Baseline survey of Birds at the Proposed Navi Mumbai International Airport (NMIA)

Report on seasonal surveys covering seasonal variation in the population of birds with a note on surveys conducted during January-March 2015

January to March, 2015

Bombay Natural History Society

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Bombay Natural History Society,
Hornbill House, S.B. Singh Road,
Mumbai 400 001, Maharashtra, India.
Tel.: (91-22) 2282 1811
Fax: (91-22) 2283 7615
Email – info@bnhs.org

Text edited by: Shripad Kulkarni, Ascharya Creative Communications

Cover design and page layout: V. Gopi Naidu, BNHS

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Recommended citation
Narwade, S.S., Prabhu, M.V., Shaikh, P.A., Ambavane, P.A. and Rahmani, A.R. (2015): Baseline survey of birds at the proposed NMIA area. Tri-monthly Report, January-March, 2015. Submitted to CIDCO, Navi Mumbai, Maharashtra by BNHS, India. Pp 41.

Baseline Survey of Birds at the Proposed Navi Mumbai International Airport (NMIA) Area

Report on seasonal surveys covering seasonal variation in the population of birds with a note on surveys conducted during January-March 2015

Principal Investigator
Asad R. Rahmani

Co-investigator
Sujit S. Narwade

Research fellows
Mrugank Prabhu
Parveen Shaikh
Priyanka Ambavane

Bombay Natural History Society

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SUMMARY

The field visits were conducted between January 2014 and March 2015, in approximately the 10-kilometre radius study area around the proposed site of Navi Mumbai International Airport (NMIA). Through this trimonthly report, we are presenting seasonal changes in the species composition, changes in the population of the resident and migratory birds at various sites in the study area, and an additional account on the surveys carried out in the study area from January to March 2015 is included.

Congregating water birds were seen foraging often on the mudflats during low tides and were observed using inland wetlands for resting during high tides. Water level at wetland was found to be a major influencing factor in the distribution of birds. For example, inland wetlands were used by the congregating birds for resting during high tide, but in such cases, the water level was controlled by local fisherfolks, resulting in fluctuations in the bird population at various other sites in the study area.

A number of potential habitats will be destroyed in the near future due to rapid development and land use pattern changes in Navi Mumbai and the adjoining areas in Raigad district, especially due to the projects such as the proposed Mumbai Trans Harbor Link (MTHL), Navi Mumbai International Airport (NMIA), and the expansion project of Jawaharlal Nehru Port Trust (JNPT). For example, Belpada Wetland at Uran, where a large number of Ducks, Storks, and Egrets congregated, was recently land filled. Impact of such habitat changes on the distribution of congregating birds needed to be studied.

Keywords: Navi Mumbai International Airport, avifauna, population variation, tide level, water level, bird hazard, habitat, development, seasons.

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) 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
6) Threat categories: EN-Endangered, VU-Vulnerable, NT-Near threatened
7) Type of movements: R-Resident, M-Migratory

Chapter I

INTRODUCTION

According to the Government of Maharashtra, 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 the city-side facilities is limited (EIA Report, CIDCO, Navi Mumbai). The need for a second airport for Mumbai has become inescapable and imperative. City and Industrial Development Corporation of Maharashtra Limited (CIDCO) proposed to set up a new international airport at Navi Mumbai in Maharashtra.

The proposed Navi Mumbai International Airport (NMIA) is located near Panvel between the existing National Highway-4B (NH4B) and Aamra Marg in Panvel Tehsil of Raigad district. The total area demarcated for the airport zone is 2,054 hectares; this includes the area for development; approximately 1,615 hectares as an Airport Zone and the remaining for off-site infrastructure such as diversion, training of rivers, approach roads, etc.

Environmental Impact Assessment (EIA) carried out for NMIA by the Centre of Environment Science & Engineering at Indian Institute of Technology, Bombay (IIT-Bombay), reported 58 species of birds from 21 locations in the 10-kilometre radius area of the proposed NMIA site. The area comprised of creeks, rivers and mangroves that serve as a good habitat for a variety of congregating bird species. Karnala Bird Sanctuary is located in close proximity to the proposed NMIA site.

The Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India has granted a conditional clearance to this project. One of the conditions (condition no. xxxi provided under specific conditions) is that an avifaunal study should be carried out in consultation with the Bombay Natural History Society (BNHS). The BNHS survey was designed to document the bird diversity and species composition at various survey sites in the 10-kilometre radius area of NMIA. A total of 260 bird species belonging to 56 families were observed in the study area since December 2011.

Chapter II

STUDY AREA

Various sites in the 10-kilometre radius area of the proposed NMIA were divided into five blocks as mentioned below, however, excluding the industrial areas and the areas with dense human habitations.

1. The proposed site of NMIA: Data was collected from wetlands, creeks, paddy fields, mangrove-covered areas, mudflats, open scrubland and shrub-land. The study area included Kombadbhuja, Ulve, Dungi, Pargaon, Chinchpada and Kopar; the villages adjacent to the proposed NMIA site, and the creeks at Gadhi, Ulve, Kalamboli and Panvel. Selected wetlands comprised of water body interspersed with mangrove patches and some scrubland cum grasslands. Common mangrove species found in the area is Grey Mangrove Avicennia marina. Other associated plant species such as Sea Holly Acanthus ilicifolius, Glory Bower Clerodendrum inerme, Common Derris Derris trifoliata, Sea Purslane Sesuvium portulacastrum, Miswak Salvadora persica. Avicennia sp. is one of the dominant mangrove species on coastal area of Navi Mumbai because of having tolerance to the salt concentrations. These are shrubby trees with an average height of three to seven metres.

2. North-west: This block includes the land primarily covered with grass and shrubs, the seashore parallel to Palm Beach Road and a part of Airoli Creek, and the water bodies around NRI Complex, DPS School, Training Ship Chanakya on Palm Beach Road, Belapur Pond and a portion of Parsik Hills.

3. North-east: This block includes Taloja, Panvel, Tembhode, Kewale, Nere and Pali villages, which is a hilly area interspersed with paddy fields, human habitations and grasslands.

4. South-west or Uran-Jawaharlal Nehru Port Trust (JNPT) area: This block includes small wetlands, and mangroves areas near the villages such as Jasai, Sonari, Belpada, Karal, Gawhan, Uran, Jaskhar and Funde.

5. South-east: This block primarily consists of reserve forest patches adjoining villages such as Mosare, Patnoli and Ransai. The southern-moist, mixed deciduous forest patch was recently added to Karnala Bird Sanctuary; NH17 (National Highway number 17) cuts through this sanctuary.

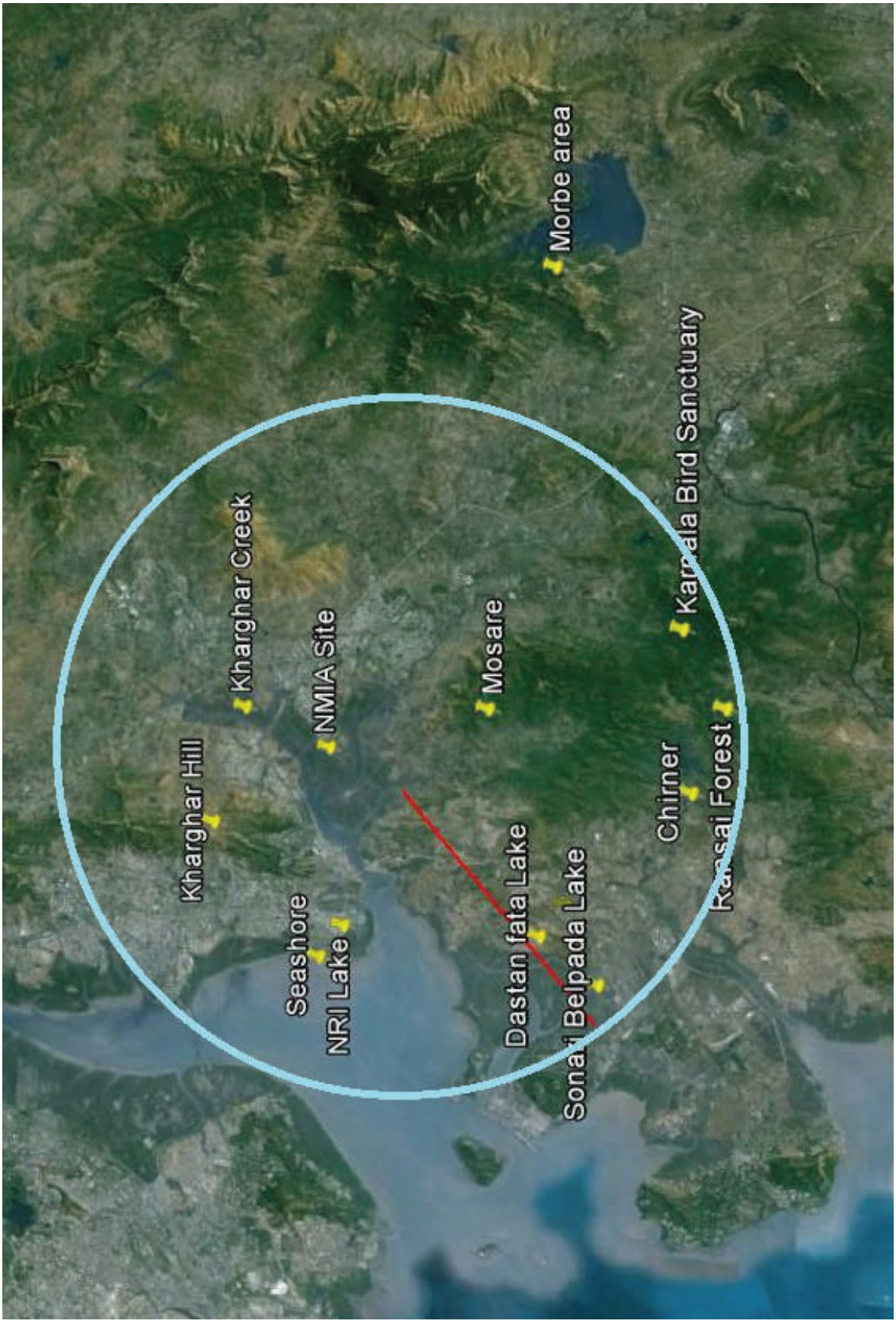
Sites selected for the study of seasonal variations in the bird population

We focussed on the following areas to collect data about temporal and spatial variation in the population of bird species.

2.1 Wetland areas

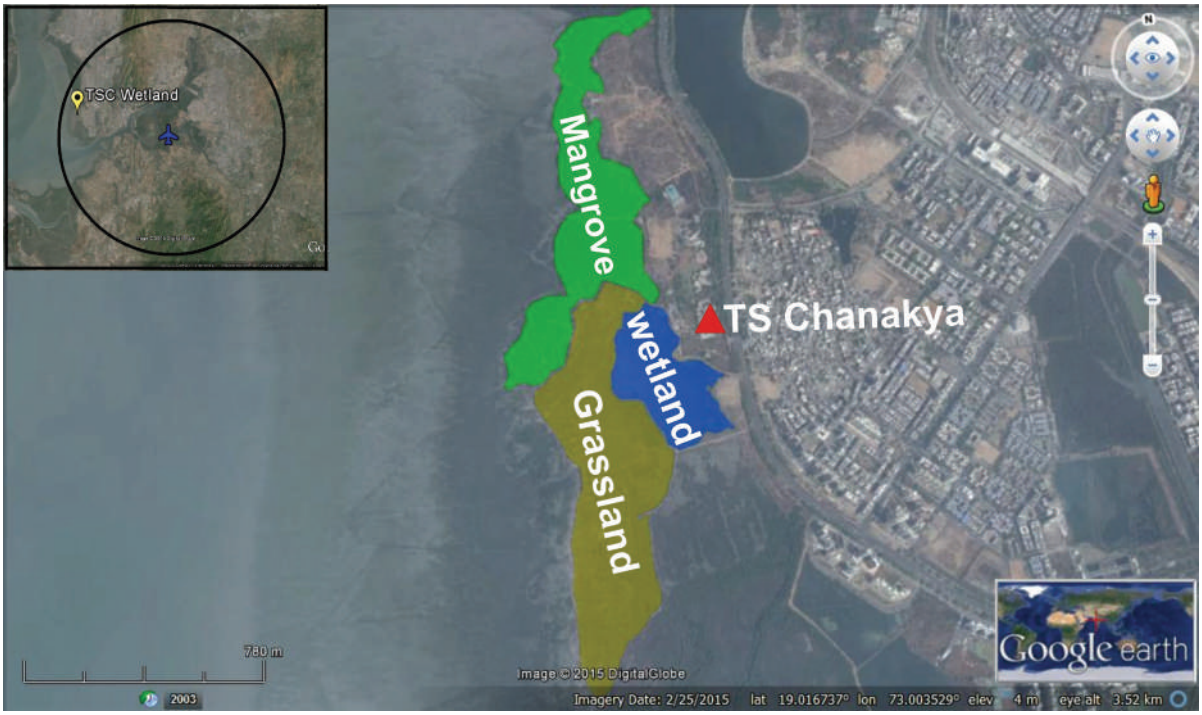
2.1.1 Wetland behind Training Ship Chanakya (TSC Wetland)

This is a small wetland spread over 15 hectares, located behind the Training Ship Chanakya Maritime Institute, on the Palm Beach Road in Seawoods, Navi Mumbai (GPS coordinates 19°0’56.92”N 73°0’19.33”E Refer to Map 2). This site has a stretch of paddy fields, shrubland, and mangroves as it touches the seashore. The water level here is controlled by local fishermen who use the tidal cycles for effective fishing.



Map 1: A Google Earth map showing the selected study sites in the 10-kilometre radius from the proposed NMIA site

TSC wetland is one of the important resting grounds for the congregating birds found in the coastal areas in Navi Mumbai. The bird population at roosting sites is observed to be fluctuating in sync with the water level in the wetland. Large congregations were usually observed when the fisherfolks emptied the wetland by breaking the barriers of the small check dams, forming funnel-like water channels. During low tides, the birds were found foraging on the open mudflats on the seashores, and during high tide, seen resting in this wetland.



