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

ANNUAL REPORT II
JANUARY-DECEMBER, 2013

Bombay Natural History Society

BNHS INDIA CONSERVING NATURE SINCE 1883

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CONTENTS

Summary

The field visits were conducted during January 2013 to December 2013, in the area falling under approximately 10-kilometre radius from the proposed site of Navi Mumbai International Airport (NMIA). Through the second annual report the BNHS survey team would like to address the temporal and spatial variation in the populations of congregating bird-species. A total of 253 bird species were reported during the study period. Out of the 27, the survey team selected 21 bird species and analysed fluctuations in their population across the months and high tide roost sites. The survey team converted the population data into percentage data for graphically presenting site usage by the birds across months and seasons. The survey team also discussed about arrival and departure periods of the migratory birds in study area.

Keywords: Navi Mumbai International Airport, Avifauna, population variation, tide timing, water level, congregatory bird species,

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 the 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 hectare; this includes the area for development; approximately 1,615 hectare 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 airport site. The area comprised creeks, rivers and mangroves which serve as a good habitat for a variety of congregating bird-species. Karnala Bird Sanctuary is located in close proximity of the proposed NMIA site.

The Ministry of Environment and Forests (MoEF), 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 253 bird species belonging to 55 families were observed in the study area since December 2011. This annual report offers insights into the quantitative data on the diversity and population of birds across selected sites and monthly observations with special emphasis on congregating bird species.

Chapter II

Study area

The survey sites in 10 kilometre radius-area of NMIA were divided by the BNHS scientists 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 scrub-land 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.
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 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.

For the study of seasonal variations in bird population, the BNHS survey team focussed on the following areas to collect data about temporal and special variation in the population of some congregating bird species.

1. **Belpada Lake**: It is located in the southwest direction of the proposed NMIA site near Sonari-Belpada village. This lake near the campus of Speedy Services was observed being used by the birds for roosting. It is surrounded by grass/shrub land from three sides and the boundary wall of Speedy Services on the fourth side. This wetland, once connected to the sea by water channels, is isolated and its water level is not dependent on the tidal cycle, therefore, it dries up in the summer. This lake is reachable from Panvel-JNPT road, and is about 2-3 km from Jasai village and about 500 metres from the toll plaza towards Speedy Container Yard.

2. **Panvel Creek and NMIA area**: Waders are usually seen on a rock-bed, exposed during low-tide, in Panvel Creek at the proposed site of NMIA near Kopar and Pargaon villages. This site is of mixed habitat and includes mangroves, open scrubland/shrub land, complex of smaller wetlands created by backwater, paddy fields as well as creeks of Gadhi, Ulve, Kalamboli and Panvel. Roosting of birds was mainly seen in area of about 40 hectares as shown in the map.

3. **Kharghar Creek:** Between harbour railway stations Kharghar and Mansarovar, it is reachable by road from Sion-Panvel Highway. Mangroves spread adjoining this creek were surveyed for the study of population of small birds. As this study area comprised a large portion covered by the mangroves it was important to know the status of smaller birds that may pose a threat to the flight safety in future.

4. **NRI Wetland**: This site lies in the northwest of the proposed NMIA site. It includes wetland spread across 19 hectares, surrounded by grass, shrubs and mangroves. Water level in this wetland was controlled mainly by the tide level and by the activities of the local fisherman. During high tide, the water enters the wetland and is retained by small check dams created by the fishermen. Mangroves cover the wetland from three sides and the fencing wall of NRI complex on one side with a thin stretch of grass and vegetation in between. The vegetation on the borders of the wetland makes it undisturbed and an enclosed habitat for birds to roost. This wetland lies behind NRI Complex, followed by a stretch of mangroves, and finally reaches the seashore. The survey team observed a majority of water birds preferred to congregate in this area during early-winter and summer. This wetland is also used as a stopover site by a number of migratory birds during the early-winter season.

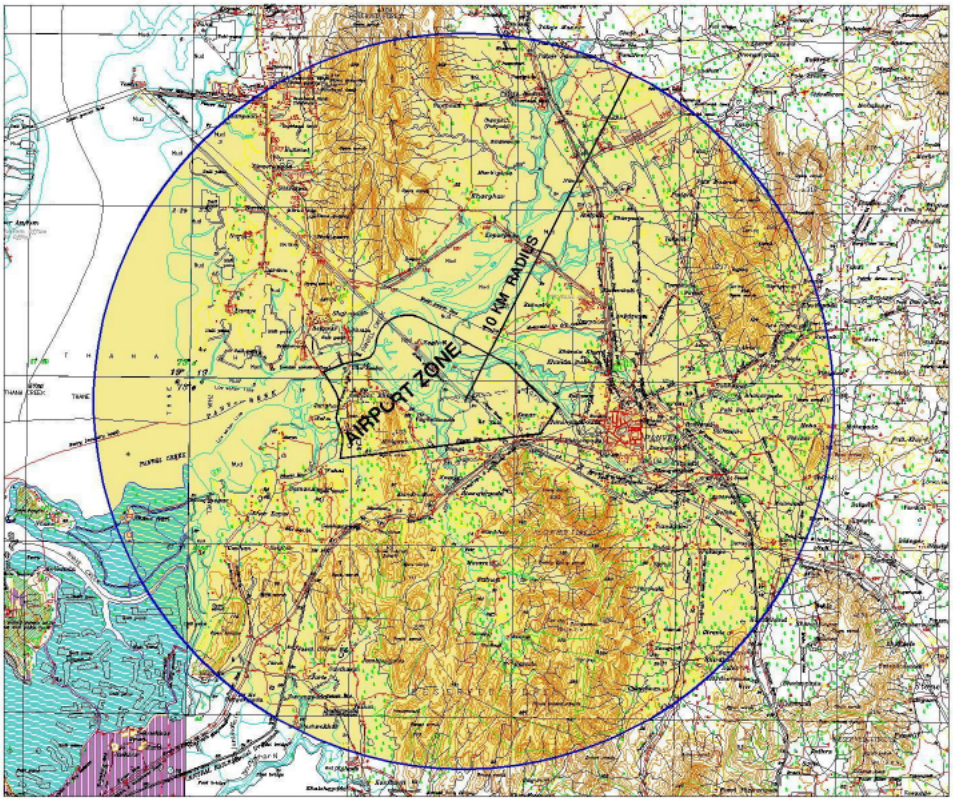
5. **TSC Wetland**: Spread over 15 hectares, this wetland lies behind Training Ship Chanakya Maritime Institute and followed by a stretch of paddy fields, shrub land and the mangroves, and finally it reaches the seashore. The water level in the wetland is primarily controlled by the local fisherman, as by the tidal cycles. A majority of water birds preferred to congregate in this area during the summer months. Birds use this site for resting during the high tide. The survey team observed that the migratory birds used this area as a stopover site during winter migration cycles.

6. **Uran-JNPT Area**: There are many small wetlands scattered across the Uran-JNPT area, flocked by waders during low tides. During late-winters, a majority of these wetlands were observed to have dried completely. Tide dependent movement of birds was observed. Many birds were seen resting during low tide also foraging in shallow water.

7. **Wetland at Jaskhar and Nhava Sheva Police Station:** The Jashkar wetland is adjacent to human habitation and bird species like Black-tailed Godwit *Limosa limos,* Black-winged Stilt *Himantopus himantopus* and Common Redshank *Tringa tetanus* were observed here. The grassland on west of Nhava Sheva Police station was a temporary wetland during monsoon and overwintering population of Black-tailed Godwit *Limosa limosa*, Heuglin's Gull *Larus heuglini*, Common Redshank *Tringa totanus*, and Eurasian Curlew *Numenius arquata* was seen here. Birds were often observed resting at this site during high tide.

8. **Forest areas**: The forest areas of Chirner, Mosare, Ransai, Patnoli and Karnala Bird Sanctuary were surveyed. All the forest areas are the mixed-deciduous and the majority of tree species found here include Jamun *Syzygium cumuni*, Goose Berry *Zizipus mauritiana*, Banyan *Ficus bengalensis*, Teak *Tectona grandis*, Red Silk Cotton *Bombax ceiba* and Anjan *Hardwickia binata*. The forest patches of

Chirner, Mosare, Ransai and Patnoli are a mosaic of different land-use-patterns such as forest, grassland, agriculture and plantation. Chirner forest was seen interspersed by the patches of Mango orchards, and Teak and Cashew plantations. Karnala Bird Sanctuary a protected area and a mixed-deciduous forest provides the most suitable habitat for the forest dwelling birds.



10km radius area around the proposed Navi Mumbai International Airport

Selected Study sites in the 10km radius area around the proposed Navi Mumbai International Airport

Chapter III

Methodology

Multiple site surveys were conducted between December 2011 and December 2013. The BNHS survey team used binoculars (Nikon Monarch 10x X 40x) for correct bird identification and a digital SLR-camera (Cannon 550D, Cannon with 400 mm fixed-focus lens) for documentation of bird-species and observations for each survey site. The photographs of unidentified birds are maintained for further studies. 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 by family using Manakadan & Pittie (2001) as the key, and Rasmussen & Anderton (2012) was followed for the nomenclature. A GPS instrument was used for the collection of accurate geographical coordinates.

The birds were counted using the Estimated-block Method (Bibby, et.al. 2000) for different species, according to the congregation size during roosting time. The transects were laid in habitats such as forests, open lands, grassland, Mangrove patches and agricultural lands. The Total Count 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). The observations were recorded continuously for two hours before and after high tide for each high-tide wetland. Every site was visited at least once in a month.

To understand the trends in population, diversity and movement of birds in study area, the quantitative data collected during the study period was compared across months and presented through graphs (Musgrove et al, 2003). For better comprehension of the population fluctuations, the field-data about congregating bird-species was selected on basis of the avifaunal diversity. The total number of species observed was estimated at each site and species richness was compared across the months. Similarly population count at different sites was estimated and compared across months of the survey duration. Some important flocking bird species were monitored regularly at the selected sites mentioned in study area and population change was compared across the season and the sites, considering the bird hazard these species may pose to the operations of the proposed airport.

The maximum population and species count of a particular month for a particular site was considered for the analysis. To study the monthly variations in population of a species, the maximum count of individuals during particular month at particular site was considered for the analysis of the selected 21 congregating bird-species. The survey team considered winter from October to December, late winter from January to March, summer from April to June and monsoon from July to September.

Chapter IV

Results

4.1 Monthly variations in the species diversity at select sites in the study area

The total number of species was estimated at each of the selected sites and species diversity was compared across the months.

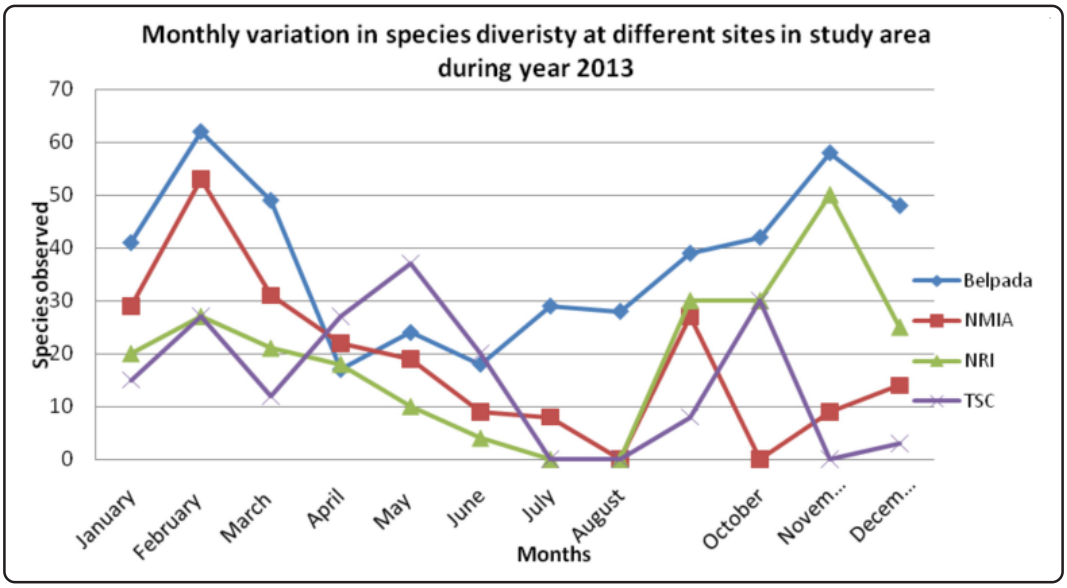


Figure 1: Changes in the species diversity at selected sites in study area

Waders and other migrants at Belapda wetland

4.1.1) Species diversity at Belpada Lake – The BNHS survey team recorded seasonal fluctuations in the population of birds; primarily due to the availability of water and habitat changes. A gradual increase in the species count was observed during the post-monsoon and early-winter period, and a decline during the summer season . The rise in the species count was due to the arrival of migratory populations wintering in this area, while the number of species had a sudden decline in the summer season, primarily because the rapid drying of the wetlands.

During monsoon, the water level in the wetland was very high about two metre and hence there were no birds. After heavy showers, wetlands were flooded with water and were seen inhabited by birds like coots, swamp hens and jacanas.The birds were seen congregating at this site mainly after September. The highest number of species (62) was recorded between January and March (Fig. 1).

4.1.2) TSC Wetland on the Palm Beach Road – Between June and October, the water level in this wetland was very high about one metre and hence very few birds were seen here. In October 2013 a huge mixed-flock of waders approximately 80,000 congregated at this

Mixed flock of waders in Flight at TSC wetland

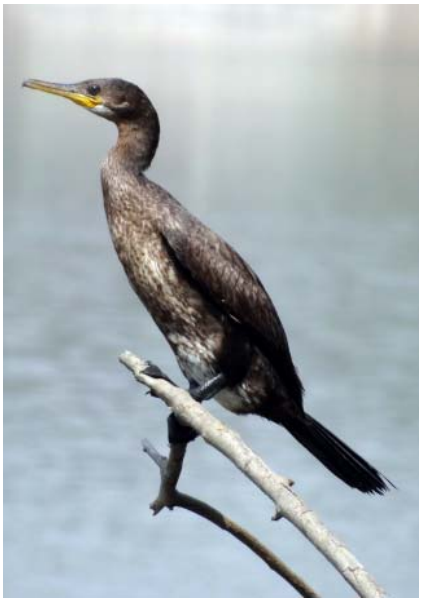
Waders in Flight at NRI Lake

site for a very short time, suddenly increasing the number and diversity of bird-species. The birds were seen using this as a stopover site during migration or before dispersing in the nearby areas. Barring this single instance, never again such huge congregation was seen at this site during the survey period. The survey team observed an increase with highest number of 37 species from January to March because of the water level in this wetland compared to monsoon was low (Fig. 1). Birds were seen using this site during high tide when the adjoining seashore and creeks get flooded with sea- water.

4.1.3) Wetland behind NRI Complex of Palm Beach Road – Here, the species-count was the highest about 50 species in winter and the lowest four species in monsoon. In November 2013, some species like Northern Pintail *Anas acuta*, Common Teal *Anas crecca* were observed using this wetland as a stopover site. Most of the species observed during this time were migratory and the site was used for resting by many birds during high tides. When the fishermen drained out water from these pools for fishing, a patch of mudflat was exposed or it remained under shallow water. The BNHS survey team observed that these patches of exposed mudflats attracted a large number and variety of birds for foraging, thereby occasionally increasing the bird population and species diversity of this site.

4.1.4) Proposed NMIA site – Species count was the highest about 53 species during early-summer period and the lowest nine species during winter (Fig. 1). It indicated that the birds used this area mainly during January to May when all other inland wetlands were dry.

4.2 Seasonal changes in the population of some congregating bird-species at selective sites in the study area



Indian Cormorant

1. ***Indian Cormorant or Indian Shag Phalacrocorax fuscicollis*** – It is a resident species found in Pakistan, Sri Lanka, and on the east up to Indo-China border (BirdLife International, 2014) and distributed throughout India but in Himalayas not seen beyond foothills (Ali and Ripley, 1983). Breeding season is variable, depending on the region, local water conditions and monsoon during July-February (Del Hoyo *et. al.*, 1992).

Indian Cormorant was reported as an uncommon species by Abdulali *(*1981), common by Monga (2003), and Prasad (2003) reported its breeding during rainy seasons at *Thane* and *Dombivali*.

In study area the survey team observed this species at all the wetlands along with other cormorant species. It was seen in inland as well as marine habitats, including lakes, mangrove creeks, rivers and tidal estuaries. This species was always observed foraging or resting on the edges of wetland and on mangroves. The population was very fluctuating throughout the year and congregation of hundred individuals was seen roosting at proposed NMIA site and a wetland near Sanjeevani School (Figure 2A, 2B). In February 2013 the survey team observed more than 500 individuals flying from Panvel Creek towards Palm Beach Road. In winter of 2013 the survey team had observed 500 individuals at NMIA site and about 100 individuals at wetland near Sanjeevani School. Later during the summer, the population decreased to 50 individuals at the proposed site of NMIA and no individuals were observed at Sanjeevani School wetland.

