International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

A Study on Avian Diversity with Reference to Species Richness and Dominance Indices in Rani Talab and Kuber Pond, Rewa, Madhya Pradesh, India

Neetika Rai[1], Pushpendra Singh[2], Santosh Kumar Kushwaha[3]

[1]Department Of Zoology, Government Model Science College, Rewa (M.P.) India
[2]Government Postgraduate College, Amarpatan Maihar (M.P.) India
[3]Government Vivekanand Postgraduate College, Maihar, Madhya Pradesh, India

ABSTRACT:
In conclusion, the diversity of aquatic birds is fascinating, spanning a wide range of species, adaptations, feeding habits, and distribution patterns. These birds have evolved various specialized traits that allow them to thrive in aquatic habitats, playing crucial roles in ecosystem dynamics and serving as indicators of habitat health. Studying and preserving this diversity is essential for understanding the intricate relationships within ecosystems and conserving these remarkable avian species. Shannon wiener species indeed and Simpson's dominance indeed was recorded 1.71 $\log_{(k)}$ and 0.21 1/D in first year and 1.69 $\log_{(k)}$ and 0.2283 1/D at all stations during first and second year of research period respectively

Keywords: Adaptations, distribution, dynamics, indicators.

INTRODUCTION:

Aquatic birds, also known as water birds, exhibit a remarkable diversity in terms of species and adaptations to their aquatic habitats. These birds have evolved unique characteristics that allow them to thrive in aquatic environments such as rivers, lakes, wetlands, and the ocean. Let's explore the various aspects of aquatic bird diversity:

1. **Species Diversity:** Aquatic birds encompass a wide range of species from different taxonomic families, each with its distinct characteristics. Some common examples include ducks, geese, swans, herons, egrets, pelicans, gulls, terns, cormorants, and penguins. Each species within these families has adapted to specific ecological niches and environments, resulting in diverse behaviors, feeding habits, sizes, and plumage.
2. **Adaptations for Aquatic Life:** Aquatic birds possess unique anatomical and physiological adaptations that enable them to thrive in water. These adaptations vary depending on the bird's specific habitat and ecological niche. For example, webbed feet allow them to swim efficiently, while waterproof feathers and oil glands maintain buoyancy and provide insulation, protection, and improvement in aerodynamics for flying. Additionally, elongated beaks, specialized bills, and serrated edges aid in catching and consuming their preferred aquatic prey.

3. **Feeding Habits:** Aquatic birds exhibit diverse feeding behaviors, influencing their beak shape and feeding strategies. Some species are primarily filter feeders, using their beaks to strain small organisms and debris from the water. Others are dive-feeding birds, capable of diving underwater to catch fish, crustaceans, or mollusks. Wading birds use their long legs and sharp bills to probe the water for prey, while some birds like pelicans employ spectacular methods like plunge-diving from great heights to catch fish.
4. **Migration and Distribution:** Aquatic birds are known for their remarkable migratory patterns and wide distribution across the globe. Many species embark on long-distance migrations, flying thousands of miles between breeding and wintering grounds. These migrations allow them to access different food sources and exploit various habitats throughout the year. The distribution of aquatic birds is influenced by factors such as temperature, food availability, and breeding sites.
5. **Ecological Importance:** Aquatic birds play a vital role in the ecosystem as both predators and prey. They help control populations of aquatic organisms, including fish and invertebrates, thus maintaining a balanced ecosystem. Additionally, their movements and feeding activities promote the mixing of nutrients between aquatic and terrestrial environments, benefiting both aquatic and terrestrial organisms.

Fowler and Cohen (1995) studied and designed various statistical analysis used in the assessment of the of various aspects of birds to measure the ecological status in an ecosystem. Engelhard and Ritchie (2001) studied the effects of macrophyte and their species richness on wetland ecosystem functioning and services. GPCB (2003) assessed physical, chemical and biological analysis of water as well as wastewater, Gandhinagar, Gujrat, India. Bodegom et. al., (2004) studied and identified to the key problems in ecology of wetland using various scales and uncertainty analysis. Burkert et. al., (2004) examined to hydrological parameters and catchment area and an artificially divided dystrophic lake in reference to limnology Fuchskuhle lake. Euliss et. al., (2004) studied to conceptual framework for biological studies interpretation in wetland.

