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Dr. Poonam N Kurve

Department of Zoology,
VPM's B. N. Bandodkar College
of Science, Dnyandeep, Thane,
Maharashtra, India

Habitat dependent avifaunal diversity along the coastline of Raigad district, (M.S.), India

Dr. Poonam N Kurve

Abstract

Present study envisages bird diversity along various shores of Dist. Raigad, Maharashtra, India. The study was carried out from year 2012-2015 using point count, total count and vehicle transect method. Notable diversity of birds depending upon habitat morphology was observed during the study which revealed total 46 bird species belonging to 12 families. The sandy rocky shore of Akshi showed highest bird diversity i.e. 37 species followed by sandy shore of Revdanda that revealed 32 species whereas; at muddy rocky shore of Salav I and muddy shore of Salav II showed 19 and 18 bird species respectively. The data was also interpreted for migratory status which revealed 30% resident and 70% migratory birds underlining importance of such coastal habitats. As per the IUCN red list, 89% of the species found were Least Concern category, 9% from Near Threatened category while 2% species were Endangered.

Keywords: Avifauna, Akshi, Revdanda, Salav, migratory, resident

1. Introduction

India is a country having coastal coverage on east, west and south sides by Bay of Bengal and Arabian Sea respectively. The coastline admeasuring 7500 km in length, exhibits remarkable floral and faunal diversity which has been well explored by researchers. Monsoon rainfalls, diverse geographic and climatic conditions and heterogeneity of natural habitats are the most important factors that contribute to an increase in biodiversity (Karr, 1976) ^[7] thereby playing a role as indicator taxa. Among vertebrates, birds are significant in ecosystem assessment. In marine ecosystem, coastal birds play key role in maintaining ecological balance. They act as primary and tertiary consumers in the food chain and help in recycling of nutrients. Coastal birds are indicators of health of marine environment locally as well as globally (S. Balasubramian 2012) ^[1]. Their numbers, distribution and habitat usage yield insights to quality and status of ecosystem (Ismail *et al.*, 2012) ^[5].

Intertidal flora and fauna along coastline forms an important dietary share of resident as well as migratory birds. Hence, migratory birds have a stopover at this productive feeding ground of marine ecosystem during their migration path (M. Klaassen *et al.*, 2012) ^[8].

Indian subcontinent supports diverse avifauna (1300 bird species which constitute 13% of the world's bird population) which includes 141 endemic species (Grimmett *et al.*, 1999) ^[3]. This avifauna comprises resident and migratory water-birds and coastal birds. There are about 229 species of winter migrants that visit Indian subcontinent, every year (Grimmett and Inskipp, 2013) ^[4]. Maharashtra state hosts over 43.67% of these birds (Mhatre K., 2013, Clements and James 2000) ^[9, 2].

Avian diversity in India has been studied extensively, but most of it has been in protected ecosystems such as national parks, wildlife sanctuaries and other IBA (Important bird area), (Urfi, 2005) ^[11]. There is significant bird diversity outside protected areas which remains neglected and understudied. Further, coastal areas are under serious threat due to sand dredging, coastal land reclamation and pollution. It has resulted into habitat destruction and alarming decline in the number and diversity of wader bird population (E. A. Jayson, 2002) ^[6]. This makes it necessary to document the current avifaunal diversity. As such even the base line data is not available from many such places which can give valuable inputs in the field of ornithology. So, there is an urgent need to provide attention and generate the baseline data.

The present study deals with waders and other birds observed on the shore at selected locations with varied habitats from Raigad district.

Correspondence

Dr. Poonam N Kurve

Department of Zoology,
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of Science, Dnyandeep, Thane,
Maharashtra, India

1.2 Study Area

Geographically Raigad district of Maharashtra state is positioned at the coast of Arabian Sea. On its east are the Western Ghats. Towards south is Ratnagiri district which is

part of Konkan region and on the north is the metro city Mumbai. Four study locations were identified on the basis of geomorphological characters along the coastline for recording data of avian diversity.

