Baseline survey of birds at proposed Navi Mumbai International Airport (NMIA) area

Report on seasonal surveys covering seasonal variation in population of birds

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Bombay Natural History Society

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Baseline survey of birds at Navi Mumbai International airport area Report on seasonal surveys covering seasonal variation in population of birds

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Baseline survey of birds at proposed NMIA area - Report on seasonal surveys covering seasonal variation in population of birds

Summary

The avifaunal surveys were carried out during January 2012 to March 2013, in 10 km radius area of proposed Navi Mumbai International Airport (NMIA), Navi Mumbai, Maharashtra, India. This report is mainly focussed on seasonal variation in population of birds at various roosting sites in study area. During high tide we assumed that bird count in roosting sites will give estimation about population of birds in study area. Information on Species richness, evenness index, dominance index and similarity indices were calculated for different sites for different seasons. It was observed that bird congregation depends on tide levels and occurs usually in shallow water. Population of congregating birds in different roosting areas was observed changing seasonally.

Keywords: Navi Mumbai International Airport, Avifauna, winter, summer, Wetland.

1. Abbreviations used

1) NMIA - Navi Mumbai International Airport
2) BNHS - Bombay Natural History Society
3) JNPT - Jawaharlal Nehru Port Trust
4) EIA - Environmental Impact Assessment
5) DPS NRI complex – Delhi Public school and Non Residential Indian Complex
6) Habitats**: P** - Paddy field, **GS** - Mixed habitat of Grassland and Shrub land, **RS** - Rocky Seashore, **W** - Wetland, **MD** - Mudflats, **MC** - Mangrove and Creeks, **NH** - Near human habitation, **F** - forest
7) Threat categories**: EN** - Endangered, **VU** - Vulnerable, **NT** - Near threatened
8) Type of movements**: R** - Resident, **M** – Migratory
9) TSC- Training Ship Chanakya

Name of the sites frequently used in the text:

Belpada: Wetland between Sonari and Belapda

TS Chanakya: Wetland behind TS Chanakya

DPS-NRI: Wetland behind NRI complex

CHAPTER I

1. INTRODUCTION

1.1 Background

Navi Mumbai is a city on the west coast of Maharashtra, India. It was developed in 1972 as a twin city of Mumbai. Navi Mumbai lies on the mainland on the eastern shore of Thane Creek. The city limits stretch from Airoli near Thane in the north, to Uran in the south. When Navi Mumbai was developed in 1970s, City and Industrial Development Corporation (CIDCO) was the authority that looked after the development and maintenance of the city. CIDCO prepared a developmental plan for Navi Mumbai covering 95 villages from Thane and Raigad district.

1.2 Brief description of the proposed airport project

The existing airport at Mumbai is fast reaching saturation level and the scope for further enhancement of passenger and cargo handling facilities, aircraft maintenance and city side facilities is limited. Hence, the need for a second airport in Mumbai has become inescapable and imperative, Therefore CIDCO, Navi Mumbai proposes to set up a new international airport at Navi Mumbai, Maharashtra. The land required for the project is located in an area of 1160 hectares (2867 acres) accommodating two parallel runways for independent operation. It is proposed to be commissioned in 2014. The Ministry of Environment and Forests (MoEF) has given clearance to this project on the basis of some conditions. One of the conditions (condition no. xxxi provided under specific conditions) is that an avifaunal study should be carried out in consultation with the BNHS.

Gulls and waders roosting at TS Chanakya wetland

CHAPTER II

STUDY AREA

1. Location and description of site

The proposed site is accessible from Mumbai-Pune Highway via Navi Mumbai and is surrounded by 10 villages, namely Kambad Bhuje, Ganeshpuri, Ulve, Mulgaon, Vaghiliwada, Owle, Pargaon, Kopar, Koli, and Chinchpada.

Roosting sites in 10 km radius of the study area

2. Study Site

Initially, the entire 10 km radius of the area, around proposed NMIA was surveyed, excluding industrial areas and dense human habitations. Later the study was concentrated on the following major roosting areas of birds around proposed NMIA site. While transects were laid in all mangrove areas for study of roosting birds.

(1) NMIA site: This zone is of mixed habitat and includes mangroves, open scrubland/ shrub land and a complex of smaller wetlands created by backwater, paddy fields as well as creeks of Gadhi, Ulve, Kalamboli and Panvel. Roosting of birds was mainly observed in the area of about 40 hectares as shown in the map.

Google earth map of NMIA site and bird roosting area

(2) DPS NRI: This is located to the Northwest direction of proposed NMIA area. It includes wetland of near about 19 hectares area, surrounded by grasses, shrubs and mangroves. Water level in the wetland was seen maintained mainly by the tide level and local fishermen. During high tide wetland receives water and maintained by small check dams created by the local people. Wetland is covered by mangroves from three sides and fencing wall of NRI complex on one side with thin stretch of grass and vegetation in between. This vegetation on the borders of the wetland makes it more undisturbed and enclosed habitat for birds for roosting.

Google earth map of DPS-NRI Lake

(3) Belpada: This region is located in the southwest direction of NMIA site and is a complex of small wetlands spread all over the region near the areas of Jasai, Dastan fata and Sonari-Belpada. Inland wetland of near about 34 hectares of the area was observed to be used by birds for roosting near speedy company at Belpada. It is surrounded by grass/shrub land from three sides and boundary wall of 'Speedy' company from one side. This wetland was once connected to the sea by water channels. Now it has no more connectivity and its water level is not dependent on tide and gets dried up in summer.

Sonari-Belpada wetland

(4) TS Chanakya: This wetland covers the area of near about 15 hectares which is covered by paddy fields, trees, mangroves, and finally seashore from Palm Beach Road towards seaside. Water from the wetland is maintained by local fishermen and is also dependent on tide level. It was observed that the majority of water birds were found to congregating in this area during summer season, when water level becomes shallow.

TS Chanakya wetland

(5) Mangrove areas – Mangroves spread adjoining to the above mentioned bird roosting areas were surveyed for study of population of small birds. As the study area comprises of large portion covered by mangroves, it is important to know the status of smaller birds which may be a threat to runway clear zone in the future.

CHAPTER III

METHODOLOGY

The areas were surveyed using binoculars (Nikkon Monarch 10x X 40x) and digital camera (Cannon 550D, Cannon 400 mm fix lens). Birds were identified as following, Ali & Ripley (1983), Grimmett *et al.* (2000) and Rasmussen & Anderton (2005). The list of birds was arranged family wise following Manakadan & Pittie (2001). The known roosting and foraging areas were monitored to study the seasonal movement of the birds.

Birds were counted using estimated blocks Bibby, *et.al* (2000) for different species according to their congregation size during the roosting time. The Total count method was used to count congregating water birds and waders. Every site was visited at least fortnightly. Data from different counts was used to calculate Diversity Indices and Species Abundance Lamberson *et. al* (2011) and Dipu *et. al* (2012) for comparative analysis to study the temporal (seasonal) variations in bird population. The abundance of Species was calculated using formula N/n where 'N' is total number of individuals of a species sighted and 'n' is total number of visits in which the individual of respective species was observed for each site and compared across seasons.

Transects were laid in mangroves and open areas and birds perching as well as sheltering in mangrove and associated plants were counted. Density of the birds was calculated using total number of individuals of a species recorded in all transects and divided by total number of transects laid. Count of maximum number of birds sighted in respective roost site during a particular season was used for preparation of area chart.

Species richness, evenness, index of dominance and similarity was calculated using the following formulas.

i) Species richness = $\frac{(S - 1)}{LogN}$, (Margalef 1958)

Where S= total number of species; N= total number of individual of all species.

ii) Evenness index = $\frac{H}{LogS}$ (Pielou 1969)

Where H= Shannon Wiener diversity index; S = Total number of species

iii) Index of dominance = $\sum (n_i/N)^2$ (Simpson 1949)

Where n_i = number of individual of a species (of one habitat) N = Total number of individual of all species (of one habitat)

iv) Index of similarity (S) = $\frac{2C}{A + B}$ (Sorensen 1948)

Where: A= number of species in community/Habitat A

B= number of species in community/Habitat B

C= number of species common in both A & B

Observations were taken during year 2012-13 and divided into summer (February to May) and winter (October to January), for study of seasonal variations in abundance of roosting birds at various sites. Data from monsoon season (June to September) was not taken into consideration in calculation of different indices because of absence of migratory birds and dispersal of resident birds in all over the area because of deep water level in roosting areas. We could not reach many sites due to inaccessibility in habitats such as mangroves, creeks, salt pan because of high rainfall in monsoon. Bird abundance was calculated for the roosting places per unit areas mentioned in the study area. Transects were laid in 1 km distance in mangrove and associated plant with 50 m width in both sides in six plots. Therefore density of birds in mangrove habitat is calculated as per 10 ha unit area.

Waders in flight at TS Chanakya wetland

CHAPTER IV

RESULTS

1. Results and observations of birds in roosting sites

1.1 Wetland behind DPS NRI area

This wetland is located near sea shore and preferred by most of the migratory birds mainly for roosting and foraging, for example water level of the wetland was found to be dependent on tide levels and human activities. Sea water, during considerably high tide was seen flowing through water channels and usually maintained by the local fishermen for fishing activities. Birds were observed only in shallow water.