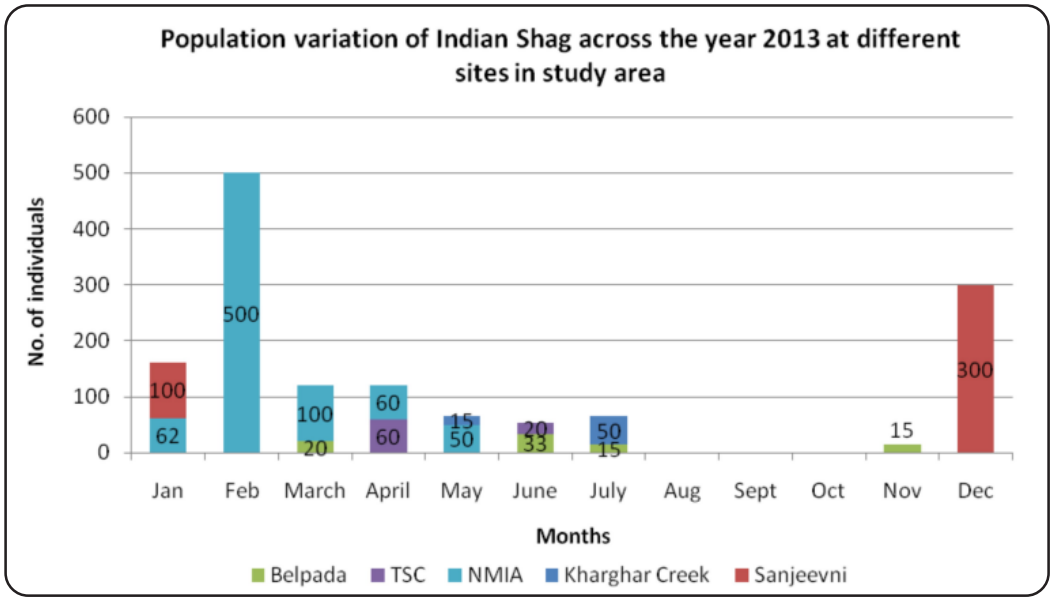


Figure 2A: Monthly variation in population of Indian Shag at various sites

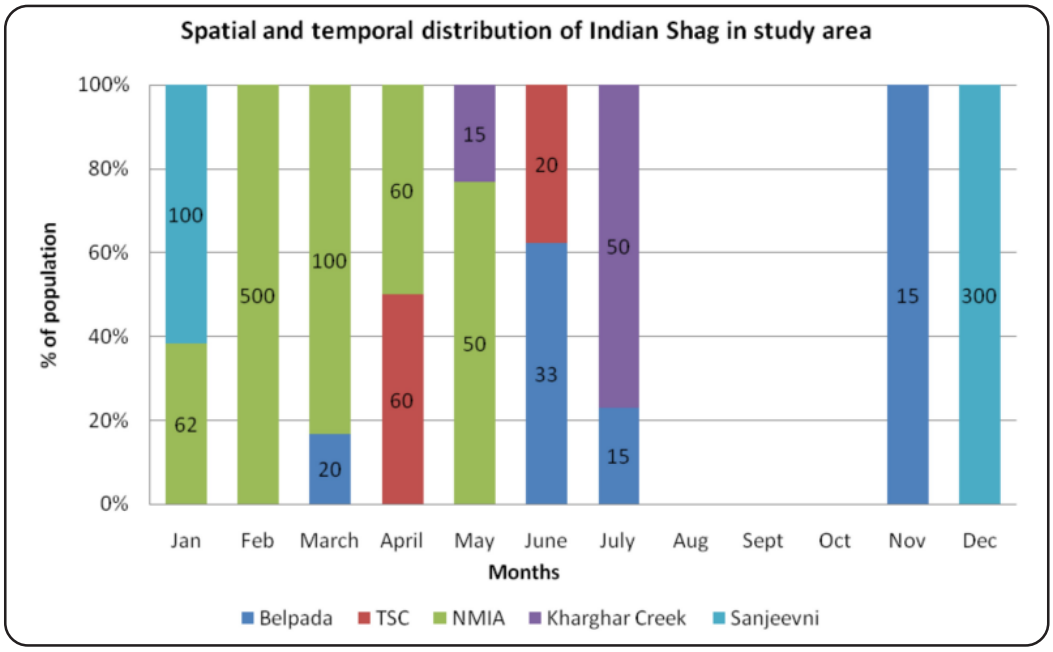
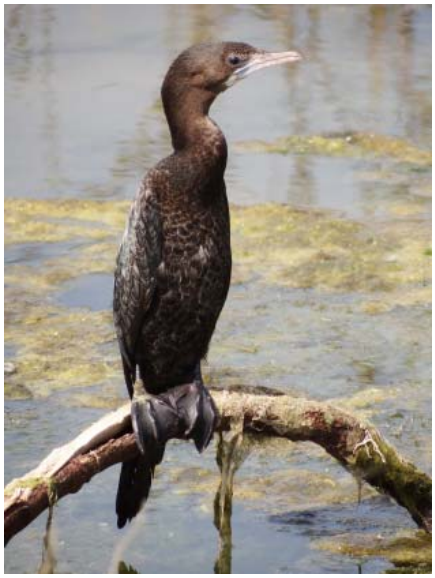


Figure 2B: Spatial and temporal distribution of Indian Shag in the study area

2. **Little Cormorant *Phalacrocorax niger*** – *It* is a resident bird, occurs from Indian and Indo-Chinese Subregion to Java (BirdLife International, 2014). Distributed throughout Indian subcontinent except the Himalayas (Ali and Ripley, 1983). Typically breeds in trees or bushes in flooded areas. Food mainly small freshwater fish, frogs and tadpoles. Feeds by diving and sometimes fishes co-operatively. Breeding season is very variable, depending on region, but mainly during June-August (Del Hoyo *et. al.* 1992).



Little Cormorant

It was reported as a common-flocking species (Abdulali, 1981). It is a fairly common resident and a local migrant with breeding records from November to February and April to September (Prasad, 2003), common in all over Mumbai (Monga, 2003) and frequently sighted at open water bodies at Mahul (Verma *et. al.* 2001-02).

The survey team observed this species throughout the year at all the wetlands, mangroves and creeks in the study area. The survey team observed this species either feeding on fishes or resting on the edges of wetland and in mangroves. The population fluctuated throughout the year and a population of hundreds was observed resting at proposed NMIA site. The survey team observed a population of 200 individuals at NMIA site during March and April 2013 and this count later decreased to as few as six individuals, in monsoon. Our team observed this species well distributed in all the wetlands during winter but in the summer all the individuals started congregating at Panvel and Kharghar creek area (Fig. 3A, 3B).

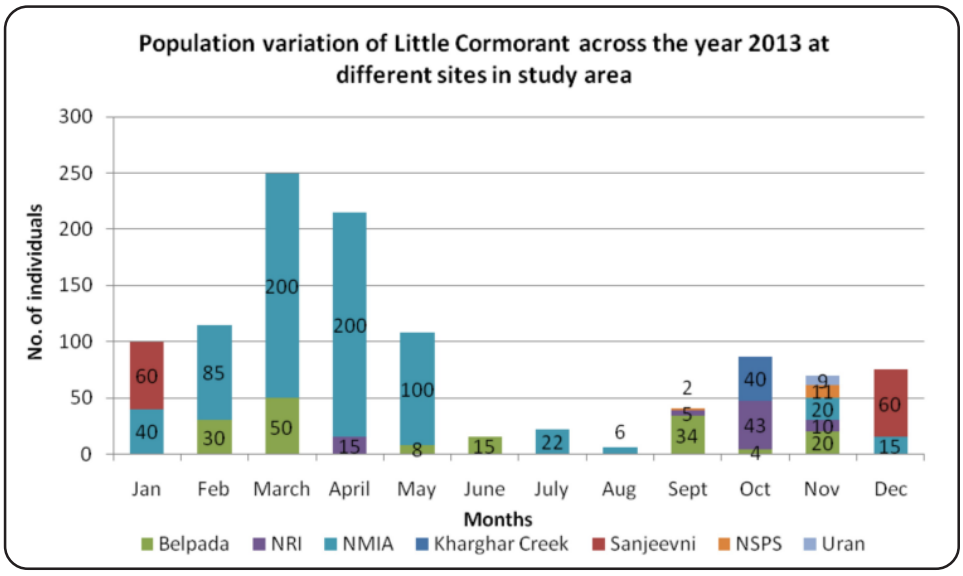


Figure 3A: Monthly variation in population of Little Cormorant at various sites

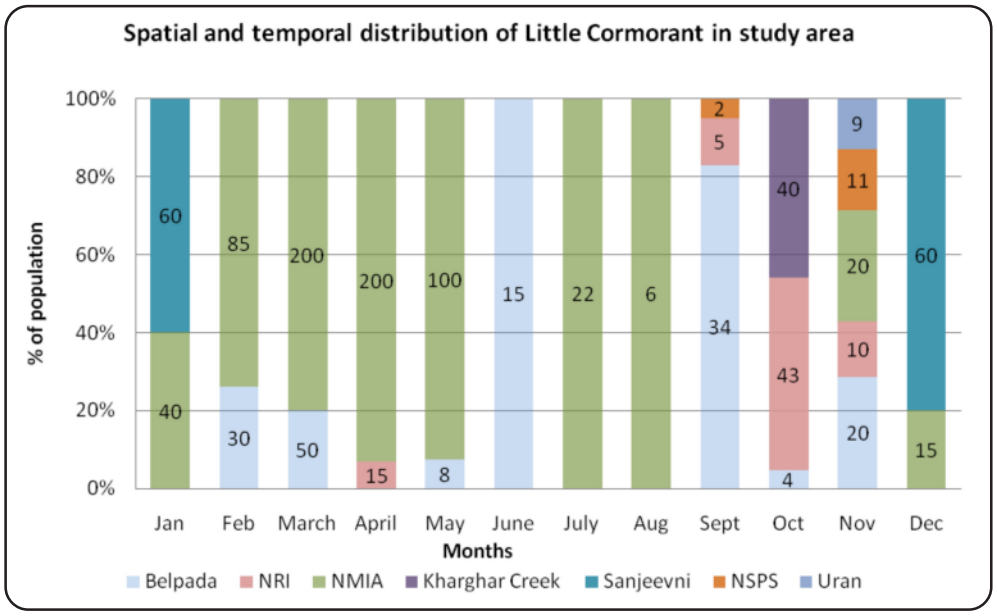


Figure 3B: Spatial and temporal distribution of Little Cormorant in the study area

3. **Eastern Cattle Egret *Bubulcus coromandus*** is a common resident bird**.** It occurs in the South and East Asia to Australia and New Zealand (Bird Life International, 2014). Distributed throughout Indian subcontinent (Ali and Ripley, 1983). Most populations of this species were reported to be making long-distance dispersive movements related to food resources in connection with seasonal rainfall (del Hoyo *et al.* 1992). The species breeds throughout the year in the tropics with different regional peaks (del Hoyo *et. al.* 1992) depending on food availability (Kushlan and Hancock 2005). Outside of the breeding season the species remains gregarious (Brown *et al.*1982, del Hoyo *et al.* 1992), feeding in loose flocks of 10-20 individuals (Brown *et al.* 1982) and often gathering in flocks of hundreds or even thousands of individuals where food is abundant (del Hoyo *et al.* 1992). Commonly seen with native grazing mammals or domesticated livestock (Kushlan and Hancock 2005) and following farm machinery to capture disturbed prey (del Hoyo *et al.* 1992).

Eastern Cattle Egret resting at Belpada

The species inhabits grasslands, livestock pastures, marshes, mangroves but rarely saline areas (Kushlan and Hancock 2005, del Hoyo *et al.* 1992). Its diet consists primarily invertebrates such as insects such as locusts, grasshoppers (del Hoyo *et al.* 1992, Kushlan 1984, Hancock and Kushlan 1984), frogs, tadpoles, molluscs, fish, lizards, small birds, rodents and vegetable also (del Hoyo *et al.* 1992).

It has been seen usually in flocks all over Mumbai and adjoining areas (Monga 2003, Abdulali 1981) reported as a local migrant (Prasad, 2003) and seen in agricultural land, aquatic grass and marshy places at Mahul (Verma *et. al.* 2001-02).

During the survey the team observed this species as a common and distributed throughout the study area. Congregation of 30-50 individuals was often observed at Belpada Lake; primarily because of the garbage dump in the vicinity of the wetland. There was no major fluctuation in population of this species in the study area except in May 2013 where we observed only 6 individuals as the birds might have moved outside the study area for breeding or foraging (Fig. 4A, 4B).

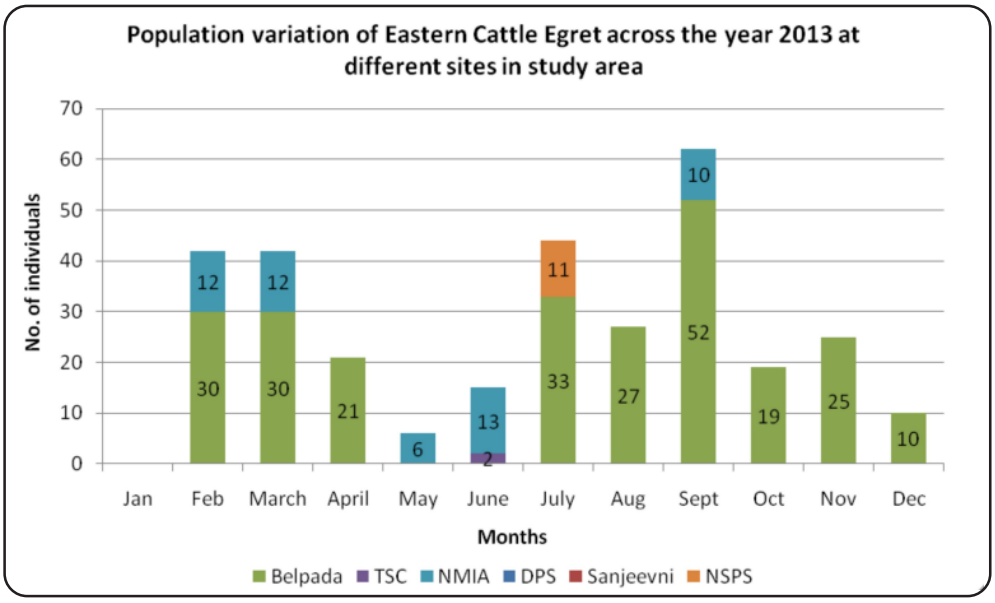


Figure 4A: Monthly variation in population of Eastern Cattle Egret at various sites

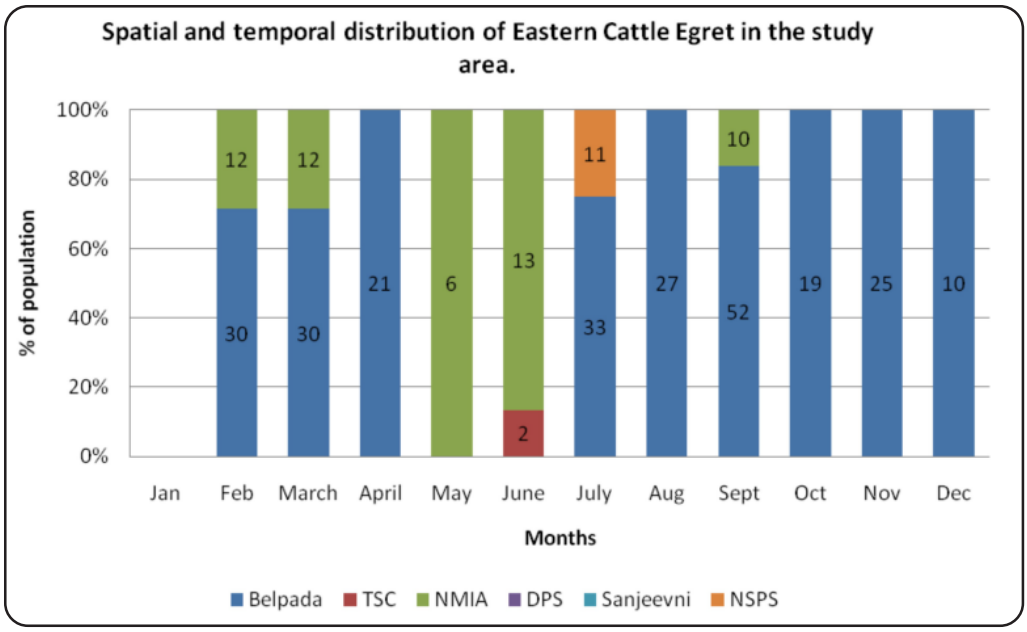


Figure 4B: Spatial and temporal distribution of Eastern Cattle Egret in the study area

4. **Painted Stork *Mycteria leucocephala*** is a near threatened (NT) species as per the International Union for Conservation of Nature (IUCN) Red List. Once it was common but now scarce in Pakistan, a rare summer visitor in Nepal terai, a straggler to the coastal regions of Bangladesh, locally abundant in Sri Lanka, rare and possibly extinct in China, rare in Myanmar, on verge of extinction in Thailand, rare in Laos and Vietnam, resident in Cambodia with over 4-5,000 pairs, vagrant in Peninsular Malaysia (BirdLife International, 2014). Widespread and common resident in the plains of Indian Union, except Andaman and Nicobar Islands (Ali & Ripley 1983). There are an estimated 15,000 individuals in the south Asia and fewer than 10,000 in the south-east Asia (Perennou *et. al.* 1994), with populations declining throughout. It frequents freshwater marshes, lakes and reservoirs, rice paddies, river banks, intertidal mudflats and salt-pans. Breeding season is post winter to monsoon.

Painted Stork

According to Abdulali (1981) it was an uncommon flocking species and (Prasad, 2003) noted it as a local migrant in Mumbai.

The survey team observed this species roosting in group of hundreds at Belpada and NRI Lake and foraging in wetlands, mudflats and seashore. The team also observed the population varying at different sites depending on the season and water level in the wetland (Figure 5A, 5B). A congregation of about 100-150 individuals was observed at Belpada Lake and NRI Lake during the winter of 2013 and in the summer the population was four individuals, because of drying of the wetlands during the summer. During the summer months, a few individuals were observed scattered at different sites and in the mangroves behind Belpada Lake and NRI Lake on Palm Beach Road. Post monsoon the survey team observed a few juveniles along with adults in a group at Belpada Lake.

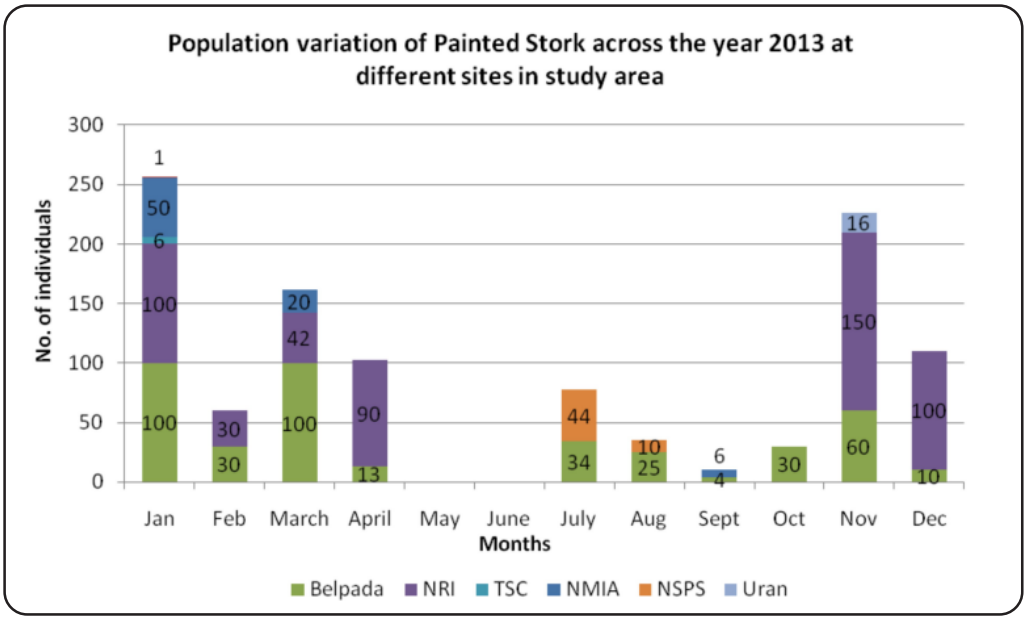


Figure 5A: Monthly variation in population of Painted Stork at various sites

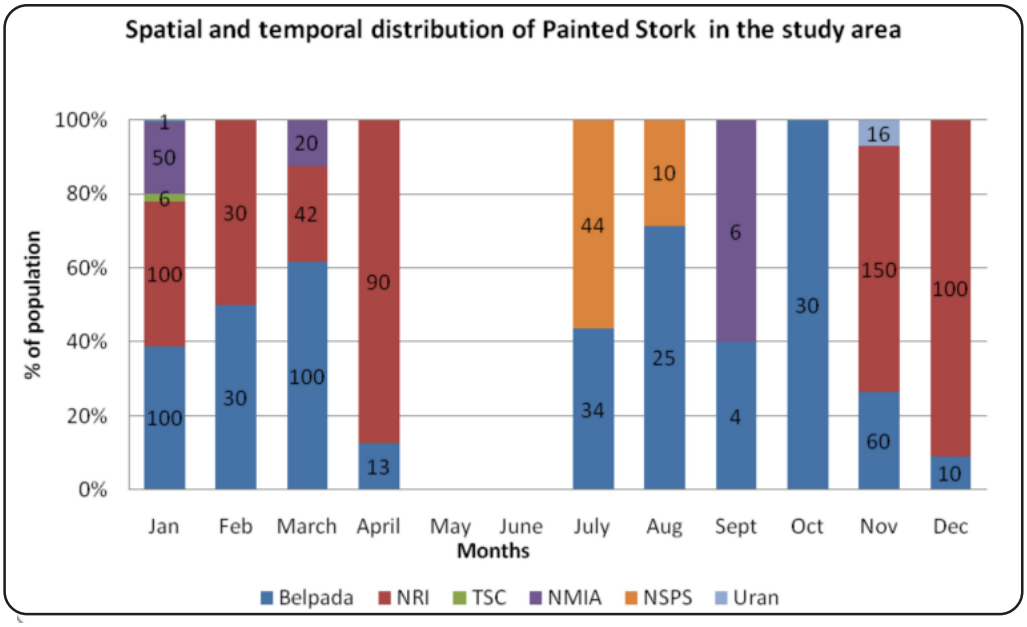


Figure 5B: Spatial and temporal distribution of Painted Stork in the study area

5. **Black-headed Ibis *Threskiornis melanocephalus*** is a near threatened (NT) species as per the International Union for Conservation of Nature (IUCN) Red List. It is a wide spread species in South and South East Asia, occurs in China, Pakistan, Hong Kong, Nepal, Sri Lanka, Vietnam, Philippines, Cambodia, Malaysia, Bangladesh, and Indonesia (Bird Life International, 2014), and distributed throughout India (Ali & Ripley, 1983).

