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Avian diversity at Sonvad water reservoir in Dhule district (Maharashtra): An important wetland site for waterfowl

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Abstract

The avifauna of Sonvad water reservoir near Dhule (Maharashtra) included a total of 220 species of birds from 61 families and 21 orders. The birds were classified by residential status, occurrence, feeding guild as well as on utilization of microhabitats. The sighting records show visits by at least 11 bird species (4.55%) of 'Near Threatened' species of the red-data book of International Union for Conservation of Nature. Common Pochard (*Aythya ferina*) is the only 'Vulnerable' species sighted occasionally in good numbers, while Egyptian Vulture (*Neophron percnopterus*) is the only 'Endangered' species sighted once. In view of the considerable avian biodiversity, Sonvad water reservoir is an important wetland for birds. It has the potential to develop into a bird sanctuary with suitable protection, adequate management and coordinated efforts of local and Government authorities.

Keywords: Avian diversity, wetland, waterfowl, anthropogenic factors

Introduction

The birds are bio-indicators of ecosystems as the changes in the environment occur, they respond by changing their composition, behaviour and population [1]. Water birds are most important components of wetland ecosystem as they occupy important position in the food web of wetland nutrient cycle [2]. Several studies on avian biodiversity in freshwater bodies reported earlier are limited with interpretations on restricted factors and lack in holistic and broad views of status of avifauna [3-7].

Sonvad freshwater reservoir near Dhule city in Maharashtra state is known to support wide species of birds including considerable waterfowl. Earlier published records for Dhule district do not show status of the birds at the Sonvad wetland [8, 9]. The present study reports the avifaunal diversity at Sonvad reservoir, feeding guild, habitat use and also critically analyses possible threats and conservation measures in relation to socio-economic aspects and different anthropogenic pressures.

2. Material and Methodology**2.1 Study area**

Sonvad freshwater reservoir is located 17 km from Dhule city in the state of Maharashtra. The direction is north on NH-52 (Mumbai-Agra highway). The site is 2 km to the eastern side from the NH-52 with geo-coordinates 21°04'17.7"N and 74°50'19.0"E. It is fed by the small water channels at the western side (Fig-1). The water level greatly increases in monsoon as well as immediate period after monsoon rains, due to inflow of water through inlet channels. Subsequently the water level decreases as it is periodically released for irrigation of nearby cultivated fields. The bird observations were recorded from all the water covered area as well as marshy land surrounding the reservoir and also the terrestrial area of mixed habitat at around 100 meters radius from the wetland.

2.2 Methods

The sighting records during regular field visits at the study site were meticulously maintained. Binocular Olympus 10*50X, was used for observations of birds and Canon-SX50hs camera with maximum optical magnification equivalent to 1200 mm of conventional tele-lens was used for photography. Identification of bird species was confirmed using field guides [10-12]. Bird counting was done according to the methods described earlier [13, 14].

The data collected during the field surveys are reported on 'eBird web portal' for the study area [15]. It was also used to estimate diversity indices and status of bird species. The bird counts were conducted during 03Dec 2012 to 07 Nov 2022. Field visits were mostly in morning (7.30 am to 10.00 am) and in evening (4.00 pm to 6.30 pm). During summer months,

it started about an hour earlier in morning as well as completed an hour late than the winter months.

All the recorded and confirmed bird species were classified based on their status of stay, abundance, habitat use and feeding guild with reference to the study site,



Fig 1: Sonvad reservoir, the study site. (Google Earth 2022.)

2.2.1 Status

Status of bird species (with reference to the study site) was assigned as defined below based on *eBird* records from Dec 2012 up to Nov 2022 during the field surveys are reported on 'eBird web portal' for the study area [15]. It was also used to estimate diversity indices and status of bird species. The bird counts were conducted during 03 [15].