Map 2: A Google Earth map of TSC Wetland

VIKAS PISAL

Lesser Flamingo congregation at TSC Wetland

2.1.2) Wetland behind non-resident Indian (NRI) colony

This site is in the northwest direction of the proposed NMIA site and located behind NRI Colony, in Navi Mumbai (19°0'18.02"N, 73°0'43.68"E Refer to Map 3). This wetland is spread across 20 hectares, surrounded by grass, shrubs, and mangroves. A small bund divided the wetland in two parts: the side towards human settlement is mainly used for fishing activities by the locals, and the farther side of wetland has mangrove cover from two sides and the fencing wall of NRI colony. A thin stretch of vegetation on the periphery of the wetland separates it, and makes it a safer habitat for the congregating birds. Access to the wetland is further restricted after a fence was constructed around it in 2013, leaving a narrow path. Recently trees were planted along the entry path, and the residents in the surrounding societies have been using this path for jogging. Anthropogenic pressures from local fisherfolks, joggers, and bird watchers are rapidly increasing with each passing day.

Map 3: A Google Earth map of NRI Wetland

2.1.3) Kalundre River and the proposed NMIA site

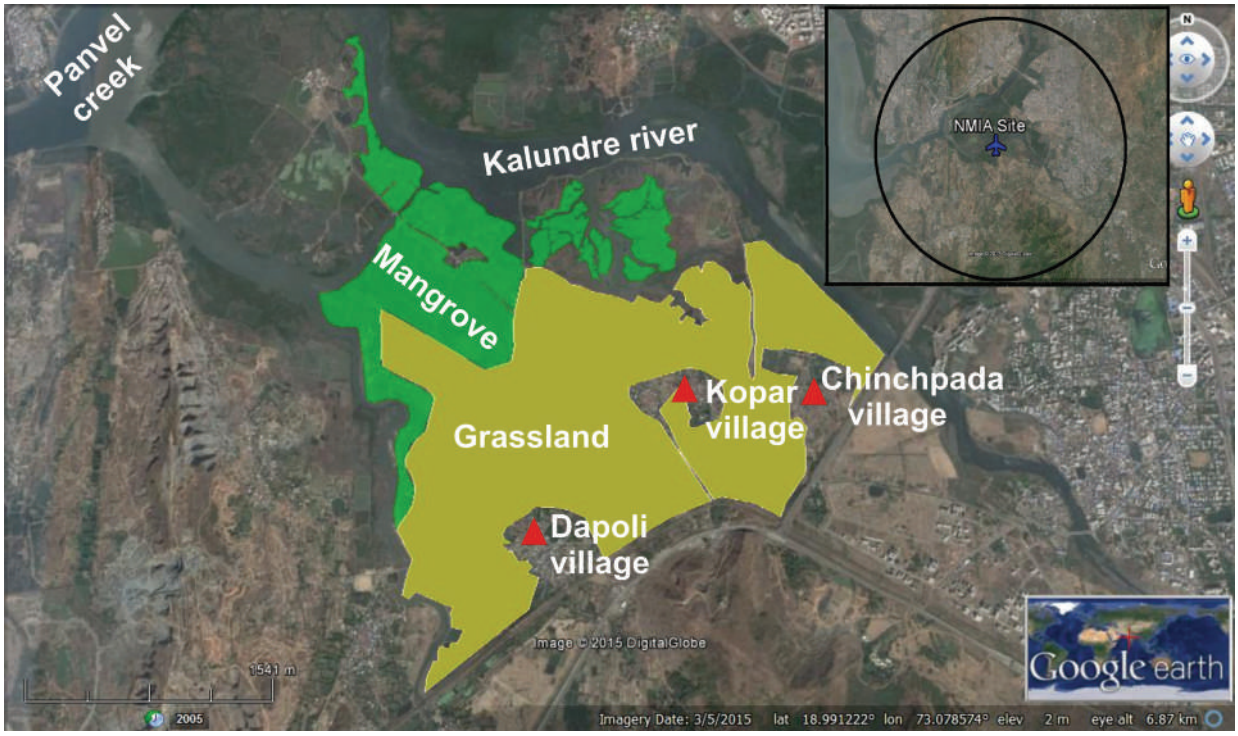
Kalundre River joins the Panvel Creek and flows parallel to the proposed site of NMIA (18°59'20.37"N, 73°03'37.55"E Refer to Map 4) near Kopar and Pargaon villages. Congregating birds were seen foraging in this creek only during low tides.

The proposed NMIA site (measuring approximately 1,160 hectares) is a mixed habitat of mangroves, open scrubland/ shrubland, and a complex of smaller wetlands created by backwater, paddy fields and the creeks form by Gadhi, Ulve, Kalamboli and Panvel rivers. This site was broadly classified into four categories, on the basis of the land use pattern as mentioned below:

1. Mangrove patches are spread over approximately 20 per cent area of the proposed NMIA site
2. Grassland, paddy fields and abandoned salt-pans cover about 50 per cent area
3. Hilly undulating area, used as stone quarries, cover about nine per cent
4. Area under human settlement is about 20 per cent

SUJIT NARWADE

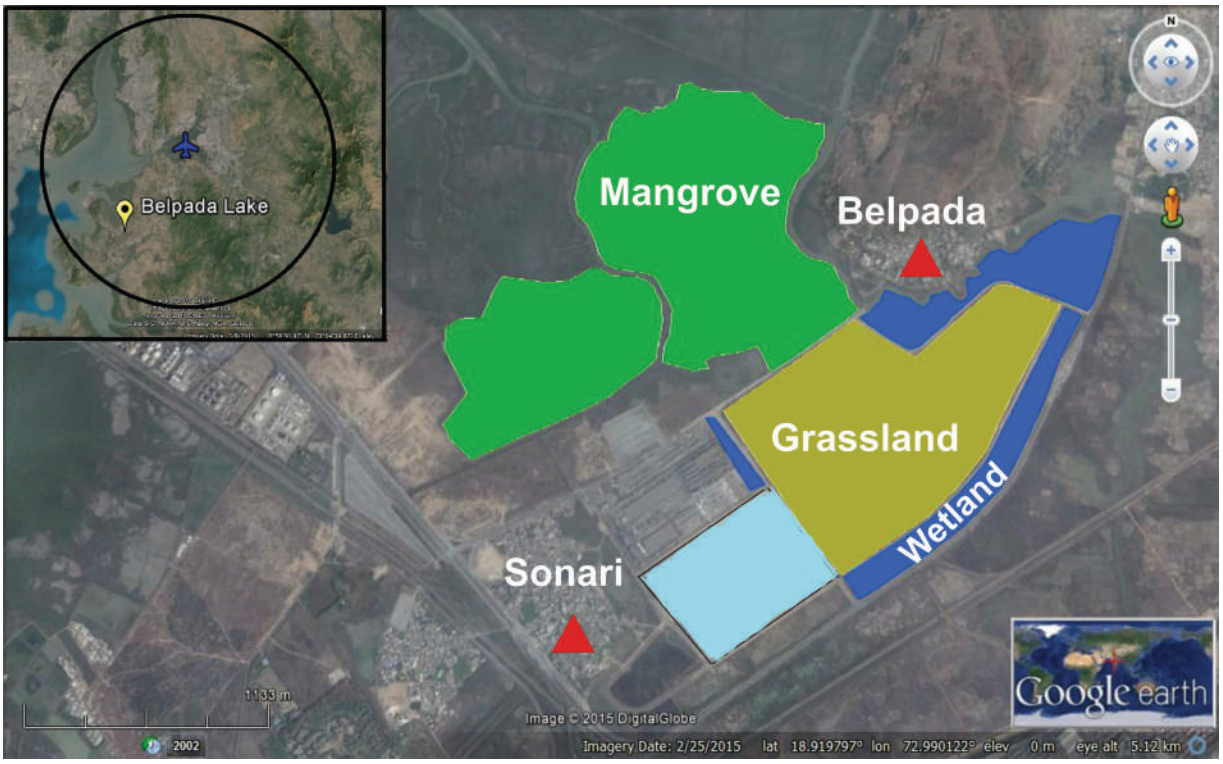
Thousands of Lesser Flamingo were seen congregating at NRI Wetland during late winter 2014-15



Map 4: A Google Earth map of the proposed NMIA site

2.1.4) **Sonari-Belpada Wetland**

It is located in the southwest direction of the proposed NMIA site between Sonari and Belpada villages (18°54'41.97"N, 72°59'43.29"E Refer to Map 5), adjacent to Speedy Services container yard, and next to JNPT Toll Plaza. This site is reachable from Panvel-JNPT road, at about 2-3 kilometres from Jasai village. The area of the wetland is about 50 hectare which was measured using Google Earth application. It is surrounded by grassland and shrubland on South-west, South-east and North-east sides, and a boundary wall of the container yard on the North-west side. Once a part of coastal mudflat, this site is now isolated from the sea, and has become an inland wetland that gets completely dry in the summer months.



Map 5: A Google Earth map of the Sonari-Belpada Wetland

PARVEEN SHAIKH

Birds were seen using NMIA creek during low tide

PARVEEN SHAIKH

Small congregation of waders and terns at NMIA Creek

PARVEEN SHAIKH

Egrets perching on the mangroves at Belpada

2.1.5) **Wetland near Panje, Uran**

A wetland area situated along Dongri, Funde, and Panje villages (18°54'3.04"N, 72°57'1.86"E Refer to Map 6) was observed to be used by waders during high tides. Spread over 100 hectares, this wetland is located within the confines of a Special Economic Zone (SEZ) in Uran, Navi Mumbai. The SEZ was identified here in 2009 and the boundary wall was constructed around the wetland separating it from sea shore. This wetland, located approximately three kilometres from Nhava Sheva police station, is easily accessible by a tar road. This wetland faces anthropogenic pressure so it is a safer foraging and roosting area for congregating birds.

Map 6: A Google Earth map of the wetland at Panje, Uran

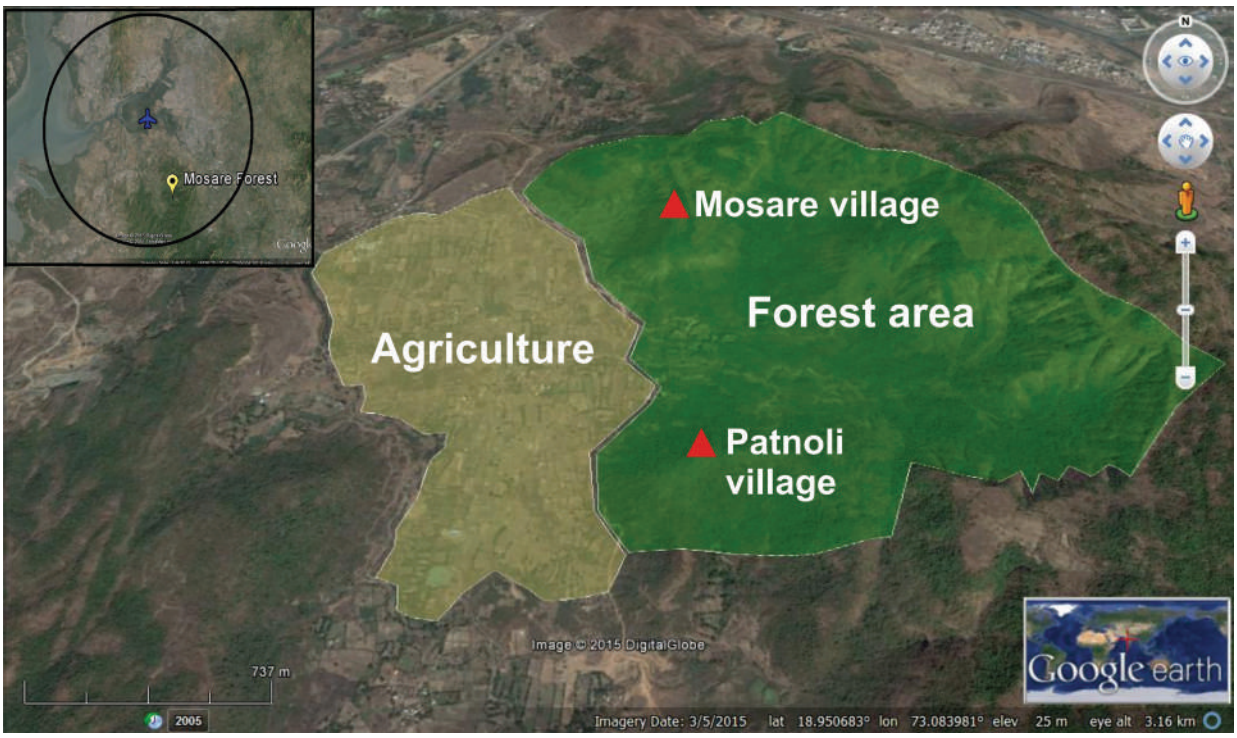
2.2) **FOREST AREAS**

2.2.1) **Forest patch near Mosare-Patnoli villages**

A reserved forest patch on top of a hillock situated between Mosare and Patnoli villages (18°57'23.97"N, 73° 5'8.47"E Refer to Map7) was selected for the survey of forest birds. Agricultural lands cultivated by locals from nearby villages surround the base of this forested hillock. The forest atop is a mix deciduous type, and represented by vegetation like Jamun *Syzygium cumini*, Ber *Zizipus jujuba*, Banyan *Ficus bengalensis*, Teak *Tectona grandis*, Red Silk-Cotton *Bombax ceiba*, Karanj *Pongamia pinnata* and Anjan *Hardwickia binata*.

We regularly surveyed a three kilometre long transect starting from agriculture patch at the base, through a mix deciduous forest on the hillock, and ending at a stream bed which is located at the top of the hill.