Bird congregation was more during the winter which slowly declined towards peak summer. Species such as Grey Plovers, Lesser sand Plovers, Temminck's stint, Curlew Sandpiper, Black-headed Gull, Brown-headed Gull, Whiskered Tern, Caspian Tern and Pied Avocet were seen in abundance in winter. Birds such as Eurasian Spoonbill, Painted Stork were more abundant in summer (see fig 1). There was no change in the population of Brown-headed Gull as it does not necessarily requires shallow water as compared to the other birds as mentioned above and can also be found floating on the deep water. While, birds such as River Tern were observed only in summer.

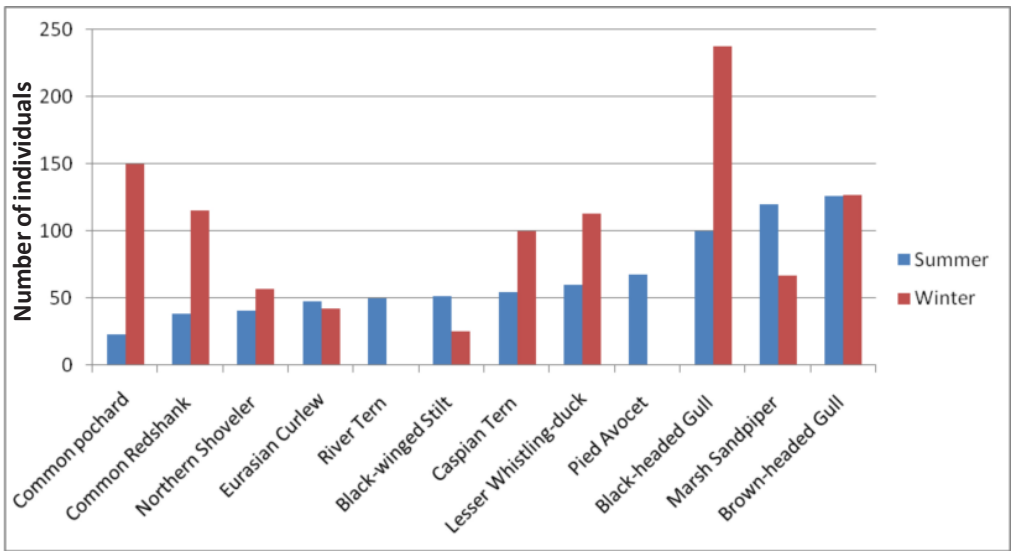


Fig: 1: Species abundance across the season at DPS NRI site (n=6)

Large number of waders in flight at DPS-NRI Lake

Congregation of birds at DPS-NRI Lake during summer

Population of birds changes according to the tide level at roosting places

Congregation of waders during high tide at DPS-NRI Lake

1.2 Wetland behind TS Chanakya Maritime university at Palm Beach Road

This region is located adjacent to the sea shore and its water level was usually high in winter. Birds were seen moving and congregating here during summer when water was shallow. Almost no congregation of birds is observed during winter. Bird congregation, especially waders and lesser flamingos were seen during the summer and reducing towards arrival of monsoon. Curlew Sandpiper, Broad-billed Sandpiper, Lesser Sandpiper, Greater Sandpiper and Grey Plovers were abundant in this region during the summer than in the winter, along with mixed flocks of gulls and terns (see fig 2)

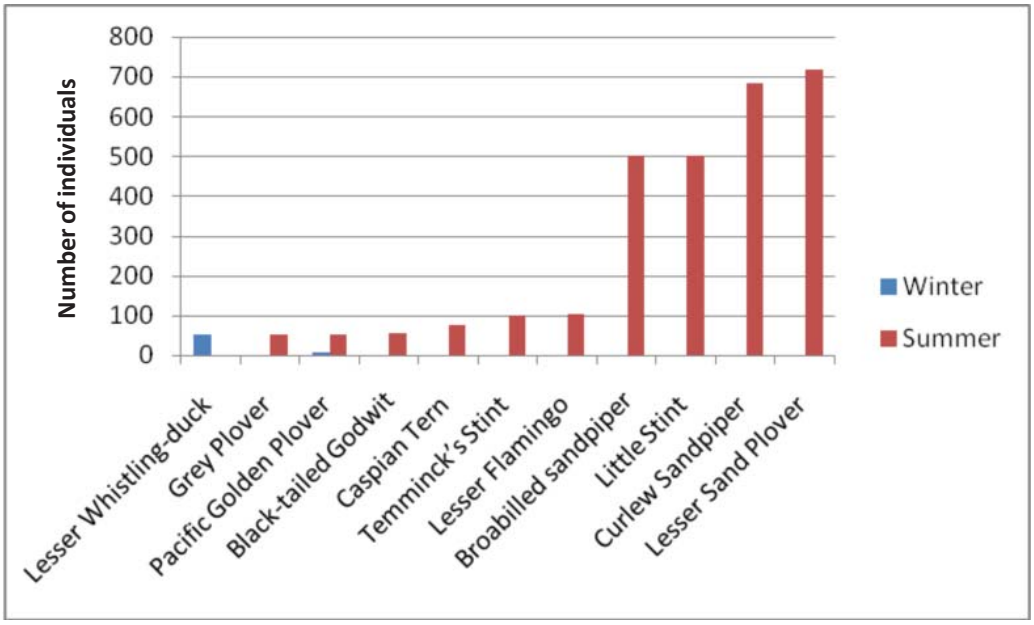


Fig: 2: Comparative account of species abundance at TS Chanakya site (n=4)

Gulls and waders roosting at T.S Chanakya wetland during summer

Huge number of Lesser Flamingos was observed at sea shore near Palm Beach Road

Congregation of birds at T.S Chanakya wetland

1.3 Wetland of Sonari-Belpada area in Uran

This wetland is far away from the shore area as compared to the other roosting sites as mentioned above. It is surrounded by grassland and shrub land which is observed with water during monsoon till late winter. As a result congregation of bird was also observed here more during the winter which found slowly decreasing towards the summer. As there is no direct connectivity to the sea this wetland dries up by the summer. Birds such as Common Teal, Northern Pintail, Garganey, Eurasian Spoonbill, and Painted Stork were more abundant in the winter. Whereas, Lesser Sand Plover, Black-tailed Godwit, Pied Avocet, Curlew Sandpiper, Ruddy Shelduck were abundant in summer (see fig 3). Due to insufficient water in peak summer very few birds were seen here in April-May.

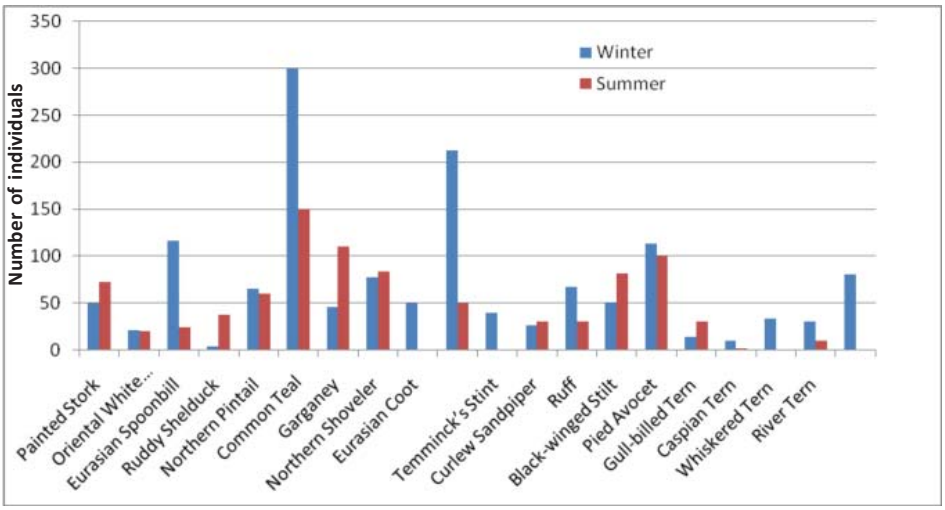


Fig: 3. Seasonal variation in species abundance at Sonari-Belpada are (n=7)

Flock of waders in flight at Belpada

Shallow water provide foraging habitat for waders and water birds

Dog chasing water birds usually lead to sudden movement of birds

Flock of Ducks were observed roosting at Belpada Lake

Few individual of Ruddy Shelduck were observed in early summer

1.4 Proposed NMIA area

This site is adjacent to Panvel creek and is mainly used by birds for foraging during low tide and adjacent areas, for roosting during high tide. Movement of birds in this area was observed high in the summer when other inland water bodies get dried up. Species like Common Redshank, Terek Sandpiper and Pacific Golden Plover were abundant here (see fig 4).