1. Resident (R) refers to the status when the species sighted throughout the year and with positive evidence of nesting and breeding (+).
2. Migrant (M) species, sighted regularly in the study area only during specified period or in a given season every year (known long distance / true migrant, w-Winter, s-Summer).
3. Local migrant (LM) species, sighted during specific period in a year and also seen on neighbouring district (short distance migrant).
4. Passage migrant (PM) A known migratory species sighted occasionally in the study area for short duration.
5. Vagrant, (V) not normally distributed, sighted only once, and has no earlier records.
6. Endemic (E) species known to be distributed only in India, which also includes the site area.

2.2.2 Occurrence

(Abundance) of species with reference to the site as defined below and also include population density as available from *eBird* and IUCN website [15, 16].

1. Abundant (A) individual birds of a species seen in significant numbers at all the times in majority of field visits (>75%).
2. Common (C) A species with good numbers of individuals during most of the sightings (25-75%).
3. Uncommon (U) Species seen with very few individuals, or occasional sightings (<25%). <24 confirmed records.
4. Rare (¶) Species sighted only once, in very small numbers in the study area in a year.

2.2.3 Microhabitat

(MH): Use and exploitation of habitat by birds within the study area are classified as given below.

Open (Ow) water depth > 2-3 ft; Shallow water (Sw) depth up to 1 ft; Mudflats (Mf) water soaked soft mud; Marshy area (Ma) Wet land with firm ground also includes dry bank area surrounding water; Cultivated land (Cl) includes agricultural land as well as urban land; Grassland (Gl) pastures within a km radius; Scrub forest (Sf) with short to medium sized bushes/thorny trees; Well wooded area (Wf) in the vicinity of the site with higher population of larger trees intermixed with all types of bushes.

2.2.4 Feeding Guild (FG)

Guilds are defined according to the locations, attributes, and feeding activities of their component species [17]. According to the feeding habits, birds were divided as aquatic herbivores, insectivore, omnivores, piscivores, carnivores, these are classified for the birds sighted in the study areas given below, H = Herbivore, I = Insectivore, O = Omnivore, P = Piscivore, CV = Carnivore, F = Frugivore, G = Granivore. (If a bird species known to be consuming variety of food material, then the species is categorised based on the predominant food matter consumed in the study area.)

The diversity of birds sighted in the study area was quantified using the various indices. Such as Shannon-Wiener index (H'), Species Richness (d'), and Evenness index (j') were used to estimate population status of the bird species at the site [18]. The diversity indices were calculated for various seasons based on the complete and verified checklists for the given period of date and time.

3. Observations and results

Field visits and sighting records for 9 years and 11 months period, between 03 Dec 2012 to 07 Nov 2022, served as data base. The avifauna included a total of 220 species of birds from 61 families and 21 orders.

1. Abundance: This metric provides a measure of how commonly a species is sighted relative to other species in

the region. It is observed that maximum 58.64% of the total species reported are 'Common'. Whereas 19.55% of the reported species are 'Uncommon' followed closely by 18.64% species which are 'Abundant' (Table-1).

- Majority of the bird species observed in the site area are resident species (45.91% of the total species), this is followed by true long-distance migrants (40.45%) and local migrants (12.73%) (Table-1).
- Of the total bird species, maximum number (55%)

species were sighted on dry land. It is followed by species seen on marshy area (23.48%) and water birds (19.55%). (Table-1).

- Feeding guild wise distribution show that almost 42% of the bird species are insectivores, followed by omnivores (24%) and carnivores (17.27%). The piscivores were at 5th rank (5.43%) after herbivores (5.91%) of the total. (Table-1).

