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Avian Diversity and Assembly: A Guild-Based Approach For The Gamen, Mahi Reservoir, Banswara, Southern Rajasthan

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Abstract:
The species diversity, guild and status of the avifauna in the Gamen Mahi reservoir, Banswara Southern Rajasthan was investigated during January 2019 to June 2020. The line transects method with a constant length and variable width was used in the study. The presence of 61 species of birds belonging to 19 families and 11 orders were observed. Non-passerine bird species dominated over the passerine bird species in relative diversity. Data of residential status revealed that 21 species were resident and rest 40 were either winter or summer migrants. Gamen, Mahi reservoir supported 22 (36.06%) omnivorous, 28 (45.90%) carnivorous, 6 (9.83%) insectivorous, and 5 (8.19%) herbivorous birds. It was further reported that. Gamen, Mahi reservoir backwater supported 52 least concern, 3 vulnerable, and 6 near-threatened species of birds. It is hoped that the study will help draw the attention of the public and state government towards conserving the Gammon Mahi reservoir, Banswara, Southern Rajasthan, and protecting its avian fauna.

Keywords: *Avian diversity, Guilds, Functional ecology, Bird assemblages, Community assembly, Gamen Mahi Reservoir.*

I. Introduction

Birds constitute a diverse assemblage of organisms that fulfil significant ecological functions across various habitats. Comprehending the determinants of avian diversity is crucial for formulating effective conservation strategies. This study investigates the notion of guilds and their use in analysing bird assemblages. We examine how implementing a guild-based approach improves traditional species richness indicators and offers insights into the ecological composition of bird groups. Guilds can reveal hidden trends in avian diversity and assembly mechanisms by examining resource utilisation strategies and ecological niches. We will evaluate the merits and demerits of this strategy and its potential contributions to the research of avian ecology and conservation. Birds are one of the most important animal species in the ecological system. They are rather simple to examine and keep an eye on. A global consensus has now been reached on the idea of "using birds as bio-indicators for recognising terrestrial ecosystems rich in biodiversity." The link between landscape habitat and bird ecology can be examined through bird surveys (Tu, *et al.,* 2020).

To explain how important local or regional landscapes are for bird conservation, there is a need to know a lot about the different kinds of birds and how they live together. Also, assessing bird communities has become an important part of protecting biodiversity because it helps figure out what needs to be done to protect areas with a lot of people because variety of birds is a strong bio-indication signal (Bregman *et al*. 2014; Kandel *et. al*., 2018). migratory water birds travelling short and large distances. Wetland areas are home to a diverse range of birds (Valste & Palmgren, 1984.). Protected areas, including wildlife sanctuaries, national parks and biodiversity reserves, are increasingly acknowledged as being essential to sustaining biodiversity and performing vital ecological functions like ecosystem services, climatic stabilisation, carbon sequestration, groundwater recharge, nutrient retention, and natural disaster prevention (DeFries et al., 2007).Shekhawat and Bhatnagar (2014) characterise biological diversity as the variety of organisms and denote the spectrum of ecological resources within a specific locale. The biodiversity of a certain location assesses the availability and dispersion of ecological assets and their use by the organisms residing in that habitat. The presence, distribution, and magnitude of biophysical resources in a certain habitat are essential for assessing diversity of species and survivability in that habitat (Kumar & Sahu, 2020; Kumar & Sahu, 2019). The presence of many creatures indicates a specific area's biological richness. Biodiversity encompasses the complete collection of genes, animals, and ecosystems within a given area. Species are discrete entities of biodiversity, each fulfilling a unique function within an ecosystem. Hence, the assessment of species extinction and the degradation of the gene pool provides a significant challenge to the community (Trivedi, 1999). Birds represent a significant component of the Earth's biodiversity. They are ubiquitous, present throughout the globe. Birds inhabit diverse habitats due to varying geographical conditions that support their survival (Tandan et al., 2015). Consequently, avian diversity

serves as a significant indicator of species richness within a natural habitat (Egwumah et al., 2017). The variety of species found in various floral and faunal parts of Sri Lankan home gardens shows a great deal of heterogeneity among species assemblages from various geographic and agro-ecological zones (Pushpakumara et al., 2012).