Flock of Black-headed Ibis in mudflats interspersed with Mangroves in Uran

It was earlier reported as a local migrant and uncommon (Abdulali, 1981). Breeding was recorded from Deccan Maharashtra during late winter to summer (Prasad, 2003) and it was usually seen in aquatic grass, creeks and mangroves at Mahul (Verma *et. al.* 2001-02).

The survey team observed it as a very common species at all the water bodies in the study area in small flocks of four to five individuals at all the sites. The species inhabits marshes, lakes, rivers, paddy fields, tidal creeks, mudflats and mangroves tending to be nomadic in response to water levels and feeding conditions. The team often observed 10-15 individuals resting at the proposed NMIA site and feeding at seashore, creeks, mudflats and inland water bodies. The team also observed the population fluctuating during different season but 20-30 individuals were observed at Belpada in March 2013 and 30-40 individuals was seen at propose NMIA site. In May 2013 the team recorded a sharp decline in the population and no individuals were observed, possibly because the population shifted outside the study area for breeding (Figure 6A, 6B).

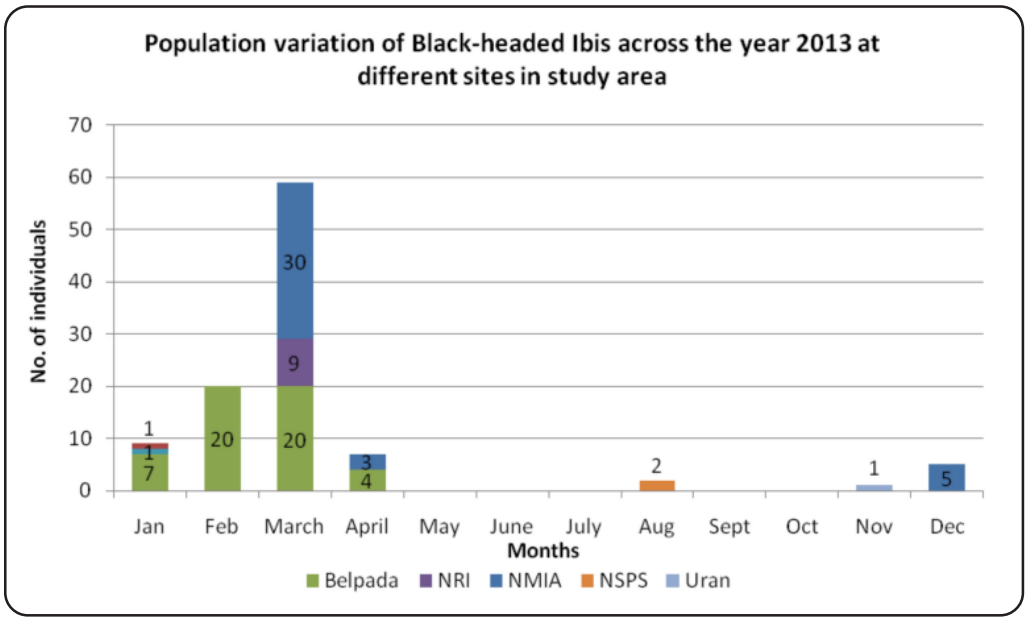


Figure 6A: Monthly variation in population of Black-headed Ibis at various sites

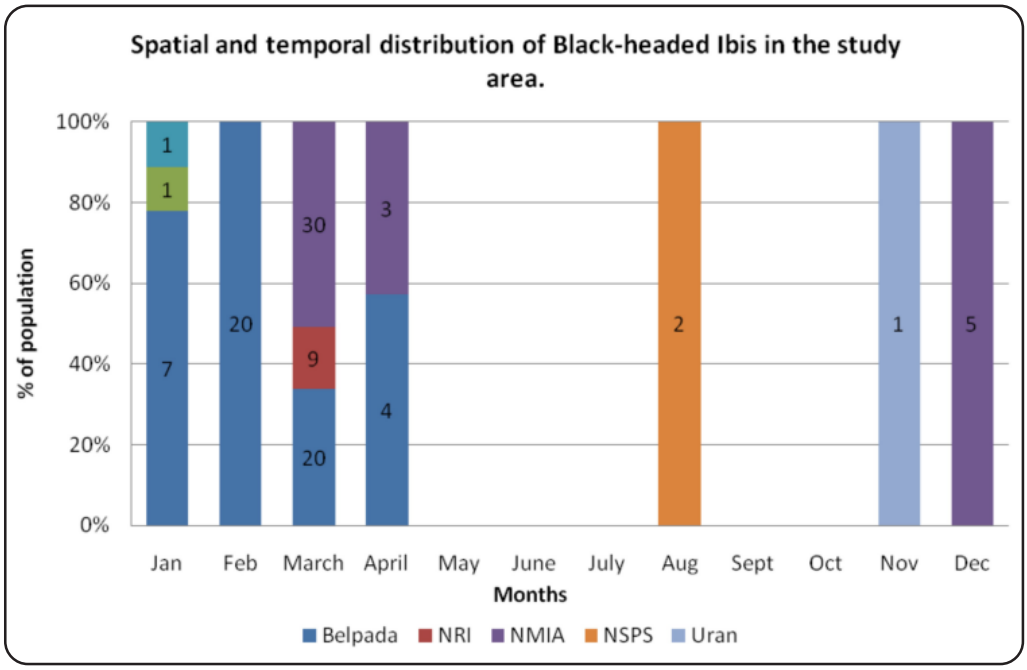


Figure 6B: Spatial and temporal distribution of Black-headed Ibis in the study area

6. **Eurasian Spoonbill *Platalea leucorodia*** is a common resident bird, occurs from South Spain, Holland and South East Europe to Central & Eastern Asia, Persian Gulf, Sri Lanka, West-East Africa and South East China (BirdLife International, 2014). In India partly resident and nomadic, distributed throughout India, plains and plateau country (Ali & Ripley, 1983). **T**he breeding population in Palearctic (Euro-Siberian) region is fully migratory (del Hoyo *et al.* 1992) but may only travel short distances (Snow and Perrins 1998) while other populations are resident and nomadic (del Hoyo *et al.* 1992). Congregation up to 100 individuals (Hancock *et al.* 1992) was seen foraging gregariously. It is most active during the morning and evening but in coastal areas it forages at low tide regardless of the time of day (Hancock *et al.* 1992).

These birds found in shallow (del Hoyo *et al.* 1992) wetlands of less than 30 cm deep with mud generally avoiding waters with rocky substrates, thick vegetation or swift currents (Hancock *et al.* 1992). Its food consists of adult and larval insects, molluscs, crustaceans, worms, tadpoles and small fish (del Hoyo *et al.* 1992, Hancock *et al.* 1992).

Eurasian Spoonbills at Belpada wetland

In Mumbai and around, it was recorded as occasional, local migrant and flocking species (Abdulali, 1981). It was recorded as an uncommon resident, with breeding records from Deccan Maharashtra from January to May (Prasad, 2003). They were also observed in mixed flock with Painted Storks *Mycteria leucocephala* (Sarkar, 2008).

The survey team observed this species mostly feeding while walking and sweeping the partly open bill from side to side. They were often observed in compact flocks of 30-40 individuals at Belpada. This species was present during winter and summer in the study area but only few individuals were seen during monsoon. The team regularly saw the individuals roosting and feeding in the flocks of hundreds. During the winter 200-250 individuals were observed at Belpada Lake and in the summer, no individuals were observed because of the lack of water in the lake. In summer the birds shifted to NRI Lake, TSC lake and the wetlands at the proposed site of NMIA (Fig. 7A,7B).

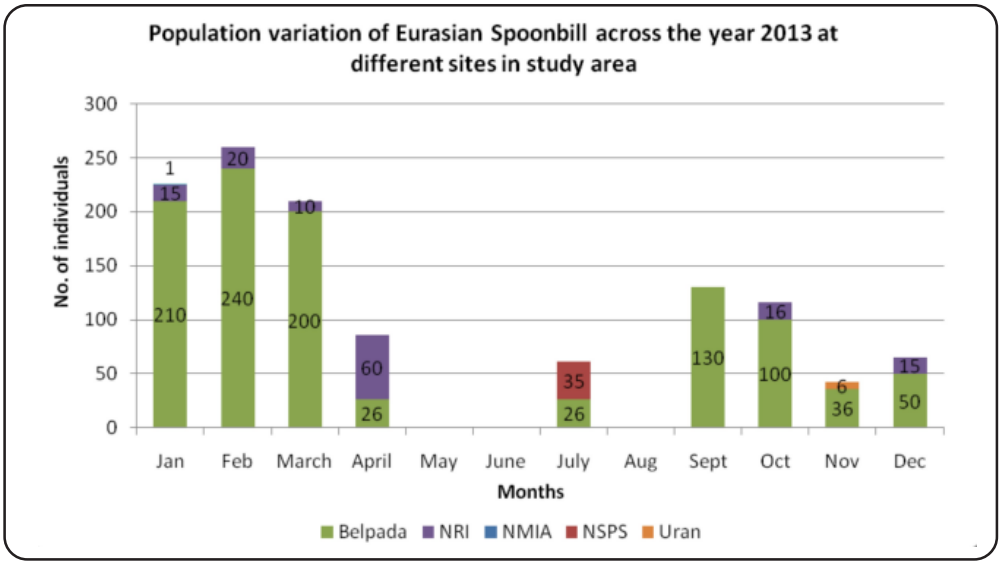


Figure 7A: Monthly variation in population of Eurasian Spoonbill at various sites

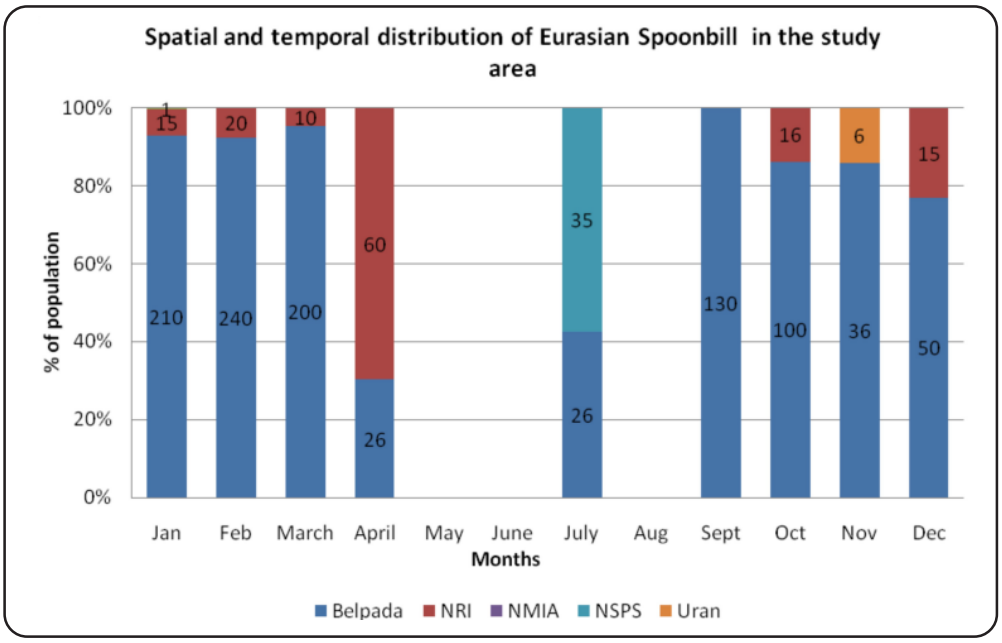


Figure 7B: Spatial and temporal distribution of Eurasian Spoonbill in the study area

7. **Lesser Flamingo *Phoeniconaias minor*** – It is a near threatened (NT) species as per the International Union for Conservation of Nature (IUCN) Red List of Threatened Species. This species has major distribution in Africa and South Asia and it breeds mainly in the Rift Valley lakes of East Africa in Ethiopia, Kenya and Tanzania with population of about 1.5-2.5 million birds (Delany and Scott 2006). Three smaller breeding congregations occur in West Africa, in southern Africa and in Asia, in India and Pakistan (BirdLife International, 2014). Approximately 3, 90,000 birds occur in the Rann of Kutch in north-western India (Delany and Scott 2006). It is distributed in North-west India in Rajasthan, Gujarat and Western Gangetic plains with some stray records of specimen collection from Mumbai, Maharashtra; Hyderabad, Andhra Pradesh, and Odisha (Ali & Ripley 1983).

Lesser Flamingo congregation in thousands at NRI Lake

This species makes extensive movements in response to adverse environmental conditions (del Hoyo *et. al.* 1992, Borello *et. al.* 1998, L. Bennun in litt. 1999, McCulloch *et. al.* 2003, Childress *et. al.* 2007). The Asian and southern African populations are partially migratory, with many making regular movements from their breeding sites inland to coastal wetlands when not breeding (McCulloch *et. al.* 2003, Jadhav and Parasharya 2004). The species breeds in huge colonies of many thousands of pairs often mixed with Greater Flamingo *Phoenicopterus roseus* (del Hoyo *et. al.* 1992). The timing of breeding is irregular and varies geographically depending on the timing of the rains (Brown *et. al.* 1982). It feeds almost entirely on microscopic blue-green algae and benthic diatoms found only in alkaline lakes, salt pans (del Hoyo *et. al.* 1992). To a lesser extent, the species will also take small aquatic invertebrates such as rotifers (del Hoyo *et. al.* 1992).

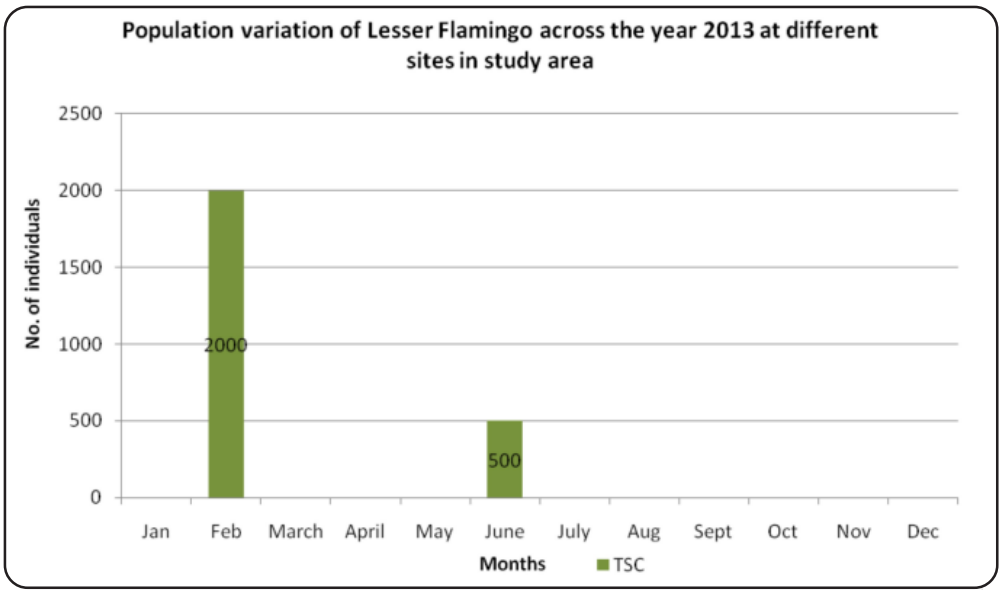


Figure 8A: Monthly variation in population of Lesser Flamingo at various sites

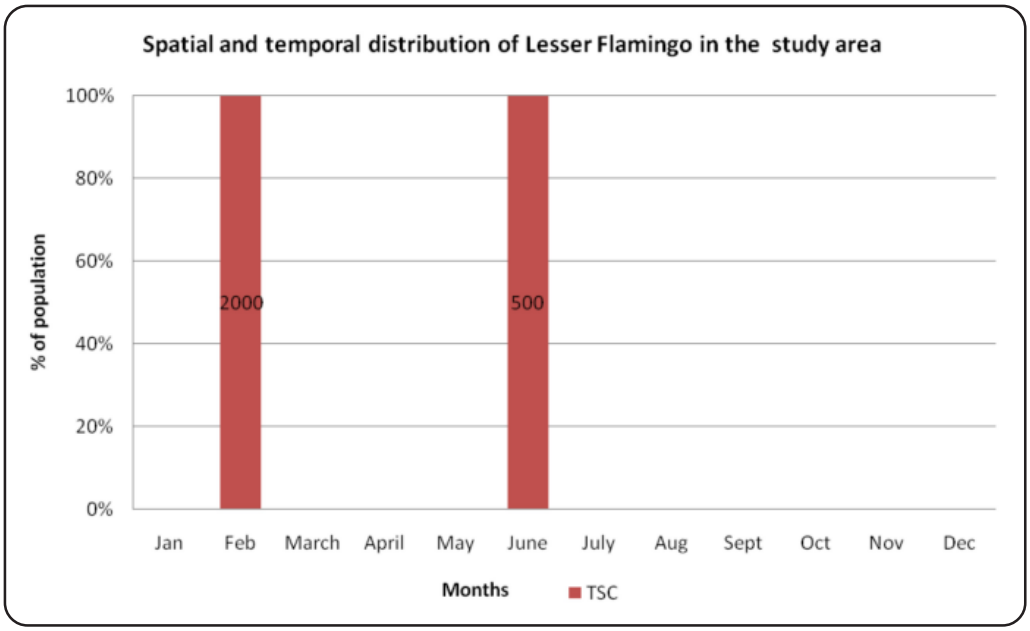


Figure 8B: Spatial and temporal distribution of Lesser Flamingo in the study area

Earlier in Mumbai and adjoining regions, it was reported as stray or vagrant and a flocking species (Abdulali, 1981). It was recorded in large numbers and regular near Mumbai (Prasad, 2003) and between 2000 and 2002 there were records from Sewri , Uran, and Thane creek of flocks of up to 3,000 birds (Monga, 2003). Thousands of Flamingos were sighted on the mudflats of Sewri during low tide in the April in 1984 (Sowrirajan, 1994). A flock of about 20,000 individuals of Greater and Lesser Flamingo was sighted at Sewri (Woodward, 2007).

The survey team observed it in the huge flocks of about 5,000-6,000 individuals foraging on the seashore alongside Palm Beach Road, mainly during late-winter and summer in 2013 The same birds were observed roosting in the wetland at NRI Lake and the wetland behind TSC on the Palm Beach Road (Figure 8A, 8B) during high tide period.

8. **Northern Pintail *Anas acuta*** – It is a winter migrant species, found in all Nearctic (North America, Greenland, Mexico) and Palearctic (Euro-Siberian) regions. The breeding period is between July and August (Scott and Rose 1996) after which flocks move southwards to winter during August onwards (Madge and Burn 1988, Scott and Rose 1996). The species is highly gregarious in winter and during migration often forming enormous concentrations (Madge and Burn 1988, Scott and Rose 1996). The size of flock depends on the size of the wetland (Snow and Perrins 1998). During winter found throughout the India (Ali & Ripley, 1983). During the winter it frequents large inland lakes (Scott and Rose 1996). This species is opportunistic feeder (Johnsgard 1978) and omnivorous that means feed on animal as well as plant materials (del Hoyo *et al.* 1992).