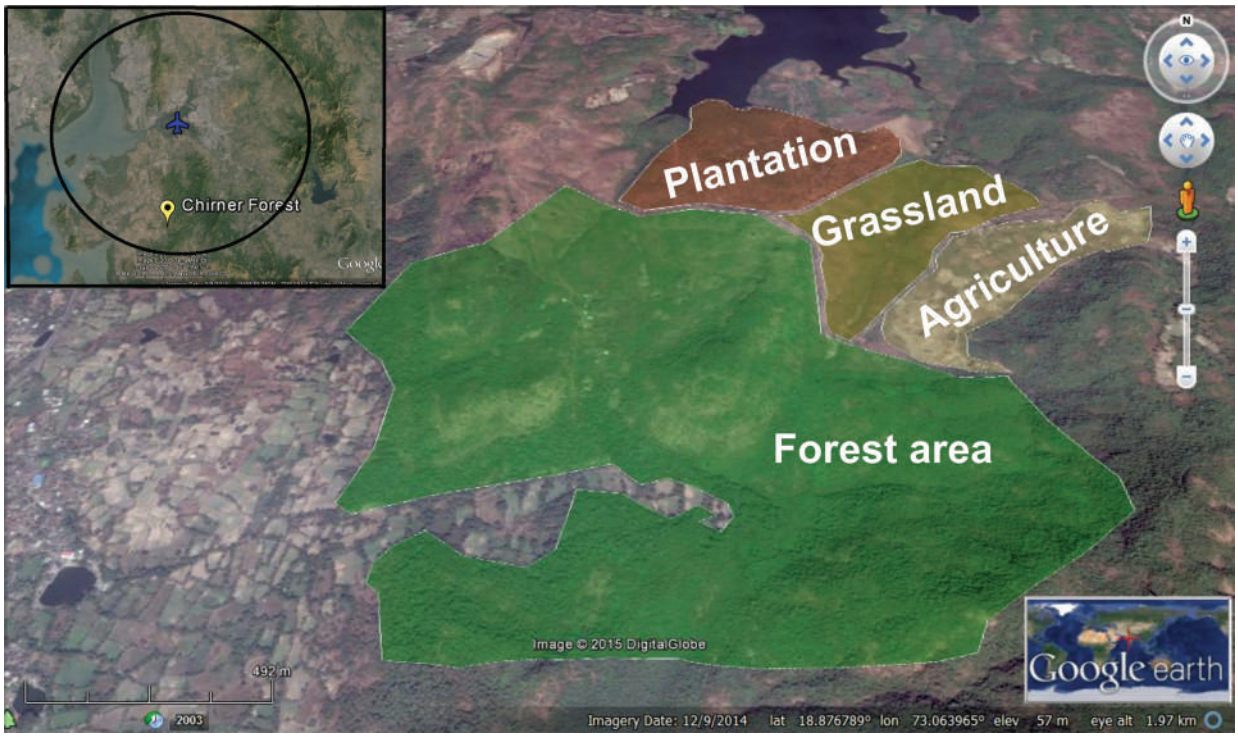
Large trees surrounding Mosare village were also surveyed for the communal roosting birds such as egrets, crows, parakeets and herons



Map 7: A Google Earth map of Mosare-Patnoli forest area

2.1.2) Chirner forest

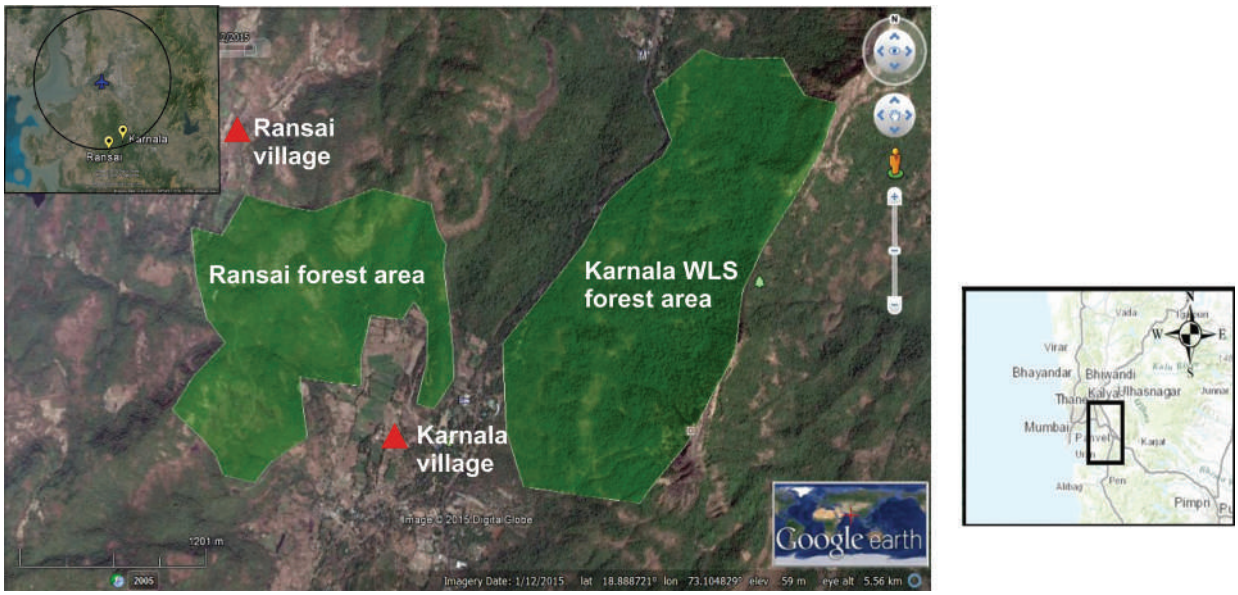
The deciduous forest patch between Chirner village and Ransai Dam (18°53'4.43"N, 73° 3'22.50"E Refer to Map 8) is dominated by trees such as Jamun *Syzygium cumini*, Ber *Zizipus jujuba*, Banyan *Ficus bengalensis*, Teak *Tectona grandis*, Red Silk- Cotton *Bombax ceiba* and Anjan *Hardwickia binata*. This site is a mosaic of different habitats such as forest, grassland, agriculture, Teak and Cashew plantations, and Mango orchards. A two kilometre long transect was surveyed regularly. We found that this area is under pressure due to human activities including quarrying, farming, firewood collection, and cattle grazing.



Map 8: A Google Earth map of Chirner forest area

2.1.3) **Karnala Bird Sanctuary and Ransai Forest**

The sanctuary is located in Panvel Taluka of Raigad district, just outside Mumbai, in Matheran and Karjat area (18°53'39.97"N, 73° 6'57.50"E Refer to Map 9). The sanctuary is spread over 14.12 square kilometre area, with a centre point at the historic Karnala Fort. The sanctuary is approachable by road via Mumbai Goa highway. Ransai forest area, on the other side of the highway, was recently added to the sanctuary. It was also surveyed during the study. We used the existing forest paths and trails to conduct bird surveys.



Map 9: A Google Earth map of Karnala Bird Sanctuary and Ransai forest

Black-hooded Oriole at Ransai Forest

Chapter III

METHODOLOGY

Multiple site surveys were conducted between January 2014 and December 2014. We used a pair binoculars (Nikon Monarch 10x X 40x) for correct bird identification, and a digital SLR-camera (Cannon 550D, with Cannon 400 mm fixed-focus lens) for documentation and observation of the bird species, at each survey site. The bird species were recorded (sighting or call) on the field, and direct observations were made by walking along roads, hills, forest-paths, wetlands, mangroves and creek areas. The birds were identified by referring to Ali & Ripley (1983), Grimmett et al. (1998), and Rasmussen & Anderton (2012). The list of birds was arranged family wise, following Manakadan & Pittie (2001). Rasmussen & Anderton (2012) was followed for the nomenclature. A GPS device was used to collect accurate geographical coordinates.

Every selected wetland site was visited at least once in a month and birds were counted using the Estimated-block Method (Bibby et al. 2000) for different species, according to the congregation size during roosting time. The observations were recorded continuously for two hours before and after high tide for each wetland. To understand the trends in population, diversity and movement of birds in wetlands, the quantitative data was collected and the maximum count of individuals of a species in a season was compared across seasons and presented through graphs. We considered winter from October to December, late winter from January to March, summer from April to June and monsoon from July to September for getting information about seasonal variation in the population of birds. The Population Method was used to estimate the count of congregating water birds and waders during High Tide Wetland Surveys (Koffijberg et al. 2003, Donal and Clark 1991) and the total bird count during the high tide roost at selected wetland was compared. Some important flocking bird species were regularly monitored at the selected sites mentioned in study area and population change was compared across the seasons and the sites, considering the bird hazard these species may pose threat to the operations of the proposed airport. Line transects were conducted once every season on the existing trails in mangroves, forest and grassland. Strip transect sampling method was used, and birds were counted within 50 m distance from the line (Buckland 2008).

Chapter IV

OBSERVATIONS & RESULTS

4.1 Seasonal variation in the species composition of water birds at selected sites

In early winter, the number of migratory bird species was higher than summer. In the summer, majority of the resident species were seen at Belpada Lake and the proposed NMIA site, while the migratory birds such as waders, gulls and terns were seen at NRI Wetland, TSC Wetland, and Panje Wetland. The species diversity was observed to be the highest at Belpada Late in the monsoon as majority of the resident bird species including Lesser Whistling Duck *Dendrocygna javanica*, Indian Spot-billed Duck *Anas poecilorhyncha*, Painted Stork *Mycteria leucocephala*, and Pheasant-tailed Jacana *Hydrophasianus chirurgus* were seen congregating here starting from the pre-monsoon period.

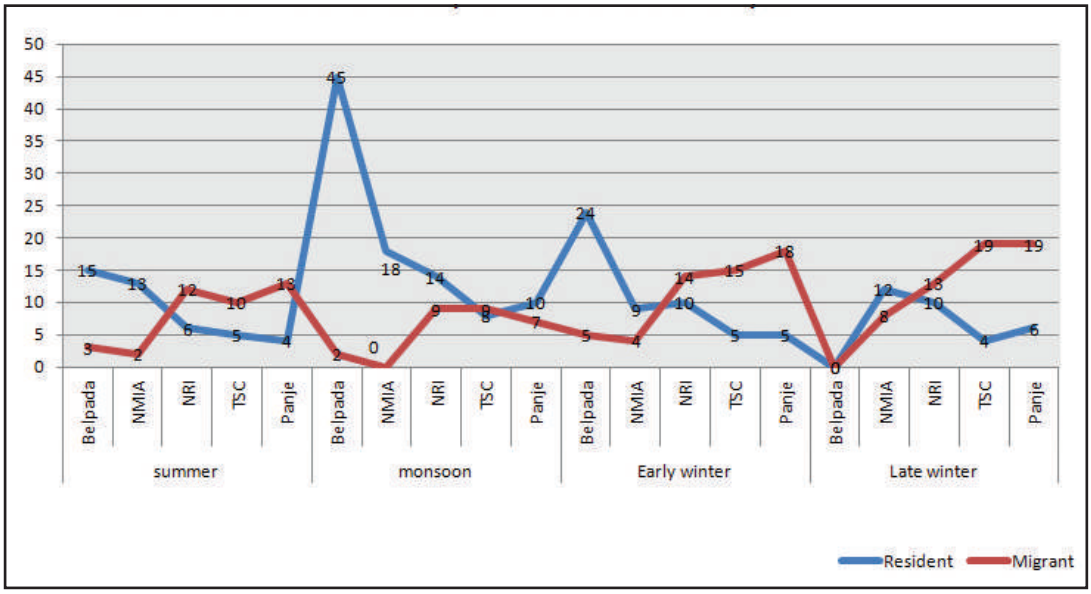


Fig 1: Seasonal variation in species richness at selected sites in the study area

4.2 Seasonal variation in the population of birds at selected sites

4.2.1 Belpada Lake

In the summer of 2014, the total bird count at Belpada Lake was less compared to the monsoon because the wetland dries every year during summer. We observed only small flocks of waders and a few individuals of resident species such as Eastern Cattle Egret *Bubulcus coromandus*, Little Egret *Egretta garzetta,* and Painted Stork *Mycteria leucocephala* in the shallower parts of the wetland. Due to the land filling activity, very few birds were observed in the winter of 2014 as compared to the previous year. December 2014 onwards the wetland was completely land filled, leaving no space for the water birds.

4.2.2 The proposed NMIA Site (Panvel creek and adjoining area)

The total bird count was low in monsoon at the NMIA wetland area because of high water level, and reduced benthic zone exposure. In the late winters, when migratory and resident birds use the creek for foraging during the low tides, the bird population was recorded to be the highest. For details please see Figure 3.