The Concept of the Guild: The concept of guilds provides a framework for examining avian populations based on typical ecological roles, rather than exclusively on taxonomic affiliations. A guild is a collection of animals that comparably utilise analogous resources, irrespective of their evolutionary lineage. For instance, insectivorous birds such as swallows and warblers are classified in distinct families yet perform the analogous job of extracting insects from vegetation. Grouping species into guilds according to foraging behaviour, food, or nesting behaviours provides insights into the functional organisation of avian communities.

Benefits of a Guild-Centric Methodology:

The guild-based methodology presents numerous benefits compared to conventional species richness assessments:

- Functional Significance: It elucidates the ecological roles of various avian taxa within an environment.
- Comparative Analysis: This facilitates the study of avian communities across various habitats or environmental gradients by analysing alterations in guild composition.
- Comprehending Community Assembly: It elucidates the assembly mechanisms that influence avian communities. Competition among species within the same guild may elucidate their abundance patterns.
- Conservation Applications: Identifying guilds that are susceptible to environmental changes can guide the development of tailored conservation measures.

Although the guild concept is a beneficial instrument, it is crucial to recognise its constraints. Establishing distinct and biologically pertinent guild categories can be difficult, as species may display adaptable foraging behaviours that obscure guild delineations. Moreover, environmental factors outside resource utilisation might affect avian dispersion, necessitating a comprehensive approach to comprehending avian diversity.

The Gamen Mahi Backwater, a vital freshwater ecosystem in Rajasthan, India, supports a diverse assemblage of bird species. Understanding the factors shaping this diversity is crucial for its conservation. This study employs a guild-based approach to analyse avian diversity and assembly patterns within the backwater. We examine resource use strategies and ecological niches of bird communities, categorizing them into functional guilds. By analysing guild composition and richness, we aim to reveal insights into the functional organization of the bird community and the ecological processes driving its assembly.

II. Material And Methods

Study area

The Gamen, Mahi Reservoir, Banswara, Southern Rajasthan. These stagnant waters This location is regarded as a crucial habitat for avian observation and provides socioeconomic benefits such as tourism activities (notably boating and surfing), along with livelihood services including fishing and harvesting. Figure 1 illustrates the map of the study area, The Gamen, Mahi Reservoir, Banswara, Southern Rajasthan.

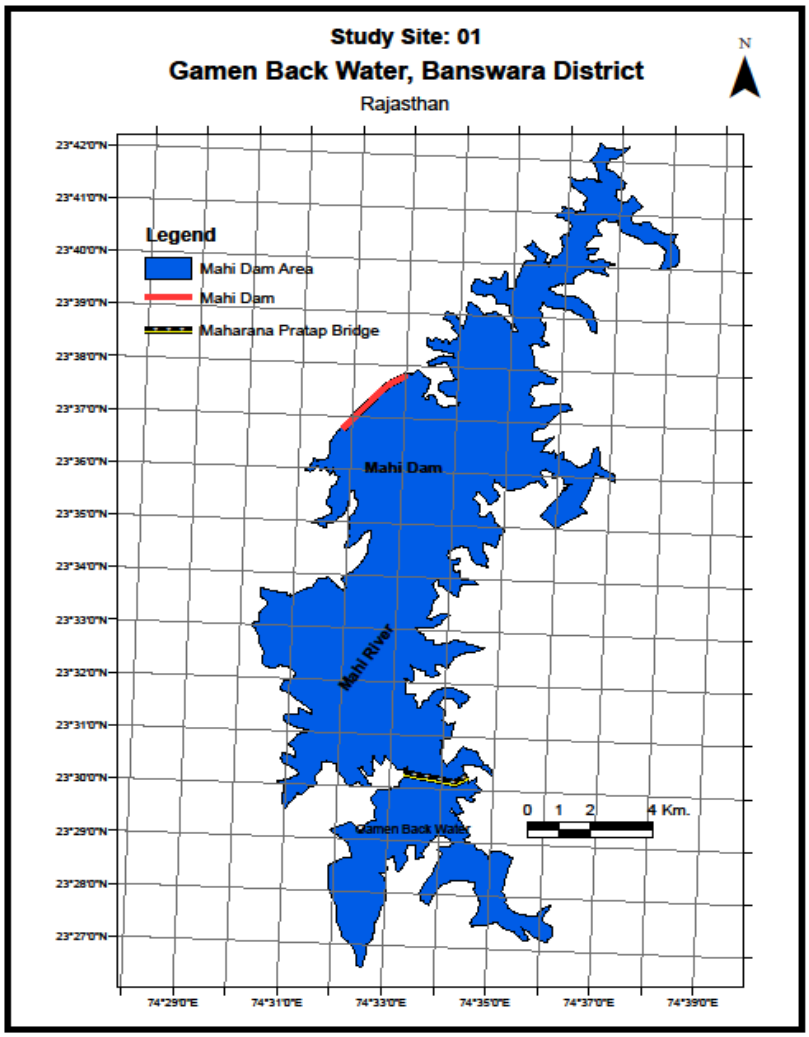

Fig 1 – Study area.