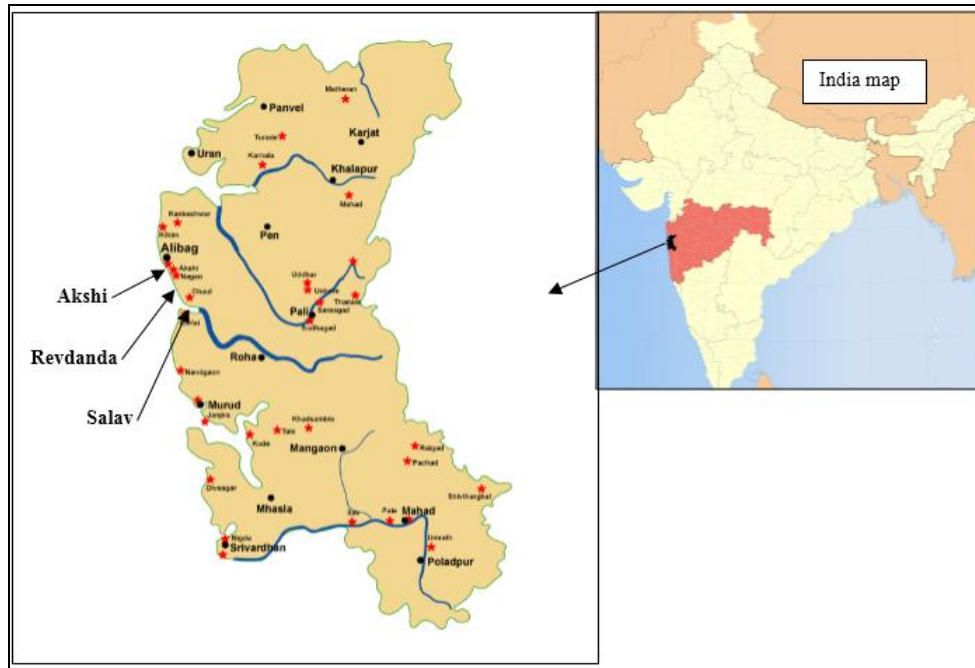


Fig 1: Map showing study locations

1. Sandy and rocky shore (SRS) - Akshi ($18^{\circ}37.24'85''N$ $72^{\circ}53.07'97''E$) beach located north to Revdanda about 7km from Alibag. This location is characterized by clean long sandy beach with few isolated but prominent rocky patches.
2. Sandy shore (SS) - Revdanda ($18^{\circ}33.00'78''N$ $72^{\circ}55.25'78''E$) is located between Akshi and Salav about 15km from Alibag. It is a long stretch of sandy habitat with dominance of bivalves in the intertidal zone.
3. Rocky and muddy shore (MRS) – Salav I: This station ($18^{\circ}31.21'71''N$ $72^{\circ}55.29'49''E$) is situated further south to Akshi and about 19km from Alibag. Near this station is an Industrial area of *Vikram Ispat*.
4. Muddy shore (MS) - Salav II ($18^{\circ}32.20'36''N$ $72^{\circ}56.07'02''E$) is a creek with dominance of mangroves and mangrove associates (confluence of *Kundalika* river and Arabian Sea forming a creek).

2. Material and Methods

The study was carried out from January 2012 to December 2015. Locations were surveyed twice a month by considering tidal activities and birds were observed with help of binoculars (Comet 10x50). The birds were identified up to species using field guides (Grimmitte and Inskipp, 2013) [4]. Photographs were taken wherever possible so as to identify the bird accurately to species level. Birds in flight were also recorded during the survey. The anecdotal sightings of some species were also included in the data for long term study. Following methodologies were adopted for sampling:

2.1 Point count method: A suitable vantage point was selected at each location from where the flocks of birds can be observed. The duration of observation was about 3-4 hrs depending upon the inflow of tidal waters.

2.2 Vehicle Transect: Survey was carried out by hiring a boat from local fisherman. Long boat rides were arranged so as to observe the birds on mudflats and pelagic birds. The species encountered were observed and identified. This method has been approved by Wetland International (WI) and is used internationally for wetland bird surveys.

2.3 Total Count: Total count method was also employed for documenting bird diversity. Direct observations were made either by slow walking across the shore or approaching near a birds or flock without disturbing them. The method was found to be very useful as it encompassed most of the species at all locations and also gave few rare sightings.

