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RESEARCH ARTICLE

Aquatic bird diversity around Navaratan Sagar of Dhor, uranium mineralization site of Jahazpur Basin, Bhilwara (Rajasthan), India

■ **Bhagawatilal Jagetiya and Sonu Kothari**

SUMMARY

The radioactive mineral deposits of Bhilwara district lies at Bhunas and Jahazpur areas. In Jahazpur, Dhor and Teekhi ka Jhonpara are the main sites of uranium occurrence. Navaratan Sagar of Dhor, Jahazpur Basin, Bhilwara (Rajasthan), a water body, situated at 25°31' North latitude and 75°20' East Longitude. The said water body (Navaratan Sagar) is situated around uranium mineralization site of Dhor. Water bodies constitute a treasury of biodiversity. These have highly complex water and land interactive systems and are supposed to be the most fertile and productive sites. These are providing the habitat to the local and migratory bird species and playing key role in maintaining the balance in natural environmental parameters. Birds occupy a special position in an aquatic ecosystem. They not only have an aesthetic role but also occupy a very special position in the food chain. Birds, like all organisms, depend on their habitats for food, water, shelter and opportunities to breed and raise young. Climate change may alter animal behaviour, population size, species distributions, plant/animal communities as well as ecosystem function and stability. Biodiversity differs from place to place so because environmental conditions of the area as well as the range of tolerance of the species can occur in that area. Environmental changes due to natural metal mineralization also exert the selective pressure on biodiversity. Hence, every mineralization site has its specific biodiversity which may be indicator of that mineralization. There is very little work on aquatic bird diversity around uranium mineralization areas in India, in general and Navaratan Sagar of Dhor, Jahazpur Basin of Rajasthan, in particular. The important aim of this work was to evaluate the general bird diversity and explore indicator bird species of uranium mineralization. The all sighted birds around Navatan Sagar of Dhor, uranium mineralization site were common and fresh water resident. A total of 26 bird species belonging to 19 families were encountered during the study period. Among these, 21 species were resident, and 5 species were winter migrants. No indicator bird species for uranium mineralization was observed. Water samples from different sites were also collected to record physico-chemical parameters. The water of Navaratan Sagar has good amount of dissolved oxygen reflects that it is an undisturbed fresh water ecosystem. Diminution in water retention in this water body in summer has affected the bird diversity in the study area. It is concluded that Navaratan Sagar may be a good habitat to local and migratory birds.

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The radioactive mineral deposits of Bhilwara district lies at Bhunas and Jahazpur areas. In Jahazpur, Dhor and Teekhi ka Jhonpara are the main sites of uranium occurrence (Purohit, 2007). Navaratan Sagar of Dhor, Jahazpur Basin, Bhilwara (Rajasthan), a water body, situated at 25°31'North latitude and 75°20' East Longitude. The said water body (Navaratan Sagar) is situated around uranium mineralization site of Dhor. Water bodies constitute a treasury of biodiversity. These have complex water and land interactive systems and are supposed to be the most fertile and productive sites in the world. These are known for their abundance of birds. The use of water bodies and their resources is widespread among many diverse bird taxa of the world (Lemeed, 2011). These are providing the habitat to the local and migratory bird species and playing key role in maintaining the balance in natural environmental parameters (Bhat *et al*., 2009). Birds occupy a special position in an aquatic ecosystem. They not only have an aesthetic role but also occupy a very special position in the food chain (Bhatnagar *et al*., 2008). They are of great economic importance to the human society. They play an important role in controlling population of different insects and pests. They play the role of scavengers and pollinating agents and also help's in dispersal of seeds of different vegetations. They provide rich food for mankind and are known to man since ages (Rasal and Chavan, 2011). Saxena (1975) has studied the flora and fauna of Bharatpur Bird Sanctuary which support the bird life. Hussain *et al*. (1984) has studied the profile of Chilka Lake in Orissa. Singh and Roy (1990) studied the ecology of birds of Kawar Lake in Bihar. Hosetti *et al*. (2001) studied the ornitho-ecological aspects on Gudavi Bird Sanctuary, Shimoga. Inac *et al*. (2008) studied the bird species of Kumasir Lake, Turkey. Different types of birds are observed at Salim Ali Lake in Aurangabad (Rasal and Chavan, 2011). Birds, like all organisms, depend on their habitats for food, water, shelter and opportunities to breed and raise young. Climate change may alter animal behaviour, population size, species distributions, plant and animal communities and ecosystem function and stability (Raphael Martin, 2008). Birds face many challenges from climate change, with declines in diversity near the top of the list. The potential for local or continental extinctions increases with the extent of warming (Thomas *et al*., 2004). The measure of diversity, known as species richness, is particularly susceptible to local declines as climate changes because bird species richness tends to be lower in hot areas than cold areas (Currie, 2001). In some studies of individual bird species in Europe, species are already showing evidence of shifts in populations and in some cases, declines (Both *et al*., 2006 and Lemoine *et al*., 2007). A study was conducted to assess the impact of mining and associated activities on the diversity and distribution of birds by Gajera *et al.* (2013). The result of the study indicated that the diversity and abundance of birds were less in zones which are located close to the mines in comparison to the zones far from the mines. Roy *et al.* (2018) conducted a similar study in Ecuador and concluded that mining activities severely decrease biodiversity including avifaunal diversity. Water bird exploration was conducted to address the importance of water quality, documentation of vegetation and avian diversity of the ponds and findings illustrated the varied responses from different bird groups and demonstrated the importance of water quality and vegetation to enhance community abundance and diversity (Muralikrishnan *et al.*, 2017). Meena *et al.* (2018) recently reported 53 bird species belonging to 16 families in Kekri (Ajmer), Rajasthan.