According to Abdulali (1981) it is a flocking species and Prasad (2003) recorded it from Borivali; a northern suburb of Mumbai, where it was mostly seen in salt-pans and open water bodies at Mahul (Verma *et. al.* 2001-02). Abdulali & Ali (1981) reported this bird in small numbers in Mumbai area.

Northern Pintail at Belpada

The survey team observed this duck-species at Belpada Lake and NRI Lake, but in the summer a few individuals were also observed at Panvel creek near the proposed site for NMIA, as the water in inland wetlands dried. This species started arriving in the October in the study area and In October 2013, the survey team counted 50 individuals at Uran and 10 individuals at Belpada Lake. In the following months there was an increase in the population, and the team saw about 300 individuals at NRI Lake in November 2013. This flock later moved to Belpada Lake. After February 2013 the population declined to about 50 individuals at Belpada Lake and a few birds were observed resting at Panvel creek. In the summer, the population declined as the birds started migrating back to the breeding grounds and the team did not record any individuals during April to September (Figure 9A, 9B).

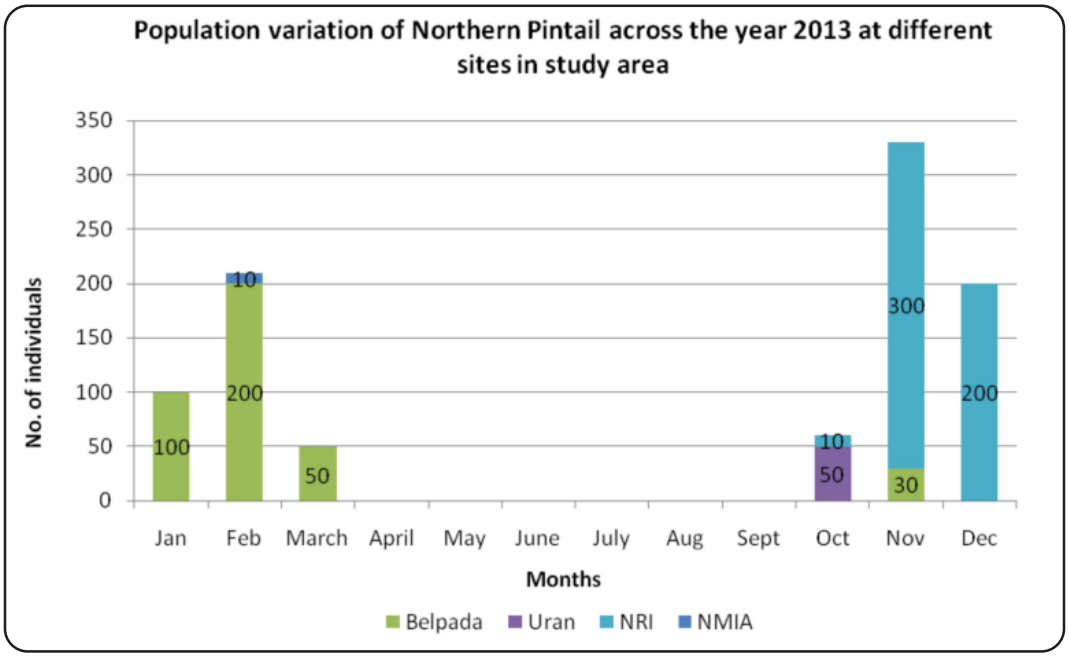


Figure 9A: Monthly variation in population of Northern Pintail at various sites

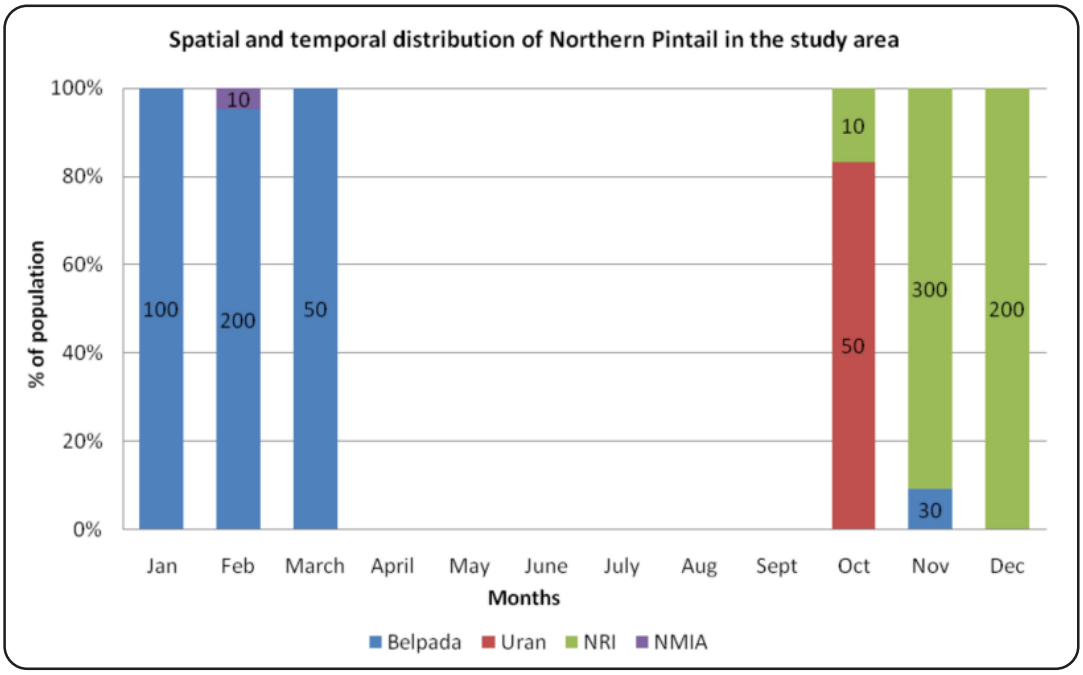


Figure 9B: Spatial and temporal distribution of Northern Pintail in the study area

9. **Common Teal *Anas crecca*** – It is a migratory species found in most of North and Central Palearctic (Euro-Siberian) region (BirdLife International, 2014), throughout the India in winter (Ali & Ripley, 1983). The breeding season is from May onwards (Madge and Burn 1988) and southward migration occurring between October and November (Scott and Rose 1996). It starts returning from the wintering ground late-February onwards (Scott and Rose 1996). During winter the species forms large concentrations, with large flocks of 30-40 and sometimes hundreds of individuals gathering at winter roosting sites (Brown *et al.* 1982, Madge and Burn 1988). Species frequents marsh and lake habitats with high productivity and abundant vegetation (Brown *et al.*1982, Kear 2005b) as well as artificial reservoirs (Snow and Perrins 1998). During winter the species mainly takes the seeds of aquatic plants (del Hoyo *et al.* 1992) grasses and agricultural grain (del Hoyo *et al.* 1992, Kear 2005b). In India this duck species is found throughout the region (Ali & Ripley, 1983).

Common Teal at Belpada wetland

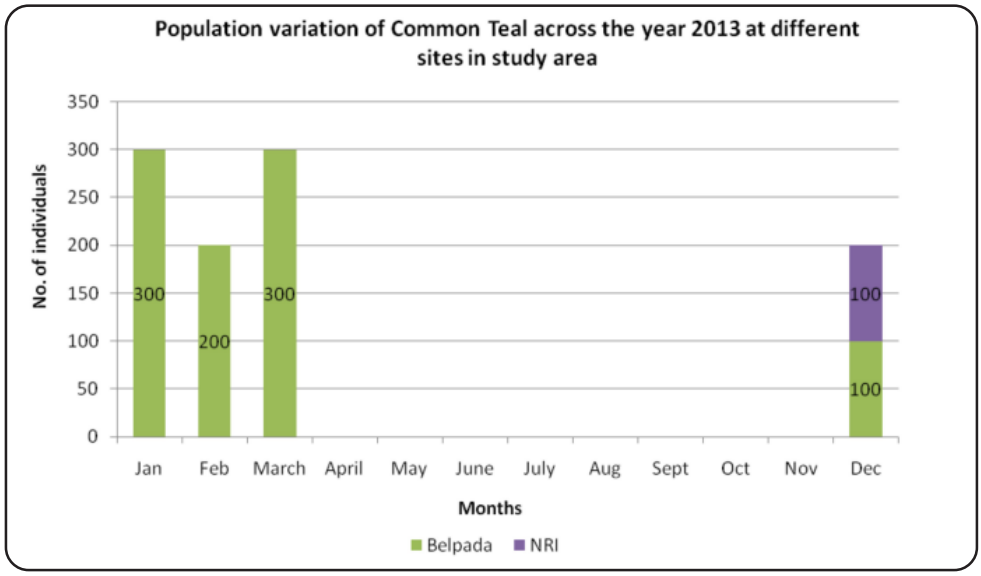


Figure 10A: Monthly variation in population of Common Teal at various sites

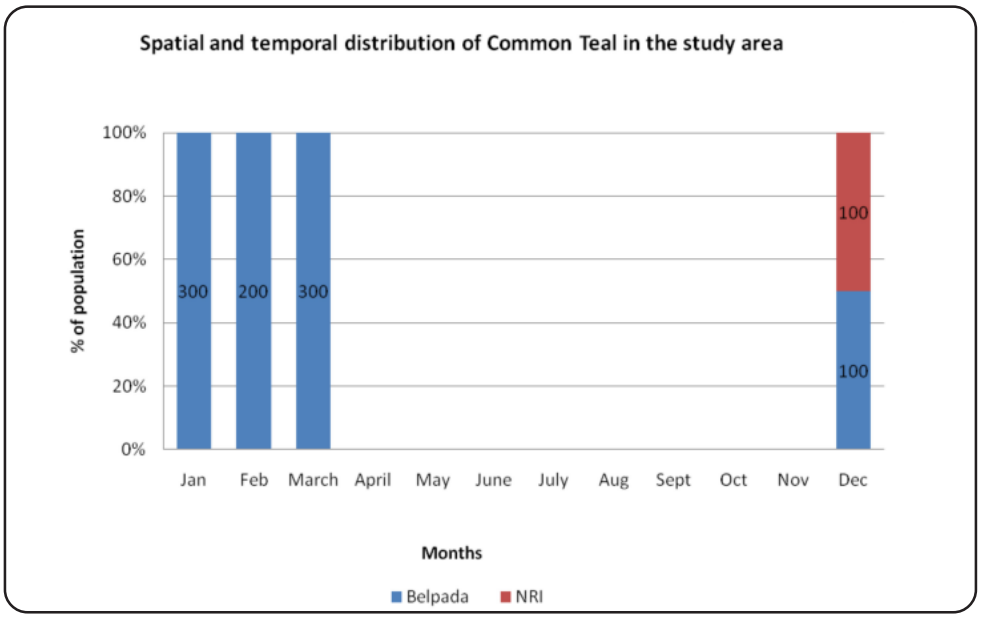


Figure 10B: Spatial and temporal distribution of Common Teal in the study area

Earlier it was from Mumbai region as a flocking species (Abdulali, 1981). It was seen throughout the Western Maharashtra and adjoining areas (Prasad, 2003) and it was mostly seen in salt-pans and open water bodies at Mahul (Verma *et. al.* 2001-02).

The survey team observed it from January to March in the study area albeit restricted to Belpada Lake and NRI Lake. Thes ducks were seen resting and foraging along with the other duck species at Belpada Lake. In the summer of 2013 the population declined as the birds started migrating to the breeding grounds and the survey team did not observe any individuals between April and November (Figure 10A, 10B).

10. **Northern Shoveler *Anas clypeata*** – It is a winter migrant species, occur from most of Nearctic (North America, Greenland and Mexico), Palearctic (Euro-Siberian) regions (BirdLife International). In India this duck species found in winter all over the region (Ali & Ripley, 1983). It arrives on the breeding grounds from mid-April to June, (Madge and Burn 1988, del Hoyo *et. al.* 1992). The species forages diurnally and roosts communally at night (Brown *et. al.* 1982). Suitable habitats include well-vegetated lakes and marshes and with muddy shores and substrates in open country (Madge and Burn 1988, del Hoyo *et. al.* 1992, Kear 2005, Johnsgard 1978, Brown *et. al.* 1982). It also frequents artificial waters (Snow and Perrins 1998), tidal mudflats (del Hoyo *et. al.* 1992, Kear 2005b), estuaries (Madge and Burn 1988). Its food consists of small aquatic invertebrates such as adult and larval insects (del Hoyo *et. al.* 1992, Johnsgard 1978, Brown *et. al.* 1982).

Ducks resting at Belpada

According to earlier records from Mumbai and adjoining areas, it is a flocking species (Abdulali, 1981). It was recorded in very small numbers around Mumbai during 2000-02 (Prasad, 2003), however seen regularly near wetlands at Uran in 2008 (Sarkar, 2011).

The survey team observed this duck species in Belpada Lake and NRI Lake during January to March period. In winter, October to December a few individuals were also observed at Kharghar and Panvel creek. These birds started arriving in winter in the study area. The survey team counted 50 individuals at NRI Lake, in October 2013, and in the later months, a gradual increase in the population was recorded, and around 100 individuals were seen. The team estimated 150 individuals resting and foraging along with the other duck species at Belpada Lake. In the summer the population started declining as the birds migrated to the breeding grounds. No individuals were observed from April to September 2013 (Fig. 11A, 11B) in the study area.

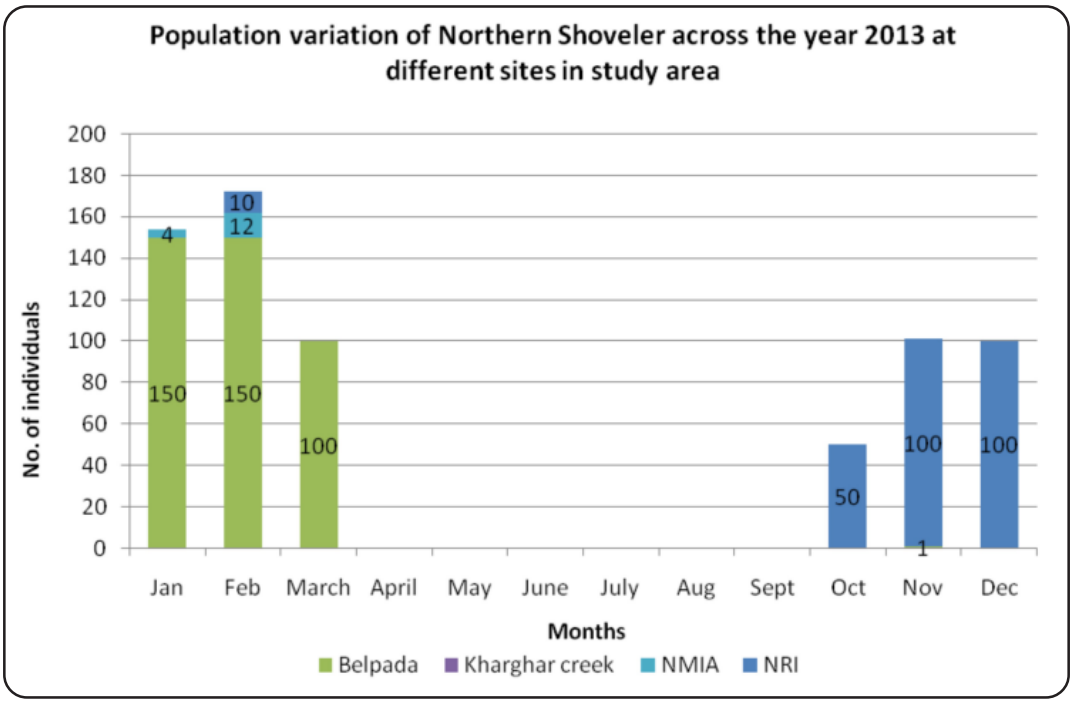


Figure 11A: Monthly variation in population of Northern Shoveler at various sites

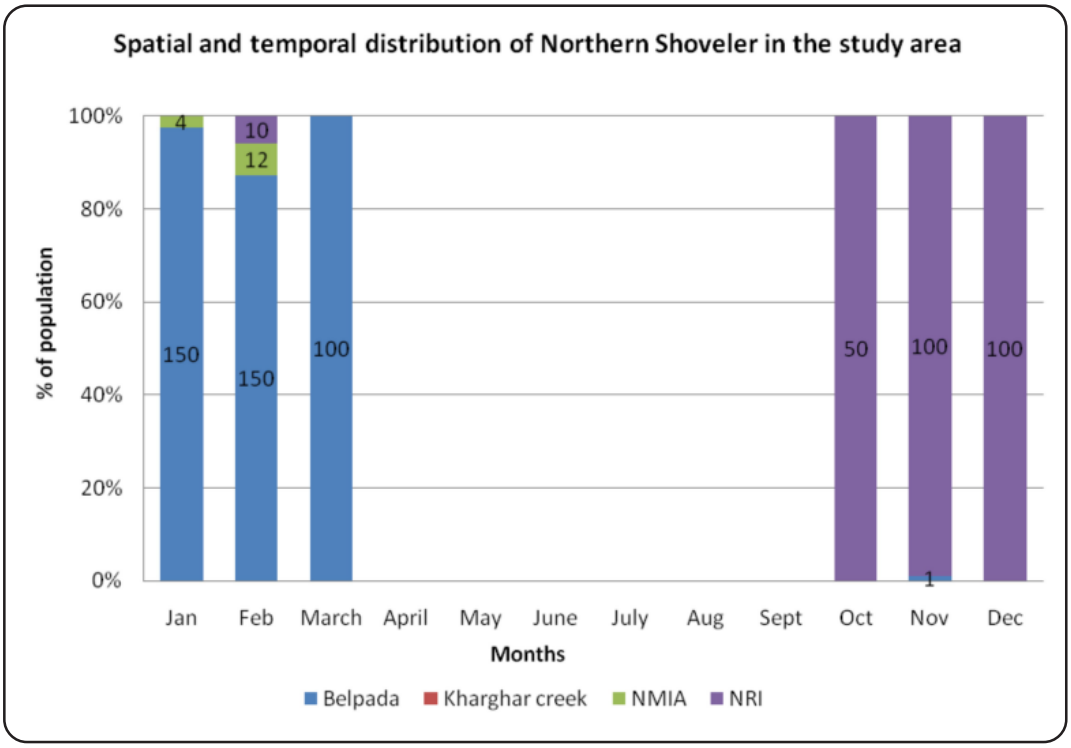


Figure 11B: Spatial and temporal distribution of Northern Shoveler in the study area

11. **Eurasian Coot *Fulica atra*** – It is a local migratory species found in Europe, North Africa, Central Asia to Japan and South to Indian Sub continent and Sri Lanka. Wintering to South to West & North-East Africa, South-East Asia and Philippines (del Hoyo *et al.* 1996)**.** In India this species found throughout the region during winter season (Ali & Ripley, 1983). Most populations in warm and temperate regions are resident (del Hoyo *et al.* 1996), often making nomadic dispersive movements according to changing water levels and seasonal rainfall (Urban *et al*. 1986, del Hoyo *et al.* 1996). Southward movements occur from mid-August to November (Taylor and van Perlo 1998), with the return passage occurring from late-February (Taylor and van Perlo 1998) to May (del Hoyo *et al.* 1996). The species shows a preference for shallow water with adjacent deeper water of more than 2 meters for diving (Taylor and van Perlo 1998), and muddy substrates, marginal, emergent, floating or submerging vegetation (del Hoyo *et al.* 1996, Snow and Perrins 1998, Taylor and van Perlo 1998). This species is omnivorous, although its diet consists primarily of vegetable matter (del Hoyo *et al.* 1996).

Eurasian Coot

Previous records from Mumbai and adjoining areas mentioned it as an occasional migrant and a flocking species (Abdulali, 1981), breeding was recorded from Mahalaxmi, Mumbai from July to December (Prasad, 2003).