Avian survey and data analysis:

Bird surveys were conducted throughout the research region from March 2019 to Feb 2020, encompassing the extensive geographic periods, thereby building a scientific foundation for the bird species. The biweekly survey was executed throughout the entire environment. The avian counts were conducted in the morning, from 06:00 to 11:00 hours, as this period is optimal for observing the majority of birds in activity. The survey commenced at the coastal zone of the research area, and the complete backwaters were traversed along the water's periphery, utilising a boat with minimal disruption. Appropriate steps were taken to ensure that birds were counted individually. Birds in flight above the research area were also enumerated. The total count and block count methodology (Howes & Bakewell, 1989) was employed to estimate the avian population. The total count method involved selecting an appropriate vantage point inside the study area to enumerate all the birds in a specified region. The block count approach was utilised for extensive and monospecific flocks. The identification of avian species was aided with a field guide (Ali, 1997; Kumar et al., 2005; Grimmett et al., 2016). Observations and avian counts were conducted utilising binoculars (10 x 50) and documented with a Nikon D7200 camera equipped with a 55-300 mm lens. The data analysis was conducted utilising MS Excel 2019.

1. Migration status: Contingent upon the dynamics and seasonal variations the bird species were classified as follows: Resident species, observed year-round; LM-Resident species, exhibiting local migration; WM-Winter Migrants, represented by only one or a few observations.
2. Relative abundance: Based on the likelihood of observation across different habitats within the study area at any given moment, the avifauna were classified as A-Abundant, observed on 9 to 10 out of 10 visits; C-Common, observed on 6 to 8 out of 10 visits; O-Occasional, observed on 3 to 5 out of 10 visits; and R-Rare, observed on fewer than 2 out of 10 visits.

3. IUCN Status: This study highlights many impacting factors on priority species, categorising avifauna and their relevance according to the IUCN Red List of endangered birds. It encompasses LC - Least Concern and NT - Near Threatened.
4. Relative diversity: Relative diversity (RDi) denotes the ratio of the total number of species within a family to the overall species count (%). The calculation was performed using the formula (Koli 2014).

III. RESULT:

The current study sought to document the diversity of bird species at The Gamen, Mahi Reservoir, Banswara, Southern Rajasthan. Line transect and point count methodologies were employed to observe various avian species. A total of 61 avian species in 11 orders and 19 families were documented; among them, 21 were resident, 22 were winter migrants, 18 were resident migrant migrants. Anatidae was found to be the most dominant family with 13 species and accounted for 21.31 % of the total bird diversity, followed by Scolopacidae 16.39%, Ciconiidae 8.19%, Ardeidae, Threskiornithidae and Rallidae 6.55%for each, Charadridae, Laridae, Phalacrocoracidae 4.91% for each, Alcedinidae and Jacanidae 3.27% for each, Anhingidae, Artamidae, Gruidae, Phasianidae, Campephagidae, Phoenicopteridae, Hemiprocnidae and Rostratulidae 1.63 % for each in the research area. The analysis of food and feeding guilds indicated that the carnivorous guild is the most prevalent, succeeded by omnivores, insectivorous and herbivorous. Of the total recorded species, 51 exhibit falling global population trends, while six species (Black-necked Stork, Painted Stork, Oriental Darter, River Tern, Eurasian Curlew, Black-headed Ibis) are categorised as Near Threatened, and the Woolly necked Stork, Sarus Crane, Common Pochard is classified as Vulnerable according to the IUCN Red List. Species richness was markedly greater in farmland, succeeded by the main campus and experimental orchards. The Relative diversity index (RDI)indicated that the primary campus and agricultural area have the highest diversity 21.31% in avian communities. This underscores the importance of these study sites as critical habitats for bird species of conservation concern.