Table 1: Avifauna based on their status of stay, abundance, habitat use and feeding guild with reference to the study site

	Residence Status	Abbreviation	Species	%
1	Resident	R	101	45.91
2	Migratory	M	89	40.45
3	Local migratory	LM	28	12.73
4	Passage migratory	PM	02	0.91
	Total		220	100.00
Habitat type				
1	Open water	(Ow+Sw)	43	19.55
2	Marshy area	(Ma+Mf)	51	23.18
3	Dry land	(Cl+Gl+Sf+Wf)	121	55.00
4	Other	(Oth)	5	2.27
	Total		220	100.00
Occurrence				
1	Abundant	A	41	18.64
2	Common	C	129	58.64
3	Uncommon	U	43	19.55
4	Rare	☆	06	2.72
5	Vagrant	V	01	0.45
	Total		220	100.00
Feeding Guild				
1	Insectivore	I	92	41.81
2	Omnivore	O	53	24.09
3	Carnivore	CV	38	17.27
4	Herbivore	H	13	5.91
5	Piscivore	P	12	5.45
6	Frugivore	F	07	3.18
7	Granivore	G	03	1.36
	Total		220	100.00

The sighting records at Sonvad reservoir show visits by at least 11 bird species which are rated as 'Near Threatened' category as per the red-data book of IUCN (Table-2) and they constitute only 4.55% of the total species. Common Pochard (*Aythya ferina*) is the only 'Vulnerable' species sighted occasionally in good numbers, while Egyptian Vulture

(*Neophron percnopterus*) is the only 'Endangered' species sighted once on 05.3.2013 (Table-2). Sykes's lark (*Galerida deva*) is the 'Endemic' species sighted regularly at the study site. Majority of the bird species 208 (94.55%) are of 'Least concern' category.

Table-2: IUCN Red data bird species sighted in the study area.

	Common English Name	Binomial Name	Order, (Family)	IUCN Cat*
1	Common Pochard	<i>Aythya ferina</i>	Anseriformes; (Anatidae)	VU
2	Ferruginous (white eyed) Pochard [©]	<i>Aythya nyroca</i>	Anseriformes; (Anatidae)	NT
3	Painted Stork	<i>Mycteria leucocephala</i>	Ciconiiformes (Ciconiidae)	NT
4	White Ibis	<i>Threskiornis melanocephalus</i>	Pelecaniformes (Threskiornithidae)	NT
5	Oriental Darter	<i>Anhinga melanogaster</i>	Suliformes (Anhingidae)	NT
6	Egyptian Vulture	<i>Neophron percnopterus</i>	Accipitriformes (Accipitridae)	EN
7	Pallid Harrier	<i>Circus macrourus</i>	Accipitriformes (Accipitridae)	NT
8	Black-tailed Godwit	<i>Limosa limosa</i>	Charadriiformes (Scolopacidae)	NT
9	Curlew Sandpiper	<i>Calidris ferruginea</i>	Charadriiformes (Scolopacidae)	NT
10	River Tern	<i>Sterna aurantia</i>	Charadriiformes (Laridae)	NT
11	Red-headed Falcon	<i>Falco chicquera</i>	Falconiformes (Falconidae)	NT

* IUCN Category: Near Threatened (NT). Vulnerable (VU), Endangered (EN);

©30.11.2021 Species is not in the geographic range as shown by IUCN Red List of Threatened Species, Version 2021-1 [16]

The diversity indices season-wise appear in Table-3. The total species as well as species richness (d' index) go almost

parallel. These were low in summer and shoot up in winter season (Fig-2). However, the Shannon-Wiesman index (H')

shows only marginal changes. It was low (2.5296) in the summer season while high (3.5784) in the post-monsoon season. Whereas the Evenness index (j') shows very minor

changes from lowest (0.1283) in summer season and highest (0.9013) in post-monsoon month.

Table 3: Avifauna: Diversity indices

Season	Count date	Species	Total count	S-W Index (H')	Evenness Index (j')	Species Richness (d')
Summer	11.03.2020	62	453	2.5296	0.1283	23.3425
Rainy	23.08.2020	53	297	3.5784	0.9013	30.1576
Winter	20.11.2020	92	1656	3.1123	0.6883	28.2691
Summer	09.05.2021	46	606	3.2896	0.8692	16.1727