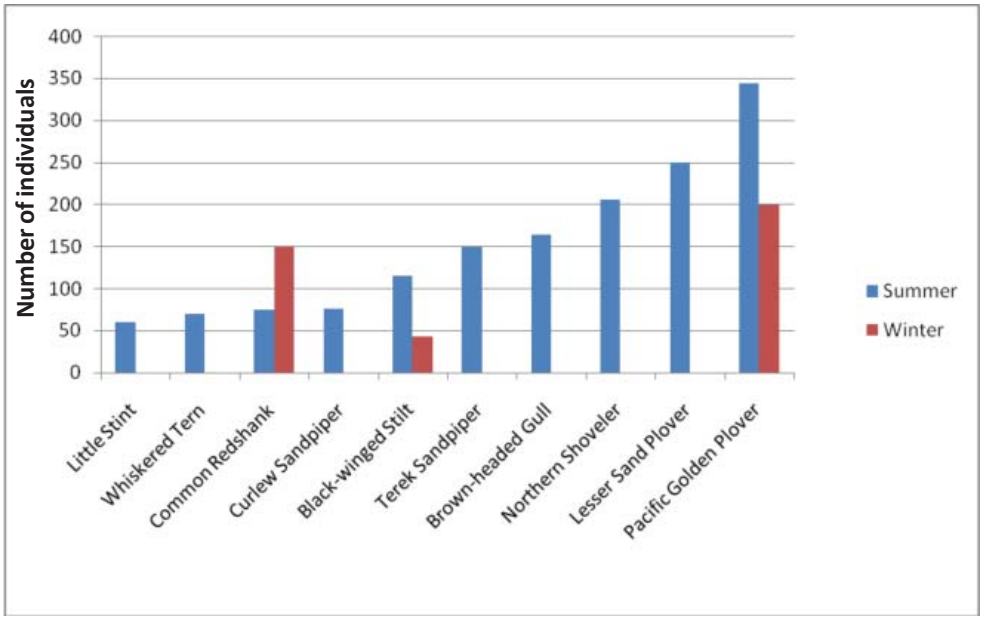


Fig 4: Comparative species abundance across season at NMIA site (n=6)

Congregation of birds in creek area at NMIA site in summer

Black-headed Ibis at NMIA

Proposed NMIA site

Storks and Cormorants roosting at NMIA site

Waders were observed in flocks during low tide at NMIA site

1.5 Observations carried out in mangrove areas

Seasonal variation in densities of birds was calcualted after conducting transects in various sites of mangroves in the study area. In winter season, density of passerine birds such as Rosy Starling, Black-headed Bunting and Baya Weaver was observed high, as shown in (fig 5). These birds were mainly seen roosting in comparatively undisturbed area of NMIA region which comprises of mixed habitat of creek, mangroves and paddyfields. Birds were seen foraging in paddyfield areas and roosting in nearby mangroves. Indian Shag was observed almost all over the year with changing population during high and low tide .

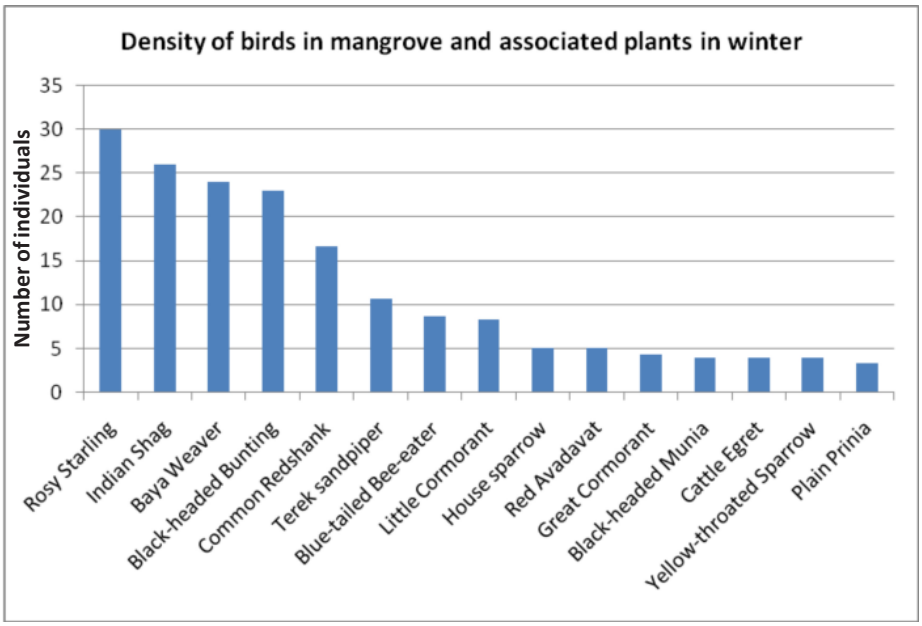


Fig. 5: Bird density at mangrove and associated plants in winter (n=3)

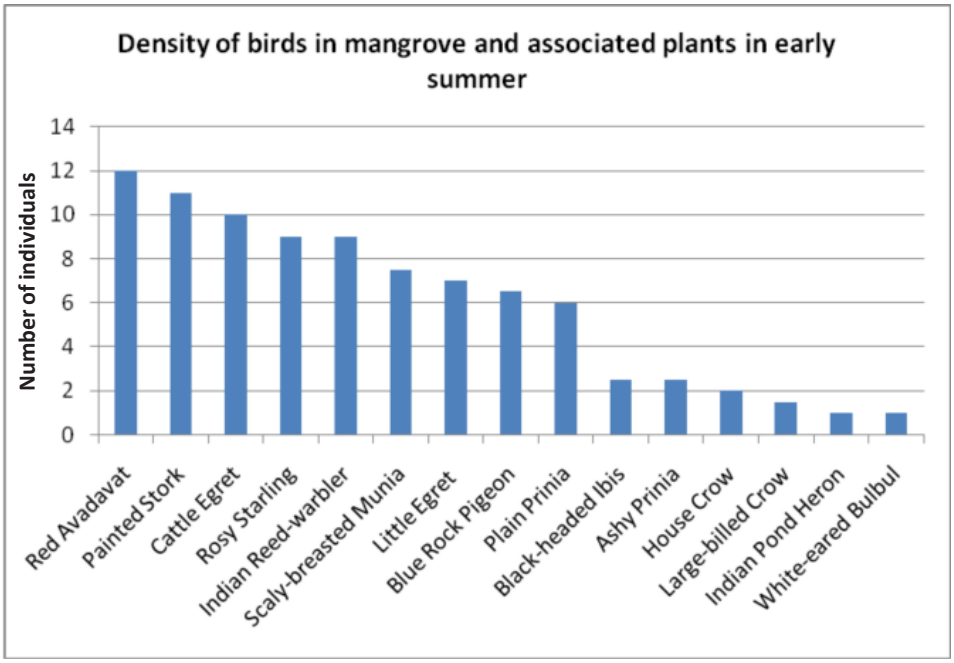


Fig. 6: Bird density at mangrove and associated plants in early summer and late winter (n=3)

In late winter and early summer, birds such as munias, egrets and Blue Rock Pigeons were found more in number. Presence of Indian or Clamorous Reed Warbler was detected because of its noisy breeding calls in summer. Due to drying of adjoining wetlands, birds such as Painted Stork was also seen in good numbers (see fig 6). Small birds such as prinias, warblers and bulbuls were heardcontinuously calling in mangrove areas in late summer and early the moonson season (see fig 7).

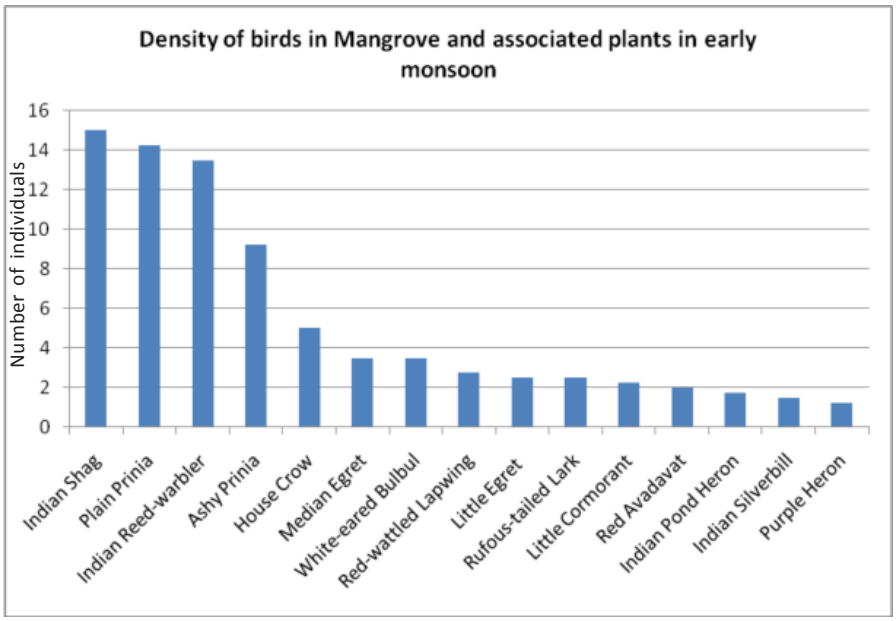
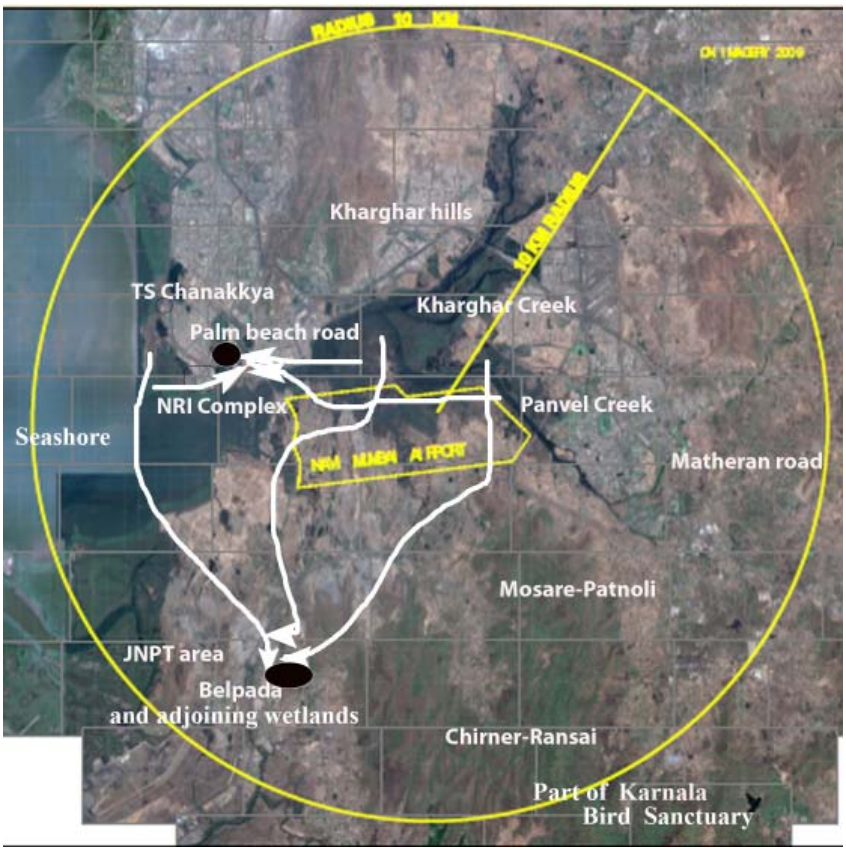