3. Result and Discussion

During the literature survey, it was found that very few records of bird diversity from Raigad district are available (Pawar P., 2011; and Mhatre K., 2013) [10, 9] and most of them are about terrestrial and wetland bird diversity. The avifaunal diversity along Alibag coastline is yet to be recorded scientifically. This could be the first scientific reporting of shore birds observed at the above mentioned habitats although; some birding enthusiasts have made few observations. Recently similar research reports have been published by Khot, 2016 and Quadros, 2015 from Sindhudurg district.

The present study focuses on diversity and distribution of avifauna along four habitats with different sediment characters from Raigad district of Konkan region.

The data obtained was interpreted on the basis of systematics, IUCN status and migratory status.

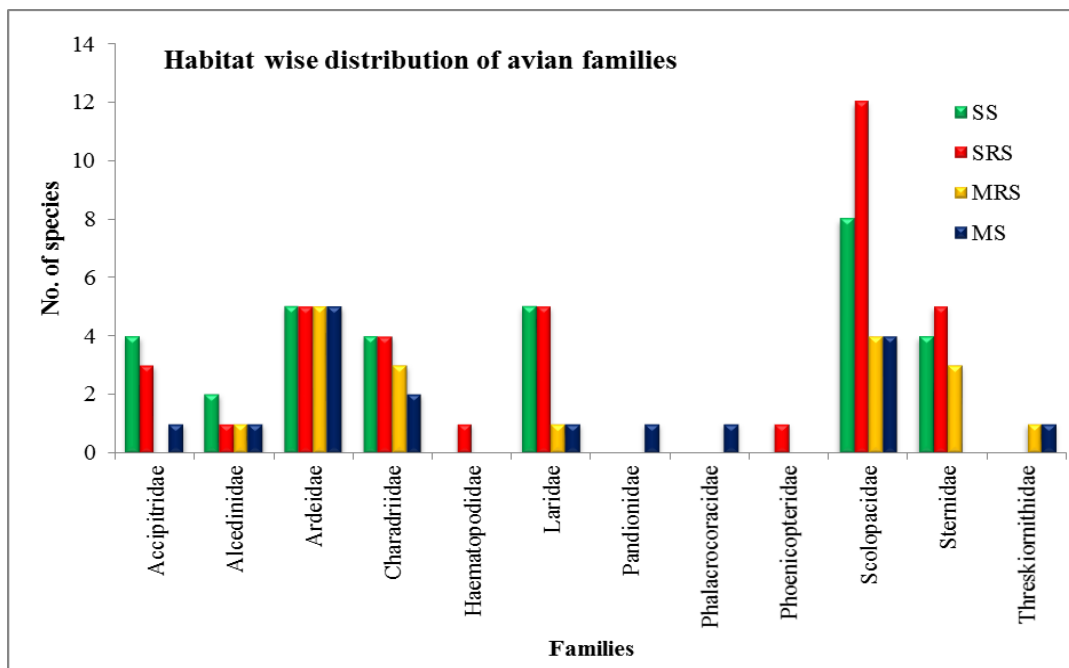


Fig 2: Habitat wise distribution of Avian Families

Familywise bird diversity of the different habitats has been graphically represented (Fig. 2) which illustrates dominance of *Scolopacidae*, followed by *Ardeidae*, *Charadriidae*, *Laridae* and *Sternidae* of order Charadriiformes. Total 46 species of birds were observed at the locations during entire study period. Among the study locations, rocky sandy-shore of Akshi showed maximum number of bird species (i.e.37). The sandy and rocky patches shelter larger variety of gastropods and bivalves which form vital part of the wader’s diet. These birds also require shore with flat surface where they can land upon. Akshi and Revdanda coasts have uniform, gradual slope of continental shelf which enables smooth landing of birds. At sandy shore of Revdanda, that shows dominance of bivalves, 32 species of birds were observed. At Akshi, 12 species from family *Scolopacidae* were found, 8 species at Revdanda and 4 species at both Salav Stations. It is followed by family *Ardeidae* which is represented by 5 members at all sites. Family *Charadriidae* is represented by 4 species at Revdanda and Akshi; 3 species at Salav I (MRS) and 2 species at Salav II (MS). From the family *Laridae*, 5 members each at Akshi and Revdanda and one species at both Salav stations. Family *Sternidae* shows 5 species at Akshi, 4 at Revdanda, 3 species at Salav I and absent from Salav II. Family *Scolopacidae* consists of birds such as