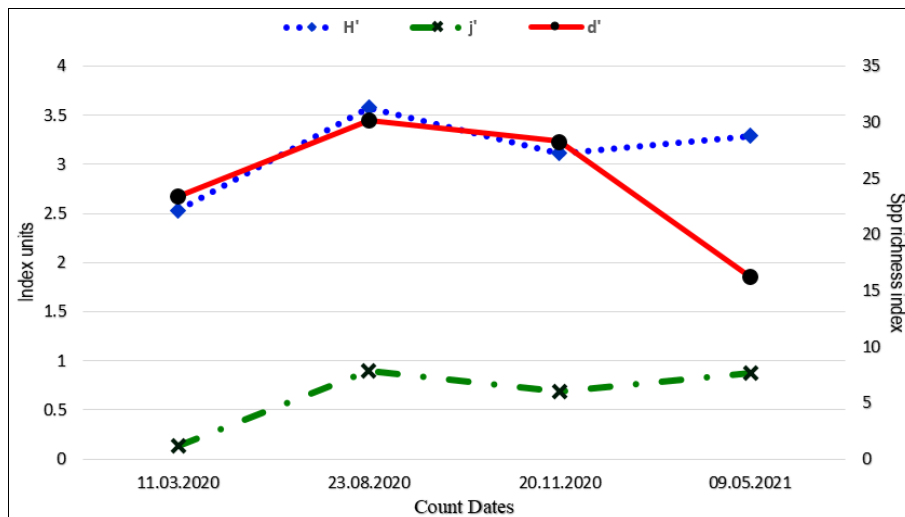


Fig 2: Diversity indices at Sonvad Reservoir. S-W Index (H'), Evenness Index (j'), Species Richness (d')

In the study period, three incidences of hunting of waterfowl were recorded, trapping of quails and partridges activity was also observed, apart from regular fishing using nylon nets was observed.

4. Discussion

Sonvad water reservoir is a medium scale irrigation project under the Irrigation department of Maharashtra state Government. Sonvad project of Dhule tehsil has 2147 hectare area (Fig-1). The water level fluctuates in various seasons and therefore the avian biodiversity in and around the water body is not uniform. It fluctuates depending on the water level and duration. The reservoir is not found in a completely dry state. In very few instances it was holding around 10% of the normal capacity in peak summer seasons, during the observation period of almost 10 years.

The data on species abundance show maximum occurrence of common species. The diversity of avifauna is found to be high due to the diversity of habitats. Almost all types are present in and around the reservoir, except dry hot sandy desert type and dense evergreen forest habitat. The dominant habitat is freshwater wetland, associated with grassland, mixed scrub forest intermingled with cultivated agricultural fields.

The habitat utilization by birds shows an interesting pattern. The higher percentage of terrestrial species is due to the clubbing of species found on cultivated agricultural land area, grasslands, scrub as well as mixed wooded habitat. When the birds preferring wetland habitat like open and shallow waters (waterfowl or true water birds) as well as mudflats and marshy wetland around water bodies (water dependent birds) are clubbed, then such species tally becomes 43%. This scenario may change if the interferences, disturbances are controlled as well as over exploitation of reservoir water is

brought under some control.

The term 'Feeding guild' refers to a group of unrelated species that feed on similar foods (such as benthivore, detritivore, herbivore, insectivore, omnivore, planktivore, piscivore), or the types of food that an individual organism feeds upon [17]. It is not necessary that the species within a guild occupy the same, or even similar, ecological niches. Guilds are defined according to the locations, attributes, or activities of their component species. The data on feeding guild at Sonvad reservoir show a different pattern contrary to the expectation. The site is a wetland, and it is expected that piscivores should have in larger numbers, however in reality such feeders are only 5.43% at 5th rank. The topmost feeders are insectivores (42% of the total species). This pattern is due to the distribution of habitats around the wetland, changing water level in the reservoir and also due to the larger interferences by fishermen who harvest fishes round the year by spreading nylon nets submerged in water.