Table 1 – Avifaunal Diversity of Geman Back Water

FAMILY	SPECIES NAME	GUILD STATUS	RESIDENTIAL STATUS	CONSEVATION STATUS
Anatidae	*Graylag Goose*	hervivorous	M	LC
Anatidae	*Knob-billed Duck*	hervivorous	R	LC
Anatidae	*Ruddy Shelduck*	omnivores	RM	LC
Anatidae	*Cotton Pygmy-Goose*	hervivorous	R	LC
Anatidae	*Garganey*	omnivores	M	LC
Anatidae	*Northern Shoveler*	omnivores	M	LC
Anatidae	*Gadwall*	omnivores	M	LC
Anatidae	*Eurasian Wigeon*	hervivorous	M	LC
Anatidae	*Mallard*	omnivores	RM	LC
Anatidae	*Northern Pintail*	hervivorous	M	LC
Anatidae	*Green-winged Teal*	omnivores	M	LC
Anatidae	*Common Pochard*	omnivores	M	VU
Anatidae	*Tufted Duck*	omnivores	M	LC
Phasianidae	*Indian Peafowl*	omnivores	R	LC
Phoenicopteridae	*Greater Flamingo*	omnivores	RM	LC
Hemiprocnidae	*Crested Treeswift*	insectivorous	R	LC
Hemiprocnidae	*Eurasian Moorhen*	omnivores	RM	LC
Rallidae	*Eurasian Coot*	omnivores	RM	LC
Rallidae	*Watercock*	omnivores	R	LC
Rallidae	*White-breasted Waterhen*	omnivores	R	LC
Gruidae	*Sarus Crane*	omnivores	R	VU
Charadriidae	*Yellow-wattled Lapwing*	carnivorous	R	LC
Charadriidae	*Red-wattled Lapwing*	insectivorous	R	LC
Charadriidae	*Little Ringed*	insectivorous	RM	LC

	Plover			
Rostratulidae	*Greater Painted-Snipe*	omnivores	R	LC
Jacanidae	*Pheasant-tailed Jacana*	carnivorous	R	LC
Jacanidae	*Bronze-winged Jacana*	omnivores	R	LC
Scolopacidae	*Eurasian Curlew*	omnivores	M	NT
Scolopacidae	*Ruff*	carnivorous	M	LC
Scolopacidae	*Common Snipe*	carnivorous	M	LC
Scolopacidae	*Common Sandpiper*	carnivorous	RM	LC
Scolopacidae	*Green Sandpiper*	carnivorous	M	LC
Scolopacidae	*Spotted Redshank*	carnivorous	M	LC
Scolopacidae	*Common Greenshank*	carnivorous	M	LC
Scolopacidae	*Marsh Sandpiper*	insectivorous	M	LC
Scolopacidae	*Wood Sandpiper*	omnivores	M	LC
Scolopacidae	*Common Redshank*	omnivores	M	LC
Laridae	*Black-headed Gull*	omnivores	M	LC
Laridae	*Little Tern*	carnivorous	M	LC
Laridae	*River Tern*	carnivorous	M	NT
Ciconiidae	*Asian Openbill*	carnivorous	R	LC
Ciconiidae	*Black Stork*	carnivorous	M	LC
Ciconiidae	*Woolly-necked Stork*	carnivorous	R	VU
Ciconiidae	*Black-necked Stork*	carnivorous	R	NT
Ciconiidae	*Painted Stork*	carnivorous	RM	NT
Anhingidae	*Oriental Darter*	carnivorous	RM	NT
Phalacrocoracidae	*Little Cormorant*	carnivorous	RM	LC
Phalacrocoracidae	*Great Cormorant*	carnivorous	RM	LC
Phalacrocoracidae	*Indian Cormorant*	carnivorous	RM	LC
Ardeidae	*Purple Heron*	carnivorous	RM	LC
Ardeidae	*Intermediate Egret*	carnivorous	RM	LC
Ardeidae	*Little Egret*	carnivorous	RM	LC
Ardeidae	*Cattle Egret*	omnivores	RM	LC
Threskiornithidae	*Glossy Ibis*	carnivorous	RM	LC
Threskiornithidae	*Black-headed Ibis*	carnivorous	R	NT
Threskiornithidae	*Red-naped Ibis*	omnivores	R	LC
Threskiornithidae	*Eurasian Spoonbill*	carnivorous	RM	LC
Alcedinidae	*Common Kingfisher*	carnivorous	RM	LC
Alcedinidae	*Pied Kingfisher*	carnivorous	R	LC
Artamidae	*Ashy Woodswallow*	insectivorous	R	LC
Campephagidae	*Small Minivet*	insectivorous	R	LC