Uranium is a ubiquitous element (Laroche *et al*., 2005). The environmental transport of uranium is strongly influenced by its chemical form. It is generally one of the more mobile radioactive metals and can move down through soil with percolating water to underling ground water (Meinarth *et al*., 2003). Uranium may bio-concentrate in certain food crops and in terrestrial and aquatic organism (ANL, 2005). There is very little work on bird diversity around uranium mineralization areas in India, in general and Navaratan Sagar of Dhor, Jahazpur of Rajasthan, in particular (Jagetiya and Purohit, 2006). In present study, an attempt has been made to investigate the indicator bird species, if present for uranium mineralization. Moreover, the present study is the first attempt to document the bird diversity Navaratan Sagar of Dhor, Jahazpur Basin.

MATERIAL AND METHODS

The study was carried out for a period of one year from January 2010 to December 2010, during which the

study site were visited twice a month. Observations were made twice a day, between 08.30-10.30 hrs and 16.00-1800 hrs. The birds were observed through direct sighting with the help of binoculars with zoom and photographed with Nikon D90 camera. They were identified with the help of field guide like Grimmett *et al*. (1999); Grewal (2000) and Woodcock (1980) and further, confirmed at Keoladeo National Park, Bharatpur. The local status was deduced by observations through the seasonal study of the water body (Navaratan Sagar). To study the habitat component of birds at Navaratan Sagar, the water samples were also collected for the determination of physico-chemical parameters such as pH, Total dissolved solids, Dissolve oxygen, BOD, Total alkalinity, Temperature, Transparency, Free CO_2 and Chloride. The parameters were determined during winter season in year 2010. The parameters were determined using standard methods as described in APHA (1987) and Trivedy and Goel (1989).

RESULTS AND DISCUSSION

During the study period of one year (January, 2010 – December, 2010) a total of 26 bird species belonging to 19 families were encountered in the said water body (Navaratan Sagar). Their local status was analyzed through the seasonal study data. Among these 21 species were resident (R) and 5 species were found to be winter migrants (WM). All the birds sighted during the course of study are enlisted in Table 1.

Physico-chemical parameters determined during winter season shows that air temperature varied from 15°C to 18°C while water temperature varied from 10°C to 13°C, pH varied from between 7.50 to 8.20, dissolved oxygen varied between 8.50 to 9.50 mg l^{-1}. Free CO_2

Table 1: Bird species sighted in Navaratan Sagar along with their local status

Sr. No.	Family	Scientific name	Common name	Local status	Total number of birds (Avg. Y^{-1})
1.	Podicipedidae	*Tachybaptus ruficollis*	Little Grebe	WM	2
2.	Phalacrocoracidae	*Phalacrocorax niger*	Little Cormorant	R	30
3.	Ardiiedae	*Ardeola grayii*	Pond Heron	R	8
		Bubulcus ibis	Cattle Egret	R	20
		Egretta garzettta	Little Egret	R	45
4.	Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	R	15
5.	Charadriidae	*Vanellus indicus*	Red-Wattled Lapwing	R	25
		Charadrius dubius	Little Ringed Plover	WM	22
6.	Scolopacidae	*Limosa limosa*	Black-tailed Godwit	WM	3
		Tringa nebularia	Common Green Shank	WM	2
		Actitis hypoleucos	Common Sandpiper	WM	18
7.	Rallidae	*Amaurornis phoenicurus*	White-breasted Waterhen	R	12
8.	Burhinidae	*Burhinus recurvirostris*	Great thick-knee	R	3
9.	Motacillidae	*Motacilla alba*	White Wagtail	R	5
		Motacilla maderaspatensis	White-browed Wagtail	R	4
10.	Alcedinidae	*Halcyon smyrnensis*	White-throated Kingfisher	R	3
11.	Corvidae	*Corvus splendens*	House Crow	R	2
12.	Dicruridae	*Dicrurus macrocercus*	Black Drongo	R	6
13.	Sturnidae	*Sturnus pogodarum*	Brahminy Starling	R	2
14.	Passeridae	*Passer domesticus*	House Sparrow	R	16
15.	Muscicapidae	*Turdoides striatus*	Jungle Babbler	R	2
16.	Pycnonotidae	*Pycnonotus cafer*	Red-vented Bulbul	R	6
17.	Columbidae	*Streptopelia senegalensis*	Laughing Dove	R	7
18.	Alaudidae	*Mirafra cantillans*	Singhing bush Lark	R	3
		Eremopterix grisea	Ashy Crowned Sparrow Lark	R	5
19.	Hirundinidae	*Hirundo smithii*	Wire-tailed Swallows	R	12

