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Fish diversity dynamics and ecological assessment of Dejla Dewda Dam

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Abstract

This study suggests the assemblage of fish diversity in Dejla Dewda Dam from 2017-2019. It also assesses the ecological status of the aquatic ecosystem using diversity indices such as species richness, Shannon-Wiener diversity index and Simpson's dominance index, Simpson Diversity of Index, Evenness and Magralf Index were applied to analyse the fish community composition and diversity. The outcome suggest that fish population are abundant with variety fish species which show ecosystem is healthy and stable. Diversity indices essential for balanced fish community and maintaining favourable water quality standards, which are important for sustaining aquatic life. This study important for ecological health highlight the water quality standard should be maintained well for conservation of biodiversity. This outcome suggests potentiality of ecosystem and suggest future conservation strategy.

Keywords: Diversity indices, fish diversity, dejla dewda dam, water quality and conservation

1. Introduction

Reservoirs has various type of riverine fish species which also encourage commercial fisheries. Fish faunal diversity major gateway for the exploitation of fresh water reservoir for food (Battul *et al.*, 2007) [1]. Fish diversity composition are fundamentals to the ecosystem health of freshwater ecosystems. It provides an opportunity to gain insights responses of aquatic systems and interactions among human and environmental changes at range of spatial scales. Dejla Dewda Dam which is the largest water body of the area act as a suitable site to address fish population diversity and species interaction within this ecosystem. The present study analyses fish diversity and community structure of the Dejla Dewda Dam in terms species richness, evenness, Shannon-Wiener index and Simpson Index and the ecological balance of dam aquatic will be determined. Identifying the composition of fish species and their distribution patterns will provide insight into the factors shaping the local fish community through effects like water quality, habitat or anthropogenic impacts (Thirumala *et al.*, 2011) [11]. This study aims to highlight essential ecological roles of various fish species, as well as the degree of sustainability of the entire fish community and use this information to assist comprehension of biodiversity conservation need alongside management options that permit more sustainable fisheries.

2. Material and Methods

2.1 Study Area

The Dejla Dewda Dam, located on the Kunda River, which is tributary of the Narmada River. It is essential man-made reservoir present on Dejla & Dewda village in Bhagwanpura tehsil of Khargone district, Madhya Pradesh. This dam serves as key water sources such household activities, irrigation and fish farming activities. During the study three sample stations are selected and marked as: S-1, S-2 and S-3.

2.2 Fish Collection and Statical analysis

Fishes were collected with help of local fishermen by using conventional methods. These methods were performed with gill net, drag net, hand net and cast net with different mesh size. The counting of fish is carried out further calculation of data.

Diversity Indices Fish diversity was analyzed in the study area of the diversity index.

2.2.1 Diversity Indices

The formula which can be used to calculate Relative Abundance:

$$RA = \frac{\text{number of individuals of a species}}{\text{number of individuals of all species}} \times 100$$