MATERIALS AND METHOD

The present piece of research work was carried out during November 2019 to October 2020 keeping in view investigating On Avian Diversity with reference to Species Richness and Dominance Indices in Rani Talab and Kuber Pond, Rewa, Madhya Pradesh, India

(A) Description of research study site:

Rani Talab Pond and Kuber Pond:

Selected sites are Rani Talab and Kuber Talab. The total area of Rani Talab and Kuber Talab is approx 37.57 acres and 6 acres respectively. These ponds became very popular after reconstruction for its beauty and safety. Water is used for bathing and washing but now a days it has remarkable for fish culture and avifauna.

(B) Avian faunal Diversity :

When it comes to assessing the diversity of bird species in a pond ecosystem, there are several methods that can be employed. Here is a step-by-step approach to calculating bird diversity:

1. **Surveying:** Conduct a systematic survey of the bird species present in the pond ecosystem. This can be done through visual observations, using binoculars or a spotting scope, and listening for bird calls

or songs. It is important to observe birds across different times of the day and seasons to capture a broader range of species.

2. **Species Identification:** Accurately identify and record the bird species observed during the survey. Field guides and bird identification apps can be extremely helpful tools for this purpose. Note down the characteristics of each species, such as size, coloration, behavior, and habitat preferences.
3. **Counting:** Document the number of individuals observed for each bird species. This can be done by estimating the count visually or by using more specific bird survey techniques, such as point counts (recording all individuals within a fixed radius) or transect counts (walking along a predetermined path and recording birds within a defined area).
4. **Data Organization:** Create a comprehensive list that includes the bird species observed, their corresponding counts, and any additional information obtained during the survey. This data can be organized in a spreadsheet or a database for easier analysis.
5. **Diversity Indices:** Calculate diversity indices to quantify the biodiversity of bird species in the pond ecosystem. One commonly used index is the Shannon-Wiener Index, which takes into account the species richness (number of species) as well as their relative abundance. Other indices like Simpson's Diversity Index also be utilized.
6. **Interpretation:** Once the diversity indices are calculated, interpret the results to understand the overall bird species diversity in the pond ecosystem. Higher diversity values indicate a greater variety of bird species and a more balanced ecosystem, while lower values may suggest a more limited range of species or potential environmental issues.

Remember that calculating bird diversity is an ongoing process, as bird populations can fluctuate over time. Regular monitoring and surveys will provide a more comprehensive understanding of the bird diversity in the pond ecosystem and help track any changes that may occur.

Bird surveys in the above areas were conducted bi-monthly from August 2019 to July 2021. Birds were surveyed using digital (Lumix MDC-FZ 1000 and Canon PowerShot SX540HS) digital cameras (10x20) to record birds. We made direct observations of birds and observed species by walking across roads, tracks, wetlands, grasslands and agricultural fields. These observations were made at various locations around large wetlands, forests and agricultural areas.

Birds were identified following Ali and Ripley (1983) Grimmett et. al., (2011), after identification they did family wise and location wise distribution.

OBSERVATION AND RESULT

Avian-faunal diversity and it's indices

Avian diversity refers to the wide range of bird species found in different habitats and ecosystems around the world. Birds are a diverse group of vertebrates, with over 10,000 species identified so far. They can be found in various shapes, sizes, and colors, adapted to survive in a variety of environments ranging from rainforests to deserts, and from mountains to oceans. Avian diversity is also reflected in their behaviors, feeding habits, and mating rituals. Some birds are skilled hunters, while others rely on seeds and fruits for sustenance. Some species migrate thousands of miles every year, while others are sedentary and stay in the same area throughout their lives. This diversity is not only fascinating but also essential for the balance of our ecosystems. Birds play a crucial role in pollination, seed dispersal, insect control, and nutrient recycling. Their unique characteristics and adaptations make them valuable indicators of the health of our environment. However, human activities such as habitat destruction, pollution, and climate change pose significant threats to avian diversity. It is crucial to

protect and conserve these magnificent creatures to maintain their vital role in our ecosystems and ensure their survival for future generations. Overall, avian diversity is a reminder of the rich and intricate tapestry of life on our planet.

Avian species named Anser anser, Egret flava, Podiceps cristatus, Anas crecca, gallinule chloropus, Azura kingfisher, venules indicus were recorded in which Anser anser belong to Anseriformes of order and Anatidae family, egret flava of Pelecaniformes order and Ardeidae family, Podiceps cristatus of podicipedid, and crecca of Anseriformes and Anatidae, gallinule chloropus of Gruiformes order and Rallidae family, azwee icinyfisher of coraciiforms order and alcidines and vavanellus indicus of chardriordae and charadriidae family were recorded during the tenure of research work (Table 1 and 2).