The present data on the avifauna of Sonvad reservoir indicates considerable diversity in relation to other water bodies in the Dhule district. The site becomes even more important when we consider the occurrence of thirteen IUCN red data species [16]. Of these, 11 species are in the 'Near Threatened' category. Therefore, to support these as well as other similar red data species, it becomes absolute necessity to take adequate serious measures to prevent degradation, misuse or over exploitation of the wetland. Increasing public awareness in local rural as well as city dwellers should become top priority in bird conservation at this site.

When the avian diversity in various major seasons is analysed, interesting finding emerge. Species richness (d') is the simplest measure of biodiversity and is simply a count of the number of different species in a given area. Seasons wise

the total species as well as d' index go almost parallel. It was low in summer and shoots in post-monsoon and winter season (Fig-2). However, the Shannon-Wiesman index (H') show only marginal changes. It was low (2.53) in early summer season while high (3.58) in post-monsoon (Fig-2). This shows variation in the avian diversity with season. Species evenness (j') is a diversity index, a measure of biodiversity which quantifies how equal the populations are numerically. This j' index show negligible changes annually with respect to the seasons (Fig-2) indicating the species populations are unaffected in seasons.

4.1 Socio-Economic aspects

The water body is used mainly for irrigation of cultivated land. Hence the top priority of authorities is crop irrigation which support agriculture. The secondary use is by fishermen who regularly harvest fishes and earn some livelihood by selling them in local rural / city markets. Minor and least use is by poachers and hunters who exploit waterfowl, mainly migratory ducks for the meat. The reservoir has not been used for recreational purposes as there is no scope for tourism.

4.2 Possible threats

1. **Hunting:** Three incidences of hunting of waterfowl observed in the area during the study period. The hunters were appeared to be urban people with guns who shot the ducks and other water birds. Hunting incidences recorded during peak migration of waterfowl. The motives of hunting appear to be for meat and not for recreational purposes.
2. **Poaching:** Local people, mostly rural from economically weaker sections, engaged in trapping quails and partridges for their livelihood as they sell these birds in local market.
3. The water body is also utilized for fishing. Regular annual contracts are under taken officially by individuals and fishermen organizations. They catch fish using thin nylon net in several parts of the reservoir. In the shallow waters, it becomes lethal when birds get trapped and entangled in the abandoned nets.

4.3 Conservation measures

Considering the status and avian diversity of sonvad reservoir, it is imperative to maintain the biodiversity of the wetland. And also, to increase the essential avian biodiversity, some measures and interventions are necessary. These are suggested as given below,

1. **Restrictions on land use:** Restrictions on cultivation around the shallow land area of the lake which comes under maximum flood in the post monsoon period.
2. **Fishing restrictions:** Limited time and days, total ban during peak migration period of waterfowl, avoid nylon nettings, encourage alternative ecofriendly fishing methods.
3. **Management of water use:** Regulation of water release for irrigation in schedule manner as per the need, keeping in view of the minimum residual water level reserved in the reservoir.
4. **Prevention of hunting:** Strict ban on hunting by enforcing law and order by forest department and with constant vigil by local village administration through NGOs and volunteers.

Regular monitoring and surveillance of this wetland will absolutely help to keep track of bird species (migratory and threatened) visiting and utilising this important wetland site as favourable feeding ground in future.

5. Conclusion

Sonwad reservoir is an important and favourable feeding site for birds. The sighting records at Sonwad reservoir show visits by at 11 bird species of 'Near Threatened' category as per the red-data book of IUCN. Common Pochard (*Aythya ferina*) is the only 'Vulnerable' species sighted occasionally in good numbers, while Egyptian Vulture (*Neophron percnopterus*) is the only 'Endangered' species sighted once. Sonwad reservoir has several threats and anthropogenic pressures such as uncontrolled water draining for agricultural activities, over-fishing, hunting and poaching. Several conservation measures are suggested such as restrictions on land use, management of water use, fishing, protection and prevention of hunting. In view of the rich avian biodiversity, it has the potential to develop into an important bird sanctuary, with suitable protection, management of water use and coordinated efforts of local and Government authorities.

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