Rm-resident migrant, M- winter migrants, R- resident, LC- Least concern, NT-Near Threatened, V-Vulnerable

Table 2 – Family Based RDI of Geamn Back Water

Row Labels	Count of Species	RDI
Alcedinidae	2	3.278689
Anatidae	13	21.31148

Anhingidae	1	1.639344
Ardeidae	4	6.557377
Artamidae	1	1.639344
Campephagidae	1	1.639344
Charadriidae	3	4.918033
Ciconiidae	5	8.196721
Gruidae	1	1.639344
Hemiprocnidae	2	3.278689
Jacanidae	2	3.278689
Laridae	3	4.918033
Phalacrocoracidae	3	4.918033
Phasianidae	1	1.639344
Phoenicopteridae	1	1.639344
Rallidae	3	4.918033
Rostratulidae	1	1.639344
Scolopacidae	10	16.39344
Threskiornithidae	4	6.557377

IV. Discussion:

Ali and Ripley (1987), found in the Indian subcontinent is home to 176 bird species that are exclusive only to that region. A total of 24 Important Bird Areas and two Ramsar sites have been designated for the specific purpose of conservation. The world consists of 146 families and 23 orders of birds. Acosta et al. (2010) discovered a total of 169 marsh birds and 166 land birds in rice field agroecosystems in North, South, Central America, and the Caribbean. The Anatidae family was the 16th most populous. In a study conducted by Dapke et al. (2015), the avifauna's diversity and seasonal abundance were observed from January to December 2014 in Nagpur. The study found a total of 62 bird species, from 11 orders and 38 families. In all 57 species residents, two transient migrants, one breeding migrant, and two winter migrants.

Rani et al. (2023) noticed in 149 birds species of 137 species were classified as Least Concerned, 9 as Near threatened, 2 as Vulnerable, and 1 as Endangered Sultanpur National Park of Haryana. Asmare et al. (2023) recorded in the Awi zone of Ethiopia. According to IUCN classed 45 species classed as least concern, while 2 species were listed as near threatened and severely endangered.

Jatav et al. (2003) found 28 omnivores, which make up 17.64% of the total population. Additionally, there are 29 carnivores, accounting for 23.21% of the population. Insectivores make up 40% of the population in the Shergarh Wildlife Sanctuary, Atru, Baran district of Rajasthan. Katuwal et al. (2016) recorded a total of 3642 instances of 178 distinct species. They observed the highest number of species were found in the feeding guilds of insectivores ninty six species and omnivores twenty-four species during different seasons.

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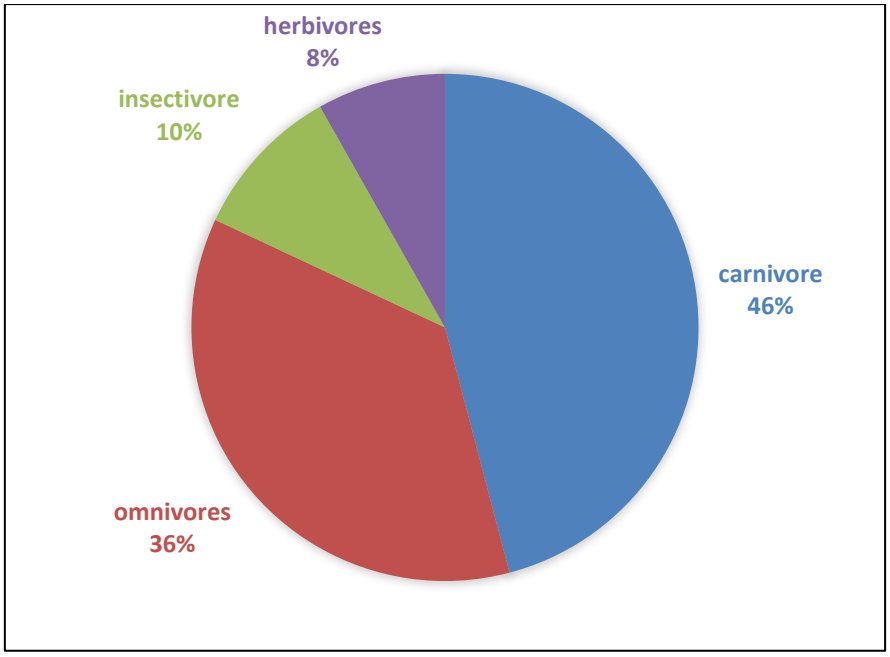