Average annual Shannon Weinar index was recorded 1.84 $\log_{(k)}$ at all stations in first year of research work , while it was 2.02 $\log_{(k)}$ at all stations in the second year of research period in Rani Talab Pond, Rewa (Table 3 and 4). Dominance index was calculated 0.1761 1/D at all stations and 0.178 1/ D at all stations in first and second year of research period in Rani Talab Pond, Rewa respectively (Table 3 and 4).

In Kuber Pond seven species of avian fauna were recorded having 6 orders viz. charadriiforms, coraciiforms, Gruiformes, Passeriformes, Pelecaniformes and podicioedformes, 7 families viz., slopeside, charadriidae, alcidines, ralliedae, motacillidae, Ardeidae and podicipedidae. And 7 species viz., Tringa ochiopus, Vanellus indicus, Agure kingfisher, Fulyca atra, Motacillia flava, Egret flava and Podiceps cristaths, all the species which were recorded comes under the least concerned IUCN 3.1 status and abundant species in research site area (Table 2).

Shannon wiener species indeed and Simpson's dominance indeed was recorded 1.71 $\log_{(k)}$ and 0.21 1/D in first year and 1.69 $\log_{(k)}$ and 0.2283 1/D at all stations during first and second year of research period in Kuber Pond, Rewa respectively (Tables 5 and 6).

Table 1 : Avian-faunal Diversity in Four Sampling Sites of Rani Talab Pond, Rewa (M.P.) from August 2019 to July 2021

S.N.	Order	Family	Scientific Names	Common Names	Status	Abundance
1.	Anseriformes	Anatidae	Anser anser (Linnaeus, 1758)	Domestic Goose, White Goose	Domesticated	Most Common
2.	Pelecaniformes	Ardeidae	Egret flava, Ardea alba modesta	Egret, Heron	LC (IUCN 3.1)	Most Common
3.	Podicioediformes	Podicipedidae	Podiceps cristatus (Linnaeus, 1758)	The Great Crested Grebe	LC (IUCN 3.1)	Common
4.	Anseriformes	Anatidae	Anas crecca (Linnaeus, 1758)	Eurasian Teal	LC (IUCN 3.1)	Common

5.	Gruiformes	Rallidae	Gallinula chloropus (Linnaeus, 1758)	Moorhen	LC (IUCN 3.1)	Common
6.	Coraciiformes	Alcedines	Azure kingfisher (Ceyx azureus)	Kingfisher	LC (IUCN 3.1)	Most Common
7.	Chardriiformes	Charadriidae	Vanellus indicus	Red Wattled Lapwing	LC (IUCN 3.1)	Most Common

Table 2 : Avian-faunal Diversity in Four Sampling Sites of Kuber Pond, Rewa (M.P.) from August 2019 August to July 2021

S.N.	Order	Family	Scientific Names	Common Names	Status	Abundance
1	Chardriiformes	scolopacidae	tringa ochiopus (Linnaeus, 1758)	Green Sandpiper	LC (IUCN 3.1)	Most Common
2	Chardriiformes	Charadriidae	Vanellus indicus	Red Wattled Lapwing	LC (IUCN 3.1)	Most Common
3	Coraciiformes	Alcedines	Azure kingfisher (Ceyx azureus)	Kingfisher	LC (IUCN 3.1)	Most Common
4	Gruiformes	Rallidae	Fulica atra (Linnaeus, 1758)	Eurasian Coot	LC (IUCN 3.1)	Common
5	Passeriformes	Motacillidae	motacillia flava (Linnaeus, 1758)	Yellow Wagtail	LC (IUCN 3.1)	Common
6	Pelecaniformes	Ardeidae	Egret flava, Ardea alba modesta	Egret, Heron	LC (IUCN 3.1)	Most Common
7	podicioediformes	podicipedidae	Podiceps cristatus (Linnaeus, 1758)	The Great Crested Grebe	LC (IUCN 3.1)	Common

Table 3 : Average annual Avian faunal Diversity's Shannon-Weinar and Simpson Index in for Sampling Sites of Rani Talab Pond, Rewa (M.P.) from August 2019 to July 2020

			Shannon-Weinar Index		Simpson Index
Species' Name	**Number**	**pi**	**lnpi**	**pi*lnpi**	**pi square**
Anser anser (Linnaeus, 1758)	**10**	**0.22**	**-1.51**	**-0.34**	**0.0497**

