, cast nets and hook and lines. Samples of scales from 548 specimens in the length ranges between 97 to 687 mm were examined for determination of age composition, age and growth.

The scale based aging techniques have been the prevailing methodology utilized by fisheries scientists in the estimation of freshwater fish age since the early part of the 20th century [44]. Scales have gained favor as they are relatively easy to collect and do not require the fish to be sacrificed. The total length of each fish (in mm, from the tip of snout and the end of longest caudal fin rays) was measured and recorded. The Key scales were collected from the region just below the dorsal fin (3 to 4 rows) above the lateral line and were thoroughly washed in tap water until all extra matter got completely removed and mounted intact in between two glass plates. The ring formation was determined according to the criterion suggested by [45-48]. Almost all the annuli, except the one, appeared as light relatively transparent bands, concentrically arranged around the whole of the anterior sculptured part of the scales. Annual ring formation was recorded in the present fish. Ring 1, 2 and 3…… were denoted to 1+ 2+ and 3+…. age of the fishes.

Results and Discussion

The scales were studied for the estimation of age composition, age and growth increment in the present study because of easy availability and accuracy. A total of 548 specimens (male and female) in length ranges between 97 to 687 mm and age classes of 0+ to 9+ were estimated. In *C. carpio*, continuous circulate surrounds the focus of scale in 1+ age group but higher age group some distance was recorded due to size of scales. The circle are arranged uniformly in the anterior field. The formation of transparent and opaque zones was common of all age group fishes.

The significant differences in growth increment were recorded in present study to compared previous studies in other rivers, globally. The fish attained mean length of 203, 325, 413, 478, 529, 565, 594, 621 and 643 mm, respectively at the end of 1+ to 9+ years of the life cycle (Table 1). The maximum growth increment was observed in first year with 203 mm of the life span. The growth percentage was fluctuated from age to age of the fishes (Fig. 1). The growth increment unit was used per year. The fishes showed very higher growth rate in first two years of the life cycle. The growth increment of fishes was in an order

with very systematic (Table 1). Growth in fishes is not throughout the year and the fluctuations in the growth expressed itself on the scales of the fish. The size composition of 97-179, 157-293, 247-367, 355-463, 390-494, 442-501, 487-557, 542-591, 573-652 and 631-687 mm was observed for the corresponding 0+, 1+, 2+, 3+, 4+, 5+, 6+, 7+, 8+ and 9+ age groups, respectively. The result also indicates that the age composition and growth rate of *C. carpio* in the invaded waters of the Tons River is very suitable for the fish and would lead to further growth in all parameters. Therefore, there is needed to take urgent precautionary measures to safeguard the valuable endemic species and Indian major carp (*Catla catla, Labeo rohita, Cirrhinus mrigala*) of the river.

In the present study, age classes of 0+ to 9+ were estimated from the Tons River at Prayagraj, Uttar Pradesh, India. Growth is a complex mechanism, which represents the outcome of the interactions among several biotic and abiotic factors operating behavioral and physiological processes. The number of age classes in any stock is greater when the survival rates are high [36, 49-51]. [52] Brown *et al.* (2005) recorded a number of 12-20 years old carp in the mid-Murray River and associated Bamah forest wetlands. The mean length in different age classes of *C. carpio* was 18.1, 22.01, 28.7, 33.5, 35.2, and 36.67 cm in a life span of 1-7 years, respectively in the Almas Dam Lake in Turkey [53]. The mean length of the present study was comparatively higher than reported by [53].

Several factors as the richness of species, quality of the water, stock of the fish, and supply of the food can account for the fluctuation in the growth rate of the fish [39, 46-47, 54-56]. The differences in mean length attained in the same period in different regions may be due to variations in the climatic and ecological conditions of the regions. In addition, *C. carpio* populations increase rapidly in tropical climates due to the abundance of food supply and optimum temperature. [42] Dwivedi and Mayank (2013) reported that the *C. carpio* attained an average length of 19.0, 26.7, 37.5, 41.1, 45.5, 49.6, 54.9, 59.5, 63.1, 66.2, 70.9 and 76.2 cm, respectively at the end of 1+ to 12+ years of the life cycle from the Yamuna River, Uttar Pradesh, India. Several factors can account for the fluctuation in the age and growth rate as like quantity and quality of available food, the richness of species, density of exotic species (Example especially *Cyprinus carpio*) quality of the water (For example organic load, heavy metal concentration), maturity and spawning cycle [57-69]. This species can typically live for around 20 years in the wild freshwater ecosystem (for example rivers) [70-71].

Age composition	No. of specimens	Size composition (mm)	Mean length (mm)	Growth rate (mm)
0+	*37*	*97-179*	*155*	
1+	*132*	*157-293*	*203*	*203*
2+	*117*	*247-367*	*325*	*122*
3+	*102*	*355-463*	*413*	*88*
4+	*76*	*390-494*	*478*	*65*
5+	*43*	*442-501*	*529*	*51*
6+	*21*	*487-557*	*565*	*36*
7+	*12*	*542-591*	*594*	*29*
8+	*5*	*573-652*	*621*	*27*
9+	*3*	*631-687*	*643*	*22*

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, India

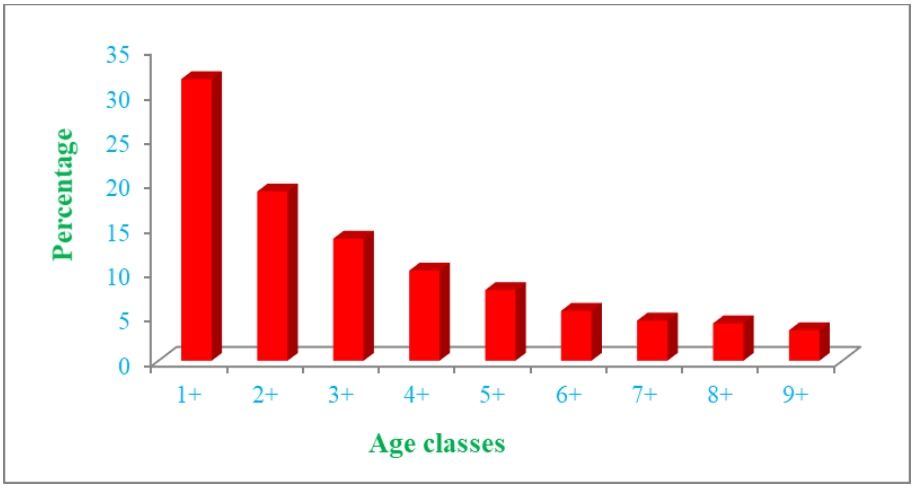

Fig 1: Growth percentage in different age classes of *Cyprinus carpio* from the Tons River

Conclusion

It may be concluded that the age and growth of *C. carpio* is healthy and good in the Tons River at Prayagraj, Uttar Pradesh, India. It is a fast-growing fish in first two years (1st and 2nd). Age composition also indicated that the species is fully invaded in the Tons River. Thus restricted gillnet use and closed season practices (example breeding season) could bring better recruitment and better fish size in long period.

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