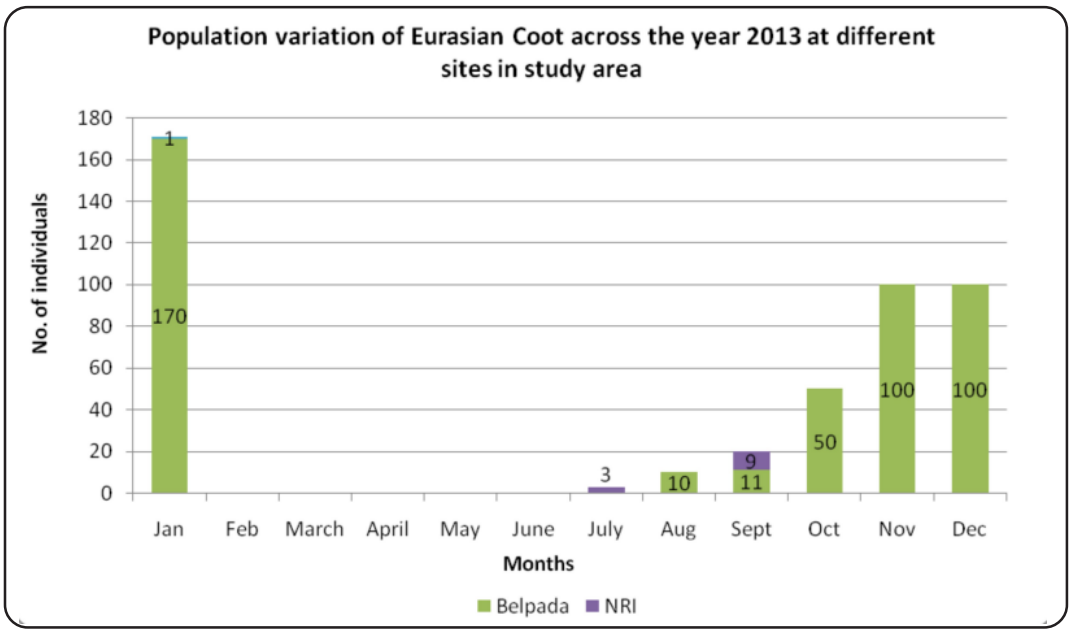


Figure 12A: Monthly variation in population of Eurasian Coot at various sites

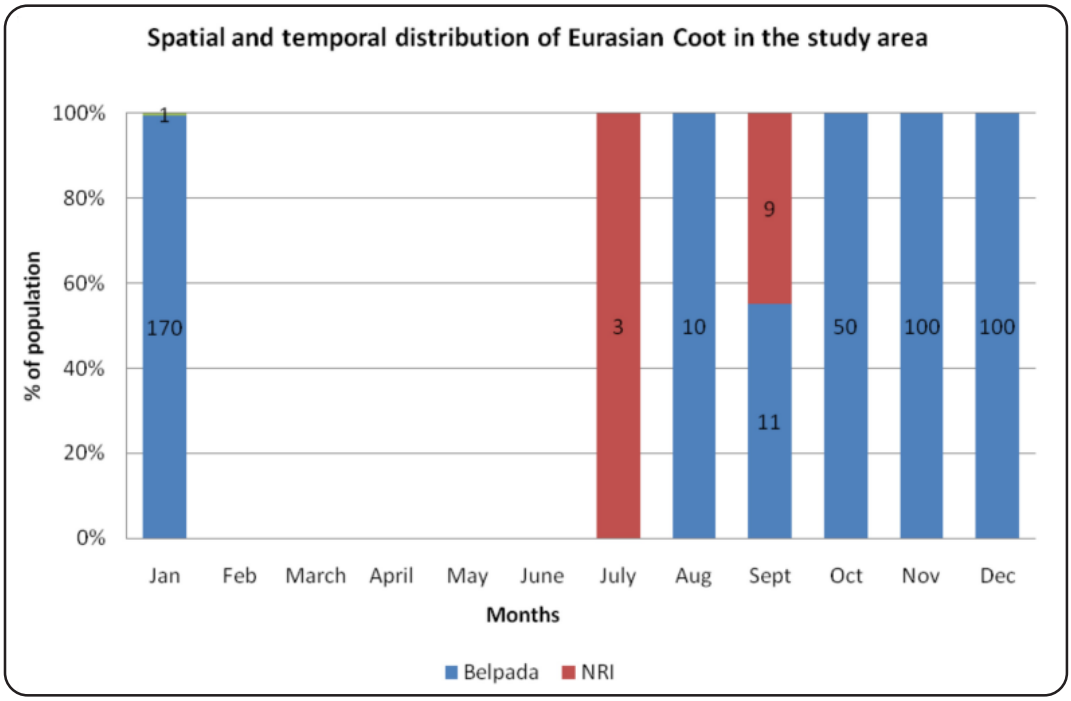


Figure 12B: Spatial and temporal distribution of Eurasian Coot in the study area

The survey team observed this species mainly at Belpada Lake and only a few individuals were sighted at NRI Lake on Palm Beach Road. The team observed an increasing trend in the population from the July to December of 2013. In July only three individuals were seen at NRI Lake but later in August 10 individuals were seen and this population increased to 100 individuals in December 2013. No birds were observed from February to June, because of the local migration. The survey team observed a few juveniles along with adults between August and September (Figure 12A,12B).

12. **Lesser Sand Plover *Charadrius mongolus*** is a migratory species distributed from Central Asia and Siberia wintering in South-East Africa to India. Subspecies *Charadrius mongolus atrifrons* Wagler 1829, is found in Himalayas and Southern Tibet (del Hoyo *et. al.* 1996). It arrives to India, South Arabia and East Africa in early August to mid September from its breeding grounds in central Siberia (del Hoyo *et. al.* 1996). The breeding population in Himalayas and southern Tibet winters in a range or areas from India to Sumatra (Hayman *et. al.* 1986), returning to its breeding grounds between late-February to April (del Hoyo *et. al.* 1996). Within Indian limits it is common winter visitor to the coastal India (Ali & Ripley 1983) and it breeds in high Himalayas in parts of Ladakh, Lahul and Sikkim.

Lesser Sand Plover at Uran

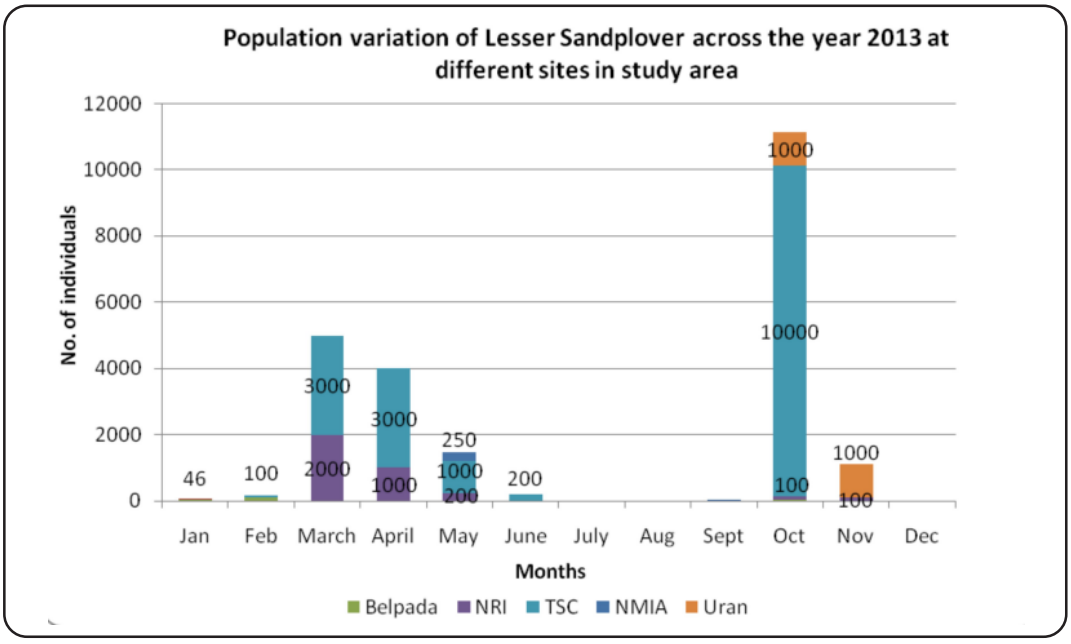


Figure 13A: Monthly variation in population of Lesser Sand Plover at various sites

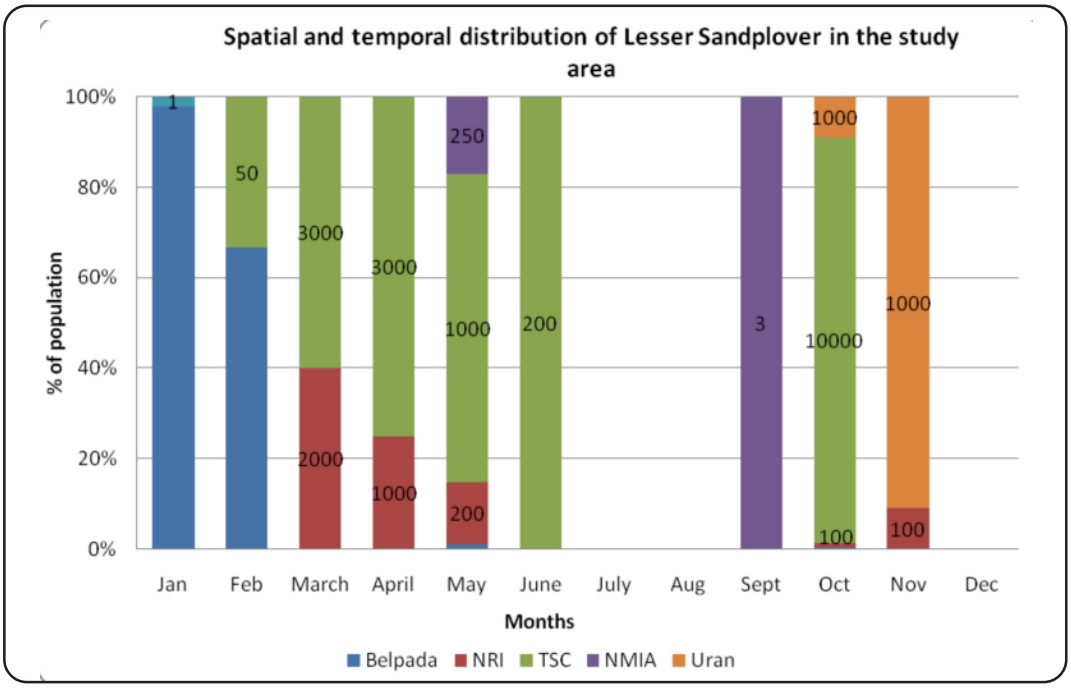


Figure 13B: Monthly variation in population of Lesser Sand Plover at various sites

Over-wintering birds can be found throughout the year in their wintering grounds (Hayman *et. al.* 1986, del Hoyo *et. al.* 1996). The species is mainly observed in coastal regions during the non-breeding season, preferring sandy beaches, mudflats of coastal bays and estuaries, sand-flats and dunes near the coast (Urban *et. al.* 1986, del Hoyo *et. al.* 1996), occasionally frequenting mangrove mudflats.

Previous records from Mumbai and adjoining areas report it as stray or vagrant (Abdulali, 1981), as a common winter visitor along the coast, rare inland (Prasad, 2003). The earliest migration was recorded in August (Stairmand, 1969) and latest till March (Ali & Abdulali, 1939). Regular sightings were recorded from Sewri mudflats; on the eastern cost of Mumbai (Woodward, 2007) and Mahul (Verma *et. al.* 2001-02).

The survey team observed this species very commonly in the study area, often seen resting in the inland water bodies during high tide and flying towards seashore for foraging during low tide. This species was observed arriving in the study area in October. A population of 10,000 individuals was observed for a week at Wetland behind TSC in October 2013 and later, a stable population of 1500-2500 individuals was seen at NRI Lake, TSC Wetland, and the adjoining seashore areas. The survey team assumed that some of the birds used the TSC Wetland as a stopover site during migration (Figure 13A, 13B). During summer, the population started declining as the birds started their return journey from March end .

13. **Common Redshank *Tringa tetanus*** – It is a winter visitor, occurs from North Siberian region, North Italy, Tunisia and Turkey and East to West Siberia; winters from Mediterranean to tropical Africa, India and Indonesia (BirdLife international, 2014). Winter visitor to India and recorded from all over India except Andaman and Nicobar Islands (Ali & Ripley 1983). Breeding period of Common Redshank is from March to August (Hayman *et. al.* 1986). Arrive in wintering grounds from June to October, and return passage occurs between February and April (Hayman *et. al.* 1986). It forages singly or in small groups (del Hoyo *et. al.* 1996) or occasionally in larger flocks of up to 300 individuals, especially at roosting sites. In winter, it is largely coastal (del Hoyo *et. al.* 1996), seen in rocky, muddy and sandy beaches, mangroves, salt marshes, tidal mudflats (del Hoyo *et. al.* 1996). This species feeds on insects, spiders and annelid worms as well as molluscs, crustaceans and occasionally small fish and tadpoles (del Hoyo *et. al.* 1996).

Common Redshank at Belpada wetland

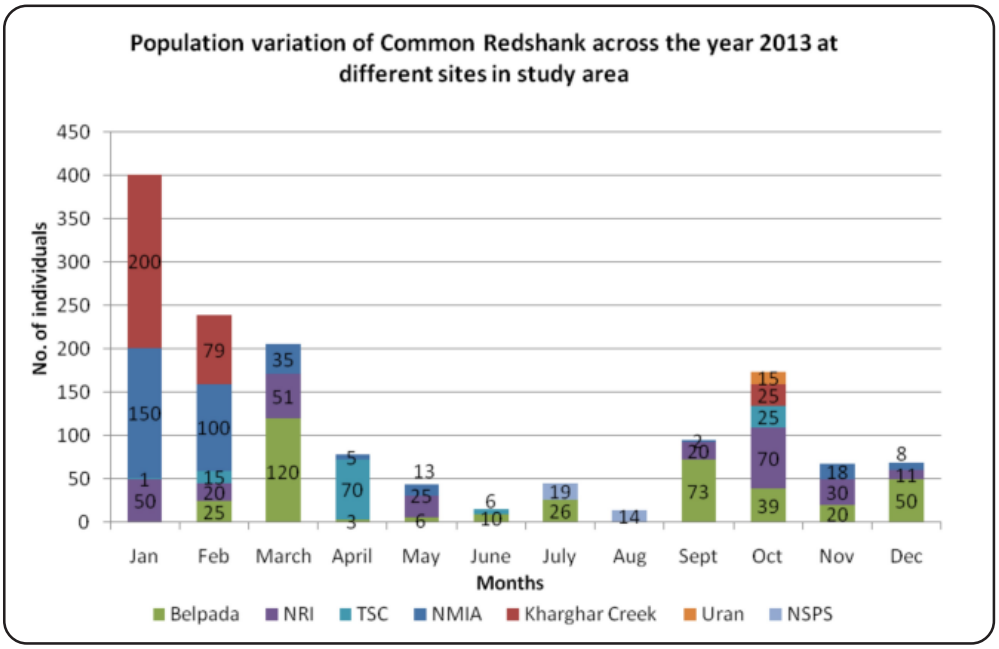


Figure 14A: Monthly variation in population of Common Redshank at various sites

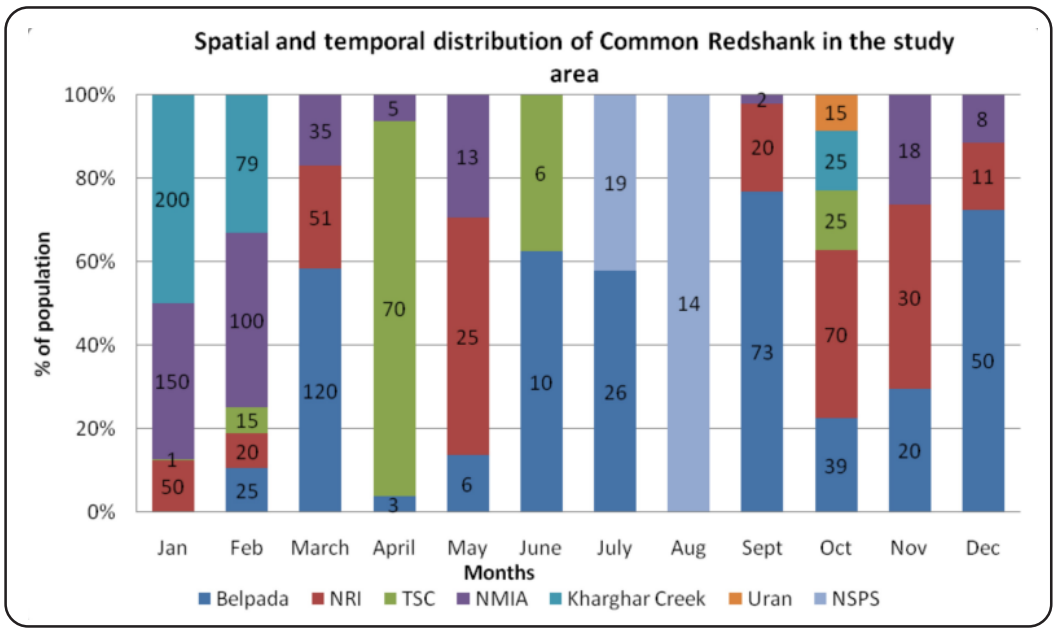


Figure 14B: Spatial and temporal distribution of Common Redshank in the study area

Previously it was recorded from Mumbai and adjoining areas as a flocking species (Abdulali, 1981), more common along the western coastline (Prasad, 2003). The earliest date of migration was recorded on July 29, and the latest record is of May 25, 1939 in Mumbai (Ali & Abdulali, 1939) and *it was observed* in marsh lands, salt pans and creesks at Mahul (Verma *et. al.* 2001-02).

The survey team observed Common Redshank *Tringa tetanus* at all the wetland areas, and with the changing population depending on the water level in a particular wetland, in different seasons. This species was usually seen foraging as a solitary bird or in a closed group of about 5-10 birds each, and sometimes seen roosting in a group of 100 to 200 birds. These birds were seen throughout the year and not restricted to any specific wetland. They were observed foraging and resting in creek, inland wetland, mangroves and mudflats all over the study area (Fig. 14A,14B). Population of 150-200 individuals was seen resting in mangroves of Kharghar Creek as well as Panvel Creek in early winter season of 2013.

14. **Black-tailed Godwit *Limosa limosa*** is a winter migrant and a near threatened (NT) species as per the International Union for Conservation of Nature (IUCN) Red List of Threatened Species. It has a large but fragmented breeding range extending from Iceland to the eastern part of Russia, with wintering populations in Europe, Africa, the Middle East and Australasia (del Hoyo *et. al.* 1996). Migratory region extending from the Republic of Ireland to Australia, encompassing the Mediterranean, sub-Saharan Africa, and parts of the Middle East, India, Indochina, Taiwan, the Philippines, Indonesia, and Melanesia (Dutson, 2011). Winter visitor to India, most common in North India, diffusing eastwards to Bihar, Orissa and West Bengal, rare in Sothern India and Ceylon (Ali & Ripley 1983). The global population has recently been estimated at 634,000-805,000 individuals (Wetlands International, 2014). It breeds from April to mid-June (Gunnarsson *et. al.* 2006). The species migrates towards wintering grounds between late-June and October. The return passage to the breeding grounds between February and April (del Hoyo *et. al.* 1996).