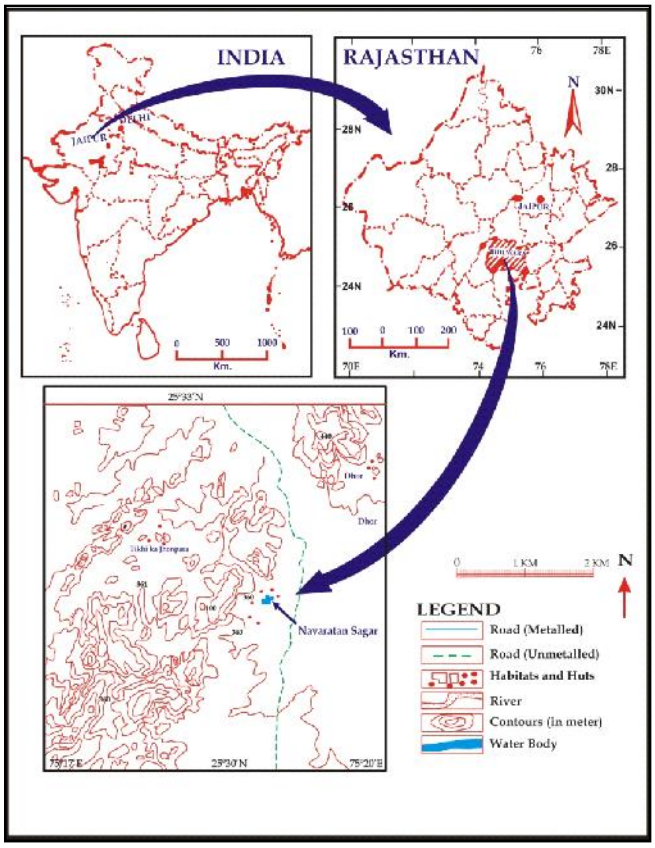


Plate 1 : Study site

was negligible during winter season (especially in month of December 2010). Total dissolved solids varied between 77-80 mg l^{-1}, transparency varied between 38 to 45 cm, BOD varied between 1.00 to 2.50 mg l^{-1}, total alkalinity varied between 160 to 180 mg l^{-1} and chloride varied between 56.00 to 86.00 mg l^{-1}. The results are summarized in Table 2.

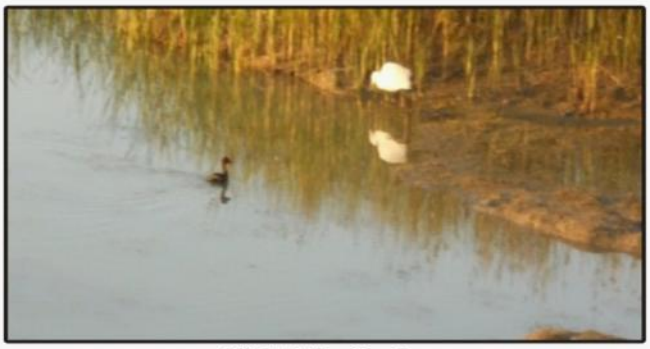
India is a mega biodiversity nation. It has a great diversity of habitats, starting from Kanniyakumari to Kashmir and Gujarat to Assam. It includes desert, grassland and forest as well as the highest ranges of mountains in the world. All these result in having area with rich biodiversity (Nalawade *et al*., 2008). Biodiversity differs from place to place so because environmental conditions of the area as well as the range of tolerance of the species can occur in that area (Jagetiya *et al*., 2011). Biodiversity are very sensitive to environmental changes. Environmental changes due to natural metal mineralization also exert the selective pressure on biodiversity. Hence, every mineralization site has its specific biodiversity which may be indicator of that mineralization. Birds may also be the indicator of metal mineralization. If we go through literature we find that a bird *Lipaugus vociferans* is the Gold and Quartz reefs indicator. The human activities and interference are also destructing the natural water body characteristics. The natural water bodies are losing the natural habitat of migratory birds at many places. There is a need to study such aquatic ecosystems for understanding the gravity of environmental problems and to find solution to improve the habitat of migratory birds which directly help in protecting the bird's species (Nalawade *et al.*, 2008). Activities of water birds are considered as indicator of quality of the aquatic ecosystem and form the terminal links in many aquatic food chains and as a result they reflect changes originating in several different ecosystem components (Rajashekhar and Venkatesha, 2011).