Egret flava, Ardea alba modesta	8	0.18	-1.71	-0.31	0.0334
Podiceps cristatus (Linnaeus, 1758)	3	0.07	-2.66	-0.18	0.0047
Anas crecca (Linnaeus, 1758)	2	0.05	-3.50	-0.16	0.0021
Gallinula chloropus (Linnaeus, 1758)	4	0.09	-2.40	-0.22	0.0084
Azure kingfisher (Ceyx azureus)	10	0.23	-1.46	-0.33	0.0522
Vanellus indicus	7	0.16	-1.83	-0.29	0.0256
Total	44	1.00	-15.07	-1.84	0.1761

Table 4 : Average annual Avian faunal Diversity's Shannon-Weinar and Simpson Index in four Sampling Sites of Rani Talab Pond, Rewa (M.P.) from August 2020 to July 2021

			Shannon-Weinar Index		Simpson Index
Species' Name	Number	pi	lnpi	pi*lnpi	pi square
Anser anser (Linnaeus, 1758)	10	0.21	-1.57	-0.34	0.0458
Egret flava, Ardea alba modesta	11	0.22	-1.51	-0.34	0.0504
Podiceps cristatus (Linnaeus, 1758)	10	0.20	-2.65	-0.54	0.0413
Anas crecca (Linnaeus, 1758)	4	0.08	-2.52	-0.20	0.0064
Gallinula chloropus (Linnaeus, 1758)	1	0.03	-3.50	-0.09	0.0007
Azure kingfisher (Ceyx azureus)	8	0.16	-1.83	-0.29	0.0257
Vanellus indicus	4	0.09	-2.40	-0.22	0.0083
Total	47	1.00	-15.98	-2.02	0.1786

Table 5 : Average annual Avian faunal Diversity's Shannon-Weinar and Simpson Index in four Sampling Sites of Kuber Pond, Rewa (M.P.) from August 2019 to July 2020

			Shannon-Weinar Index		Simpson Index
Name of species	Number	pi	lnpi	pi*lnpi	pi square
tringa ochiopus (Linnaeus, 1758)	5	0.25	-1.39	-0.35	0.0641
Vanellus indicus	4	0.22	-1.51	-0.32	0.0463
Azure kingfisher (Ceyx azureus)	4	0.19	-1.67	-0.32	0.0361
Fulica atra (Linnaeus, 1758)	1	0.04	-3.21	-0.12	0.0100
motacillia flava (Linnaeus, 1758)	1	0.03	-3.50	-0.09	0.0010
Egret flava, Ardea alba modesta	4	0.22	-1.51	-0.32	0.0500

Podiceps cristatus (Linnaeus, 1758)	**1**	**0.06**	**-2.81**	**-0.18**	**0.0030**
Total	**20**	**1.00**	**-15.60**	**-1.71**	**0.2105**

Table 6 : Average annual Avian faunal Diversity's Shannon-Weinar and Simpson Index in four Sampling Sites of Rani Talab Pond, Rewa (M.P.) from August 2020 to July 2021

			Shannon-Weinar Index		Simpson Index
Name of species	**Number**	**pi**	**lnpi**	**pi*lnpi**	**pi square**
tringa ochiopus (Linnaeus, 1758)	**8**	**0.31**	**-1.18**	**-0.37**	**0.0984**
Vanellus indicus	**5**	**0.19**	**-1.67**	**-0.31**	**0.0347**
Azure kingfisher (Ceyx azureus)	**5**	**0.18**	**-1.71**	**-0.30**	**0.0311**
Fulica atra (Linnaeus, 1758)	**1**	**0.04**	**-3.21**	**-0.13**	**0.0100**
motacillia flava (Linnaeus, 1758)	**2**	**0.06**	**-2.81**	**-0.17**	**0.0010**
Egret flava, Ardea alba modesta	**5**	**0.18**	**-1.71**	**-0.30**	**0.0500**
Podiceps cristatus (Linnaeus, 1758)	**1**	**0.05**	**-2.30**	**-0.11**	**0.0030**
Total	**26**	**1.00**	**-14.59**	**-1.69**	**0.2283**

DISCUSSION:

The manmade water bodies constructed by man to satisfy his own needs also form important habitats for several avian species. For the conservation of nature, management of such habitats irrespective of their sizes is necessary (Kushlan 1986). To study any ecosystem the birds serve as important component as they have the ability to fly away and avoid any obnoxious condition. Hence, they are considered as important health indicators of the ecological conditions and productivity of an ecosystem (Newton 1995; Desai and Shanbhag 2007; Li and Mundkur 2007). The most important parameters of the bird study are the species richness (Nilsson and Nilsson 1978; Weller 1978; Murphy *et al*. 1984), their density (Patterson 1976) and diversity (Krebs 1985). However, among avian communities, the components of diversity are known to differ between locations and seasons (Kricher 1972, 1975; Austin and Tomoff 1978; Rotenberry 1978; Rotenberry *et al.* 1979; Smith and MacMahon 1981; Nudds 1983; Powell 1987; Bethke *et al*. 1993). The density and species richness of birds are expected to be highest during winter when migratory population arrive and minimum during monsoon when the migratory population leave the area and the resident species are engaged in the nesting activities.