sandpipers, curlews, redshank, greenshanks. Egrets and herons come under family *Ardeidae* whereas; *Charadriidae* comprises of mainly plovers. *Laridae* includes all Gulls while *Sternidae* includes Terns. This shows overall dominance of waderspecies over total bird diversity. Family *Scolopacidae* and *Laridae* show good difference in no. of species at Akshi, Revdanda and Salav I and II. This could be because of peculiar coastal landforms of Salav I and II and further, the anthropogenic disturbances as compared to Akshi and Revdanda. Also, the members of these families could be more sensitive towards pollution than the others such as *Ardeidae* (Egrets and herons) which are more tolerant and found commonly even in polluted areas. While on the other hand, *Charadriidae* and *Sternidae* are represented more or less evenly at all locations. Although having mudflats, Salav II

shows comparatively least no. of species. It is at Akshi, that vagrant appearance of juvenile greater flamingo was recorded that too only once during the entire study period. The birds Great Knot, Caspian Plover and Eurasian Oyster Catcher were recorded only at Akshi coast and were not observed at the other stations whereas; Black headed Ibis observed at Salav was never seen at Akshi or Revdanda. White bellied sea eagle was recorded at Revdanda and Similarly Osprey was seen only at Salav.

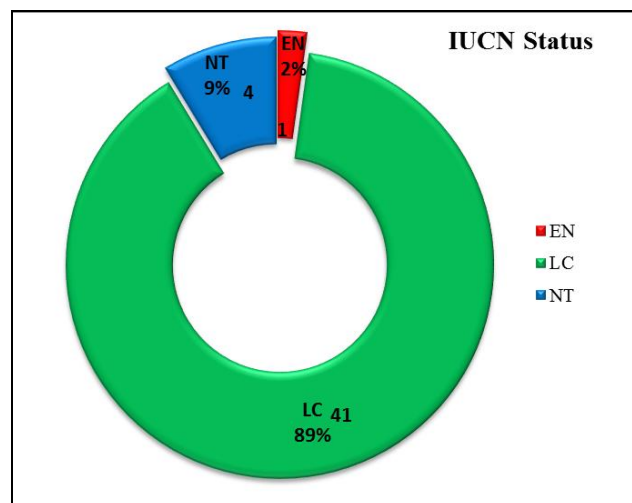


Fig 3: IUCN status

Fig. 3 depicts bird diversity at the four stations and status of species according to IUCN Red list (3.1). As it is seen in graph, 41 (89%) of total species found, are categorized as least concern (LC), 4 (9%) as Near threatened (NT) and just one species (2%) as Endangered (EN). Four Near threatened species are Eurasian Curlew, Curlew sandpipers, Eurasian Oystercatcher and Black headed Ibis while Endangered species is Great Knot. These species and their habitats are of conservation importance. This, underlines the significance of such areas which provide these species a safer feeding ground and habitat.

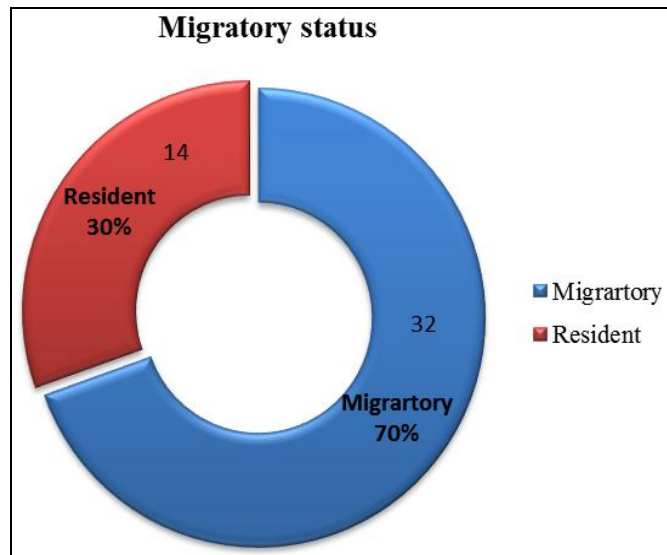


Fig 4: Migratory Status

Fig. 4 shows proportion of migratory and resident bird species in the total bird diversity. Out of total species encountered during the study, migratory species contribute 70% while resident species are 30%. Out of these 70%, most are waders. Migratory birds form very important part of avifaunal

diversity of India.

