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Atul Trivedi

Department of Zoology, Swami
Atmanand Government English
Medium College, Jagdalpur,
Chhattisgarh, India

Comparative analysis of age and growth of *Oreochromis niloticus* in the Yamuna and Ganga Rivers

Atul Trivedi

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Abstract

This study presents a comparative analysis of the age and growth characteristics of *Oreochromis niloticus* populations from the Yamuna and Ganga Rivers in India. Utilizing scale-based age determination methods and evaluating growth rates, we identified significant differences in growth trajectories and age distributions between these populations. The results highlight the influence of environmental conditions and habitat characteristics on fish growth, underscoring the necessity for region-specific management strategies to promote sustainable fisheries.

Keywords: Oreochromis Nilotic's, fisheries, *Oreochromis niloticus*, Yamuna and Ganga Rivers

Introduction

Understanding the age and growth dynamics of fish species is crucial for effective fisheries management and conservation. *Oreochromis niloticus*, commonly known as the Nile tilapia, is a prominent aquaculture species with growth patterns that vary based on environmental factors. This study aims to compare the age structure and growth rates of *O. niloticus* in the Yamuna and Ganga Rivers. By assessing the impact of environmental conditions on fish growth, we seek to provide insights into region-specific management practices necessary for sustainable fisheries.

Materials and Methods

Sample Collection and Preparation

Fish samples were collected from the Yamuna and Ganga Rivers near Prayagraj. Scales were extracted from the upper posterior region below the dorsal fin, following the methods of Bagenal and Tesch (1978) [3]. Scales were cleaned using a 5% KOH solution, rinsed with distilled water, and dried under pressure to prevent cracking.

Age Determination

Age determination was carried out by counting annuli on the scales, where each annulus represents one year of growth. Fish were categorized into age groups (e.g., 0, 1+, 2+), and the number of annuli was recorded to determine the age of each fish.

Growth Rate Calculation

Growth rates were calculated based on the mean lengths of fish at different age groups. Annual growth increments were derived by comparing lengths between successive age groups. Growth rates for the Yamuna and Ganga River populations were compared to identify differences.

Results

Yamuna River

The age structure of *O. niloticus* in the Yamuna River ranged from 0 to 6+ years. The mean lengths and growth rates at various ages are detailed in Table 1.

Corresponding Author:

Atul Trivedi

Department of Zoology, Swami
Atmanand Government English
Medium College, Jagdalpur,
Chhattisgarh, India

Table 1: Age and growth of *Oreochromis niloticus* from the Yamuna River at Prayagraj.

S. No.	Age	Size range (cm)	Mean length (cm)	Growth rate (cm)
1.	0	8.5-16.6	13.48	
2.	1+	15.0-27.6	20.69	20.69
3.	2+	22.3-35.5	29.05	8.36
4.	3+	28.8-46.5	36.62	7.57
5.	4+	35.4-51.8	40.76	4.14
6.	5+	40.5-53.2	46.55	5.79
7.	6+	45.0-57.2	51.01	4.46

Ganga River

The age structure of *O. niloticus* in the Ganga River ranged from 0 to 5+ years. The mean lengths and growth rates at various ages are detailed in Table 2:

Table 2: Age and growth *Oreochromis niloticus* of from the Ganga River at Prayagraj.

S. No.	Age	Size range (cm)	Mean length (cm)	Growth rate (cm)
1.	0	10.0-16.6	13.47	
2.	1+	13.0-24.2	19.03	19.03
3.	2+	18.0-33.6	26.4	7.46
4.	3+	23.0-46.0	36.97	10.48
5.	4+	32.0-52.0	40.76	3.79
6.	5+	41.0-57.0	47.66	6.90

Discussion

The comparative analysis of *O. niloticus* populations from the Yamuna and Ganga Rivers reveals significant differences in both age and growth characteristics. Fish in the Yamuna River exhibit a longer lifespan, reaching up to 6+ years, compared to 5+ years in the Ganga River. In terms of growth, the Yamuna River population shows higher growth rates in the early years but experiences a slower decline in growth rate compared to the Ganga River population.

In the Ganga River, *O. niloticus* displays more rapid growth during the early years, followed by a gradual slowdown in later years. This may be attributed to variations in environmental factors such as water temperature, food availability, and habitat structure. Similar observations have been noted in other studies, indicating that environmental conditions significantly influence fish growth (Jhingran, 1959; Kamal, 1969) [13, 15].

The differences in age group distribution between the rivers suggest variations in recruitment patterns or mortality rates. The higher proportion of younger fish in the Yamuna River might reflect differences in growth rates or recruitment success (Dwivedi & Nautiyal, 2010) [7]. Environmental factors such as pollution and habitat degradation could also play a role in these differences (Sinha, 2001; Gupta & Acosta, 2004) [3, 11]. The comparative analysis of *O. niloticus* populations from the Yamuna and Ganga Rivers reveals significant differences in both age and growth characteristics. Fish in the Yamuna River exhibit a longer lifespan, reaching up to 6+ years, compared to 5+ years in the Ganga River. In terms of growth, the Yamuna River population shows higher growth rates in the early years but experiences a slower decline in growth rate compared to the Ganga River population.

Conclusion

This study highlights significant differences in the age and growth characteristics of *Oreochromis niloticus* between the

Yamuna and Ganga Rivers. The observed variations underscore the impact of environmental and habitat conditions on fish growth and emphasize the need for tailored management strategies. Future research should delve into identifying the ecological factors influencing these growth patterns and their implications for sustainable fisheries management.

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