Mass congregation of waders at Panje Wetland in Uran

PARVEEN SHAIKH

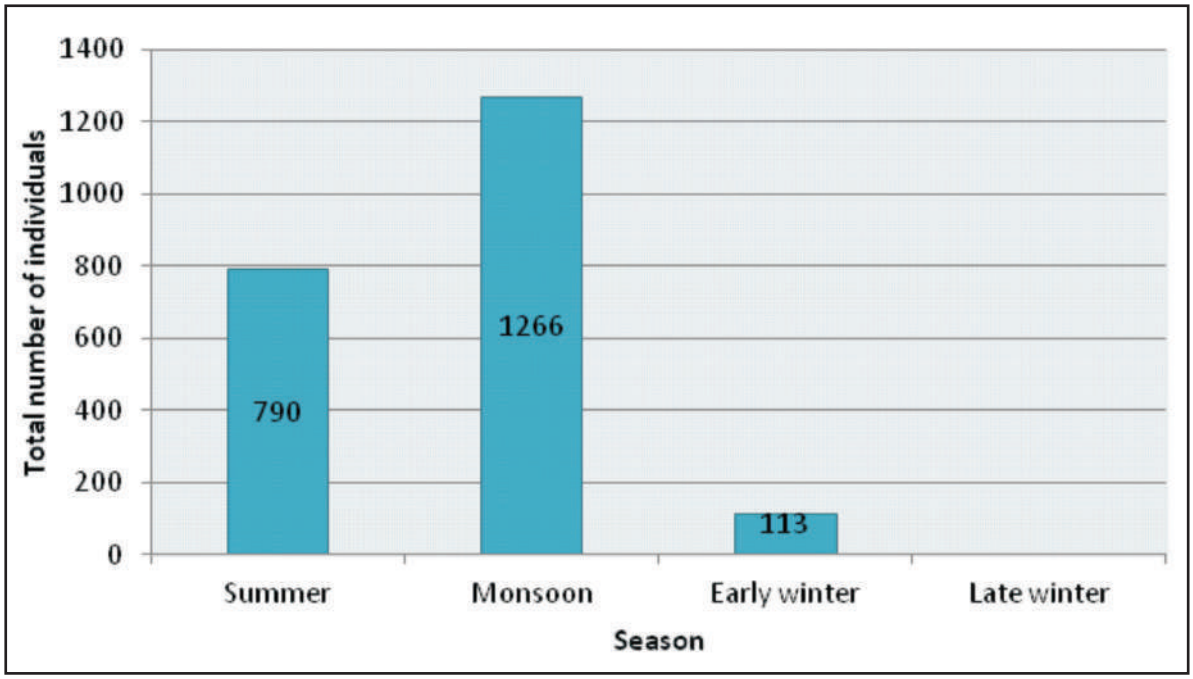


Fig 2: Seasonal Variation in the total count of birds at Belpada Lake

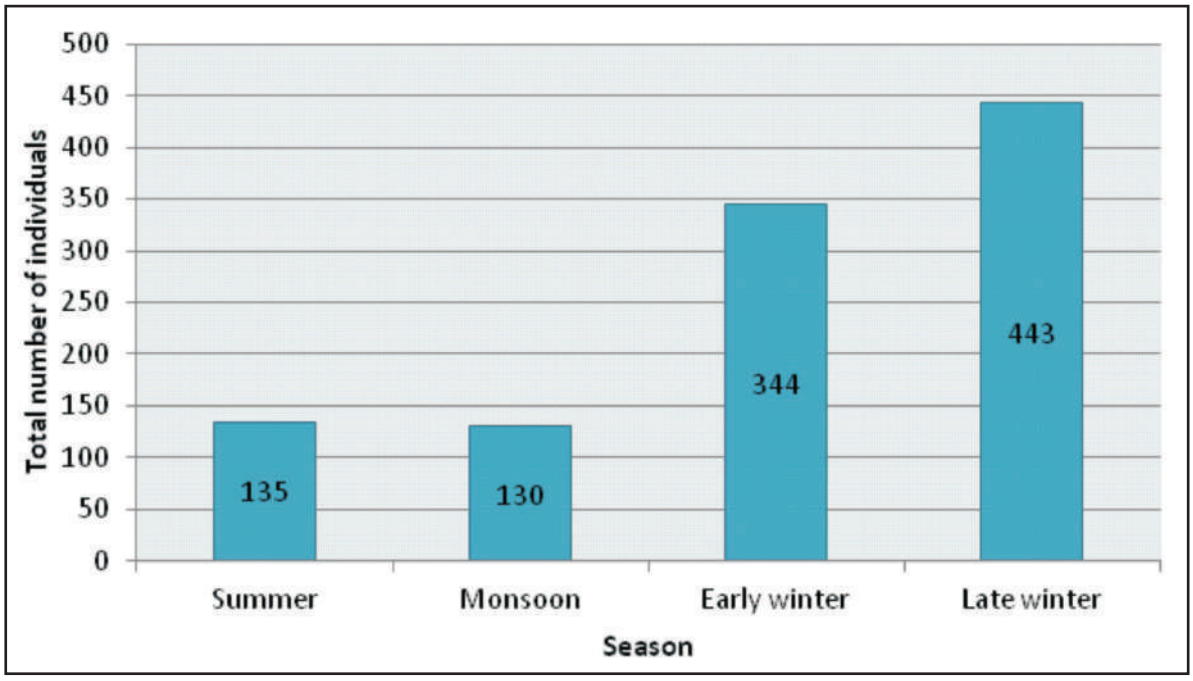


Fig 3: Seasonal variation in the total count of birds at NMIA Site (Creek)

In the summer, population of birds was very low. Twenty individuals of Lesser Sand Plover *Charadrius mongolus* and 50 Little Stint *Calidris minuta* were seen. Population of birds was slightly higher in the winter as compared to the summer, as migratory birds start arriving in the early winter. Towards the summer the migratory birds depart from the study area. Approximately 200 Individuals of Lesser Sand Plover *Charadrius mongolus,* 100 Curlew Sandpiper *Calidris ferruginea*, 300 Little Stint *Calidris minuta* and 10 Gull billed tern *Gelochelidon nilotica* were recorded here. For details please see Figure 4.

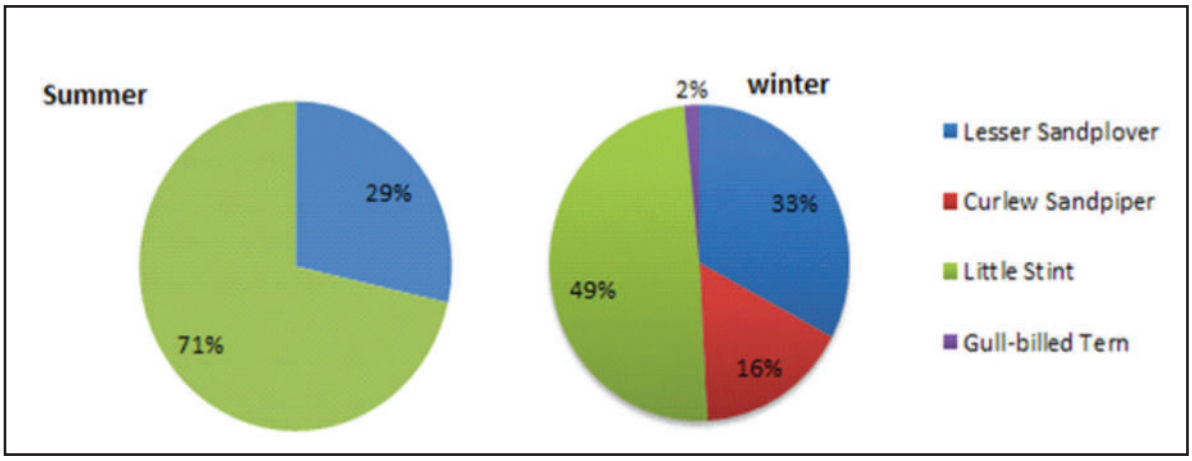


Fig 4: A comparative account of the population of selected species across seasons at NMIA Creek

4.2.3. Wetland behind NRI Complex

We observed about 7,420 birds roosting here, including Lesser Flamingo *Phoenicopterus minor*, in the summer of 2014, especially during the high tides. In the monsoon, the population was low, because only the resident bird species such as Black-winged Stilt *Himantopus himantopus*, Little Cormorant *Microcarbo niger*, and Indian Shag *Phalacrocorax fuscicollis* were seen along with a small, overwintering population of Lesser Flamingo *Phoenicopterus minor*. A large population of Lesser Flamingo was seen till mid July 2014 at this site.

Arrival of migratory birds started with onset of winter and over 15,236 birds were recorded by late winter in February 2015.

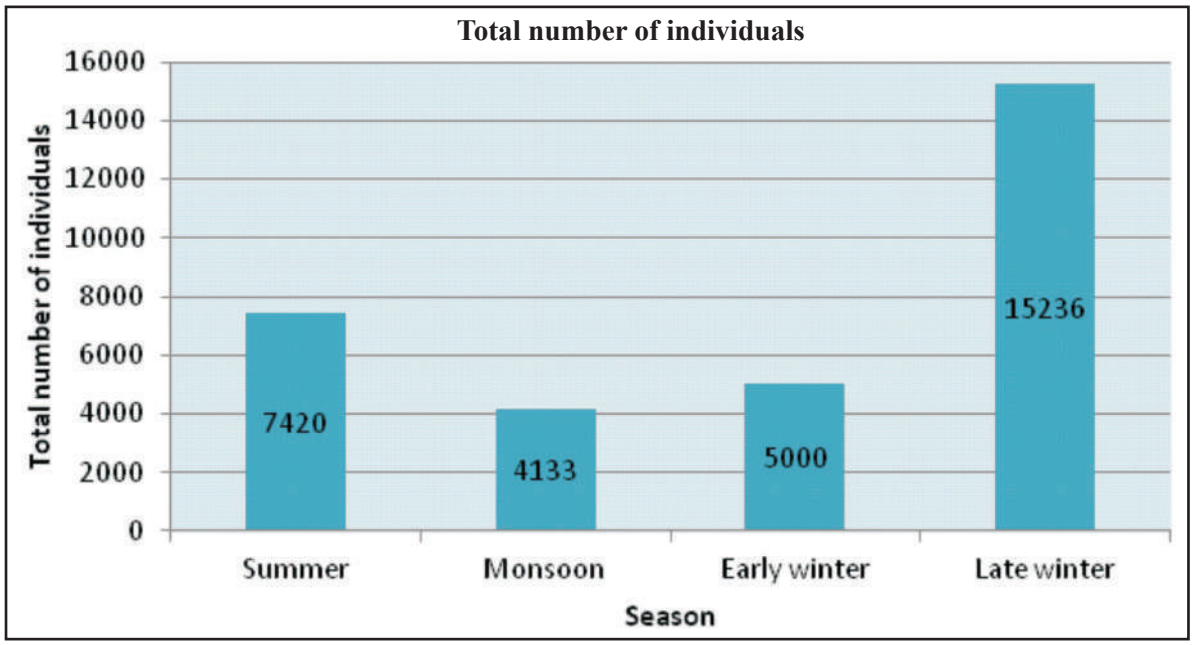


Fig 5: Seasonal Variation in the total count of birds at NRI Wetland

Around 3,500 waders were observed at NRI wetland during the summer of year 2014. We recorded 300 Little Stint *Calidris minuta*, 1,500 Lesser Sand Plover *Charadrius mongolus,* and Curlew Sandpiper *Calidris ferruginea* with 4,000 individuals of Lesser Flamingo *Phoenicopterus minor*. In the winter, water level in the wetland was high, resulting in the low count of waders at 2,000 individuals. Approximately 10,000 individuals of Lesser Flamingo *Phoenicopterus minor* were observed along with a mix flock of 1,000 Lesser Sand Plover *Charadrius mongolus*, 500 individuals of Little Stint *Calidris minuta* and Curlew Sandpiper *Calidris ferruginea* in the winter. We observed very less variation in the population of Brown-headed Gull *Larus brunnicephalus*, Common Black-headed Gull *Chroicocephalus ridibundus* and Gull-billed Tern *Gelochelidon nilotica* through the seasons, as their population was not affected by high water level in the wetlands. About 150 individuals of Brown-headed Gull *Larus brunnicephalus* and 100 individuals of Common Black-headed Gull *Chroicocephalus ridibundus* and Gull-billed Tern *Gelochelidon nilotica* were observed.

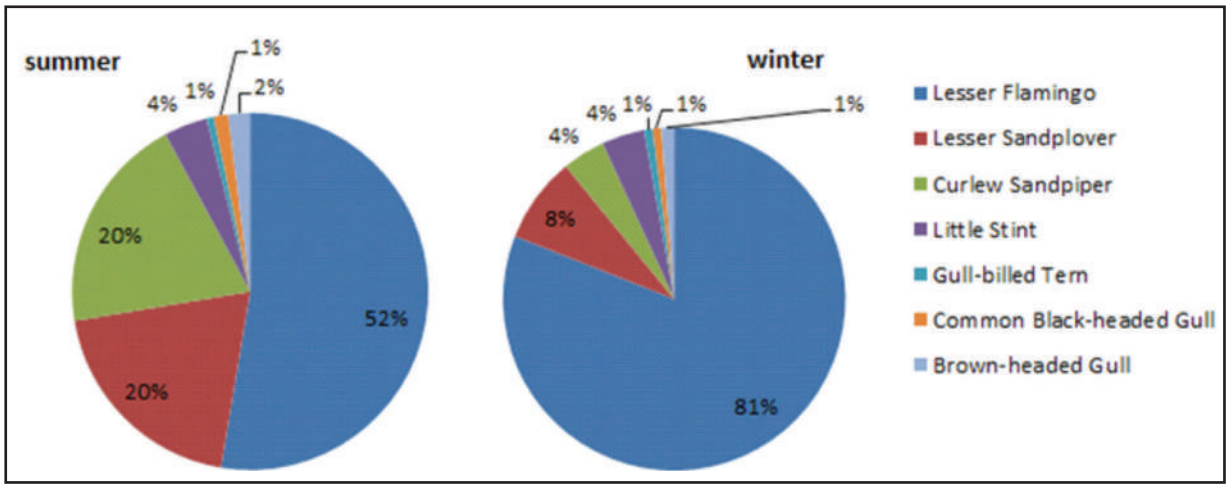


Fig 6: A comparative account of the population of selected species across seasons at NRI Wetland

4.2.4 TSC Wetland

In the summer of 2014, water level at TSC Wetland was low, thereby favourable to foraging and resting for waders. We observed a large congregation of over 13,900 birds during high tides in the summer. Besides waders, a large flock of Lesser Flamingo *Phoenicopterus minor* was seen here. In the monsoon, only resident birds and Lesser Flamingos *Phoenicopterus minor* were seen congregating at this wetland, and hence the bird count was low. In the early winter season, migratory bird species started arriving at the wetland; however, the bird count was still low compared to the summer. This wetland had high water level during the late winter season due to which we observed a highly fluctuating population of congregating birds.