Nearly 250 species of birds are known to be highly dependent on fresh water habitats out of which a large proportion (60%) belongs to a single family Anatidae, which comprises of ducks, geese and swans. Wading birds such as sandpipers (Scolopacidae), plovers (Charadriidae), herons and bitterns (Ardiiedae) and other diverse assemblage of families are also associated with inland fresh water habitats (Ananthakrishanan and Sivaramakrishnan, 2006). The present investigation showed a large abundance of fresh water birds around Navaratan Sagar. The all sighted birds in Navatan Sagar of Dhor, uranium mineralization site are common and fresh water resident. Dominent families are Ardiiedae (3 species), Scolopacidae (3 species), Charadriidae (2 species) etc. and these are the major fresh water indicator families. In present study, no specific indicator bird species was reported for uranium mineralization.

The quality of water resource is generally studied in terms of its physico-chemical parameters (Thorat and Sultana, 2006). Monitoring of water quality is the first step that can lead to management and conservation of aquatic ecosystems (Garg *et al*., 2010). The occurrences of hydrolytic vegetation featuring optimum productivity, in presence of optimal physico-chemical parameters are

Table 2: Various physico-chemical parameters of Navaratan Sagar recorded in winter season (2010)

Parameters	Air temp. °C	Water temp. °C	pH	Dissolved O_2 mg l^{-1}	Free CO_2 mg l^{-1}	Alkalinity mg l^{-1}	TDS mg l^{-1}	BOD mg l^{-1}	Transparency cm	Chloride mg l^{-1}
Range	15-18	10-13	7.50-8.20	8.50-9.50	0.00-1.00	160-180	77-80	1.00-2.50	38-45	56.0-86.0



(1) Little Grebe
Tachybaptus ruficollis

(5) Little Egret
Egretta garzettta

(2) Little Cormorant
Tachybaptus ruficollis

(6) Black-winged Stilt
Himantopus himantopus

(3) Pond Heron
Ardeola grayii

(7) Red-Wattled Lapwing
Vanellus indicus

(4) Cattle Egret
Bubulcus ibis

(8) Little Ringed Plover
Charadrius dubius

Plate 2 : Contd.....

Plate 2 : Contd.....

(9) Black-tailed Godwait
Limosa limosa

(13) Great thick-knee
Burhinus recurvirostris

(10) Common Green Shank
Tringa nebularia

(14) White Wagtail
Motacilla alba

(11) Common Sandpiper
Actitis hypoleucos

(15) White-browed Wagtail
Motacilla maderaspatensis

(12) White-breasted Waterhen
Amaurornis phoenicurus

(16) White-throated Kingfisher
Halcyon smyrnensis

Plate 2 : Contd.....

Plate 2 : Contd.....

(17) House Crow
Corvus splendens

(21) Jungle Babbler
Turdoides striatus

(18) Black Drongo
Dicrurus macrocercus

(22) Red-vented Bulbul
Pycnonotus cafer

(19) Brahminy Starling
Sturnus pogodarum

(23) Laughing Dove
Streptopelia senegalensis

(20) House Sparrow
Passer domesticus

(24) Singhing bush Lark
Mirafra cantillans

Plate 2 : Contd.....

Plate 2 : Contd.....

(25) Ashy Crowned Sparrow Lark
Eremopterix grisea

(26) Wire-tailed Swallows
Hirundo smithii

Plate 2 : (Fig. 1-26) : Aquatic birds of Navaratan Sagar, Dhor, uranium mineralization site of Jahazpur basin

acting good habitat component to the birds (Nalawade *et al.*, 2008). According to Ellis (1937), pH is an important factor, which controls the nature of aquatic environment and most of the chemical and biological reactions are governed by the pH of aquatic ecosystem. The pH was observed in acceptable range (7.50 to 8.20) as per WHO (1984) and Trivedi (1995). The water of Navaratan Sagar has good amount of dissolved oxygen reflects that it is an undisturbed fresh water ecosystem. Free CO_2 was negligible during December month. Alkalinity range confirms the good productivity level of Navaratan Sagar. Chloride status of water is indicative of its degree of pollution of animal origin. The present study provides the bird population dynamics of Navaratan Sagar over one year. It has been proved that the Navaratan Sagar may be a good habitat to local and migratory birds and winter season is found to be most favourable to water birds of Navaratan Sagar.

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