Fig. 7: Bird density at mangrove and associated plants in early monsoon and late summer (n=3)

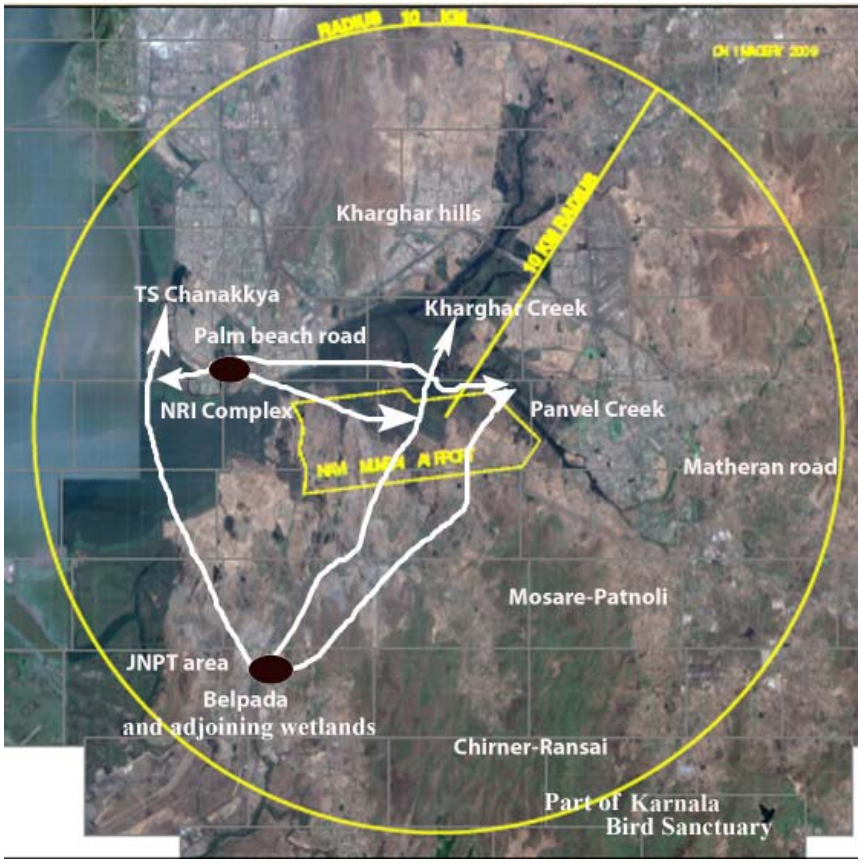
Black-headed Munia in mangroves at Kharghar

Common Redshank at mangroves of Belpada

White-eared Bulbul is a common bird in mangroves



Map showing bird movement during High Tide



Map showing bird movement during Low Tide

2. Species richness

Species richness is the number of different species represented in an ecological community, landscape or region. Higher species richness index shows high biodiversity.

The highest diversity was observed at Belpada Lake during the winter season (fig 8) as all the migratory ducks and waders congregate at this lake, whereas in summer this lake gets dried up so the birds start moving to the adjoining mangroves and other wetlands and hence the species richness index were found decreased. Lowest diversity was observed at NMIA area during the summer season.

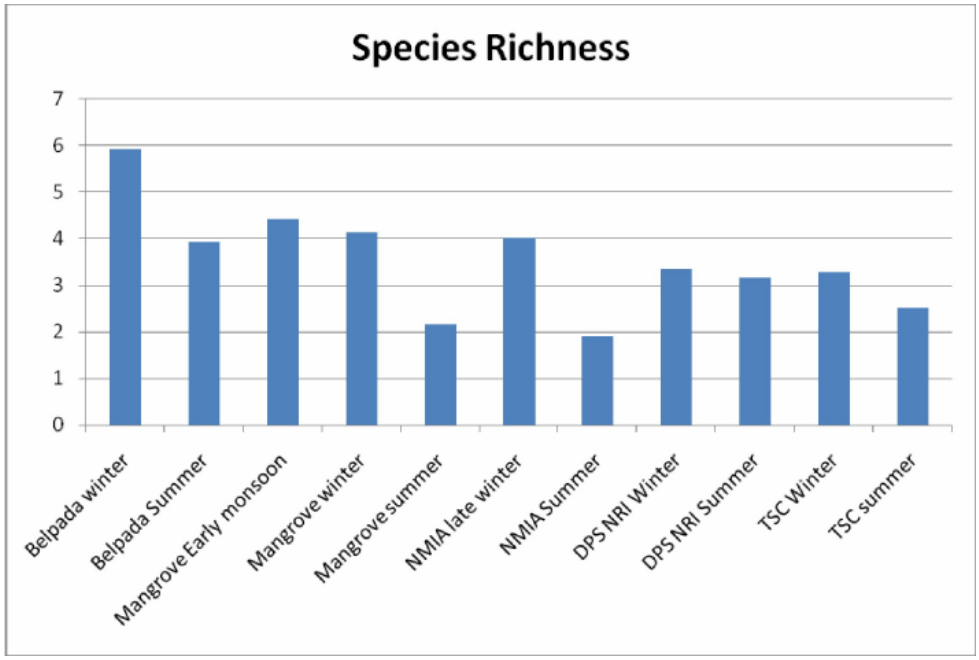


Fig 8: Species richness in different habitat during different season

3. Evenness Index

It refers to how close in numbers each species in an environment are. Mathematically it is defined as a diversity index, a measure of biodiversity which quantifies how equal the community is numerically.

Evenness index shows that whether there is same pattern of distribution of species or it varies. Higher the value of evenness index indicates more uniform distribution of species. Highest uniformity in species distribution was observed in mangroves during summer season (fig 9) as the species like munia, starlings, warbler, prinia etc were uniformly distributed throughout the mangroves, whereas the lowest evenness was observed at DPS NRi Lake in winter as the species like gulls, sandpipers and plovers over numbered the remaining species population in the lake.

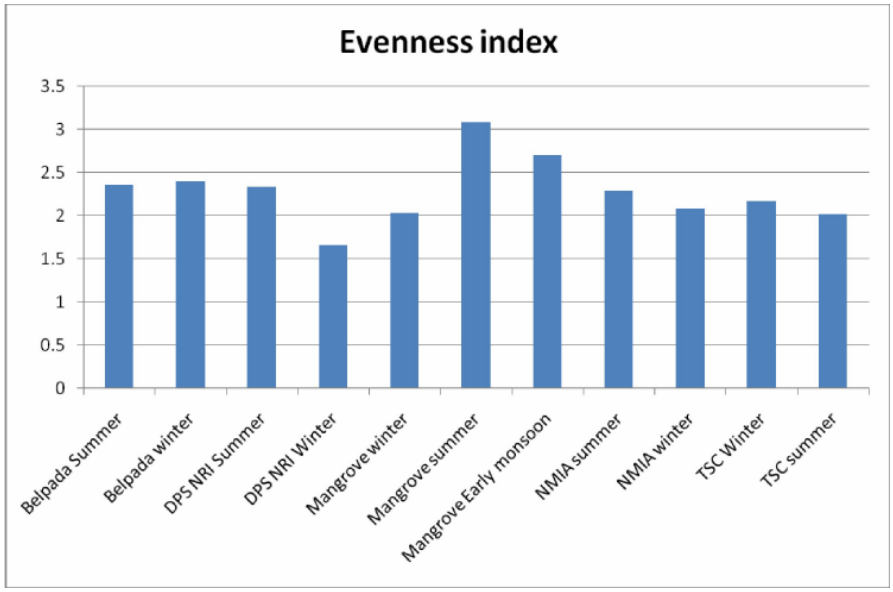


Fig 9: Evenness index in different habitat during different season

4. Index of Dominance

The index of dominance, higher the value higher dominance it has over the other species and habitat. A community dominated by one or two species is considered to be less diverse than one in which several different species have a similar abundance NMIA area was dominated by few species like Pacific Golden plover, Little cormorant, Indian Shag etc. so the Index of dominance is high (fig 10) and hence the diversity/ species richness is low. Similarly in early monsoon the mangroves area have low index of dominance as the species richness in this area is high.

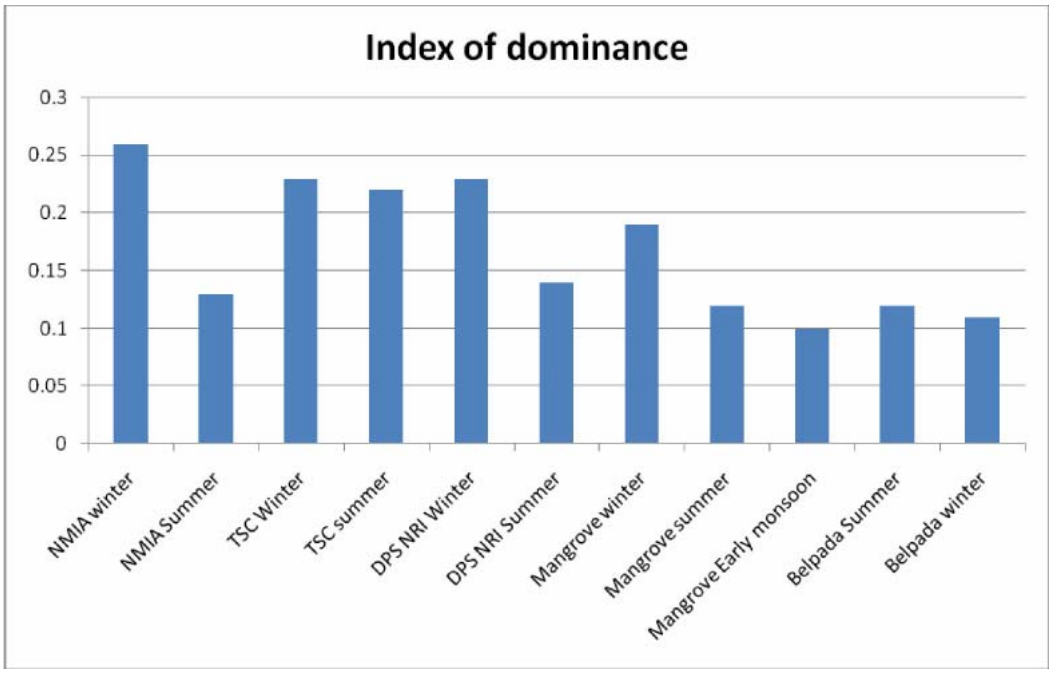


Fig 10: Index of dominance in different habitat during different season

5. Index of Similarity

The highest similarity in species composition was observed between same habitats in different season at Belpada (summer and winter), as birds found using this lake in both seasons (see table 1). In winter DPS NRI and Belpada have high similarity as the migratory birds use this two water bodies for roosting. . Species similarity between mangroves (early monsoon) and TS Chanakya (summer) shows lowest. Overall about 0.5 similarity index values indicates sharing of sites by species for roosting and foraging with population changes during different tide levels as well as in different seasons.

Table 1: Index of Similarity between different habitats during different season

Sr. No	Habitat	Index of similarity	Sr. No	Habitat	Index of similarity
1.	Belpada summer- Belpada winter	0.72	29.	NMIA winter-TSC winter	0.34
2.	DPS NRI summer-DPS NRI winter	0.68	30.	Belpada summer- TSC summer	0.31
3.	Belpada winter- DPS NRI winter	0.64	31.	DPS NRI summer- NMIA winter	0.29
4.	NMIA summer-TSC winter	0.62	32.	Mangrove early monsoon- NMIA summer	0.26
5.	Belpada summer-NMIA summer	0.57	33.	Mangrove winter-NMIA summer	0.24
6.	DPS NRI summer- TSC summer	0.57	34.	Mangrove early monsoon- NMIAwinter	0.24
7.	Belpada winter-NMIA summer	0.56	35.	Mangrove early monsoon- TSC winter	0.24
8.	Belpada summer- DPS NRI winter	0.54	36.	Mangrove winter-NMIAwinter	0.22
9.	DPS NRI winter- NMIA summer	0.52	37.	Mangrove winter-TSC winter	0.22
10.	DPS NRI winter- TSC winter	0.52	38.	Mangrove summer-NMIA winter	0.21
11.	Mangrove summer-Mangroveearly monsoon	0.51	39.	Belpada winter-Mangrove early monsoon	0.18
12.	Belpada winter-TSC summer	0.5	40.	Mangrove summer-NMIA summer	0.17
13.	Belpada winter-TSC winter	0.49	41.	Belpada summer- Mangrove early monsoon	0.16
14.	Belpada summer-DPS NRI summer	0.48	42.	Mangrove summer-TSC winter	0.16
15.	Belpada winter- DPS NRI summer	0.47	43.	Belpada winter-Mangrove winter	0.14
16.	DPS NRI winter- TSC summer	0.47	44.	DPS NRI winter-Mangrove winter	0.14
17.	Belpada summer- TSC winter	0.46	45.	DPS NRI winter- Mangrove early monsoon	0.13
18.	Mangrove winter-Mangrove summer	0.46	46.	Belpada summer-Mangrove summer	0.12
19.	Mangrove winter-Mangrove early monsoon	0.46	47.	Belpada winter- Mangrove summer	0.12
20.	Belpada summer- NMIA winter	0.43	48.	DPS NRI winter- Mangrove summer	0.12
21.	NMIA summer-NMIA winter	0.43	49.	DPS NRI summer- Mangrove early monsoon	0.11
22.	DPS NRI summer-NMIA summer	0.42	50.	Mangrove winter- TSC summer	0.11
23.	NMIA summer-TSC summer	0.42	51.	DPS NRI summer- Mangrove winter	0.1
24.	DPS NRI winter-NMIA winter	0.41	52.	Mangrove summer- TSC summer	0.1
25.	DPS NRI summer- TSC winter	0.39	53.	Belpada summer-Mangrove winter	0.09
26.	NMIA winter-TSC summer	0.38	54.	DPS NRI summer- Mangrove summer	0.09
27.	Belpada winter-NMIA winter	0.37	55.	Mangrove early monsoon-TSC summer	0.04
28.	TSC winter- TSC summer	0.35			

Discussion

Tide and water level are found to be influential factors resulting into seasonal variations in the species abundance at roosting and foraging sites. Roosting sites such as wetlands near DPS NRI, NMIA, Sonari-Belpada and TS Chanakya and adjoining mangroves are holding considerable population of the birds in the study area. These sites are also located near to the major foraging sites such as seashore and creeks. Thousands of waders and water birds were seen flying in flocks across these sites to open creeks and mudflats of the seashore for foraging (Narwade *et al* 2012).

It was also observed that bird congregation occurs usually in shallow water and population of congregating birds in different roosting areas changes seasonally (see fig 11)**.** It will be interesting to study long term impact of rapidly changing environment on the birds in the study area. Such kind of bird movement within airport influence zone will be a major concern for runway clear zone safety in future.

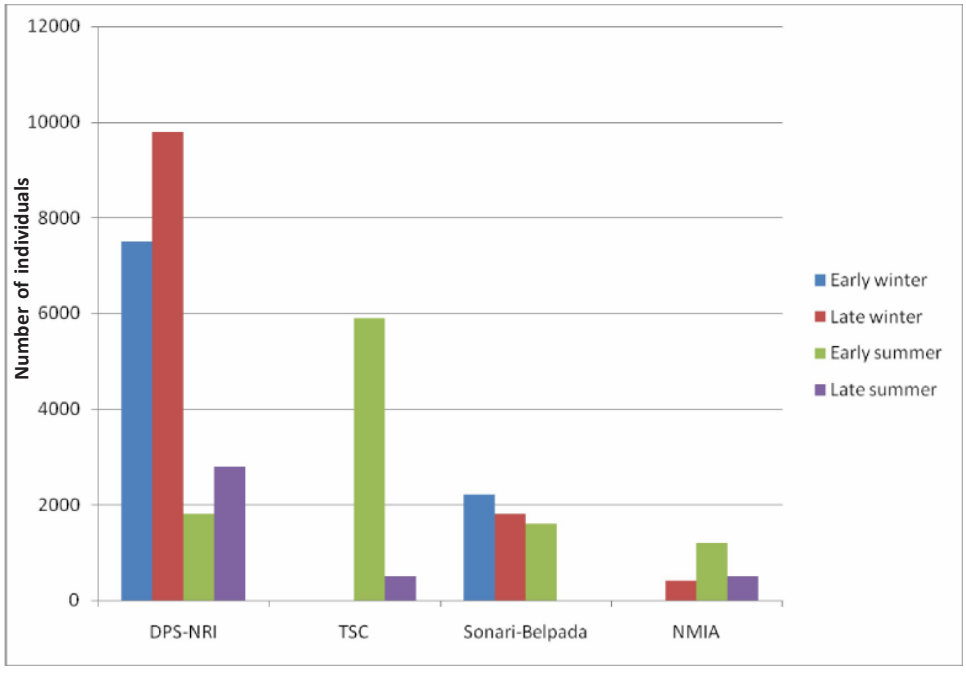


Fig. 11: Seasonal changes in congregation of birds observed in various sites

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Checklist of birds observed in Study area from December 2011-till date

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
	Family Podicipedidae					
1.	Little Grebe *Tachybaptus ruficollis*	W	IV	LC	R	Dastan Phata, DPS Lake, Belapur pond
	Family Phalacrocoracidae					
2.	Little Cormorant *Phalacrocorax niger*	W	IV	LC	R	All wetland areas
3.	Great Cormorant *Phalacrocorax carbo*	W	IV	LC	R	Ulve
4.	Indian Cormorant or Indian Shag *Phalacrocorax fuscicollis*	W	IV	LC	R	All wetland areas
	Family Ardeidae					
5.	Eastern Cattle Egret *Bubulcus coromandus*	W/P	IV	LC	R	All wetland areas
6.	Intermediate Egret *Egretta intermedia*	W/P	IV	LC	R	All wetland areas
7.	Great Egret *Egretta alba*	W	IV	LC	R	All wetland areas
8.	Little Egret *Egretta garzetta*	W/P/C	IV	LC	R	All wetland areas
9.	Grey Heron *Ardea cinerea*	W/C	IV	LC	R	All wetland areas
10.	Indian Pond Heron *Ardeola grayii*	W	IV	LC	R	All wetland areas
11.	Purple Heron *Ardea purpurea*	W/C	IV	LC	R	All wetland areas
12.	Western Reef Egret *Egretta gularis*	W/MD	IV	LC	M	Dastan Phata, Nere, Sonari-Belpada
13.	Black-crowned Night-heron *Nycticorax nycticorax*	W	IV	LC	R	Kharghar Creek, Panvel Creek
14.	Striated Heron *Butorides striatus*	W	IV	LC	R	Uran
15.	Chestnut Bittern *Ixobrychus cinnamomeus*	W	IV	LC	R	Panvel Lake
	Family Ciconiidae					
16.	Painted Stork *Mycteria leucocephala*	W	IV	NT	R	Sonari-Belpada, Kopar, wetlands at Palm Beach Road
17.	Asian Openbill *Anastomus oscitans*	W	IV	LC	R	Dastan Phata
18.	Woolly-necked Stork *Ciconia episcopus*	W	IV	LC	R	Dastan Phata, Mosare
19.	Black Stork *Ciconia nigra*	W	IV	LC	M	Ransai dam
	Family Threskiornithidae					
20.	Oriental White Ibis *Threskiornis melanocephalus*	W/C	IV	NT	R	All wetlands and mangroves

Checklist of birds observed in Study area from December 2011-till date

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
21.	Eurasian Spoonbill *Platalea leucorodia*	W	I	LC	R	Jasai, Sanjivani School, Sonari-Belpada
22.	Glossy Ibis *Plegadis falcinellus*	W	IV	LC	M	Karal
	Family Phoenicopteridae					
23.	Greater Flamingo *Phoenicopterus major*	W	I	LC	M	Sonari-Belpada, NRI
24.	Lesser Flamingo *Phoeniconaias minor*	W	I	NT	M	Wetlands and Seashore of Palm Beach Road
	Family Anatidae					
25.	Ruddy Shelduck *Tadorna ferruginea*	W	IV	LC	M	Jasai, Sanjivani School, Sonari-Belpada
26.	Northern Pintail *Anas acuta*	W	IV	LC	M	Sonari-Belpada
27.	Common Teal *Anas crecca*	W	IV	LC	M	Sonari-Belpada
28.	Spot-billed Duck *Anas poecilorhyncha*	W/C	IV	LC	R	All
29.	Mallard *Anas palatyrhynchos*	W	IV	LC	M	NRI
30.	Garganey *Anas querquedula*	W	IV	LC	M	Sonari-Belpada
31.	Northern Shoveller *Anas clypeata*	W/C	IV	LC	M	Kharghar Creek
32.	Comb Duck *Sarkidiornis melanotos*	W	IV	LC	R	Dastan Phata
33.	Lesser Whistling-duck *Dendrocygna javanica*	W	IV	LC	R	Dastan Phata, Belapur pond, Sonari-Belpada, Palm Beach raod
34.	Cotton Teal *Nettapus coromandelianus*	W	IV	LC	R	Dastan Phata, Belapur pond
35.	Common Pochard *Aythya ferina*	W	IV	LC	M	Belpada
	Family Accipitridae					
36.	Black-shouldered Kite *Elanus caeruleus*	All	I	LC	R	All areas
37.	Black Kite *Milvus migrans*	All	I	LC	R	All areas
38.	Brahminy Kite *Haliastur indus*	W/P	I	LC	R	Sonari-Belpada, Dastan Phata
39.	Black-eared Kite *Milvus milvus lineatus*	W	I	LC	M	Sonari-Belpada
40.	Shikra *Accipiter badius*	All	I	LC	R	All areas
41.	White-eyed Buzzard *Butastur teesa*	F	I	LC	R	Jasai
42.	Oriental Honeybuzzard *Pernis ptylorhynchus*	F	I	LC	R	Mosare

Checklist of birds observed in Study area from December 2011-till date

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
43.	Common Buzzard *Buteo buteo*	F	I	LC	R	Ransai, Chirner
44.	Long-legged Buzzard *Buteo rufinus*	F	I	LC	R	Mosare
45.	Western Marsh Harrier *Circus aeruginosus*	W	I	LC	M	All areas
46.	Crested Serpent-eagle *Spilornis cheela*	F	I	LC	R	Ransai, Mosare
47.	Changeable Hawk Eagle *Nisaetus cirrhatus*	F	I	LC	R	Ransai
48.	Short-toed Snake-eagle *Circaetus gallicus*	GS	I	LC	R	Chirner road
49.	Booted Eagle *Hieraaetus pennatus*	F	I	LC	M	Mosare
50.	Greater Spotted Eagle *Aquila clanga*	F	I	VU	M	Sonari-Belpada, Mosare
51.	Indian Spotted Eagle *Aquila pomarina*		I	VU	R	Sonari-Belpada
52.	White-bellied Sea Eagle *Haliaeetus leucogaster*		I	LC	R	Uran
	Family Falconidae					
53.	Common Kestrel *Falco tinnunculus*	GS	IV	LC	R	Chirner road
	Family Pandionidae					
54.	Osprey *Pandion haliaetus*	W/C	I	LC	R	Kharghar Creek, Sonari-Belpada
	Family Phasianidae					
55.	Red Spurfowl *Galloperdix spadicea*	F	-	LC	R	Kharghar hills
56.	Jungle Bush-quail *Perdicula asiatica*	F	-	LC	R	Ransai, Chirner Road
57.	Indian Peafowl *Pavo cristatus*	F	I	LC	R	Nere
58.	Rain Quail *Coturnix coromandelica*	P	-	LC	R	Chirner
	Family Turnicidae					
59.	Barred Buttonquail *Turnix suscitator*	P	-	LC	R	Chirner
60.	Yellow-legged buttonquail *Turnix tanki*	P	-	LC	R	Chirner
	Family Gruidae					
61.	Demoiselle Crane *Grus virgo*	W		LC	M	Belpada
	Family Rallidae					
62.	White-breasted Waterhen *Amaurornis phoenicurus*	W/C	IV	LC	R	Dastan Phata, Pargaon
63.	Purple Swamphen *Porphyrio porphyrio*	W	IV	LC	R	Dastan Phata, Pargaon
64.	Common Moorhen *Gallinula chloropus*	W	IV	LC	R	Belapur pond, Dastan Phata
65.	Eurasian Coot *Fulica atra*	W	IV	LC	R	Belapur pond, Dastan Phata

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Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
66.	Slaty-breasted Rail *Gallirallus striatus*	W/C	IV	LC	R	Kharghar Creek, Panvel Creek
67.	Ruddy-breasted Crake *Porzana fusca*	W/C	IV	LC	R	Kharghar Creek, Panvel Creek
68.	Brown Crake *Porzana akool*	W/C	IV	LC	R	Chirner, Uran
	Family Jacanidae					
69.	Bronze-winged Jacana *Metopidius indicus*	W	IV	LC	R	Belapur pond, Dastan Phata
70.	Pheasant-tailed jacana *Hydrophasianus chirurgus*	W	IV	LC	R	Belapur pond, Dastan Phata
	Family Charadriidae					
71.	Red-wattled Lapwing *Vanellus Indicus*	ALL	IV	LC	R	All areas
72.	Lesser Sand Plover *Charadrius mongolus*	W/MD	IV	LC	M	All mudflats in study area
73.	Greater Sand Plover *Charadrius leschenaultia*	W/MD	IV	LC	M	Behind NRI Complex
74.	Little Ringed Plover *Charadrius dubius*	W/MD	IV	LC	R	All wetlands
75.	Pacific Golden Plover *Pluvialis fulva*	W/MD	IV	LC	M	Behind TS Chanakya, Panvel Creek
76.	Kentish Plover *Charadrius alexandrines*	W/MD	IV	LC	M	All wetlands
77.	Grey Plover *Pluvialis squatarola*	W/MD	IV	LC	M	Sonari-Belpada, wetlands of Palm Beach Road area
	Family Scolopacidae					
78.	Common Snipe *Gallinago gallinago*	W	IV	LC	R	Sonari-Belpada, Dastan Phata
79.	Common Redshank *Tringa totanus*	W/MC	IV	LC	M	All (congregation at Kharghar Creek)
80.	Wood Sandpiper *Tringa glareola*	W/MC	IV	LC	M	All wetlands
81.	Common Sandpiper *Tringa hypoleucos*	W/MC		LC	R	All wetlands
82.	Common Greenshank *Tringa nebularia*	W/RS	IV	LC	M	Seashore of Palm Beach Road, Sonari-Belpada
83.	Terek Sandpiper *Xenus cinereus*	W/MC	IV	LC	M	Kharghar Creek, Kopar
84.	Green Sandpiper *Tringa ochropus*	W/MC	IV	LC	M	Sonari-Belpada
85.	Marsh Sandpiper *Tringa stagnatilis*	W		LC	M	All wetlands (more at Belpada)

Checklist of birds observed in Study area from December 2011-till date

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
86.	Black-tailed Godwit *Limosa limosa*	W	IV	NT	M	Sonari-Belpada, Sanjivani School
87.	Eurasian Curlew *Numenius arquata*	W	IV	NT	M	Behind NRI Complex
88.	Ruddy Turnstone *Arenaria interpres*	RS	IV	LC	M	Behind TS Chanakya
89.	Temminck's Stint *Calidris temminckii*	W		LC	M	All (Large congregation behind NRI Complex)
90.	Little Stint *Calidris minuta*	W	IV	LC	M	All wetland areas
91.	Curlew Sandpiper *Calidris ferruginea*	W	IV	LC	M	Sonari-Belpada, Dastan Phata, Sanjivani school (congregation of 2,000 birds behind NRI Complex)
92.	Broad-billed Sandpiper	W	IV	LC	M	Belpada, NRI Lake, TS Chanakya.
93.	Ruff *Philomachus pugnax*	W	IV	LC	M	Sonari-Belpada, Dastan Phata
94.	Dunlin *Calidris alpine*	W	IV	LC	M	Seashore of Palm Beach Road
95.	Whimbrel *Numenius phaeopus*	W	IV	LC		Sonari-Belpada
	Family Recurvirostridae					
96.	Black-winged Stilt *Himantopus himantopus*	W	IV	LC	R	All wetland areas
97.	Pied Avocet *Recurvirostra avosetta*	W	IV	LC	M	Jasai, NRI area
	Family Laridae					
98.	Gull-billed Tern *Gelochelidon nilotica*	W	IV	LC	M	All wetland areas
99.	Caspian Tern *Sterna caspia*	W/C	IV	LC	M	Wetlands of Kamothe, Panvel, Palm Beach Road
100.	Saunders' Tern *Sterna saundersi*	W/C	IV	LC	M	Wetlands of Palm Beach Road
101.	Whiskered Tern *Chlidonias hybridus*	W/C	IV	LC	M	Wetlands of Palm Beach Road, Panvel Creek
102.	River Tern *Sterna aurantia*	W/C	IV	NT	M	Wetlands of Sonari-Belpada, Palm Beach Road,

Checklist of birds observed in Study area from December 2011-till date

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
						Panvel Creek
103.	White-cheeked Tern *Sterna repressa*	W	IV	LC	M	Jasai
104.	Slender-billed Tern *Larus genei*	W	IV	LC	M	NRI, TS Chanakya
105.	Brown-headed Gull *Larus brunnicephalus*	W	IV	LC	M	All wetland areas (more than 200 at DPS lake)
106.	Black-headed Gull *Larus ridibundus*	W	IV	LC	M	All wetland areas
107.	Heuglin's Gull *Larus heuglini*	W	IV	LC	M	Airoli
108.	Palash Gull *Larus ichthyyaetus*	W	IV	LC	M	Sea shore
	Family Rynchopidae					
109.	Indian Skimmer *Rynchops albicollis* (VU)	W	IV	VU	R	NRI area
	Family Columbidae					
110.	Rock Pigeon *Columba livia*	All/NH		LC	R	All areas
111.	Yellow-footed Green-pigeon *Treron phoenicoptera*	F	IV	LC	R	Ransai
112.	Little Brown Dove *Streptopelia senegalensis*	All	IV	LC	R	All areas
113.	Eurasian Collared Dove *Streptopelia decaocto*	GS	IV	LC	R	Uran
114.	Spotted Dove *Streptopelia chinensis*	All	IV	LC	R	All areas
	Family Psittacidae					
115.	Rose-ringed Parakeet *Psittacula krameri*	All	IV	LC	R	All areas
116.	Plum-headed Parakeet *Psittacula cyanocephala*	F	IV	LC	R	Ransai
	Family Cuculidae					
117.	Asian Koel *Eudynamys scolopaceus*	All	IV	LC	R	All areas
118.	Greater Coucal (Southern Coucal) *Centropus sinensis*	All	IV	LC	R	All areas
119.	Common Hawk Cuckoo *Hierococcyx varius*	All	IV	LC	R	Mosare, Ransai
120.	Blue-faced Malkoha *Phaenicophaeus viridirostris*	All	IV	LC	R	Mosare
121.	Sirkeer Malkoha *Phaenicophaeus leschenaultia*	All	IV	LC	R	Mosare
	Family Tytonidae					
122.	Common Barn-Owl *Tyto alba*	NH	IV	LC	R	Kharghar

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Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
	Family Strigidae					
123.	Spotted Owlet *Athene brama*	F/NH	IV	LC	R	Mosare, Ransai
124.	Indian Eagle-Owl *Bubo bengalensis*	Rocky cliffs		IV	LC	R Jasai
	Family Caprimulgidae					
125.	Indian Little Nightjar *Caprimulgus asiaticus*	A/GS	IV	LC	R	Ransai
126.	Indian Jungle Nightjar *Caprimulgus indicus*	F	IV	LC	R	Ransai
	Family Apodidae					
127.	Little or House Swift *Apus affinis*	All		LC	R	All areas
128.	Asian Palm Swift *Cypsiurus balasiensis*	F/NH		LC	R	All areas
	Family Alcedinidae					
129.	Lesser Pied Kingfisher *Ceryle rudis*	W	IV	LC	R	Kopar
130.	White-breasted Kingfisher *Halcyon smyrnensis*	All	IV	LC	R	All areas
131.	Common Kingfisher *Alcedo atthis*	W	IV	LC	R	All areas
132.	Black-capped Kingfisher *Halcyon pileata*	W/F	IV	LC	R	Ransai
	Family Meropidae					
133.	Little Green Bee-eater *Merops orientalis*	All		LC	R	All areas
134.	Blue-tailed Bee-eater *Merops philippinus*	F/MC		LC	R	Kharghar Creek, Mosare
	Family Coraciidae					
135.	Indian Roller *Coracias benghalensis*	All	IV	LC	R	All areas
	Family Upupidae					
136.	Common Hoopoe *Upupa epops*	MC/GS		LC	M	All areas
	Family Bucerotidae					
137.	Indian Grey Hornbill *Ocyceros birostris*	F	I	LC	R	Mosare, Ransai
	Family Capitonidae					
138.	Coppersmith Barbet *Megalaima haemacephala*	F	IV	LC	R	Mosare, Ransai
139.	Brown-headed Barbet *Megalaima zeylonica*	F	IV	LC	R	Mosare, Ransai
140.	White-cheeked Barbet *Megalaima viridis*	F	IV	LC	R	Patnoli, Chirner
	Family Pittidae					
141.	Indian Pitta *Pitta brachyura*	F	IV	LC	R	Mosare
	Family Picidae					
142.	Eurasian Wryneck *Jynx torquilla*	F	IV	LC	R	Mosare
143.	Rufous Woodpecker *Celeus brachyurus*	F	IV	LC	R	Patnoli, Chirner