In the summer, we observed about 6,000 individuals of Lesser Flamingo *Phoenicopterus minor*, about half of them were juveniles. A mix flock of waders with about 2,500 Lesser Sand Plover *Charadrius mongolus*, 3,000 Curlew Sandpiper *Calidris ferruginea,* 200 Little Stint *Calidris minuta* along with 300 Brown-headed Gull *Larus brunnicephalus* and 400 Slender-billed Gull *Chroicocephalus genei* was seen here throughout the summer. Slender-billed Gull *Chroicocephalus genei* was observed only in the summer. As the water level at the wetland was high during the winter, very few waders were observed. In the winter approximately 7,000

PARVEEN SHAIKH

A flock of Pied Avocet was observed at NRI Wetland

PARVEEN SHAIKH

Congregation of terns was often seen at NRI Wetland

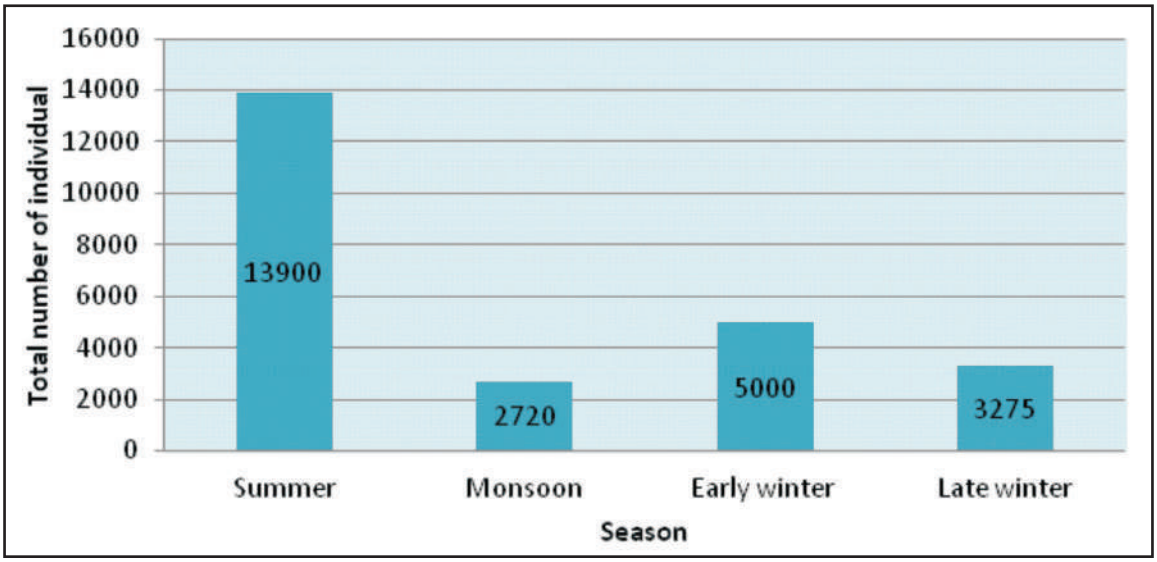


Fig 7: Seasonal Variation in the total count of birds at TSC Wetland

individuals of Lesser Flamingo *Phoenicopterus minor* were observed along with 100 individuals of Lesser Sand Plover *Charadrius mongolus*, 100 Curlew Sandpiper *Calidris ferruginea*, and 300 little stint *Calidris minuta*. Compared to 2013, we saw far lesser Terns and Gulls at this wetland. About 100 individuals of Common Black-headed Gull *Chroicocephalus ridibundus* and Brown-headed Gull *Larus brunnicephalus*, and 30 individuals of Gull-billed Tern *Gelochelidon nilotica* were also observed here.

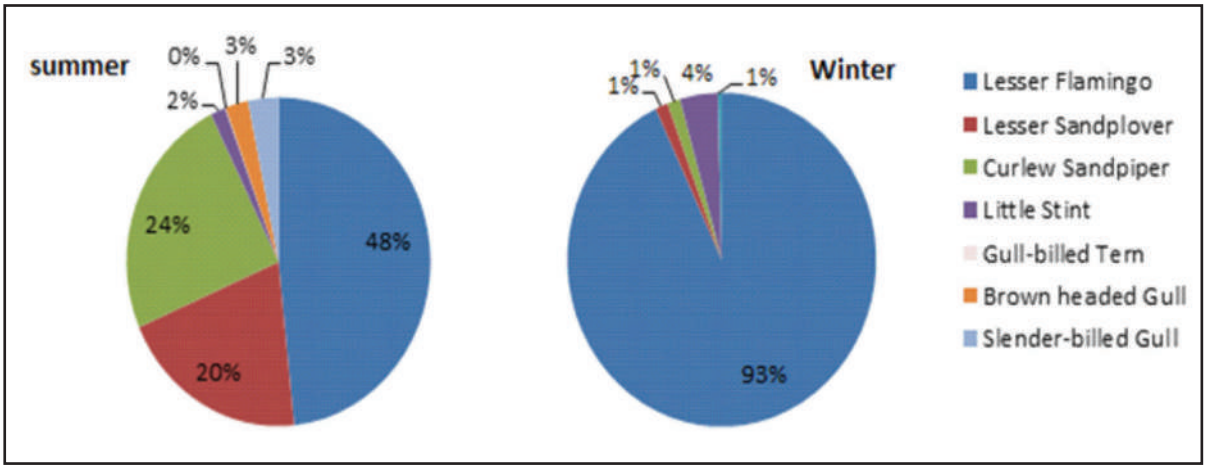


Fig 8: A comparative account of the population of selected species across seasons at TSC Wetland

4.2.5 Panje, Uran

In the summer of 2014, this wetland was completely dry, therefore, very few, and smaller flocks of waders, Terns and Gulls were observed here, drastically reducing the population count. In the post monsoon, the bird count was around 40,000 birds as the waders began arriving in September. In the early and late winter, the bird population was 80,000 and more than 1, 40,000 respectively, primarily because of a large congregation of waders. We assume, a majority of the waders from all the sites in the study area were using this wetland for roosting, because as it is closest to the seashore. Another reason for the concentration of population may be the unavailability of suitable habitats in the adjoining areas, because most of the wetlands are land filled due to the rapid urban developmental activities in the Uran area.

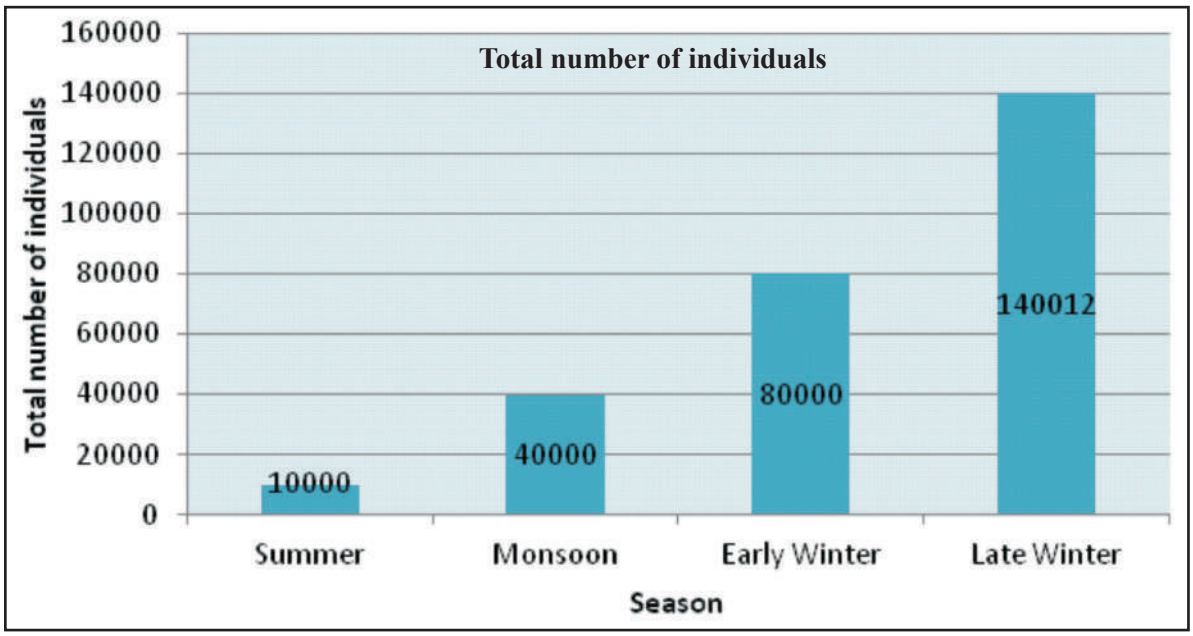


Fig 9: Seasonal Variation in the total count of birds at the Wetland near Panje village in Uran

We observed a large number of waders using this wetland during the high tide. We counted more than 10,000 birds in the wetland in the summer, and population reached to over 1, 00,000 individuals in the winter. In the summer, we observed 5000 Lesser Sand Plover *Charadrius mongolus*, 3,000 Curlew Sandpiper *Calidris ferruginea*, 2,000 Little Stint *Calidris minuta*, 50 Gull-billed Tern *Gelochelidon nilotica* and 150 individuals of Brown-headed Gull *Chroicocephalus brunnicephalus*. In the winter, 40,000 Lesser Sand Plover *Charadrius mongolus*, 30,000 Curlew Sandpiper *Calidris ferruginea*, 70,000 Little Stint *Calidris minuta* along with over 100 individuals of Gull-billed Tern *Gelochelidon nilotica* and Brown-headed Gull *Chroicocephalus brunnicephalus* were observed at this wetland.

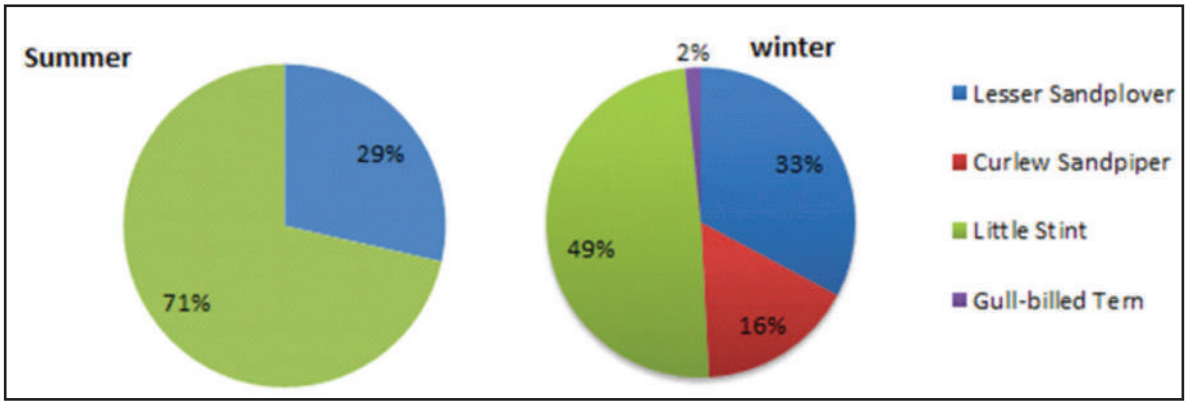


Fig 10: A comparative account of the population of selected species across seasons at the wetland near Panje village in Uran

4.3 A report on the observations carried out in the forest areas during January to March period in 2015

4.3.1 Karnala Bird Sanctuary: During our visit to the sanctuary, in January to March period in 2015, trees were shedding leaves, and blooming in flowers. The flowers attracted many nectar feeding birds. On January 15, 2015 we started transect at 7:30 a.m. from the start point i.e. check-post of Karnala Bird Sanctuary, and covered the distance of about a kilometre in 2 hours. We observed four Vigor's sunbird *Aethopyga vigorsii* and a pair of Purple Sunbird *Cinnyris asiaticus* feeding on nectar of *Calycopteris floribunda,* a large climbing shrub with vines about two to four inches in diameter. A pair of Common Woodshrike *Tephrodornis pondicerianus* and Brown-capped Pygmy Woodpecker *Picoides nanus* was seen scanning the bark of a Teak *Tectona grandis* for insects. Asian Paradise Flycatcher *Terpsiphone paradisi* female and a Black-naped Monarch *Hypothymis azurea* were seen foraging in the thickets. A very vocal pair of White-rumped Shama *Copsychus malabaricus* was observed scanning the tree holes. Around three Rufous Treepie *Dendrocitta vagabunda*, a pair of Golden-fronted Leafbird *Chloropsis aurifrons,* and a Greater Racket-tailed Drongo *Dicrurus paradiseus* were sighted foraging in the canopies of Mango trees *Mangifera indica* and Spanish Cherry *Mimusops elengi*.

On March 23, 2015 we walked the same transect. We recorded six Chestnut-shouldered Petronia *Petronia xanthocollis* and a pair of Purple Sunbird *Cinnyris asiaticus* feeding on nectar of Ash Tree *Lannea coromandelica* and *Calycopteris floribunda.* Four individuals of Puff-throated Babbler *Pellorneum ruficeps* were seen foraging in the leaf litter. We also encountered three individuals of Rufous Treepie *Dendrocitta vagabunda*, a pair of Greater Racket-tailed Drongo *Dicrurus paradiseus,* and seven individuals of Red-vented Bulbul *Pycnonotus cafer*. Three individuals of Crested Serpent Eagle *Spilornis cheela* were seen soaring in the sky.

4.3.2 Chirner: This forest covered site mostly consisted of plantation and agricultural land, interspersed with degraded patches of reserved forests. On February 4, 2014 we walked a transect of 1.5 kilometres, from 8.00 a.m. to 9.00 a.m. During the transect survey, we recorded several trees such as *Pongamia pinnata*, Jamun *Syzegium cumini*, *Cordia dicotoma, Anacardium occidentale*, *Bombax ceiba*, and *Mangifera indica.* We also observed anthropogenic activities including quarrying, farming, fire wood collection, and cattle grazing. We observed common birds like

MRUGANK PRABHU

White-rumped Shama was often observed at Karnala Bird Sanctuary

MRUGANK PRABHU

Grey-breasted Prinia at Chirner Forest

Black Drongo *Dicrurus macrocercus*, House crow *Corvus splendens*, Indian Robin *Saxicoloides fulicatus*, Little Green Bee-eater *Merops orientalis*, Common Iora *Aegithina tiphia*, and Red-whiskered Bulbul *Pycnonotus cafer.* We observed Asian Paradise Flycatcher *Terpsiphone paradisi* a typical woodland bird foraging on insects on a *Syzegium cumini.* Three individuals of Chestnut-shouldered Petronia *Petronia xanthocollis* and a pair of Purple-rumped Sunbird *Leptocoma zeylonica* were seen hovering over spider webs on *Mangifera indica*.

On March 25, 2014 we recorded seven individuals of Red-vented Bulbul *Pycnonotus cafer*, a pair of Grey-breasted Prinia *Prinia hodgsonii* and four individuals of Little Green bee-eater *Merops orientalis* on the same transect line. A few females of Asian Paradise Flycatcher *Terpsiphone paradisi* were seen foraging, along with Black-naped Monarch *Hypothymis azurea*. Three individuals of Lesser Pied Kingfisher *Ceryle rudis* were seen perching on a log near a small pond. The birds of prey such as Black-winged Kite *Elanus axillaris* and Common Kestrel *Falco tinnunculus* were seen hovering in the sky. We walked the transect from 8:30 a.m. to 11:30 a.m.