Areas such as wetlands, mudflats, coasts are winter home to them. Fortunately, India is rich in such habitats and thus is major attraction to these winter visitors.

Table 1: Habitat wise distribution of Avifauna

Sr. No.	Common Name	Scientific name	Sandy	Sandy & rocky	Rocky & muddy	Mudflats
			Revdanda	Akshi	Salav I	Salav II
Order: Charadriiformes						
Family Sternidae						
1	Caspian Tern	<i>Sterna caspia</i>	+	+	+	-
2	Gull billed tern	<i>Gelochelidon nilotica</i>	+	+	+	-
3	Whiskered tern	<i>Chlidonias hybridus</i>	+	+	+	-
4	Little tern	<i>Sternula albifrons</i>	+	+	-	-
5	Greater crested tern	<i>Thalasseus bergii</i>	-	+	-	-
Family Charadriidae						
6	Lesser Sand plover	<i>Pluvialis mongolus</i>	+	+	+	-
7	Little ringed Plover	<i>Charadrius dubius</i>	+	+	+	+
8	Kentish Plover	<i>Charadrius alexandrinus</i>	+	+	+	+
9	Caspian Plover	<i>Charadrius asiaticus</i>	+	+	-	-
Family Laridae						
10	Ruddy Turnstone	<i>Arenaria interpres</i>	+	+	-	-
11	Pallas's Gull	<i>Ichthyaeetus ichthyaeetus</i>	+	+	-	-
12	Heuglin's gull	<i>Larus heuglini</i>	+	+	-	-
13	Black headed gull	<i>Larus ridibundus</i>	+	+	-	-
14	Brown Headed Gull	<i>Larus brunicephalus</i>	+	+	+	+
15	Steppe gull	<i>Larus (heuglini) barabensis</i>	+	+	-	-
Family Scolopacidae						
16	Whimbrel	<i>Numenius phaeopus</i>	+	+	-	-
17	Redshank	<i>Tringa tetanus</i>	-	+	+	+
18	Greenshank	<i>Tringa nebularia</i>	-	+	+	+
19	Marsh sandpiper	<i>Tringa stagnatilis</i>	-	+	+	+
20	Terek Sandpiper	<i>Xenus cinereus</i>	+	+	-	-
21	Common sandpiper	<i>Actitis hypoleucos</i>	-	+	+	+
22	Wood sandpiper	<i>Tringa glariola</i>	-	+	-	-
23	Little stint	<i>Calidris minuta</i>	+	+	-	-
24	Dunlin	<i>Calidris alpina</i>	+	-	-	-
25	Curlew	<i>Numenius arquata</i>	+	-	-	-
26	Curlew sandpiper	<i>Calidris ferrugenea</i>	+	+	-	-
27	Broad billed sandpiper	<i>Limicola falcinellus</i>	-	+	-	-
28	Great Knot	<i>Calidris tenuirostris</i>	+	+	-	-
Family Haematopodidae						
29	Eurasian Oyster Catcher	<i>Haematopus ostralegus</i>	-	+	-	-
Order: Pelecaniformes						
Family Ardeidae						

30	Western reef egret	<i>Egretta gularis</i>	-	+	+	+
31	Little egret	<i>Egretta garzetta</i>	+	+	+	+
32	Great egret	<i>Casmerodius albus</i>	+	+	-	-
33	Cattle egret	<i>Bubulcus ibis</i>				
34	Pond Heron	<i>Ardeola grayii</i>	+	+	-	-
35	Intermediate Egret	<i>Mesophoyx intermedia</i>	+	-	+	+
36	Black crowned night heron	<i>Nycticorax nycticorax</i>	-	-	+	+
Family Threskiornithidae						
37	Black headed ibis	<i>Threskiornis melanocephalus</i>	-	-	+	+
Order: Suliformes						
Family Phalacrocoracidae						
38	Little cormorant	<i>Phalacrocorax fuscicollis</i>	-	-	-	+
Order Accipitriformes						
Family Accipitridae						
39	Black Kite	<i>Milvus migrans</i>	+	+	+	+
40	Brahmini Kite	<i>Haliaeetus turindus</i>	+	+	-	+
41	Black winged kite	<i>Elanus caeruleus</i>	+	+	-	-
42	White bellied sea eagle	<i>Haliaeetus leucogaster</i>	+	-	-	-
Family Pandionidae						
43	Osprey	<i>Pandionhali actus</i>	-	-	-	+
Order: Coraciformes						
Family Alcedinidae						
44	White throated Kingfisher	<i>Halcyon smirnensis</i>	+	+	-	-
45	Common Kingfisher	<i>Alcedo herculas</i>	+	-	+	+
Order Phoenicopteriformes						
Family Phoenicopteridae						
46	Greater Flamingo	<i>Phoenicopteru scruber</i>	-	+	-	-

Table 2: IUCN and migratory status of birds

Sr. No.	Common Name	IUCN Status	Migratory Status
1	Caspian tern	LC	M
2	Gull billed tern	LC	M
3	Whiskered tern	LC	M
4	Little tern	LC	M
5	Greater crested tern	LC	M
6	Ruddy Turnstone	LC	M
7	Lesser Sand plover	LC	M
8	Little ringed Plover	LC	M
9	Kentish Plover	LC	M
10	Caspian Plover	LC	M
11	Pallas's Gull	LC	M
12	Heuglin's gull	LC	M
13	Black headed gull	LC	M
14	Brown Headed Gull	LC	M
15	Steppe gull	LC	M
16	Whimbrel	LC	M
17	Redshank	LC	M
18	Greenshank	LC	M
19	Marsh sandpiper	LC	M
20	Terek Sandpipier	LC	M
21	Common sandpiper	LC	M
22	Wood sandpiper	LC	M
23	Little stint	LC	M
24	Dunlin	LC	M
25	Curlew	NT	M
26	Curlew sandpiper	NT	M
27	Broad billed sandpiper	LC	M
28	Great Knot	EN	M
29	Eurasian Oyster Catcher	NT	M
30	Western reef egret	LC	R
31	Little egret	LC	R
32	Great egret	LC	R
33	Cattle egret	LC	R
34	Pond Heron	LC	R
35	Intermediate Egret	LC	R
36	Black crowned night heron	LC	R
37	Black headed ibis	NT	M

38	Little cormorant	LC	R
39	Black Kite	LC	R
40	Brahmini Kite	LC	R
41	Black winged kite	LC	R
42	White bellied sea eagle	LC	R
43	Osprey	LC	R
44	White throated Kingfisher	LC	R
45	Common Kingfisher	LC	R
46	Greater Flamingo	LC	M

LC: Least concern; EN: Endangered; NT: Not threatened; R: Resident; M: Migratory

4. Conclusion

Anthropogenic factors like indiscriminate sand dredging, pollution by oil spills and most importantly excessive tourism are posing a threat to the existence of this bird diversity. Sand dredging, in particular is observed near muddy-rocky coast at Salav I and muddy coast near Salav II. Alibag in Raigad District has gained popularity as weekend picnic destination. Various water sports have been introduced to attract tourists from nearby metrocities. These activities are causing oil spills and other types of pollution near the beaches. The motor boats, banana rides, water scooters, and other water sports drive away birds from the intertidal region.

Further, the coastal land is being reclaimed and encroached over for construction purpose. It still aggravates the situation. The coastal area available for birds' activity is reduced and this deprives them of their feeding ground.

Considering the current state of development in and around Alibag, Dist. Raigad, the stress to resident and migratory birds is inevitable.

In order to conserve these species, it is very important to protect their habitats and maintain their quality which is under major threats from development and pollution. Thus, in current scenario, areas like Akshi, Revdanda and Salav are of utmost importance and need immediate attention and action.

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