Checklist of birds observed in Study area from December 2011-till date

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
144.	Black-rumped woodpecker *Dinopium benghalense*	F	IV	LC	R	Ransai
145.	Common Flameback *Dinopium javanense*	F	IV	LC	R	Ransai
146.	Yellow-fronted Pied Woodpecker *Dendrocopos mahrattensis*	F	IV	LC	R	Mosare, Nere
147.	Heart-spotted Woodpecker *Hemicircus canente*	F	IV	LC	R	Karnala
	Family Alaudidae					
148.	Ashy-crowned Sparrowlark *Eremopterix griseus*	GS	IV	LC	R	Uran
149.	Rufous-tailed Finch-Lark *Ammomanes phoenicura*	All	IV	LC	R	All areas
150.	Malabar Lark *Galerida malabarica*	ALL	IV	LC	R	All areas
	Family Motacillidae					
151.	Citrine Wagtail *Motacilla citreola*	W/M	IV	LC	M	All areas
152.	Yellow Wagtail *Motacilla flava*	W/M	IV	LC	M	All areas
153.	Grey Wagtail *Motacilla cinerea*	W	IV	LC	M	All areas
154.	White Wagtail *Motacilla alba*	W	IV	LC	M	All areas
155.	Large Pied Wagtail *Motacilla maderaspatensis*	W	IV	LC	R	All areas
156.	Tree Pipit *Anthus trivialis*	P/GS	IV	LC	M	All areas
157.	Paddyfield Pipit *Anthus rufulus*	ALL	IV	LC	R	All areas
	Family Hirundinidae					
158.	Wire-tailed Swallow *Hirundo smithii*	All		LC	R	All areas
159.	Barn Swallow *Hirundo rustica*	W		LC	R	All areas
	Family Campephagidae					
160.	Common Woodshrike *Tephrodornis pondicerianus*	F	IV	LC	R	Mosare
161.	Large Cuckooshrike *Coracina macei*	F	IV	LC	R	Patnoli
162.	Black-headed Cuckooshrike *Coracina melanoptera*	F	IV	LC	R	Ransai
163.	Small Minivet *Pericrocotus cinnamomeus*	F	IV	LC	R	Mosare
164.	Scarlet Minivet *Pericrocotus flammeus*	F	IV	LC	R	Ransai
	Family Irenidae					
165.	Common Iora *Aegithina tiphia*	F	IV	LC	R	Ransai
166.	Gold-fronted Chloropsis *Chloropsis aurifrons*	F	IV	LC	R	Ransai, Mosare

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Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
	Family Pycnonotidae					
167.	Red-vented Bulbul *Pycnonotus cafer*	All	IV	LC	R	All areas
168.	Red-whiskered Bulbul *Pycnonotus jocosus*	F/MC	IV	LC	R	All areas
169.	White-eared Bulbul *Pycnonotus leucotis*	MC	IV	LC	R	All areas
170.	White-browed Bulbul *PycnonotusLuteolus*	F	IV	LC	R	Chirner
	Family Laniidae					
171.	Bay-backed Shrike *Lanius vittatus*	All		LC	R	All areas
172.	Long-tailed Shrike *Lanius schach*	All		LC	R	All areas
173.	Southern Grey Shrike *Lanius meridionalis*	GS		LC	R	Chirner road
	Family Muscicapidae					
174.	Orange-headed Thrush *Zoothera citrina*	F	IV	LC	R	Ransai
175.	Jungle Babbler *Turdoides striatus*	F	IV	LC	R	Ransai, Mosare, Patnoli
176.	Tawny-bellied Babbler *Turdoides hyperythra*	F	IV	LC	R	Mosare, Patnoli
177.	Yellow-eyed Babbler *Chrysomma sinense*	F	IV	LC	R	Chirner
178.	Indian Scimitar-babbler *Pomatorhinus [schisticeps] horsfieldii*	F	IV	LC	R	Chirner, Mosare
179.	Puff-throated Babbler *Pellorneum ruficeps*	F	IV	LC	R	Mosare, Patnoli
180.	Brown-cheeked Fulvetta *Alcippe poioicephala*	F	IV	LC	R	Ransai
181.	Black Redstart *Phoenicurus ochruros*	GS	IV	LC	M	Mosare
182.	Malabar Whistling-thrush *Myophonus horsfieldi*	F	IV	LC	M	Ransai
183.	Oriental Magpie-robin *Copsychus saularis*	All	IV	LC	R	All areas
184.	Common Stonechat *Saxicola torquatus*	All	IV	LC	M	All areas
185.	Pied Bushchat *Saxicola caprata*	All	IV	LC	R	Uran
186.	Isabelline Wheatear *Oenanthe isabellina*	GS	IV	LC	M	TS Chanakya
187.	Indian Black Robin *Saxicoloides fulicatus*	All	IV	LC	R	All areas
188.	White-rumped Shama *Copsychus saularis*	F	IV	LC	R	Ransai
189.	Bluethroat *Luscinia svecica*	MC	IV	LC	M	Sonari-Belpada, Kharghar Creek, Pargaon
190.	Blue Rockthrush *Monticola solitaries*	GS	IV	LC	M	Uran
191.	Zitting Cisticola *Cisticola juncidis*	MC	IV	LC	R	Kopar
192.	Plain Prinia *Prinia inornata*	All	IV	LC	R	All areas
193.	Ashy Prinia *Prinia socialis*	All	IV	LC	R	All areas
194.	Grey-breasted Prinia *Prinia hodgsonii*	All	IV	LC	R	Mosare

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Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
195.	Clamorous Reed-warbler or Indian Great Reed-warbler *Acrocephalus [stentoreus] bruniscens*	MS	IV	LC	M	All creeks and mangrove areas
196.	Common Tailorbird *Orthotomus sutorius*	All		LC	R	All areas
197.	Lesser Whitethroat *Sylvia curruca*	GS	IV	LC	M	Uran
198.	Red-breasted Flycatcher *Ficedula parva*	GS/F	IV	LC	M	Nere
199.	Asian Brown Flycatcher *Muscicapa dauurica*	MC	IV	LC	M	Kopar
200.	White-browed Fantail-flycatcher *Rhipidura albicollis*	MC	IV	LC	M	Khargahr Creek
201.	Grey Headed Canary Flycatcher	F	IV	LC		Ransai
202.	Asian Paradise-flycatcher *Terpsiphone paradise*	F	IV	LC		Ransai, Karnala, Morbe, Chirner
203.	Tickell's Blue Flycatcher *Cyornis tickelliae*	F	IV	LC		Ransai, Karnala, Morbe
204.	Black-naped Monarch *Hypothymis azurea*	F	IV	LC		Karnala, Morbe
	Family Paridae					
205.	Great Tit *Parus major*	F	IV	LC	R	Uran
	Family Dicaeidae					
206.	Thick-billed Flowerpecker *Dicaeum agile*	F	IV	LC	R	Ransai, Karnala, Chirner, Morbe.
	Family Nectariniidae					
207.	Purple Sunbird *Cinnyris asiatica*	All	IV	LC	R	Uran
208.	Purple-rumped Sunbird *Leptocoma zeylonica*	GS	IV	LC	R	Uran
209.	Small Sunbird *Leptocoma minima*	F			R	Ransai
210.	Vigors' Sunbird *Aethopyga vigorsii*	F			R	Ransai
	Family Emberizidae					
211.	Red-headed Bunting *Emberiza bruniceps*	GS	IV	LC	M	Pargaon
212.	Black-headed Bunting *Emberiza melanocephala*	GS	IV	LC	M	Pargaon, Kharghar Creek
	Family – Estrildidae					
213.	Indian Silverbill *Euodice malabarica*	P	IV	LC	R	All areas
214.	Red Avadavat *Amandava amandava*	W/MC	IV	LC	R	Sonari-Belpada, TS Chanakya
215.	Black-headed Munia *Lonchura Malacca*	MC	IV	LC	R	Kharghar Creek, TS Chanakya
216.	Scaly-breasted Munia *Lonchura punctulata*	MC/F	IV	LC	R	Kharghar Creek, TS Chanakya, Mosare

Checklist of birds observed in Study area from December 2011-till date

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
217.	White-rumped Munia *Lonchura striata*	F	IV	LC	R	Mosare
	Family Passeridae					
218.	House Sparrow *Passer domesticus*	All	IV	LC	R	All areas
219.	Baya Weaver *Ploceus philippinus*	All	IV	LC	R	All areas
220.	Black-breasted Weaver *Ploceus benghalensis*	All	IV	LC	R	All areas
221.	Yellow-throated Sparrow *Petronia xanthocollis*	F/GS	IV	LC	R	Uran, Mosare
	Family Sturnidae					
222.	Rosy Starling *Sturnus roseus*	All	IV	LC	M	Sonari-Belpada, Nhava, Kharghar Creek, Pargaon, Kopar
223.	Brahminy Starling *Temenuchus pagodarum*	GS	IV	LC	R	Uran
224.	Grey-headed Starling *Temenuchus malabarica*	GS	IV	LC	R	Behind TS Chanakya
225.	Malabar White-headed Starling *Temenuchus blythii*	GS	IV	LC	R	Behind TS Chanakya
226.	Asian Pied Starling *Gracupica contra*	GS	IV	LC	R	All areas
227.	Common Myna *Acridotheres tristis*	All	IV	LC	R	All areas
228.	Jungle Myna *Acridotheres fuscus*	All	IV	LC	R	Mosare
	Family Oriolidae					
229.	Eurasian Golden Oriole *Oriolus oriolus*	All	IV	LC	R	All areas
230.	Black-hooded Oriole *Oriolus xanthornus*	F	IV	LC	R	Ransai
	Family Dicruridae					
231.	Black Drongo *Dicrurus macrocercus*	All	IV	LC	R	All areas
232.	Ashy Drongo *Dicrurus leucophaeus*	F	IV	LC	R	Ransai
233.	White-bellied Drongo *Dicrurus caerulescens*	F	IV	LC	R	Ransai, Patnoli
	Family Corvidae					
234.	House Crow *Corvus splendens*	All	V	LC	R	All areas
235.	Jungle Crow *Corvus macrorhynchos*	All	IV	LC	R	All areas
236.	Rufous Treepie *Dendrocitta vagabunda*	F	IV	LC	R	Mosare