Avian species named Anser anser, Egret flava, Podiceps cristatus, Anas crecca, gallinule chloropus, Azura kingfisher, venules indicus were recorded in which Anser anser belong to Anseriformes of order and Anatidae family, egret flava of Pelecaniformes order and Ardeidae family, Podiceps cristatus of podicipedid, and crecca of Anseriformes and Anatidae, gallinule chloropus of Gruiformes order and Rallidae family, azwee icinyfisher of coraciiforms order and alcidines and vavanellus indicus of chardriordae and charadriidae family were recorded during the tenure of research work (Table 1).

In Kuber Pond seven species of avian fauna were recorded having 6 orders viz. charadriiforms, coraciiforms, Gruiformes, Passeriformes, Pelecaniformes and podicioedformes, 7 families viz., slopeside, charadriidae, alcidines, ralliedae, motacillidae, Ardeidae and podicipedidae. And 7 species viz., Tringa ochiopus, Vanellus indicus, Agure kingfisher, Fulyca atra, Motacillia flava, Egret flava and Podiceps cristaths, all the species which were recorded comes under the least concerned (IUCN 3.1, 2011) status and abundant species in research site area (Table 2).

REFERENCES:

1. Ali, S. and S. D. Ripley. 1983. Handbook of the Birds of India and Pakistan (Compact Edition). University Press, Bombay, India.
2. GPCB. 2003. A Manual on Water and Wastewater Analysis. One-Day Training Programme conducted by Gujarat Pollution Control Board (GPCB), Gandhinagar, Gujarat, India.
3. Austin, G. T. and C. S. Tomoff. 1978. Relative abundance in bird populations. American Naturalist. 112: 695-699.
4. Bethke, R. W. and T. Nudds. 1993. Variation in the diversity of ducks along a gradient of environmental variability. Oecologia 93: 242-250.
5. Grimmett, R. Inskipp, C. and Inskipp, T. 1998. Birds of the Indian Sub-Continent. Christopher Helm, London.
6. Grimmett, R., C. Inskipp and T. Inskipp. 2001. Pocket Guide of the Birds of the Indian sub-continent. Oxford University Press. Mumbai.
7. IUCN (2011). IUCN Red List of Threatened Species. Version 2011.1.
8. Li, Z. W. D. and T. Mundkur. 2007. Numbers and distribution of waterbirds and wetlands in the Asia-Pacific region. Results of the Asian Waterbird Census: 2002-2004. Wetlands International, Kuala Lumpur, Malaysia.
9. Murphy, S. M., B. Kessel, L. J. Vining Source. 1984. Waterfowl Populations and Limnologic Characteristics of Taiga Ponds. J. Wild. Manag. 48: 1156-1163.
10. Newton, I. 1995. The contribution of some recent research on birds to ecological understanding. J. Anim. Ecol, 64: 675–696.
11. Nilsson, S. G. and I. N. Nilsson. 1978. Breeding bird community densities and species richness in lakes. Oikos 31: 214-221.
12. Nudds, T. 1983. Variation in richness, evenness and diversity in diving and dabbling ducks guilds in prairie pothole habitats. Can. J. Zool., 61:1547-1550.
13. Patterson, J. H. 1976. The role of environmental heterogeneity in the regulation of duck populations. Journal of Wildlife Management 40**:** 22-32.
14. Powell, G. V. N. 1987. Habitat use by wading birds in a semitropical estuary: implications of hydrography. Auk 104: 740-749.
15. Rotenberry, J. 1978. Components of avian diversity along a multifactorial gradient. Ecology 59: 693-699.
16. Rotenberry, J., R. Fitzner, and W. Rickard. 1979. Seasonal variation in avian community structure: differences in mechanisms regulating diversity. Auk 96:499-505.
17. Smith, K. and J. Mac Mahon. 1981. Bird communities along a montane sere: community structure and energetics. Auk 98: 8-28.

18. Weller, M.W. 1978. Management of Freshwater marshes for wildlife. In Good, R.E., D.F. Whingham and R.L. Simpson (Eds) Freshwater Wetlands: Ecological process and management potential. New York: