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Research Article

Age Pyramid Assessment of Commercially Important Fishes, *Cirrhinus mrigala* and *Oreochromis niloticus*, from the Tropical Yamuna River, India

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Abstract

Fish are important organisms as they indicate the ecological and environmental processes and the producer-consumer interactions. The fish samples of *Cirrhinus mrigala* and *Oreochromis niloticus* were collected from the Yamuna River at Allahabad (now Prayagraj), India, from August 2011 to July 2012. During the study period, 335 specimens of *Cirrhinus mrigala* and 516 specimens of *Oreochromis niloticus* were examined for the estimation of the age pyramid. The age groups varied from 0+ to 10+, and a heavy bottom or broad-based age pyramid was recorded in *C. mrigala*. The age groups varied from 0+ to 6+, and Urn shaped age pyramid was recorded in *O. niloticus*. The age group 2+ dominated by virtue of numbers in the lower stretch of the Yamuna River in both species of stock.

Introduction

Fishes can be utilized for the ecological and environmental valuations at all levels of biological organization; assessment trials are existing at the levels of ecosystems, populations, individuals, organic load, metal concentrations, organs, and at the cellular and molecular levels. *Cirrhinus mrigala* was an important component of the capture fishery from the Ganga and Yamuna rivers and their tributaries [1-3]. It is commercially exploited and contributes the highest proportion in the group of Indian major carp of the total landing from the river Ganga [4,5], the river Yamuna [6-7]. While now it is a major constituent of the culture fishery [8-11] in India. It is extensively cultivated in fish ponds and tanks. The species is of commercial significance due to its aquaculture potential and high consumer preference [12].

O. niloticus (Nile tilapia) is depicted in Egyptian paintings dating to approximately 5,000 years before the present [13]. *O. niloticus* is an African native fish species. It is now transplanted to many other countries of the globe, especially the tropical and subtropical parts of the world [14-17]. It has become the second most commonly consumed farmed fish after carp [4,18-19]. It is among the leading farmed species around the world. Nowadays, it has been termed as 'wonder fish', everybody's fish, or even aquatic chicken. Currently, it is powerfully invaded in the Ganga and Yamuna rivers in the surrounding Prayagraj region, Uttar Pradesh, India [20-24]. Fisheries of the Yamuna River are very vital for the livelihood of fishers/fishermen near the river bank, villagers, fish sellers, and others, India. The present study would help the fishery managers and planners in the management of the riverine fisheries in the Ganga basin, India. Present research work is also necessary to formulate informed decisions about restoration and management of the fishery, especially Indian Major Carp (*Catla catla, Labe rohita, Cirrhinus mrigala*) and rivers.

Material and methods

The fish samples of *Cirrhinus mrigala* and *Oreochromis*

niloticus (Figure 1) were collected from the lower stretch of the Yamuna River at Allahabad (now Prayagraj), India, during August 2011 to July 2012 (Figure 2). Fishes were collected using a variety of methods, including gill nets, drag nets, cast nets, and hook and lines (Figure 3).

Figure 1: Selected fish species. (A) Nain, Cirrhinus mrigala (Hamilton, 1822). (B) Nile tilapia, Oreochromis niloticus (Linnaeus, 1757), for the present investigation.

Figure 2: Sampling site in the Yamuna River at Allahabad (now Prayagraj), India, with river location.

Figure 3: Fishing activities in the Yamuna River, India.

Age pyramid

During the study period, 335 specimens of *Cirrhinus mrigala* and 516 specimens of *Oreochromis niloticus* were examined for the estimation of the age pyramid. According to Odum [25] (1971), three kinds of distribution can be depicted by an age pyramid:

A. Heavy bottom or broad-based pyramid: It indicates a rapidly growing population with a high percentage of young individuals.

B. Bell-shaped: It indicates a moderate proportion of young to old, i.e., pre-reproductive and reproductive age groups become more or less equal in size, which is characteristic of a stable population.

C. Urn-shaped: It indicates a low percentage of young individuals. If the birth rate is drastically reduced, the pre-reproductive group dwindles in proportion to the other two groups, and it results in an urn-shaped figure, which indicates that the population is senile.

The number of each age group was recorded separately for *C. mrigala* and *O. niloticus*. The number of fish of each age group was recorded and converted into a percentage to obtain a pyramid. This pyramid represents the status of the fish stock.

Result and discussion

Age pyramid of *Cirrhinus mrigala*

335 fish specimens were studied for age pyramid studies of *C. mrigala* from the lower stretch of the Yamuna River at Prayagraj, India. The age groups varied from 0+ to 10+. A heavy bottom or broad-based age pyramid was recorded in *C. mrigala.* The age group 2+ dominated by virtue of numbers in the lower stretch of the Yamuna river, with 39.40%. The present studies indicated that age class 2+ is more vulnerable to the gear and is dominant in the catches. Hence, the proportion of the 0+ age group (5.37%) was much less than 1+ age group (21.79%). The age groups 0+ and 1+ constitute immature individuals in the stock. The higher age groups contributed 20.29% (3+), 6.86% (4+), 2.69% (5+), 1.49% (6+), and 1.19% (7+). The distribution was uneven between 0+ to 1+ and 2+ to 3+ age groups, as the difference was very high (16.42%) and (19.11%), respectively. The share abruptly increased between 0+ to 1+ while abruptly declined between 2+ to 3+ age groups. The age groups 8+, 9+, and 10+ contributed 0.30 % each (Figure 4). The higher age groups were very minute in the stock.

Age pyramid of *Oreochromis niloticus*

During the research work, 516 fish specimens were examined for the estimation of the age pyramid of *O. niloticus*. The age groups varied from 0+ to 6+. Urn urn-shaped age pyramid was observed. The age group 2+ dominated by virtue

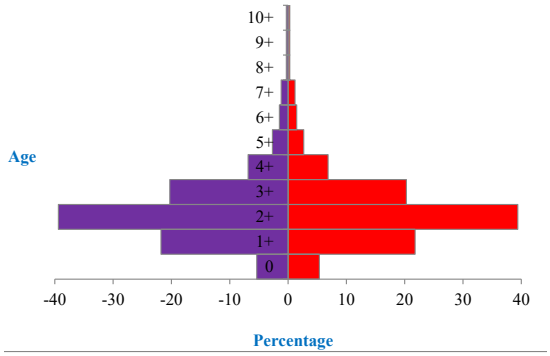

Figure 4: Age pyramid of Cirrhinus mrigala from the Yamuna river, India.

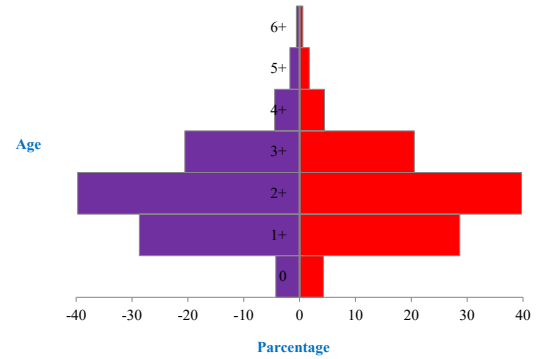

Figure 5: Age pyramids of Oreochromis niloticus from the Yamuna river India.

of numbers in the Yamuna river (39.73%). The proportion of the 0+ age group (4.26%) was much less than 1+ age group (28.68%). The age groups 1+ and 2+ indicated that the small-sized fish dominate the catch of *O. niloticus* in the lower stretch of the Yamuna River. The higher age groups contributed 20.54% (3+), 4.46% (4+), and 1.74% (5+) (Figure 5). The distribution was uneven between 0+ to 1+ and 2+ to 3+ age groups. The share abruptly increased from 0+ to 1+. The percentage abruptly declined between the 2+ to 3+ age groups as the difference was about 19.19%.

The urn-shaped age pyramid indicates a low percentage of young individuals in the total stock [6,25]. The urn-shaped age pyramid was recorded in *Cyprinus carpio* from the Ganga River at Prayagraj, India [26]. The urn-shaped pyramid indicates a low percentage of young individuals [27]. The rate of fishing is a powerful factor that affects the age composition (for example, age pyramid shape) of the stock [28-31]. Tendency for bell-shaped age pyramid in the Ken River and bell-shaped age pyramid in the Paisuni River and the Tons River were obtained in the case of *Tor tor* [32]. The age pyramid of *C. carpio* showed a tendency for urn shape as mature age groups occurred in higher proportion from the Tons river [33].

Conclusion

It may be concluded that the age pyramid indicates that the stock of *C. mrigala* is more or less stable from the lower stretch of the Yamuna River, India. But shortly, the stock of *O. niloticus* will decline. Fish stocks fluctuate in the riverine environment due to many factors as fishing pressure, abundance of fish, food supply, and water quality [34-36].

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