Black-tailed Godwit

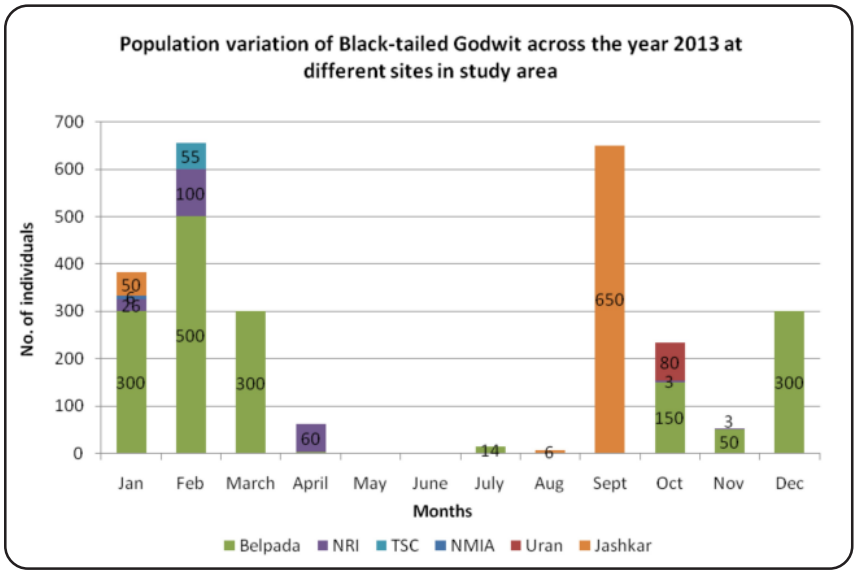


Figure 15A: Monthly variation in population of Black-tailed Godwit at various sites

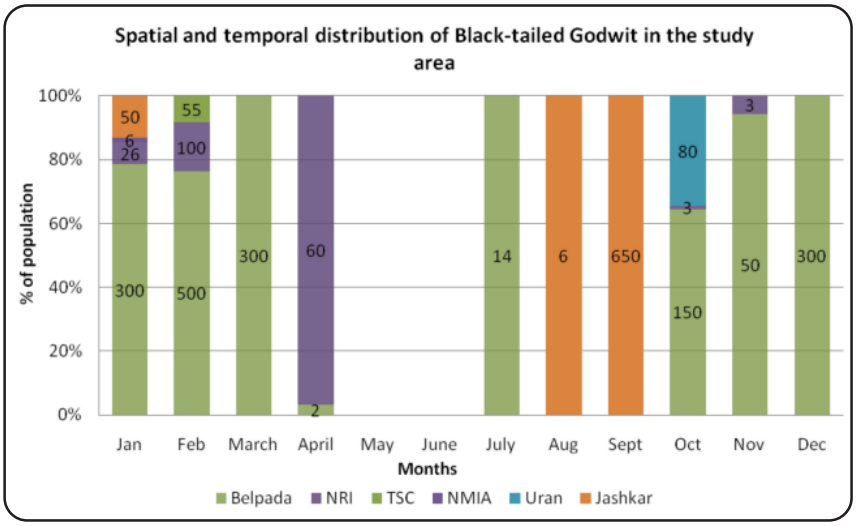


Figure 15B: Spatial and temporal distribution of Black-tailed Godwit in the study area

Earlier reported from Mumbai and adjoining areas as occasional, flocking species by Abdulali (1939), it was reported from Raigad district by Prasad (2003), and was seen in the marsh, salt pans and creeks at Mahul (Verma *et. al.* 2001-02).

The survey team observed it at all the wetlands in the study area, but the variations in population were recorded in random with the changing season, and the water level in the wetland (Figure 15A, 15B). This species were observed to arrive and depart early as compared to the other winter migratory species of the study area, seen from September to April (Narwade *et al.* 2012). A few individuals were observed overwintering in Uran. In 2013, these birds arrived in September in the study area and they were seen foraging continuously at Jaskar wetland and Belpada Lake in large congregations of about 600-650 individuals. In the later months, the population was scattered in all the wetlands and it decreased to about 100 individuals in December 2013. In the summer, birds started migrating to the breeding grounds and the survey team did not observe any individuals from May to August, 2013, except few overwintering individuals.

15. **Eurasian Curlew *Numenius arquata*** – It is a winter migrant and a near threatened (NT) species as per the International Union for Conservation of Nature (IUCN) Red List of Threatened Species. It is widely distributed, breeding across Northern Europe from the British Isles, through North-Western Europe and into Russia extending east into Siberia, east of Lake Baikal and winters around the coasts of North-West Europe, the Mediterranean, Africa, the Middle East, the Indian Subcontinent, South-East Asia, Japan and the Sundas (Bird Life International, 2014). Winter visitor to Indian coastal region and even recorded from Andaman, Nicobar and Lakshadweep Island (Ali & Ripley 1983). Most populations of this species are migratory in southern wintering grounds during July and November (del Hoyo *et. al.*1996) which return to their breeding areas between April to August (Hayman *et. al.* 1986). The species departs its wintering grounds again from February through to May, and non-breeders may remain in the wintering areas all-year-round

Flock of Eurasian Curlew and Brown Headed Gulls at NRI in October 2013

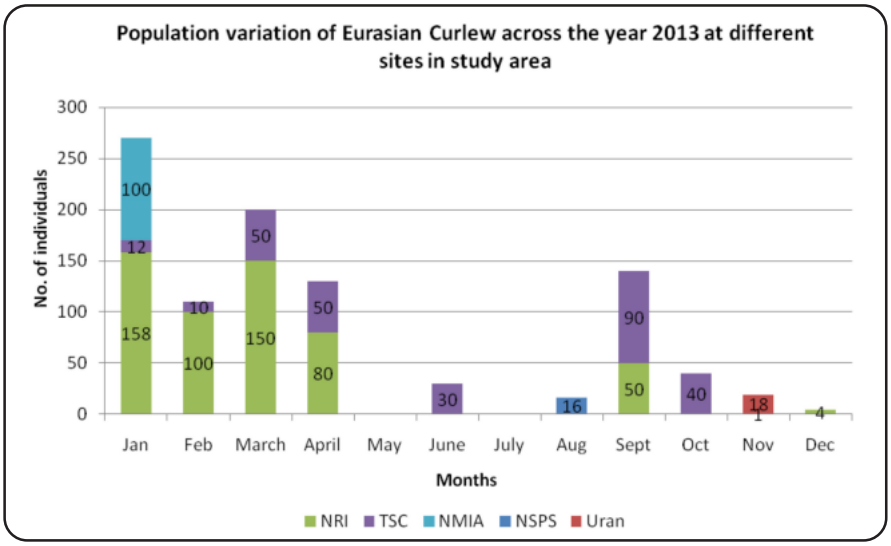


Figure 16A: Monthly variation in population of Eurasian Curlew at various sites

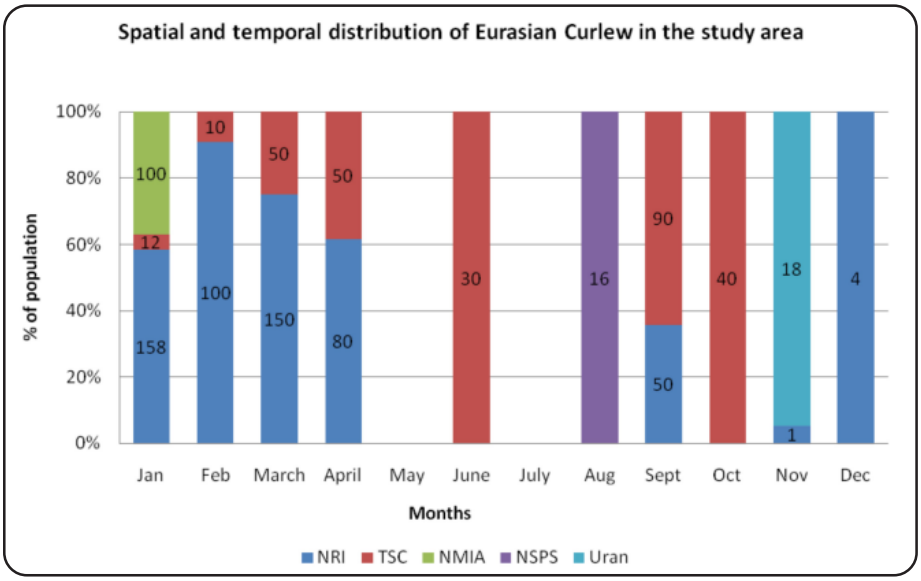


Figure 16B: Spatial and temporal distribution of Eurasian Curlew in the study area

(del Hoyo *et. al.* 1996). During the winter the species usually forages singly or in small groups (del Hoyo *et. al.* 1996) occasionally aggregating into flocks of several thousand individuals, especially at roosting sites (Snow and Perrins 1998). During the winter the species frequents muddy coasts, bays and estuaries (del Hoyo *et. al.* 1996) with tidal mudflats (Snow and Perrins 1998), rocky and sandy beaches (Johnsgard 1981; Snow and Perrins 1998), mangroves, salt marshes (Snow and Perrins 1998), inland lakes (del Hoyo *et. al.* 1996). Its diet consists chiefly of annelid worms and terrestrial insects (del Hoyo *et. al.* 1996, Johnsgard 1981).

Earlier reported in Mumbai and adjoining areas, as an occasional migrant and a flocking species (Abdulali, 1981). It was recorded as a common winter visitor along the west coast (Prasad, 2003), apparently some birds are present in the Konkan all year round (Keswal, 1886) and seen in the marsh, salt pans and creeks at Mahul (Verma *et. al.* 2001-02).

This species was commonly observed in the study area at sites such as NRI Lake, TSC Wetland and seashore at different tide levels and in different seasons (Figure 16A,16B). The survey team observed this species congregating at the inland wetlands for resting and later moving to the seashore during the low tide for probing into the soft ooze for food. These birds were present in the study area during the winter but the overwintering population was seen throughout the year, in mangroves and mudflats at Uran area. The population of about 270 individuals was observed during the January 2013 and later the population started declining. Only 20 to30 individuals were observed in monsoon.

16. **Little Stint *Calidris minuta*** – It is a winter visitor, occurs from Northern Europe and North-West & North-Central Siberia to New Siberian region, wintering from Mediterranean and Africa through Arabian Peninsula and Persian Gulf, East to Indian Subcontinent and Myanmar; Small numbers in South-East Britain and Madagascar (BirdLife International, 2014). Winter visitor to coastal region of entire Indian subcontinent (Ali & Ripley 1983). Movements to wintering grounds occur between July and November; the return migration occurs between mid-May to early-June (del Hoyo *et al.* 1996) for breeding. Many immature also remain in the wintering grounds all year round (del Hoyo *et al.* 1996). This species is gregarious in winter (Snow and Perrins 1998) and occurs in small groups (Urban *et al.* 1986), often aggregating into larger flocks to roost at high tide or at night (Hockey *et al.* 2005). In its winter range the species mainly inhabits coastal areas such as estuarine mudflats and sandy shores (del Hoyo *et al.* 1996, Hockey *et al.* 2005), tidal creeks (del Hoyo *et al.* 1996) and saltpans (Urban *et al.* 1986), but it also occurs at inland freshwater wetlands (del Hoyo *et al.* 1996). The diet of this species consists chiefly of invertebrates (del Hoyo *et al.* 1996, Snow and Perrins 1998).

Little Stint

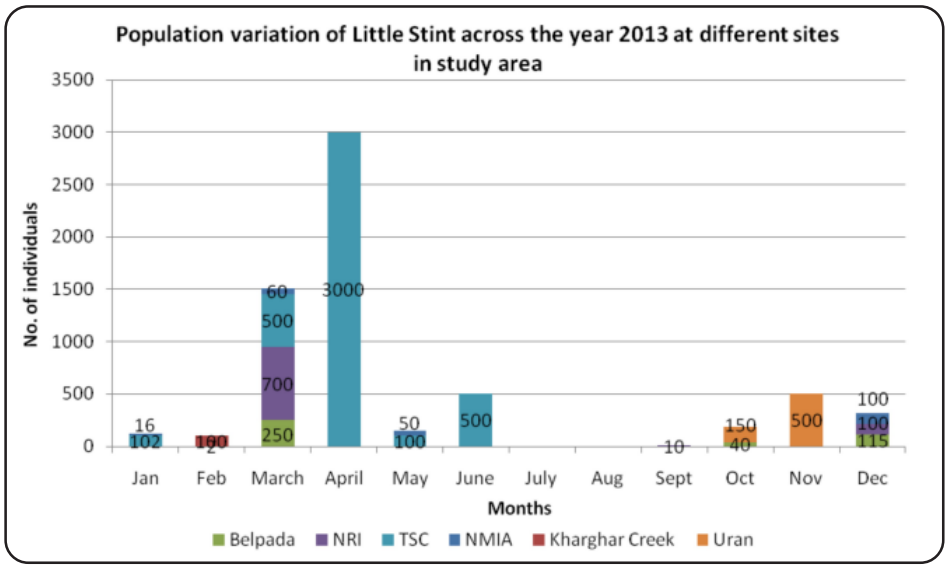


Figure 17A: Monthly variation in population of Little Stint at various sites

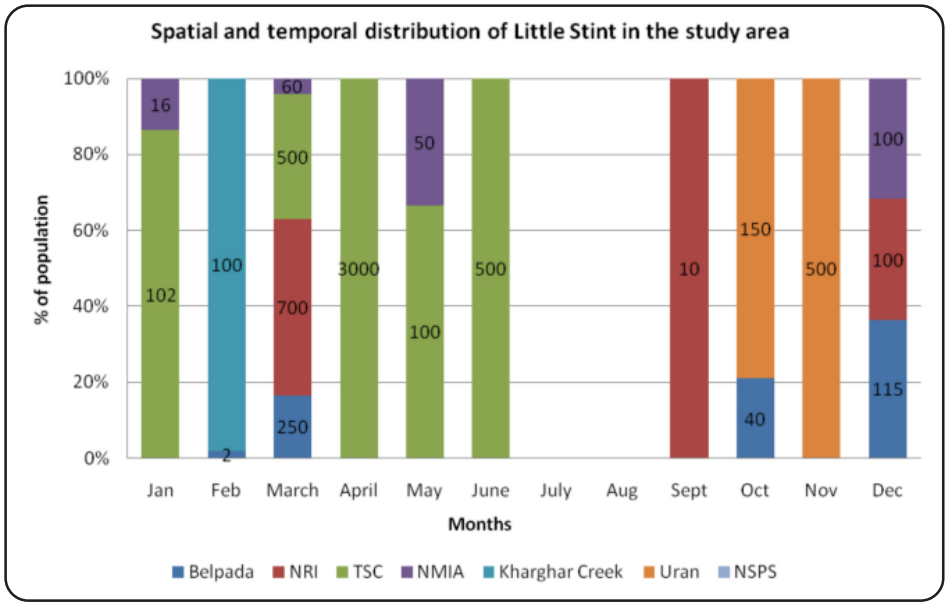


Figure 17B: Spatial and temporal distribution of Little Stint in the study area

Earlier reported from Mumbai and adjoining area, as a flocking species (Abdulali, 1981). It has been sporadic in southern Maharashtra west coast (Prasad, 2003) and was seen in the marsh, salt pans and creeks at Mahul (Verma *et. al.* 2001-02).

It is a common flocking species of the study area and the survey team often observed it in a mixed group of other small waders. The team observed them foraging on the seashore during the low tide and returning back to the inland water bodies during the high tide for resting. The survey team observed two peaks in population (Figure 17A,17B) one during arrival and the other during departure period of migration at TSC Wetland which served as a stopover site.

17. **Curlew Sandpiper *Calidris ferruginea*** – It is a common winter migrant, found from Arctic Siberia from Yamal Peninsula to Russian Gulf, winters from sub-Saharan Africa through South Asia to Australasia (Bird Life International, 2014). Arrival to the breeding grounds begins late-April to May, with arrival in the Arctic beginning in early-June, and breeding period is from June to July (del Hoyo *et. al.* 1996). Distributed throughout Indian subcontinent during wintering period (Ali & Ripley 1983). Many first year birds remain on the wintering grounds (del Hoyo *et. al.* 1996). In the winter the species chiefly occurs on coastal brackish lagoons, tidal mudflats salt marshes (del Hoyo *et. al.* 1996, Snow and Perrins 1998), exposed rocky shores (Urban *et. al.* 1986) and also inland on the muddy edges of marshes and lakes (both saline and freshwater), irrigated land (del Hoyo *et. al.* 1996), dams (Urban *et. al.* 1986) and saltpans (Khomenko 2006).

Curlew Sandpiper

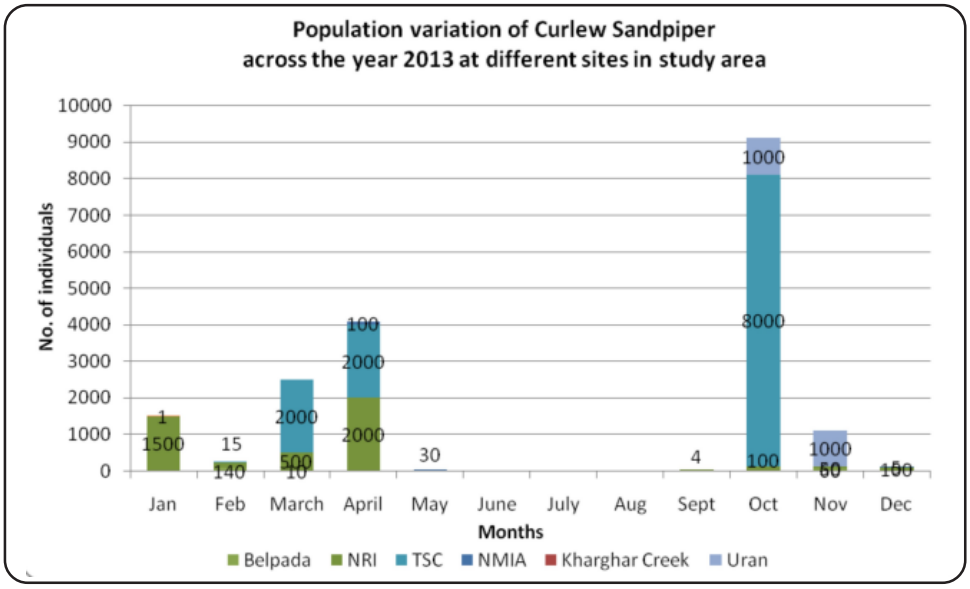


Figure 18A: Monthly variation in population of Curlew Sandpiper at various sites

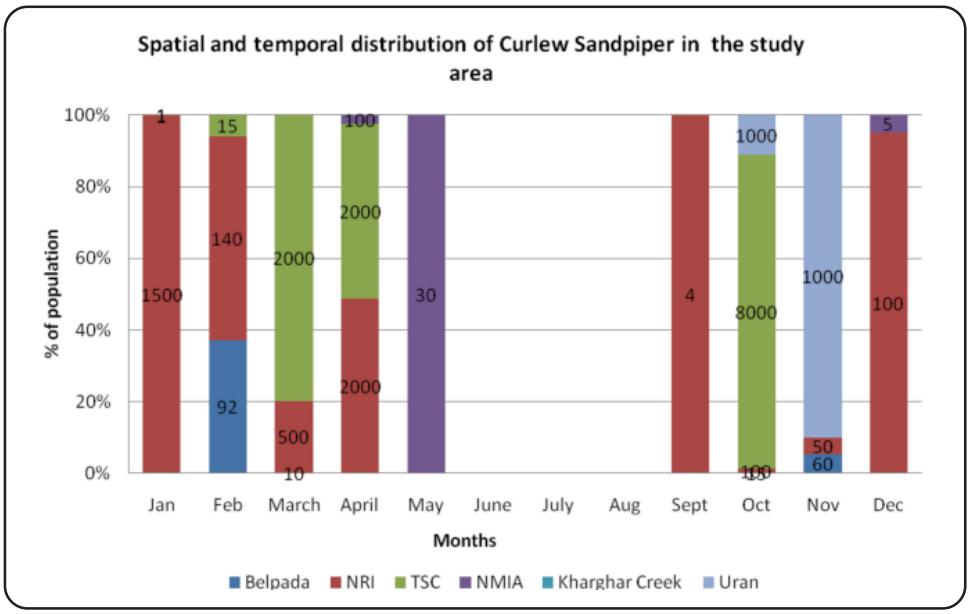


Figure 18B: Spatial and temporal distribution of Curlew Sandpiper in the study area

Earlier reported from Mumbai and surrounding areas as a flocking species (Abdulali, 1981), common on the coasts and rare inland (Prasad, 2003), near Mumbai, Ali & Abdulali (1981) reported it as 'common but overlooked'. and was seen at Dativare, Nala Sopara (Monga, 2003) and Mahul Creek (Verma *et. al.* 2001-02).