Fig. 1 – GUILD STATUS OF GAMEN MAHI RESERVOIR DURING 2019-2020

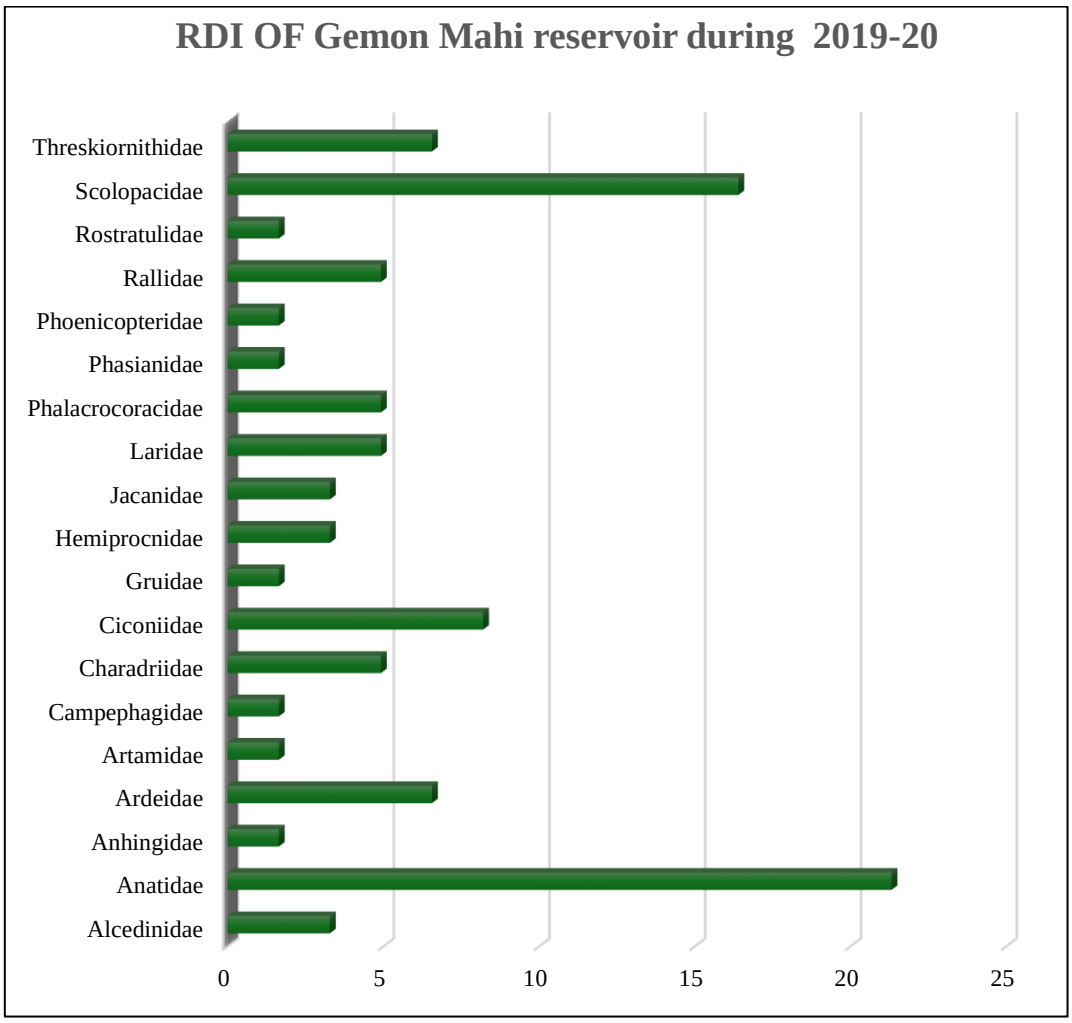

Fig. 2 – RDI OF Gemon Mahi reservoir during 2019-20.