4.3.3 **Mosare**: On February 5, 2015 we surveyed on the two kilometres long transect in the forest near Mosare village, from 7.30 a.m. to 10.00 a.m. During the transect survey, we observed two Black Drongo *Dicrurus macrocercus*, pair of Indian Robin *Saicoloides fulicatus*, Thick-billed Flowerpecker *Dicaeum agile*, Little Green Bee-eater *Merops orientalis,* two Vigor's Sunbird *Aethopyga vigorsii,* Shikra *Accipiter badius*, Common Kestrel *Falco tinnunculus and* Crested Serpent Eagle *Spilornis cheela* were seen.

On March 24, 2015 we walked the transect between 7.30 a.m. and 10.00 a.m. We observed three Vigor's Sunbird *Aethopyga vigorsii* feeding on the nectar and scanning for insects on a Red Silk-Cotton *Bombax ceiba* tree. We heard call of a Malabar Whistling Thrush *Myophonus horsfieldi* and a Brown-headed Barbet *Megalaima zeylonica*. Six individuals of Jungle Babbler *Turdoides striata* were seen foraging in the thickets of *Carissa carandas*. We also observed a pair of Grey-breasted Prinia *Prinia hodgsonii*, four individuals of Little Green bee-eater *Merops orientalis*, two Spotted Doves *Streptopelia chinensis,* Orange-headed Thrush *Zoothera citrina* and two Jungle Crows *Corvus macrorhynchos.*

4.4. Variation in the population of other migratory birds and tree roosting birds

Tree roosting species such as Cormorants, Mynas, Egrets and Crows were seen congregating in the evening on large old trees near human habitations at various sites in the study area. While birds like Black-headed Bunting *Emberiza melanocephala* and Baya Weaver *Ploceus philippinus* were found roosting in large numbers for short duration at some sites. A large number of Rosy Starling *Pastor roseus* were seen roosting on some old trees and in the mangroves patches during the winter and the summer. We observed communal roosting of birds at Mosare village, CDICO Garden in Sector 9 of Khanda Colony, Panchshil Rest House in Belapur, and near Panvel Railway Station. A detailed account of the movement of birds between tree roosting sites and foraging sites has been presented in Map 10.

Chapter V

CONCLUSION

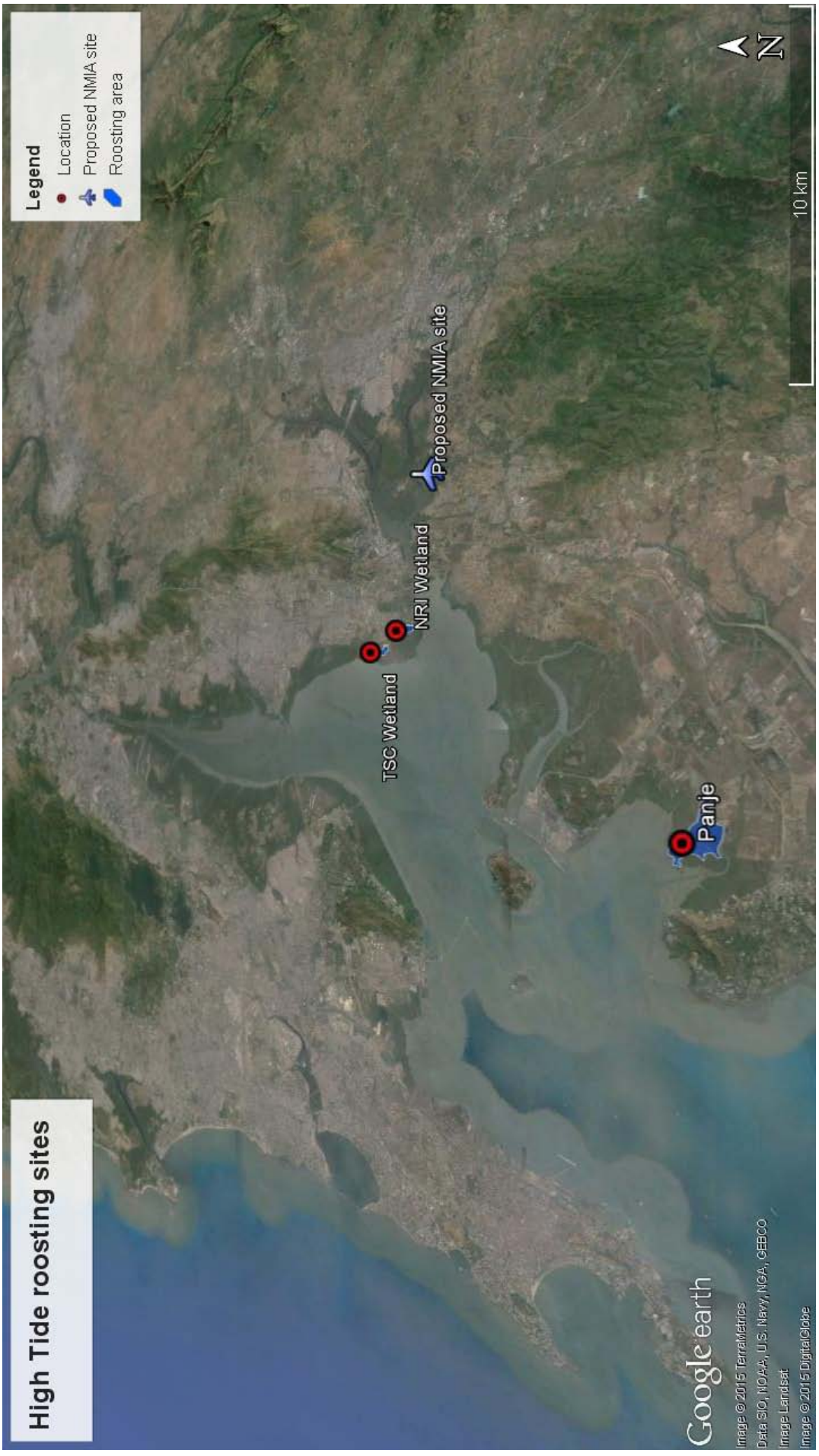
Importance of high tide roosting sites of waders in study area

The Navi Mumbai International Airport is proposed in an area having mixture of habitats such as creeks, seashore, paddy fields, forest, inland wetlands and mangroves in the surroundings. These varieties of habitats have high bird diversity which increases the concern of Bird Strike in future. Therefore we studied the movement, seasonal variation in population and habitat utilisation of birds in the 10 Kilometre radius area from the proposed airport site. Birds were seen moving between their roosting and foraging sites depending on the tide levels and other influencing factors. The spatial and temporal distribution of waders and other water birds was influenced by tide level, wetland water level and seasonal changes. The recent land use changes and land filling activities in the airport influenced zone have already affected some important wetlands. There is need to conduct a long term study to learn the effects of changing landscape and development activities on the status and distribution of bird species.

We observed communal roosting of birds such as Lesser Flamingo *Phoeniconaias minor*, Lesser Sand Plover *Charadrius mongolus*, Greater Sand Plover *Charadrius leschenaultia*, Grey Plover *Pluvialis squatarola*, Eurasian Curlew *Numenius arquata*, Common Redshank *Tringa totanus*, Little Stint *Calidris minuta* at wetlands of Panje village and Palm Beach Road area as shown in maps of high tide roosting sites. We have seen these birds roosting regularly in winter and summer seasons (October to May). Birds were seen moving in flocks from these roosting sites to open creeks and mudflats of the seashore for foraging during low tide and roosting mainly during high tide.

It is known that the day roost choice was affected by its distance from the feeding area and other microclimate (Rogers *et. al.* 2006). Birds select day roosts closer to the feeding areas, while during night, birds select safer but more distant roosts (Rogers et al. 2006). It was observed that by communal roosting, birds are benefited by increased ability to spot approaching predators, opportunity to explore new feeding areas (Donald & Clark 1991). It would be interesting to study the long-term impact of rapidly changing environment on the birds in the study area and correlate it with the status of birds in their breeding grounds. It will give us an idea about how particular species is doing at local as well as global level.

As these wetlands are located at prime location of Navi Mumbai, which is a metropolitan city, land filling activities were seen on edges of these wetlands. Because of large scale operation of Jawaharlal Nehru Port Trust (JNPT) at Uran area majority of the coastal wetlands are already land filled and very few places are left for roosting of waders in Navi Mumbai and adjoining areas (Map 11). For individual site map please refer Map No. 2, 3 and 6 in Chapter II. It is important to provide protection to such sites in rapidly changing landscapes of metropolitan cities.



Map 11: Google Earth map showing high tide roosting sites of birds in Navi Mumbai

Conditions influencing the sighting of birds at wetlands near Palm Beach road areas

Season	Tide Level	Water level	Congregatory birds usually seen	
			NRI and TSC	Panje
Early Winter		High	Terns, Gulls	Terns, Gulls, Flamingo
(October-December)		Moderate	Terns, Gulls, Flamingo	Terns, Gulls, Flamingo
	High	Low	All Birds including waders	All Birds including waders
		High	Cormorants, egrets, herons	Cormorants, egrets, herons
		Moderate	No birds	No birds
	Low	Low	No birds	No birds
Late Winter		High	Terns, Gulls	Terns, Gulls, Flamingo
(January-March)		Moderate	Terns, Gulls, Flamingo	Terns, Gulls, Flamingo
	High	Low	All Birds including waders	All Birds including waders
		High	Cormorants, egrets, herons	Cormorants, egrets, herons
		Moderate	No birds	No birds
	Low	Low	No birds	No birds
		High	Terns, Gulls	No birds
		Moderate	Terns, Gulls, Flamingo	No birds
	High	Low	All Birds including waders	Small Waders
		High	Cormorants, egrets, herons	No birds
		Moderate	No birds	No birds
Summer	Low	Low	No birds	No birds
		High	Flamingo	No birds
		Moderate	Flamingo	No birds
	High	Low	Flamingo	No birds
		High	Cormorants, egrets, herons	No birds
		Moderate	No birds	No birds
Monsoon	Low	Low	No birds	No birds

Note:

High: above 12 inches, Moderate: 6-12 inches, Low: 2-6 inches

PARVEEN SHAIKH

Panje wetland was used for resting by large congregtaion of waders

PARVEEN SHAIKH

Birds were seen feeding on the shore during the low tide

SUJIT NARWADE

Electrocution of Flamingo is common at Uran area by Sujit Narwade

Acknowledgement

We are grateful to the Ministry of Environment and Forests (MoEF), Government of India for recommending BNHS to carry out this study. We thank Soma Vijaykumar, C.G.M (Transport & Airport) and Nagendra Madiwal, Assistant Transportation Engineer (ATE), Transportation and Communication (T&C), Shri G.K. Anarse, General Manager (Environment), CIDCO, Navi Mumbai for their continuous support to run the project activity.

We are also thankful to Vikas Pisal, Driver-cum-Field Assistant, BNHS for assisting in the field work. Without the support, patience and help of many people from the BNHS this task would not have completed. We owe a particular debt of gratitude to the entire staff of the BNHS, for providing infrastructure and resources

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Annexure I
Checklist of birds observed in the 10 km radius from the proposed NMIA site

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
	Family Phalacrocoracidae					
2	Little Cormorant *Phalacrocorax niger*	W	IV	LC	R/LM	All wetlands
3	Great Cormorant *Phalacrocorax carbo*	W	IV	LC	R/LM	NRI Wetland
4	Indian Shag *Phalacrocorax fuscicollis*	W	IV	LC	R/LM	All wetlands
	Family Ardeidae					
5	Eastern Cattle Egret *Bubulcus coromandus*	W/P	IV	LC	R/LM	All wetlands
6	Intermediate Egret *Egretta intermedia*	W/P	IV	LC	R/LM	All wetlands
7	Great Egret *Egretta alba*	W	IV	LC	R	All wetlands
8	Little Egret *Egretta garzetta*	W/P/C	IV	LC	R/LM	All wetlands
9	Grey Heron *Ardea cinerea*	W/C	IV	LC	R/LM	All wetlands
10	Indian Pond-heron *Ardeola grayii*	W	IV	LC	R/LM	All wetlands
11	Purple Heron *Ardea purpurea*	W/C	IV	LC	R/LM	All wetlands
12	Western Reef-heron *Egretta gularis*	W/MD	IV	LC	R/LM	Dastan Phata, Sonari-Belpada
13	Black-crowned Night-heron *Nycticorax nycticorax*	W	IV	LC	R/LM	Kharghar Creek, NRI Wetland, Kalundre River
14	Striated Heron *Butorides striata*	W	IV	LC	R	Panje
15	Black Bittern *Dupetor flavicollis*	W	IV	LC	R/LM	NRI Wetland
16	Chestnut Bittern *Ixobrychus cinnamomeus*	W	IV	LC	R/LM	Mosare, Sonari-Belpada
	Family Ciconiidae					
17	Painted Stork *Mycteria leucocephala*	W	IV	NT	R/LM	Sonari-Belpada, NRI Wetland
18	Asian Openbill *Anastomus oscitans*	W	IV	LC	R/LM	Dastan Phata
19	Woolly-necked Stork *Ciconia episcopus*	W	IV	NT	R	Dastan Phata, Mosare
20	Black Stork *Ciconia nigra*	W	IV	LC	M	Uran
	Family Threskiornithidae					
21	Black-headed Ibis *Threskiornis melanocephalus*	W/C	IV	NT	R/LM	All wetlands and mangroves
22	Indian Black Ibis *Pseudibis papillosa*	W	IV	LC	R/LM	On old Mumbai-Pune highway near shedung village.
23	Eurasian Spoonbill *Platalea leucorodia*	W	I	LC	R/LM	Jasai, Sonari-Belpada
24	Glossy Ibis *Plegadis falcinellus*	W	IV	LC	M	Sonari-Belpada
	Family Phoenicopteridae					
25	Greater Flamingo *Phoenicopterus roseus*	W	I	LC	LM	Sonari-Belpada, NRI Wetland

R: Resident; M: Winter Migrant; LM: Local Migrant; SM: Summer Migrant; BM: Breeding Migrant; PM: Passage Migrant