$$D = \frac{n(n-1)}{N(N-1)}$$

Here,

D = Simpson Dominance Index

n = total number of organisms of particular species

N = total number of organisms of all species

- **Simpson Index Diversity**

$$D = \sum i = 1R_p 2i$$

Here,

D = Simpson Diversity

Pi = Proportional to each species abundance

R = total number of each species

- **Shannon Wiener Index**

$$H' = [\sum Pi \ln Pi]$$

Here,

H = Shannon Wiener Index

n = total number of species

- **Evenness Index**

$$E = \frac{H}{\ln S}$$

Here,

E = Evenness Index

H = Shannon Wiener Index

S = Species Richness

- **Margalef Index**

$$D = \frac{(S-1)}{\ln(n)}$$

Here,

D = Marglef

S = Species Richness

N = number of species

3. Results

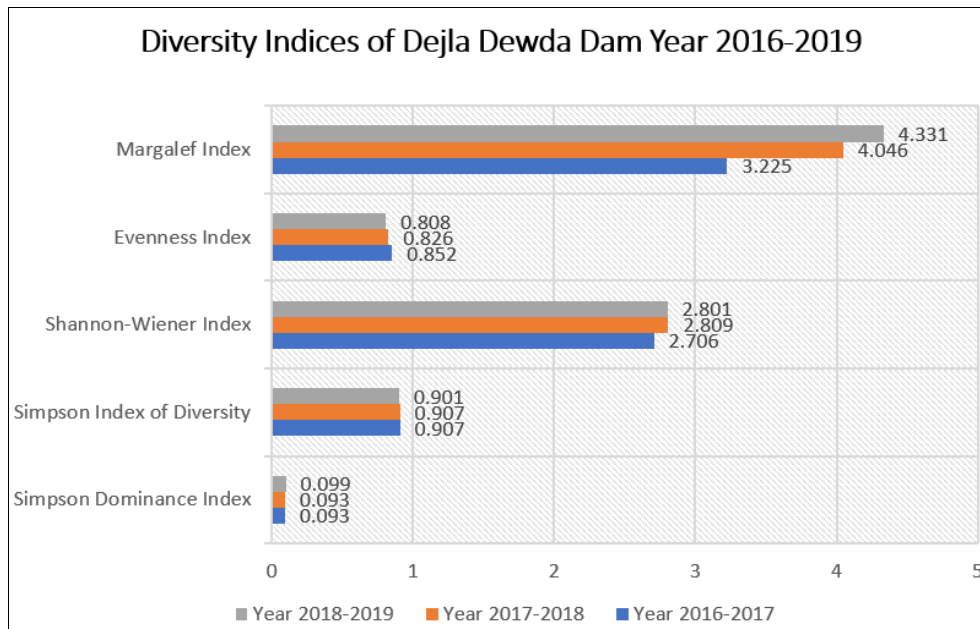
The Simpson dominance index, Simpson index of diversity, Shannon Wiener index, Evenness index, and Margalef index were used to examine diversity indices in Dejla Dewda dam. The Simpson Dominance Index, Simpson Index of Diversity, Shannon-Wiener Index, Evenness Index and Margalef Index were used to estimate biodiversity of Dejla Dewda Dam from October 2016 to September 2019. Simpson dominance index (Year 2016-17 0.093, Year 2017-18 0.093 and Year 2018-17 0.099). Simpson index of diversity (Year 2016-17 0.907, Year 2017-18 0.907 and Year 2018-19 0.901), Shannon-Wiener index (Year 2016-17 2.706, Year 2017-18 2.809 and Year 2018-19 2.801), Evenness Index (Year 2016-17 0.852, Year 2017-18 0.826 and Year 2018-19 0.808) and Margalef Index (Year 2016-17 3.225, Year 2017-18 4.046 and Year 2018-19 4.331). These results suggest that Dejla Dewda Dam conserves extensive biodiversity, there is a minute increase in species richness, which is accompanied by minor alterations in evenness. This indicates an adaptable ecosystem with increasing diversity, which cause improvement in ecological stability and resource availability inside the aquatic environment of Dam.

Table I: Relationships between species indices and pollution status (Whilm and Dorris, 1966)

Species Indices	Pollution Status
>3	Clean
1-3	Moderately Polluted
<1	Heavily Polluted

Table 2: Diversity Indices of fish species of Dejla Dewda Dam in year 2016-2019

Diversity Indices	Year 2016-2017	Year 2017-2018	Year 2018-2019
Simpson Dominance Index	0.093	0.093	0.099
Simpson Index of Diversity	0.907	0.907	0.901
Shannon-Wiener Index	2.706	2.809	2.801
Evenness Index	0.852	0.826	0.808
Margalef Index	3.225	4.046	4.331



Graph 1: Diversity Indices of Dejala Dewda Dam Year 2016-2019

4. Conclusion

The Dejala Dewda Dam's aquatic ecology has wide number of species diversity and balanced distribution, this study is conducted between October 2016 to September 2019. The low value of Simpson Dominance Index indicates minimal dominance occur by single species, whereas high value of Simpson Diversity Index and stable Shannon Wiener Index suggest that ecosystem is adaptable and healthy. The slight increase in the Margalef Index suggest upward trend in species richness, and ecological diversity. Evenness Index suggest that species abundance is changing suggesting that certain species might be establishing themselves quickly.

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