The BNHS survey team observed this species congregating in huge flocks of couple of thousands individuals along with other waders such as Lesser Sand Plover *Charadrius mongolus* and Broad-billed Sandpiper *Limicola falcinellus* in inland wetlands during high tide, and dispersing on the seashore for foraging during the low tide. Large congregation of 1500-2000 individuals were observed at NRI Lake and 7000-8000 individuals at TSC Wetland along the Palm Beach Road. This species was observed in the study area in winter as well as summer. The largest congregation 8000-9000 individuals was observed in October 2013 however, it was not seen in the following months, which indicated that some birds might have used this area as a stopover site (Figure18A, 18B). Striking chestnut-red coloured head and under parts help these birds stand out in a huge wader congregation during summer. After April the population started declining as the birds started their return migration.

18. **Pied Avocet *Recurvirostra avosetta*** – It is a winter migrant, occurs from Europe through West & Central Asia to South-East Siberia and North-East China, and locally through North Africa to East-South Africa; winters from West Europe and Africa through Middle East (del Hoyo *et al.* 1996)**.** Northern populations migrate south between August and October and return to the breeding grounds between March and May and breeding season is from April to August (del Hoyo *et al.* 1996). Breeding regularly or sporadically in North Baluchistan and Kutch, common winter visitor in north-west India, less common, sporadic, or occasional in rest of the India including coastal Maharashtra (Ali & Ripley 1983). Species forage in groups of 5-30 individuals (Urban *et al.* 1986) and gathering to roost in large flocks of several thousand individuals (Hayman

Flock of Pied Avocet observed in wetlands of Uran area

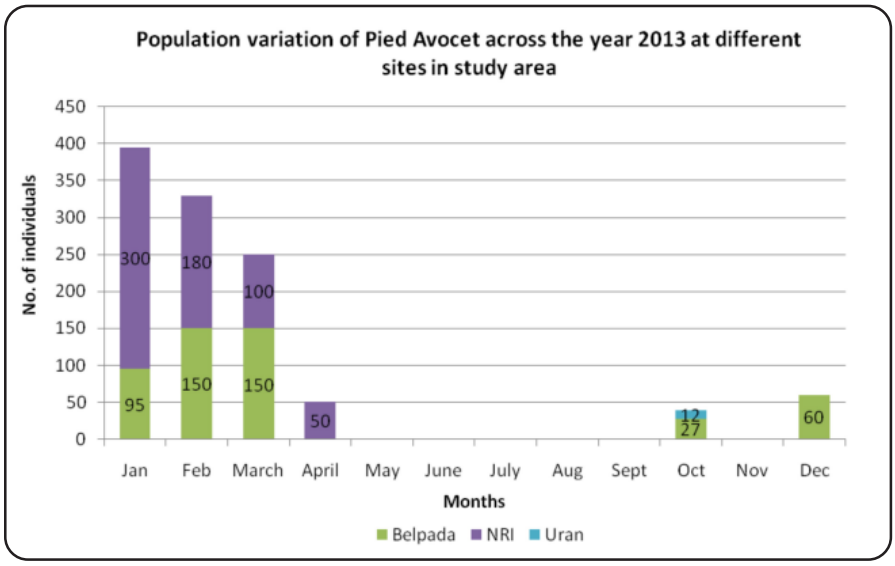


Figure 19A: Monthly variation in population of Pied Avocet at various sites

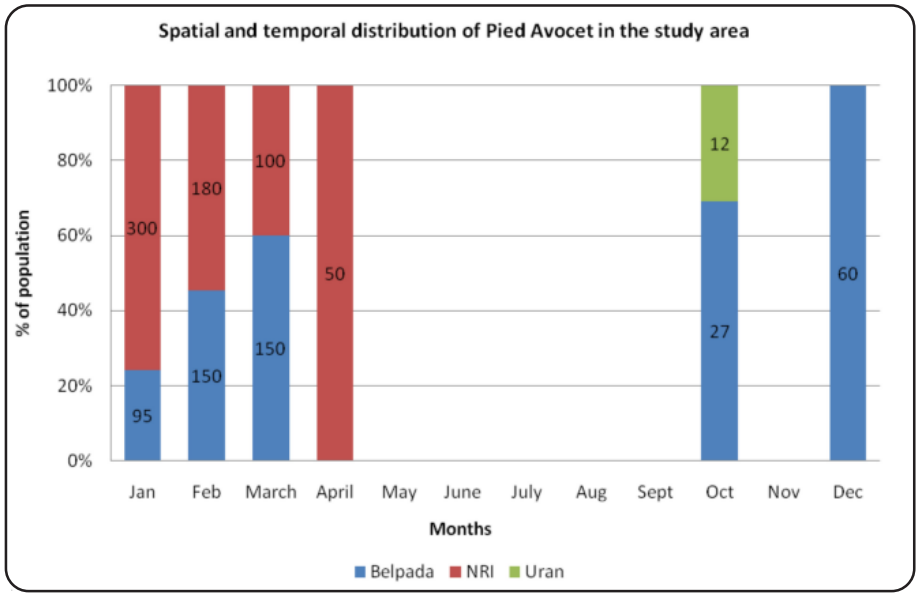


Figure 19B: Spatial and temporal distribution of Pied Avocet in the study area

et al. 1986). It inhabits coastal and inland saline lakes and mudflats (Urban *et al.* 1986, del Hoyo *et al.* 1996), saltpans (del Hoyo *et al.* 1996). It rarely occurs on inland freshwater lakes (Urban *et al.* 1986, del Hoyo *et al.* 1996). Its diet consists predominantly of aquatic invertebrates 4-15 cm long (del Hoyo *et al.* 1996) and plant matter (Urban *et al.* 1986).

From Mumbai and adjoining areas, it was previously reported as a winter migrant (Abdulali, 1981). It was reported as an occasional and flocking species (Prasad, 2003) and common along the coast; rare inland and seen in open water bodies at Mahul (Verma *et. al.* 2001-02). Sighting of about 100-200 individuals were consistently in Uran area by Sarkar (2011).

The survey team observed this species at Belpada Lake and NRI Lake , from during winter and early summer. They were always seen in flocks of 30-35 individuals, scattered all over the area and continuously foraging in shallow waters. About 300 individuals were observed congregating in January 2013 at NRI Lake. The population started declining from March and no birds were observed from May to September. (Figure 19A,19B).

19. **Gull-billed Tern *Gelochelidon nilotica*** – It is a winter migrant in study area, breeds in warmer parts of the world in southern Europe, very small isolated population is in northern Germany and Denmark, temperate and eastern Asia, both coasts of central and southern North America, the north-west and eastern coasts of South America and Australia. Wintering range include much of south Asia, Central America, New Zealand and parts of Central Africa (del Hoyo *et al.* 1996). Breeding Locally in Northwest India (Las Bela and Punjab), in winter found throughout India and locally common (Ali & Ripley 1983). On passage the species typically forages over saltpans, mudflats, marshes and wet fields (del Hoyo *et al.* 1996), overwintering on saltpans (del Hoyo *et al.* 1996) and salt marshes (Higgins and Davies 1996) or in more inland sites such as lakes, rice-fields (Snow and Perrins 1998) and saltpans (Higgins and Davies 1996). It is an opportunistic feeder and is largely insectivorous (del Hoyo *et al.* 1996, Richards 1990) as well as spiders,

Gull-billed Tern at Jaskar wetland

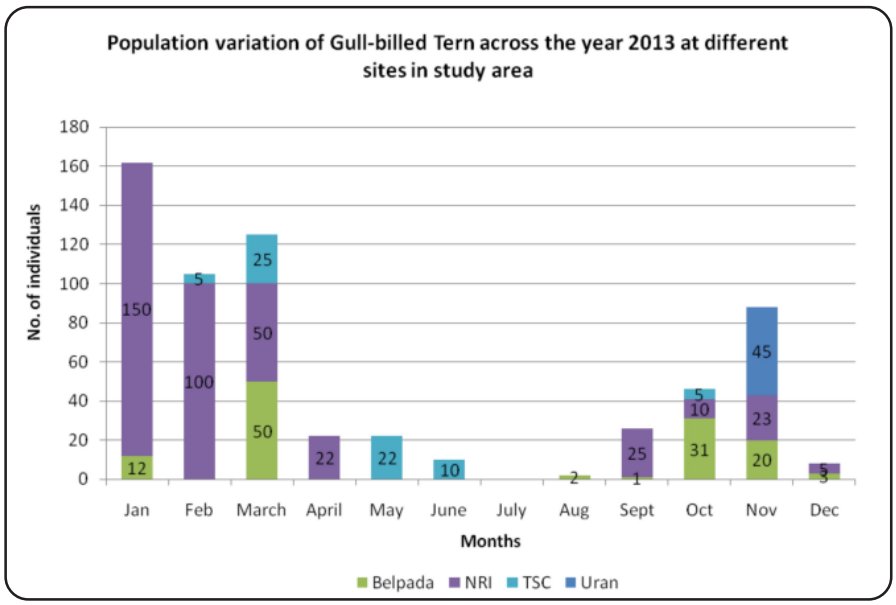


Figure 20A: Monthly variation in population of Gull-billed tern at various sites

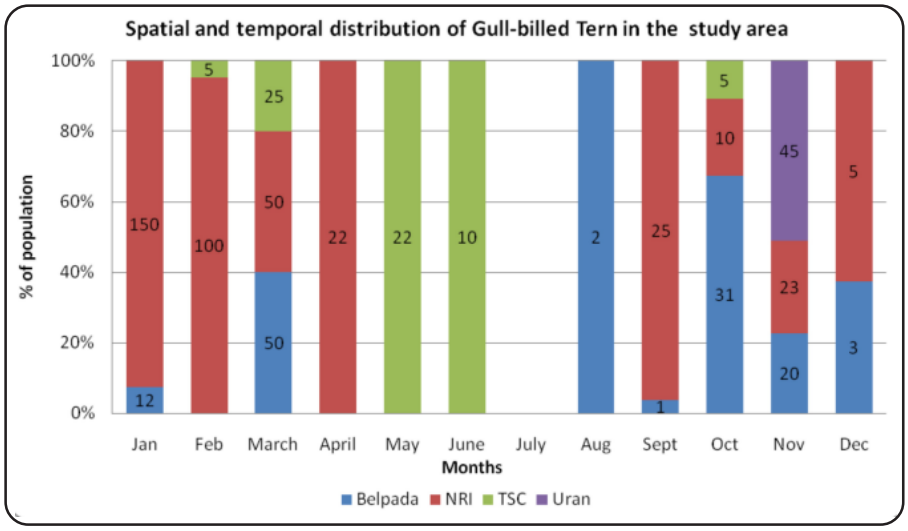


Figure 20B: Spatial and temporal distribution of Gull-billed Tern in the study area

earthworms, small reptiles, frogs, small fish (6-9 cm long), aquatic invertebrates and rarely voles and small birds (del Hoyo *et al.* 1996).

Previous records from Mumbai and adjoining areas mentioned it as a local migrant, and common flocking species (Abdulali, 1981). It was common species of the west coast (Prasad, 2003) but the population was apparently declining near Mumbai (Monga, 2001) and was usually seen in the marsh, salt pans and creek at Mahul (Verma *et. al.* 2001-02).

The survey team observed this species as a common winter visitor in the study area. These birds were seen resting in flocks at NRI Lake and TSC Lake in late winter. Few individuals were also observed at Belpada Lake, the proposed site for NMIA, and Panvel creek. During the low tide period they moved to the seashore for foraging. In the summer months, they were observed congregating with the other waders at NRI Lake and the wetland behind TSC (Figure 20A, 20B).

20. **Caspian Tern *Sterna caspia*** - It is a winter migrant and has a cosmopolitan but scattered distribution. Their breeding habitat is large lakes and ocean coasts in North America and locally in Europe Asia, Africa, and Australasia (Australia and New Zealand). The breeding season is between April and June (northern Hemisphere) or between September and December (southern Hemisphere) (del Hoyo *et. al.* 1996). Breeding Locally in Northwest India (Las Bela and Punjab), in winter wide spread and locally common (Ali & Ripley 1983). It is not a highly gregarious species in non breeding season (Snow and Perrins 1998) but may aggregate into flocks on passage (Urban *et. al.* 1986) and during the winter it may feed in loose congregations (del Hoyo *et. al.* 1996). The breeding, passage and wintering habitats of this species are similar, although during winter it is largely confined to the coast (Shuford and Craig 2002). Its diet consists predominantly of fish 5-25 cm in length (Shuford and Craig 2002) as well as the eggs and young of other birds, carrion (del Hoyo *et. al.* 1996), aquatic invertebrates (Flint *et. al.* 1984, Urban *et. al.* 1986, Shuford and Craig 2002) and earthworms (Shuford and Craig 2002).

Caspian Tern at NRI wetland

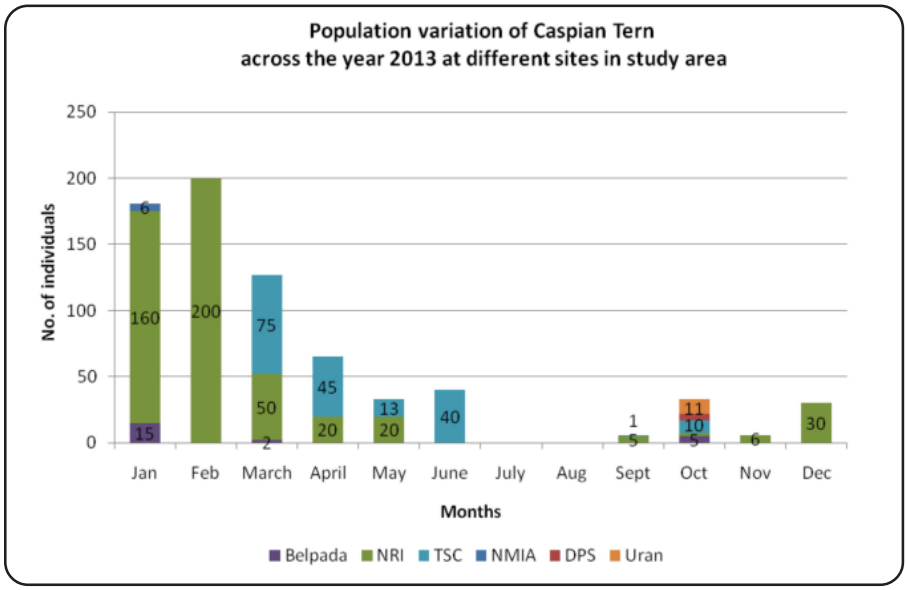


Figure 21A: Monthly variation in population of Caspian Tern at various sites

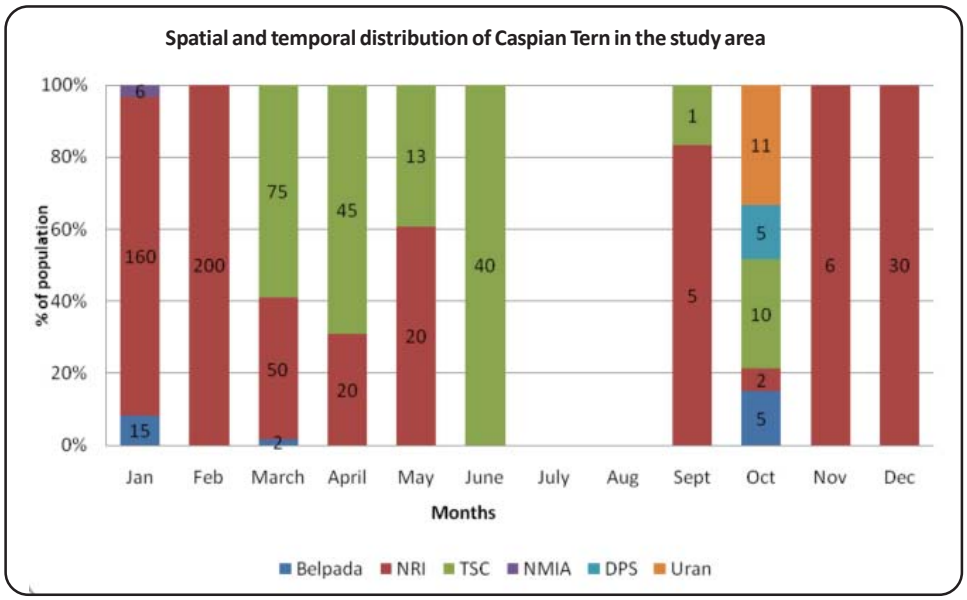


Figure 21B: Spatial and temporal distribution of Caspian Tern in the study area

Previously recorded from Mumbai and adjoining areas as an occasional visitor (Abdulali, 1981), common on the coast; uncommon inland (Prasad, 2003) and mainly seen at Mahul Creek (Verma *et. al.* 2001-02).

The survey team commonly observed this species in the study area. These birds were observed foraging mainly on the seashore, and in all the wetlands in the study area. They were seen roosting primarily at NRI Lake and the TSC Lake, along with other waders. These birds started arriving in September and the maximum population of 200 individuals was observed in February 2013. In summer the population declined as the birds returned to their breeding grounds (Figure 21A,21B).

21. **Brown-headed Gull *Larus brunnicephalus*** - The breeding range of the Brown-headed Gull is the mountains of south-central Asia from Turkestan in the west, China in east, and Tibet in the south. It winters on te coast of India, northern Sri Lanka and south-east Asia, and sparingly to the west of India up to the Arabian Peninsula (del Hoyo *et. al.* 1996). Breeds in Ladakh, cmmon winter visitor to the sea coasts throughout India (Ali & Ripley 1983). It returns to the breeding areas from late-February onwards (Scott and Rose 1996), breeding season begins May onwards (Madge and Burn 1988). During wintering season the species forms large concentrations, with large flocks of 30-40 and sometimes hundreds of individuals gathering at winter roosting sites (Brown *et al.* 1982, Madge and Burn 1988). Frequents marsh and lake habitats and other sheltered waters with high productivity and abundant vegetation (Kear 2005b) as well as artificial reservoirs (Snow and Perrins 1998), coast (del Hoyo *et al.* 1992, Scott and Rose 1996), salt marshes (Madge and Burn 1988), tidal creeks (Johnsgard 1978), intertidal mudflats (Johnsgard 1978, Kear 2005b).