Checklist of birds observed in the 10 km radius from the proposed NMIA site						
Sr. no.	**Common/scientific names**	**Habitat**	**WPA schedule**	**IUCN status**	**R/M**	**Sites**
26	Lesser Flamingo *Phoeniconaias minor*	W	I	NT	LM	NRI Wetland, Panje, TSC Wetland
27	Greylag Goose *Anser anser*	W	IV	LC	M	Sonari-Belpada
28	Ruddy Shelduck *Tadorna ferruginea*	W	IV	LC	M	Sonari-Belpada, Panje
29	Northern Pintail *Anas acuta*	W	IV	LC	M	Sonari-Belpada
30	Common Teal *Anas crecca*	W	IV	LC	M	Sonari-Belpada
31	Indian Spot-billed Duck *Anas poecilorhyncha*	W/C	IV	LC	R	All wetlands
32	Mallard *Anas palatyrhynchos*	W	IV	LC	M	NRI Wetland
33	Garganey *Anas querquedula*	W	IV	LC	M	Sonari-Belpada
34	Northern Shoveler *Anas clypeata*	W/C	IV	LC	M	Kharghar Creek
35	Comb Duck *Sarkidiornis melanotos*	W	IV	LC	R	Dastan Phata
36	Lesser Whistling-duck *Dendrocygna javanica*	W	IV	LC	R/LM	Dastan Phata, Sonari-Belpada, NRI Wetland
37	Cotton Teal *Nettapus coromandelianus*	W	IV	LC	R/LM	Dastan Phata
38	Gadwall *Anas strepera*	W	IV	LC	M	Sonari-Belpada
39	Eurasian Wigeon *Anas penelope*	W	IV	LC	M	Sonari-Belpada
	Family Accipitridae					
40	Black-winged Kite *Elanus caeruleus*	All	I	LC	R	All wetlands
41	Black Kite *Milvus migrans migrans/govinda*	All	I	LC	R	All wetlands
42	Brahminy Kite *Haliastur indus*	W/P	I	LC	R	Sonari-Belpada, Dastan Phata
43	Black-eared Kite *Milvus [migrans] lineatus*	W	I	LC	M	Sonari-Belpada
44	Shikra *Accipiter badius*	All	I	LC	R	
45	White-eyed Buzzard *Butastur teesa*	F	I	LC	R	Jasai
46	Oriental Honey-buzzard *Pernis ptylorhynchus*	F	I	LC	R	Mosare
47	Common Buzzard *Buteo buteo*	F	I	LC	R	Ransai, Chirner
48	Long-legged Buzzard *Buteo rufinus*	F	I	LC	M	Mosare
49	Western Marsh Harrier *Circus aeruginosus*	W	I	LC	M	All wetlands
50	Palid Harrier *Circus macrourus*	W	I	LC	M	Panje
51	Montagu's Harrier *Circus pygargus*	W	I	LC	M	Panje
52	Crested Serpent-eagle *Spilornis cheela*	F	I	LC	R/LM	Ransai, Mosare
53	Changeable Hawk-eagle *Nisaetus cirrhatus*	F	I	LC	R	Ransai
54	Short-toed Snake-eagle *Circaetus gallicus*	GS	I	LC	R	Chirner road
55	Booted Eagle *Hieraaetus pennatus*	F	I	LC	M	Mosare
56	Greater Spotted Eagle *Aquila clanga*	F	I	LC	M	Sonari-Belpada, Mosare

Checklist of birds observed in the 10 km radius from the proposed NMIA site						
Sr. no.	**Common/scientific names**	**Habitat**	**WPA schedule**	**IUCN status**	**R/M**	**Sites**
57	Indian Spotted Eagle *Aquila pomarina*	W	I	VU	R	Sonari-Belpada
58	White-bellied Sea-eagle *Haliaeetus leucogaster*	W	I		R	Panje
59	Black Eagle *Ictinaetus malayensis*	F	I		R	Karnala Bird Sanctuary
	Family Falconidae					
60	Common Kestrel *Falco tinnunculus*	GS	IV	LC	R/LM	Chirner, Sonari-Belpada
61	Peregrine Falcon (Shaheen) *Falco peregrinus perigrenator*	W	IV	LC	R/LM	Panje
	Family Pandionidae					
62	Western Osprey *Pandion haliaetus*	W/C	I	LC	M	Kharghar Creek, Sonari-Belpada
	Family Phasianidae					
63	Rain Quail *Coturnix coromandelica*	P	-	LC	R/LM	Chirner
64	Red Spurfowl *Galloperdix spadicea*	F	-	LC	R	Kharghar hills
65	Jungle Bush-quail *Perdicula asiatica*	F	-	LC	R	Ransai, Chirner Road
66	Indian Peafowl *Pavo cristatus*	F	I	LC	R	Mosare
67	Painted Francolin *Francolinus pictus*	GS	-	LC	R	Taloja industrial area
68	Grey Francolin *Francolinus pondicerianus*	GS	-	LC	R	Taloja industrial area
	Family Turnicidae					
69	Barred Buttonquail *Turnix suscitator*	P	-	LC	R	Chirner
70	Yellow-legged Buttonquail *Turnix tanki*	P	-	LC	R/LM	Chirner
	Family Gruidae					
71	Demoiselle Crane *Grus virgo*	W		LC	M	Sonari-Belpada
	Family Rallidae					
72	White-breasted Waterhen *Amaurornis phoenicurus*	W/C	IV	LC	R	Sonari-Belpada
73	Purple Swamphen *Porphyrio porphyrio*	W	IV	LC	R	Sonari-Belpada
74	Watercock *Gallicrex cinerea*	W	IV	LC	R/LM	Sonari-Belpada (In September 2013)
75	Common Moorhen *Gallinula chloropus*	W	IV	LC	R	Sonari-Belpada
76	Eurasian Coot *Fulica atra*	W	IV	LC	R/LM	Sonari-Belpada
77	Slaty-breasted Rail *Gallirallus striatus*	W/C	IV	LC	R	Kharghar Creek, Kalundre River
78	Ruddy-breasted Crake *Porzana fusca*	W/C	IV	LC	R/LM	Kharghar Creek, Kalundre River
79	Brown Crake *Porzana akool*	W/C	IV	LC	R	Chirner, Panje

Checklist of birds observed in the 10 km radius from the proposed NMIA site						
Sr. no.	**Common/scientific names**	**Habitat**	**WPA schedule**	**IUCN status**	**R/M**	**Sites**
	Family Jacanidae					
80	Bronze-winged Jacana *Metopidius indicus*	W	IV	LC	R	Sonari-Belpada
81	Pheasant-tailed Jacana *Hydrophasianus chirurgus*	W	IV	LC	R/LM	Sonari-Belpada
	Family Rostratulidae					
82	Greater Painted Snipe *Rostratula benghalensis*	W	IV	LC	R	Sonari-Belpada
	Family Charadriidae					
83	Red-wattled Lapwing *Vanellus indicus*	ALL	IV	LC	R	All wetlands
84	Lesser Sand Plover *Charadrius mongolus*	W/MD	IV	LC	M	All wetlands
85	Greater Sand Plover *Charadrius leschenaulti*	W/MD	IV	LC	M	NRI Wetland
86	Little Ringed Plover *Charadrius dubius*	W/MD	IV	LC	R	All wetlands
87	Common Ringed Plover *Charadrius hiaticula*	W/MD	IV	LC	M	Panje
88	Pacific Golden Plover *Pluvialis fulva*	W/MD	IV	LC	M	Kalundre river, TSC Wetland
89	Kentish Plover *Charadrius alexandrinus*	W/MD	IV	LC	M	All wetlands
90	Grey Plover *Pluvialis squatarola*	W/MD	IV	LC	M	NRI Wetland, TSC Wetland
	Family Scolopacidae					
91	Common Snipe *Gallinago gallinago*	W	IV	LC	M	Sonari-Belpada, Dastan Phata
92	Common Redshank *Tringa totanus*	W/MC	IV	LC	M	All wetlands
93	Wood Sandpiper *Tringa glareola*	W/MC	IV	LC	M	All wetlands
94	Common Sandpiper *Tringa hypoleucos*	W/MC	IV	LC	M	All wetlands
95	Common Greenshank *Tringa nebularia*	W/RS	IV	LC	M	Sonari-Belpada, NRI Wetland, TSC Wetland
96	Terek Sandpiper *Xenus cinereus*	W/MC	IV	LC	M	Kharghar Creek, Kopar
97	Green Sandpiper *Tringa ochropus*	W/MC	IV	LC	M	Sonari-Belpada
98	Marsh Sandpiper *Tringa stagnatilis*	W	IV	LC	M	All wetlands
99	'Western' Black-tailed Godwit *Limosa limosa*	W	IV	LC	M	Sonari-Belpada,
100	Eurasian Curlew *Numenius arquata*	W	IV	LC	M	NRI Wetland
101	Ruddy Turnstone *Arenaria interpres*	RS	IV	LC	M	TSC Wetland
102	Temminck's Stint *Calidris temminckii*	W	IV	LC	M	All wetlands
103	Little Stint *Calidris minuta*	W	IV	LC	M	All wetlands
104	Curlew Sandpiper *Calidris ferruginea*	W	IV	LC	M	Sonari-Belpada, Dastan Phata, NRI Wetland
105	Broad-billed Sandpiper *Limicola falcinellus*	W	IV	LC	M	Belpada, NRI Wetland, TSC Wetland
106	Ruff *Philomachus pugnax*	W	IV	LC	M	Sonari-Belpada, Dastan Phata, Panje

Checklist of birds observed in the 10 km radius from the proposed NMIA site						
Sr. no.	**Common/scientific names**	**Habitat**	**WPA schedule**	**IUCN status**	**R/M**	**Sites**
107	Dunlin *Calidris alpina*	W	IV	LC	M	Panje
108	Whimbrel *Numenius phaeopus*	W	IV	LC	M	Sonari-Belpada
	Family Recurvirostridae					
109	Black-winged Stilt *Himantopus himantopus*	W	IV	LC	R/LM	All wetlands
110	Pied Avocet *Recurvirostra avosetta*	W	IV	LC	M	Jasai, NRI Wetland
	Family Phalaropidae					
111	Red-necked Phalarope *Phalaropus lobatus*	W	IV	LC	M	Uran
	Family Laridae					
112	Gull-billed Tern *Gelochelidon nilotica*	W	IV	LC	M	All wetlands
113	Caspian Tern *Sterna caspia*	W/C	IV	LC	M	NRI Wetland, TSC Wetland, Panje
114	Saunders' Tern *Sterna saundersi*	W/C	IV	LC	M	NRI Wetland, TSC Wetland
115	Whiskered Tern *Chlidonias hybridus*	W/C	IV	LC	M	NRI Wetland, TSC Wetland, Panje
116	River Tern *Sterna aurantia*	W/C	IV	LC	R/LM	Sonari-Belpada, NRI Wetland, TSC Wetland, Panje
117	White-cheeked Tern *Sterna repressa*	W	IV	LC	M	Jasai Wetland
118	Slender-billed Gull *Larus genei*	W	IV	LC	M	NRI Wetland, TSC Wetland
119	Brown-headed Gull *Larus brunnicephalus*	W	IV	LC	M	All wetlands
120	Common Black-headed Gull *Larus ridibundus*	W	IV	LC	M	All wetlands
121	Heuglin's Gull *Larus fuscus heuglini*	W	IV	LC	M	NRI Wetland, TSC Wetland, Panje
122	Pallas's Gull *Ichthyaetus ichthyaetus*	W	IV	LC	M	NRI Wetland, TSC Wetland, Panje
	Family Rynchopidae					
123	Indian Skimmer *Rynchops albicollis*	W	IV	VU	R/LM	NRI Wetland, Panje
	Family Columbidae					
124	Rock Pigeon *Columba livia*	All /NH		LC	R	All areas
125	Yellow-footed Green-pigeon *Treron phoenicoptera*	F	IV	LC	R	Chirner, Mosare
126	Grey-fronted Green-pigeon *Treron affinis*	F	IV	LC	R	Karnala Bird Sanctuary
127	Laughing Dove *Streptopelia senegalensis*	All	IV	LC	R	All areas
128	Eurasian Collared-dove *Streptopelia decaocto*	GS	IV	LC	R	All areas
129	Spotted Dove *Streptopelia chinensis*	All	IV	LC	R	All areas
	Family Psittacidae					
130	Rose-ringed Parakeet *Psittacula krameri*	All	IV	LC	R	All areas
131	Plum-headed Parakeet *Psittacula cyanocephala*	F	IV	LC	R	Karnala Bird Sanctuary

Checklist of birds observed in the 10 km radius from the proposed NMIA site

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
132	Alexandrine Parakeet *Psittacula krameri*	F	IV	VU	R	Chirner
	Family Cuculidae					
133	Asian Koel *Eudynamys scolopaceus*	All	IV	LC	R	All areas
134	Greater Coucal (Southern Coucal) *Centropus sinensis*	All	IV	LC	R	All areas
135	Common Hawk-cuckoo *Hierococcyx varius*	All	IV	LC	R	Mosare, Ransai
136	Jacobin Cuckoo *Clamator jacobinus*	F	IV	LC	SM	Chirner, Karnala Bird Sanctuary
137	Indian Cuckoo *Cuculus micropterus*	F	IV	LC	R	Chirner, Ransai, Mosare
	Family Cuculidae					
138	Blue-faced Malkoha *Phaenicophaeus viridirostris*	All	IV	LC	R	Mosare
139	Sirkeer Malkoha *Phaenicophaeus leschenaulti*	All	IV	LC	R	Mosare
	Family Tytonidae					
140	Common Barn-owl *Tyto alba*	NH	IV	LC	R	
	Family Strigidae					
141	Spotted Owlet *Athene brama*	F/NH	IV	LC	R	Mosare, Ransai
142	Indian Eagle-owl *Bubo bengalensis*	NH	IV	LC	R	Jasai
	Family Caprimulgidae					
143	Indian Little Nightjar *Caprimulgus asiaticus*	A/GS	IV	LC	R	Ransai
144	Indian Jungle Nightjar *Caprimulgus indicus*	F	IV	LC	R	Ransai
	Family Apodidae					
145	Little Swift *Apus affinis*	NH		LC	R	All areas
146	Asian Palm-swift *Cypsiurus balasiensis*	F/NH		LC	R	All areas
	Family Alcedinidae					
147	Lesser Pied Kingfisher *Ceryle rudis*	W	IV	LC	R	Panje
148	White-throated Kingfisher *Halcyon smyrnensis*	All	IV	LC	R	All areas
149	Common Kingfisher *Alcedo atthis*	W	IV	LC	R	All wetlands
150	Black-capped Kingfisher *Halcyon pileata*	W/F	IV	LC	M	NRI Wetland
151	Black-backed Dwarf Kingfisher *Ceyx erithaca*	F	IV	LC	BM	Mosare, Karnala Bird Sanctuary
	Family Meropidae					
152	Little Green Bee-eater *Merops orientalis*	All		LC	R	All areas
153	Blue-tailed Bee-eater *Merops philippinus*	F/MC		LC	PM	Kharghar Creek, Panje, Sonari-Belpada
154	Blue-cheeked Bee-eater *Merops persicus*	GS/W		LC	PM	Sonari-Belpada, Panje

Checklist of birds observed in the 10 km radius from the proposed NMIA site						
Sr. no.	**Common/scientific names**	**Habitat**	**WPA schedule**	**IUCN status**	**R/M**	**Sites**
	Family Coraciidae					
155	Indian Roller *Coracias benghalensis*	All	IV	LC	R	All wetlands areas
156	European Roller *Coracias garrulus*	All	IV	LC	PM	Panje
	Family Upupidae					
157	Common Hoopoe *Upupa epops*	MC/GS		LC	R/LM	All areas
	Family Bucerotidae					
158	Indian Grey Hornbill *Ocyceros birostris*	F	I	LC	R	Mosare, Ransai
	Family Capitonidae					
159	Coppersmith Barbet *Megalaima haemacephala*	F	IV	LC	R	Mosare, Ransai
160	Brown-headed Barbet *Megalaima zeylonica*	F	IV	LC	R	Mosare, Ransai
161	White-cheeked Barbet *Megalaima viridis*	F	IV	LC	R	All Forest areas
	Family Pittidae					
162	Indian Pitta *Pitta brachyura*	F	IV	LC	BM	Mosare, Karnala Bird Sanctuary
	Family Picidae					
163	Eurasian Wryneck *Jynx torquilla*	F	IV	LC	M	Sonari-Belpada
164	Rufous Woodpecker *Celeus brachyurus*	F	IV	LC	R	Chirner, Karnala Bird Sanctuary
165	Black-rumped Flameback *Dinopium benghalense*	F	IV	LC	R	Ransai, Karnala Bird Sanctuary
166	Common Flameback *Dinopium javanense*	F	IV	LC	R	Ransai, Karnala Bird Sanctuary
167	Yellow-fronted Pied Woodpecker *Dendrocopos mahrattensis*	F	IV	LC	R	Mosare, Karnala Bird Sanctuary
168	Heart-spotted Woodpecker *Hemicircus canente*	F	IV	LC	R	Karnala Bird Sanctuary
169	Indian Pygmy Woodpecker *Dendrocopos nanus*	F	IV	LC	R	Karnala Bird Sanctuary
	Family Alaudidae					
170	Ashy-crowned Finch-lark *Eremopterix griseus*	GS	IV	LC	R	Uran
171	Rufous-tailed Lark *Ammomanes phoenicura*	All	IV	LC	R	All Grassland areas
172	Malabar Lark *Galerida malabarica*	ALL	IV	LC	R	All wetlands areas
	Family Motacillidae					
173	Citrine Wagtail *Motacilla citreola*	W/M	IV	LC	M	All areas
174	Yellow Wagtail *Motacilla flava*	W/M	IV	LC	M	All areas
175	Grey Wagtail *Motacilla cinerea*	W	IV	LC	M	All areas

Checklist of birds observed in the 10 km radius from the proposed NMIA site

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
176	White Wagtail *Motacilla alba*	W	IV	LC	M	All areas
177	White-browed Wagtail *Motacilla maderaspatensis*	W	IV	LC	R	All areas
178	Tree Pipit *Anthus trivialis*	P/GS	IV	LC	M	All areas
179	Paddyfield Pipit *Anthus rufulus*	ALL	IV	LC	R	All areas
	Family Hirundinidae					
180	Wire-tailed Swallow *Hirundo smithii*	All	IV	LC	R	All areas
181	Barn Swallow *Hirundo rustica*	W	IV	LC	M	All areas
	Family Campephagidae					
182	Common Woodshrike *Tephrodornis pondicerianus*	F	IV	LC	R	Mosare
183	Large Cuckoo-shrike *Coracina macei*	F	IV	LC	R	Ransai
184	Black-headed Cuckoo-shrike *Coracina melanoptera*	F	IV	LC	R	Ransai
185	Small Minivet *Pericrocotus cinnamomeus*	F	IV	LC	R	Mosare
186	Orange Minivet *Pericrocotus flammeus*	F	IV	LC	R	Ransai
	Family Irenidae					
187	Common Iora *Aegithina tiphia*	F	IV	LC	R	Ransai
188	Gold-fronted Leafbird *Chloropsis aurifrons*	F	IV	LC	R	Ransai, Mosare
	Family Pycnonotidae					
189	Red-vented Bulbul *Pycnonotus cafer*	All	IV	LC	R	All areas
190	Red-whiskered Bulbul *Pycnonotus jocosus*	F/MC	IV	LC	R	All areas
191	White-eared Bulbul *Pycnonotus leucotis*	MC	IV	LC	R	All areas
192	White-browed Bulbul *Pycnonotus luteolus*	F	IV	LC	R	Chirner
	Family Laniidae					
193	Bay-backed Shrike *Lanius vittatus*	All	IV	LC	R	All areas
194	'Rufous-backed' Long-tailed Shrike *Lanius schach erythronotus group*	All	IV	LC	R/LM	All areas
195	Southern Grey Shrike *Lanius meridionalis*	GS	IV	LC	R	Chirner
	Family Muscicapidae					
196	Orange-headed Thrush *Zoothera citrina*	F	IV	LC	R/LM	Ransai
197	Jungle Babbler *Turdoides striatus*	F	IV	LC	R	Ransai, Mosare
198	Tawny-bellied Babbler *Turdoides hyperythra*	F	IV	LC	R	Mosare
199	Yellow-eyed Babbler *Chrysomma sinense*	F	IV	LC	R	Chirner

Checklist of birds observed in the 10 km radius from the proposed NMIA site						
Sr. no.	**Common/scientific names**	**Habitat**	**WPA schedule**	**IUCN status**	**R/M**	**Sites**
200	Indian Scimitar-babbler *Pomatorhinus [schisticeps] horsfieldii*	F	IV	LC	R	Chirner, Mosare
201	Puff-throated Babbler *Pellorneum ruficeps*	F	IV	LC	R	Mosare
202	Brown-cheeked Fulvetta *Alcippe poioicephala*	F	IV	LC	R	Ransai
203	Black Redstart *Phoenicurus ochruros*	GS	IV	LC	M	Mosare
204	Malabar Whistling-thrush *Myophonus horsfieldi*	F	IV	LC	R	Ransai
205	Oriental Magpie-robin *Copsychus saularis*	All	IV	LC	R	All areas
206	Common Stonechat *Saxicola torquatus*	All	IV	LC	M	All areas
207	Pied Bushchat *Saxicola caprata*	All	IV	LC	R	All areas
208	Isabelline Wheatear *Oenanthe isabellina*	GS	IV	LC	M	TSC Wetland
209	Indian Black Robin *Saxicoloides fulicatus*	All	IV	LC	R	All areas
210	White-rumped Shama *Copsychus saularis*	F	IV	LC	R	Ransai
211	Bluethroat *Luscinia svecica*	MC	IV	LC	M	Sonari-Belpada, Kharghar Creek,
212	Blue Rock-thrush *Monticola solitaries*	GS	IV	LC	M	Karnala Bird Sanctuary
213	Blue-headed Rock-thrush *Monticola cinclorhynchus*	F	IV	LC	M	Karnala Bird Sanctuary
214	Zitting Cisticola *Cisticola juncidis*	MC	IV	LC	R	Sonari-Belpada
215	Plain Prinia *Prinia inornata*	All	IV	LC	R	All areas
216	Ashy Prinia *Prinia socialis*	All	IV	LC	R	All areas
217	Grey-breasted Prinia *Prinia hodgsonii*	All	IV	LC	R	Mosare
218	Indian Reed-warbler *Acrocephalus [stentoreus] bruniscens*	MS	IV	LC	R/LM	All mangrove areas
219	Common Tailorbird *Orthotomus sutorius*	All	IV	LC	R	All areas
220	Lesser Whitethroat *Sylvia curruca*	GS	IV	LC	M	Panje
221	Red-breasted Flycatcher *Ficedula parva*	GS/F	IV	LC	M	Mosare
222	Asian Brown Flycatcher *Muscicapa dauurica*	MC	IV	LC	R/LM	Kopar
223	White-browed Fantail *Rhipidura albicollis*	MC	IV	LC	R	NRI Wetland
224	White-spotted Fantail *Rhipidura albogularis*	MC	IV	LC	R	NRI Wetland
225	Grey-headed Canary-flycatcher *Culicicapa ceylonensis*	F	IV	LC	R/LM	Ransai
226	Asian Paradise Flycatcher *Terpsiphone paradisi*	F	IV	LC	R/BM	Ransai, Karnala Bird Sanctuary, Chirner
227	Tickell's Blue Flycatcher *Cyornis tickelliae*	F	IV	LC	R/LM	Ransai, Karnala Bird Sanctuary, Morbe

Checklist of birds observed in the 10 km radius from the proposed NMIA site

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
228	Black-naped Blue Monarch *Hypothymis azurea*	F	IV	LC	R	Karnala Bird Sanctuary, Morbe
	Family Paridae					
229	Cinereus Tit *Parus* cinereus	NH	IV	LC	R	Panje
	Family Dicaeidae					
230	Thick-billed Flowerpecker *Dicaeum agile*	F	IV	LC	R	Ransai, Karnala Bird Sanctuary, Chirner.
231	Pale-billed Flowerpecker *Dicaeum erythrorhynchos*	F	IV	LC	R	Ransai, Karnala Bird Sanctuary, Chirner.
	Family Nectariniidae					
232	Purple Sunbird *Cinnyris asiatica*	All	IV	LC	R	Ransai, Karnala Bird Sanctuary, Chirner.
233	Purple-rumped Sunbird *Leptocoma zeylonica*	GS	IV	LC	R	Ransai, Karnala Bird Sanctuary, Chirner
234	Small Sunbird *Leptocoma minima*	F	IV	LC	R	Ransai
235	Vigors' Sunbird *Aethopyga vigorsii*	F	IV	LC	R	Ransai
236	Loten's Sunbird *Cinnyris lotenius*	F	IV	LC	R	Karnala Bird Sanctuary
	Family Emberizidae					
237	Red-headed Bunting *Emberiza bruniceps*	GS	IV	LC	M	NMIA
238	Black-headed Bunting *Emberiza melanocephala*	GS	IV	LC	M	NMIA
	Family Fringillidae					
239	Common Rosefinch *Carpodacus erythrinus*	GS	IV	LC	M	Mosare
	Family Estrildidae					
240	Indian Silverbill *Euodice malabarica*	P	IV	LC	R	All areas
241	Red Avadavat *Amandava amandava*	W/MC	IV	LC	R	Sonari-Belpada, TSC Wetland
242	Tricoloured Munia *Lonchura Malacca*	MC	IV	LC	R	Kharghar Creek, TSC Wetland
243	Scaly-breasted Munia *Lonchura punctulata*	MC/F	IV	LC	R	Kharghar Creek, TSC Wetland, Mosare
244	White-rumped Munia *Lonchura striata*	F	IV	LC	R	Mosare
	Family Passeridae					
245	House Sparrow *Passer domesticus*	All	IV	LC	R	All areas
246	Baya Weaver *Ploceus philippinus*	All	IV	LC	R	All areas
247	Black-breasted Weaver *Ploceus benghalensis*	All	IV	LC	R	All areas
248	Yellow-throated Sparrow *Petronia xanthocollis*	F/GS	IV	LC	R	Uran, Mosare

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Sr. no.	**Common/scientific names**	**Habitat**	**WPA schedule**	**IUCN status**	**R/M**	**Sites**
	Family Sturnidae					
249	Rosy Starling *Sturnus roseus*	All	IV	LC	M	Sonari-Belpada, Kharghar Creek,
250	Brahminy Starling *Temenuchus pagodarum*	GS	IV	LC	R	All areas
251	Grey-headed Starling *Sturnia malabarica*	GS	IV	LC	R/LM	TSC Wetland
252	Malabar White-headed Starling *Sturnia blythii*	GS	IV	LC	R	TSC Wetland
253	Asian Pied Starling *Gracupica contra*	GS	IV	LC	R	All areas
254	Common Myna *Acridotheres tristis*	All	IV	LC	R	All areas
255	Jungle Myna *Acridotheres fuscus*	All	IV	LC	R	All areas
	Family Oriolidae					
256	Indian Golden Oriole *Oriolus kundoo*	All	IV	LC	R/LM	All areas
257	Black-hooded Oriole *Oriolus xanthornus*	F	IV	LC	R	Ransai
258	Black-naped Oriole *Oriolus chinensis*	F	IV	LC	M	Ransai
	Family Dicruridae					
259	Black Drongo *Dicrurus macrocercus*	All	IV	LC	R	All areas
260	Ashy Drongo *Dicrurus leucophaeus*	F	IV	LC	M	Ransai
261	Bronzed Drongo *Dicrurus aeneus*	F	IV	LC	R	Karnala Bird Sanctuary
262	White-bellied Drongo *Dicrurus caerulescens*	F	IV	LC	R	Ransai
263	Greater Racket-tailed Drongo *Dicrurus paradiseus*	F	IV	LC	R	Ransai, Karnala Bird Sanctuary
	Family Corvidae					
264	House Crow *Corvus splendens*	NH	V	LC	R	All areas
265	Indian Jungle Crow *Corvus [macrorhynchos] culminatus*	All	IV	LC	R	All areas
267	Rufous Treepie *Dendrocitta vagabunda*	F	IV	LC	R	Mosare

R: Resident; M: Winter Migrant; LM: Local Migrant; SM: Summer Migrant; BM: Breeding Migrant; PM: Passage Migrant

Annexure II

LIST OF MAPS

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