Brown-headed Gull at TSC wetland

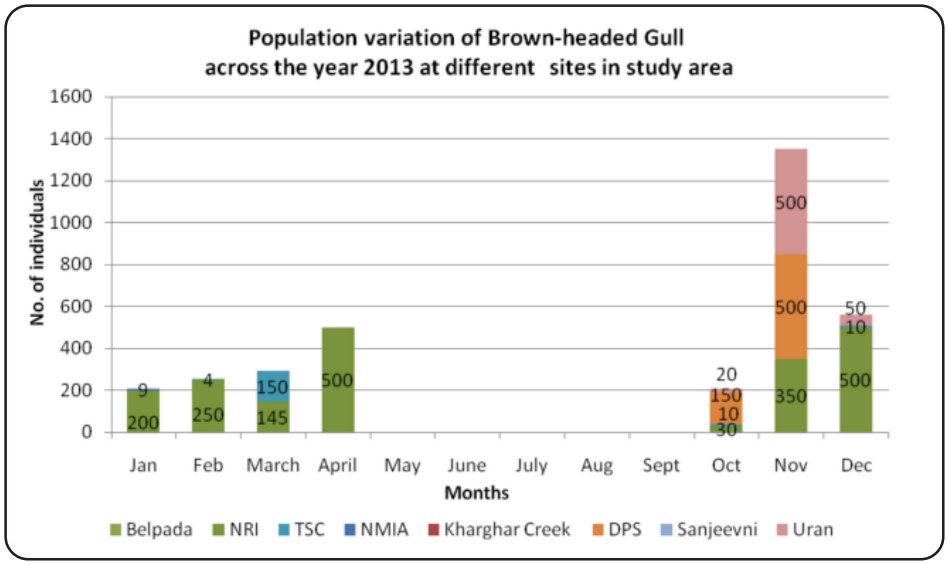


Figure 22A: Monthly variation in population of Brown-headed Gull at various sites

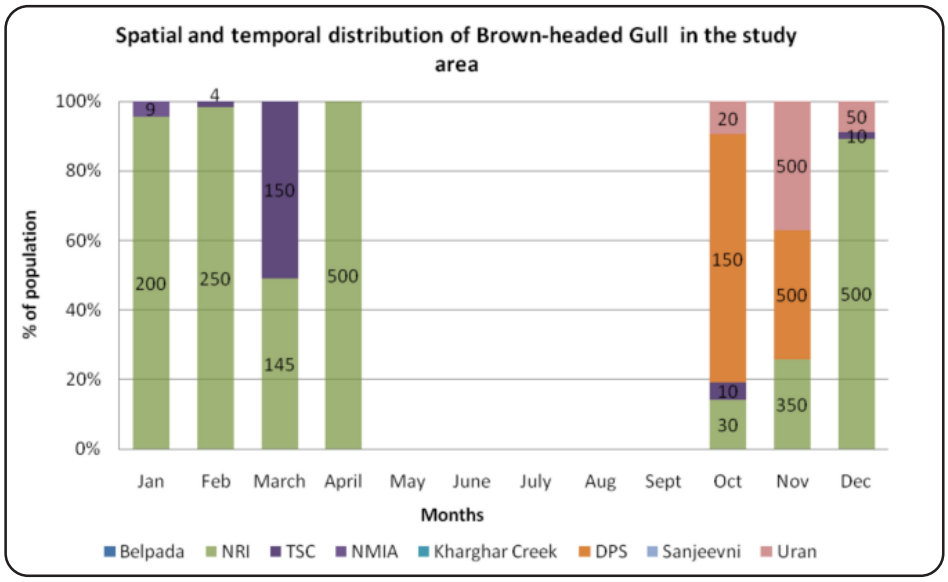


Figure 22B: Spatial and temporal distribution of Brown-headed Gull in the study area

– It was earlier records in Mumbai and adjoining areas as a common flocking species (Abdulali, 1981). It is common on the coast; fairly uncommon inland (Prasad, 2003) and seen at Mahul creek (Verma *et. al* 2001-02).

This species is a common winter migrant in the study area. The survey team observed it at all the wetlands of the study area, with population of about 500 birds at NRI Lake, DPS wetland, and Uran during the winter season (Figure 22A, 22B). Post winter this species was observed congregating at NRI Lake and later the population was restricted to TSC Lake and the seashores .

4.2 Other congregating birds which were not observed at high tide roosts

1. **Blue Rock Pigeon *Columba livia*** — The species has very large geographical range, widespread in North America, Mexico, Caribbean Islands, Ireland, United Kingdom, North Africa, Europe, Middle East, India, Pakistan, Afghanistan, Mongolia, and Australia (BirdLife International, 2014). A resident and well adapted bird to the urban life and very common bird in India (Ali & Ripley 1983). Abdulali (1981) and Prasad (2003) mentioned it a flocking and common species in Mumbai and adjoining areas.

The survey team observed it across the study area. Groups of 30-40 individuals were often observed foraging at garbage dumps, open grasslands, mangroves, and rooftops of the buildings. Many a times, flocks of 100-120 birds were seen in the grasslands and open lands.

2. **Barn Swallow *Hirundo rustica*** – It is a widely distributed species, the wintering grounds are in South America, Central America, Mexico, South Africa, Indian subcontinent, Indonesia, Malaysia, and North Australia (del Hoyo *et. al.* 1996). The breeding grounds are in the parts of Europe, North Africa, Asia, and Russia. Roosts in large congregation amongst reed-beds and thickets standing in water (del Hoyo *et. al.* 1996).

A Common wintering bird in India (Ali and Ripley, 1983) and mentioned earlier as occasional in Mumbai by Abdulali (1981), common throughout Western Maharashtra as noted by Prasad (2003). The survey team observed 50-100 individuals occasionally perching on electric wires and foraging in paddy fields, and garbage dumps in the study area.

3. **Red-headed Bunting *Emberiza bruniceps*** – It is found in the Middle East and Central Asian countries like Kazakhstan, Uzbekistan, Turkeminastan and winters in western India (del Hoyo *et. al.* 1996). Winters in most of the Indian peninsula plains (Ali & Ripley 1983). It was reported as uncommon winter migrant as occasionally in flocks in Mumbai area by Abdulali (1981) and uncommon by Prasad (2003).

An inhabitant of grassland, cultivated lands,the survey team observed these birds in flocks of 30-40 in the grasslands at Belpada and the proposed site of NMIA, interspersed with bushes and Babul *Vachellia nilotica*. It was often observed in dry paddy fields, close to study sites.

4. **Black-headed Bunting *Emberiza melanocephala*** – Uncommon winter migrant, breeds in south east Europe to Central Asian countries and some Middle East countries, abundant winter visitor to Western and Central India in Rajasthan, Gujarat, Madhya Pradesh (east to Saugor), Maharashtra (east to Nagpur and Nanded) (Ali & Ripley 1983). The wintering ground is in West India. Inhabitant of the grasslands, cultivations and fields, interspersed with bushes and Babul *Vachellia nilotica*. Earlier seen commonly in flocks in the Mumbai region by Abdulali (1981), reported as rare in south Konkan by Prasad (2003). The survey team observed about 400-500 birds in a flock at Belpada and the proposed site of NMIA feeding in the grasslands and roosting in the nearby mangroves.

5. **Rosy Starling *Sturnus roseus*** – It is common winter migrant, breeds regularly from South Ukraine East to lower Volga steppes, Central & East Kazakhstan, West Altai and West Mongolia, South to East Turkey, South Iran, Afghanistan and North West China; occasionally South East Europe, West to Czech Republic, Hungary and Italy, and possibly now breeding annually in Bulgaria, also occasionally farther East in Russia to upper R Yenisey (del Hoyo *et. al.* 1996). Non breeding birds found India and Sri Lanka, most common in Gujarat and the Deccan, decreasingly through South India, vagrant in Andaman (Ali & Ripley 1983). Mentioned earlier as seen in flocks in Mumbai (Abdulali, 1981) and observed in the mangroves at Mahul by Verma *et. al.* (2001-02).

The survey team observed these birds at all sites of the study area during winters, with flock-size ranging from 10 to 200 individuals. It was usually seen feeding in the mangroves and perching on the adjoining trees. In early winter of 2013 a number of juveniles were observed in flocks, perching on the power transmission lines.

6. **Asian Pied Starling *Gracupica contral*** - Resident and common. Found in extreme East Pakistan (Lahore area), South west China, South and east Myanmar, South China, Thailand (except east), North west Laos and Combodia, South Nepal and Bangladesh (del Hoyo *et. al.* 1996) North & Central India (East to West Assam, South to extreme Karnataka and North Andhra Pradesh), North east India (Ali and Ripley, 1983). It was reported as a common resident in Mumbai by Abdulali (1981), with breeding season extending from June to July (Prasad, 2003).

It was observed that this bird preferred the neighbourhood of the villages, towns and cities where garbage dumps offer attractive feeding opportunities. Sometimes it was seen in flocks of 30-40 individuals, sitting on power transmission wires, feeding on garbage and perching on the trees and mangroves.

Blue Rock Pigeon one of the common and widely distributed birds

Black-headed Bunting frequently seen feedign in paddy fields and grassland areas and roosting in mangroves

Rosy Starling was seen all over study area including garbage dumps

4.3 Monthly variation in population of birds observed at selected wetlands

1. **Belpada Lake —** Bird population observed at this wetland was high during January to March period. The maximum number of individuals observed at this site was 6,600 in February 2013 and the minimum number was 200 in the April 2013 (Fig. 23). The species like Black-tailed Godwit *Limosa limosa* , Common Teal *Anas crecca*, Northern Pintail *Anas acuta*, and Northern Shoveler *Anas clypeata* were observed congregating at this wetland. Very few birds were observed during April to September.

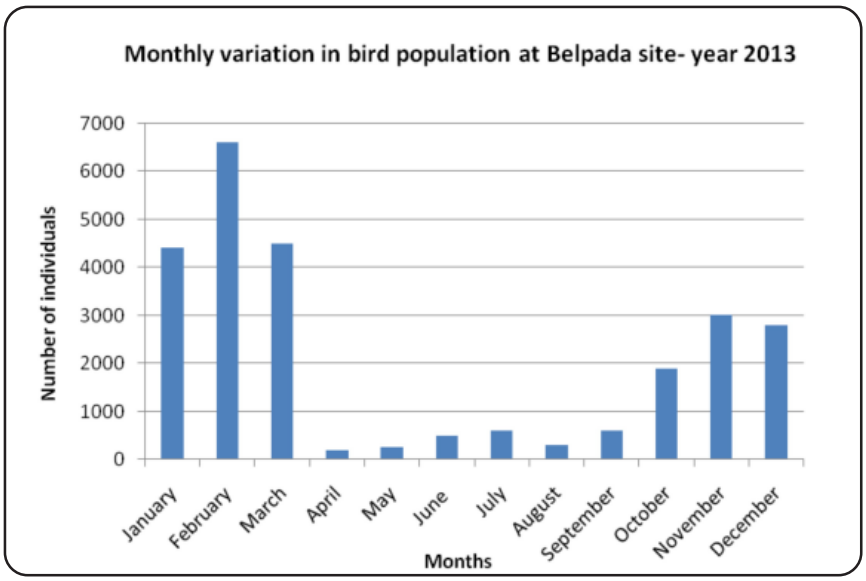


Figure 23: Monthly variation in number of birds observed at Belpada wetland

Congregation of waders at Belpada

Ducks at Belpada wetland in March 2013

Eurasian Spoonbills in flight at Belpada Lake

Greater Flamingo at Belpada

2. **TSC Wetland** — It was observed that bird count at this site was below 300 individuals during June to September. Birds were often observed during early winter and late summer i.e. during the arrival and the departure period for migratory birds. The count was 20,000 in October 2013 when a huge congregation of waders was observed for a week and later there were very few birds (Figure 24). Most of the species observed during this month at this site were migratory that used this wetland as a stopover site during migration, resulting in abrupt increase in the bird count at this wetland in October.

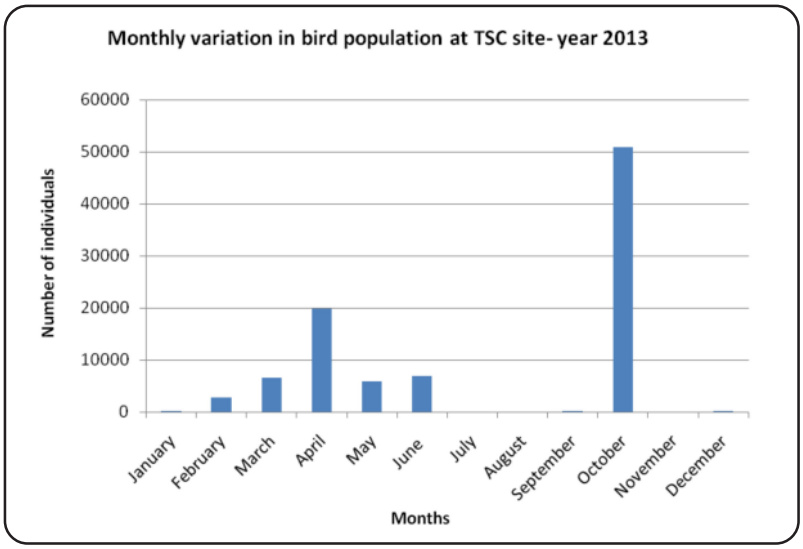


Figure 24: Monthly variation in maximum number of birds observed at TSC wetland

Lesser Flamingo at TSC Shore of Palm Beach road

Huge congregation of waders at TSC wetland

3. **NRI Lake** — The bird count was recorded high in November and December of 2013 followed by the decrease in till April 2013. The bird count was low from peak summer to monsoon; from May to August. The maximum number of individuals sighted was 30,000 during November 2013 (Figure 25).

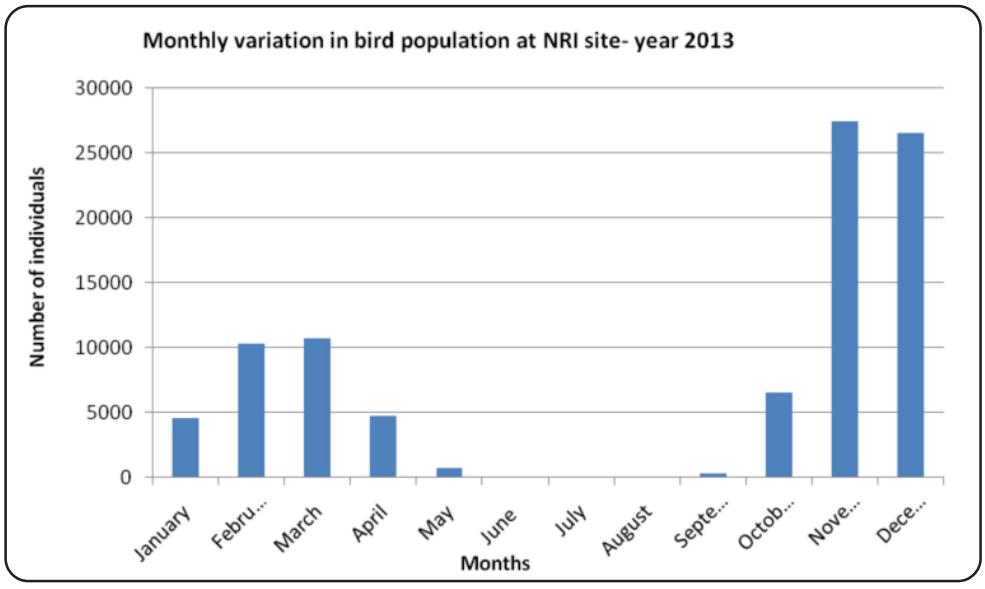


Figure 25: Monthly variation in number of birds observed at NRI wetland

Bird congregation at NRI Wetland

Flock of Pied Avocet at NRI - wetland

4. **Panvel creek and the wetlands at the proposed site of NMIA** – The maximum number of birds seen at this site were very high (4,500) in February 2013 because many migratory bird species were observed congregating at this site as other wetlands in the vicinity were dry. Very few birds were seen from June to December (Figure 26).

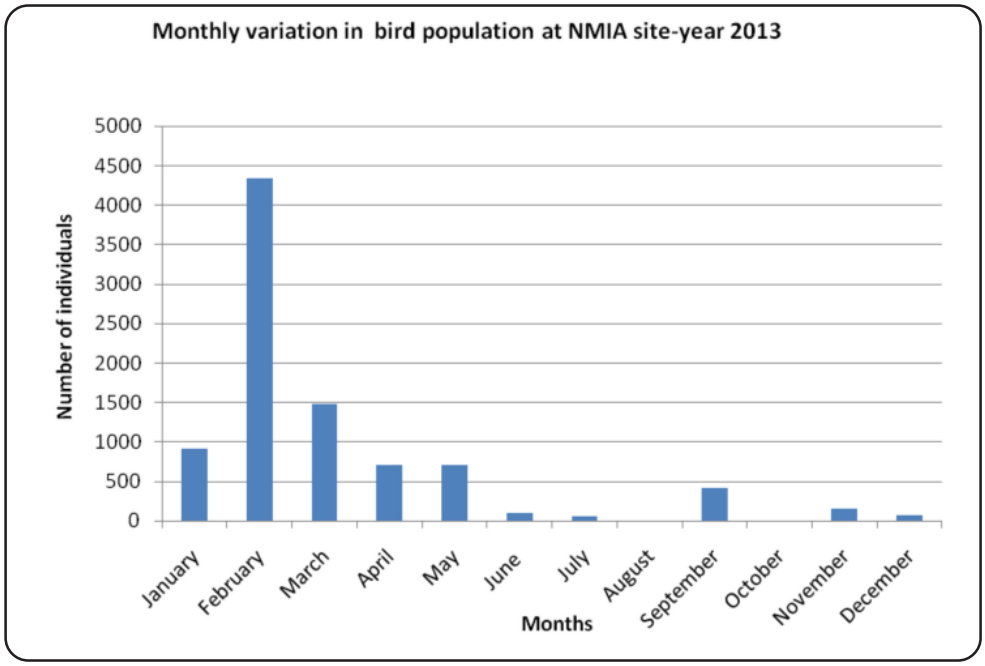


Figure 26: Monthly variation in maximum number of birds observed at proposed NMIA area

Chapter V

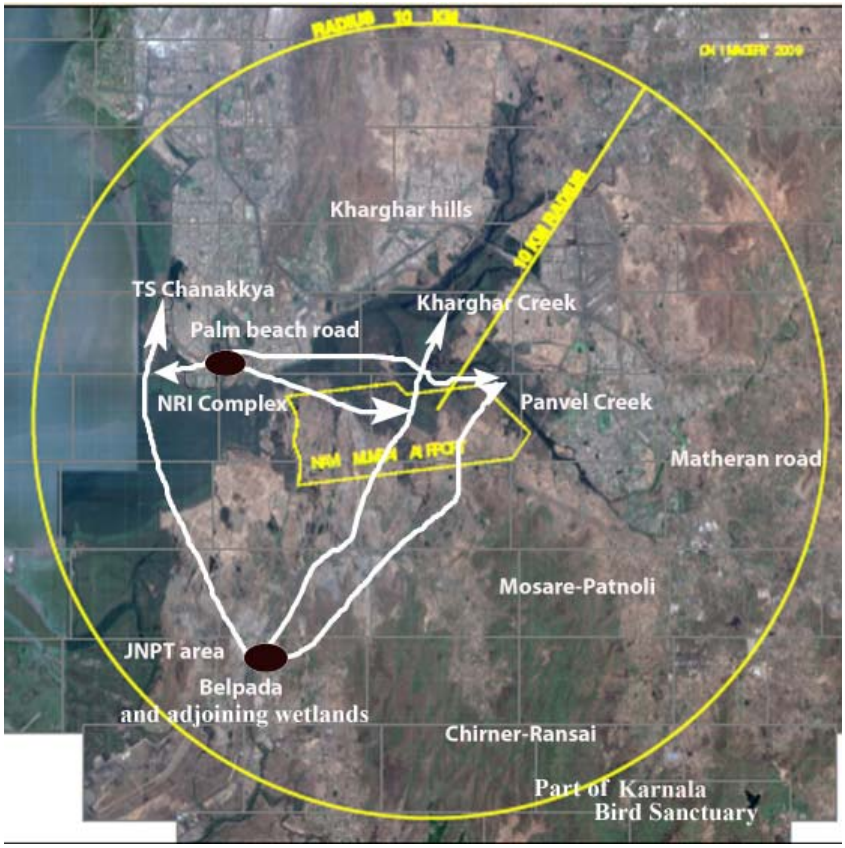
Discussion

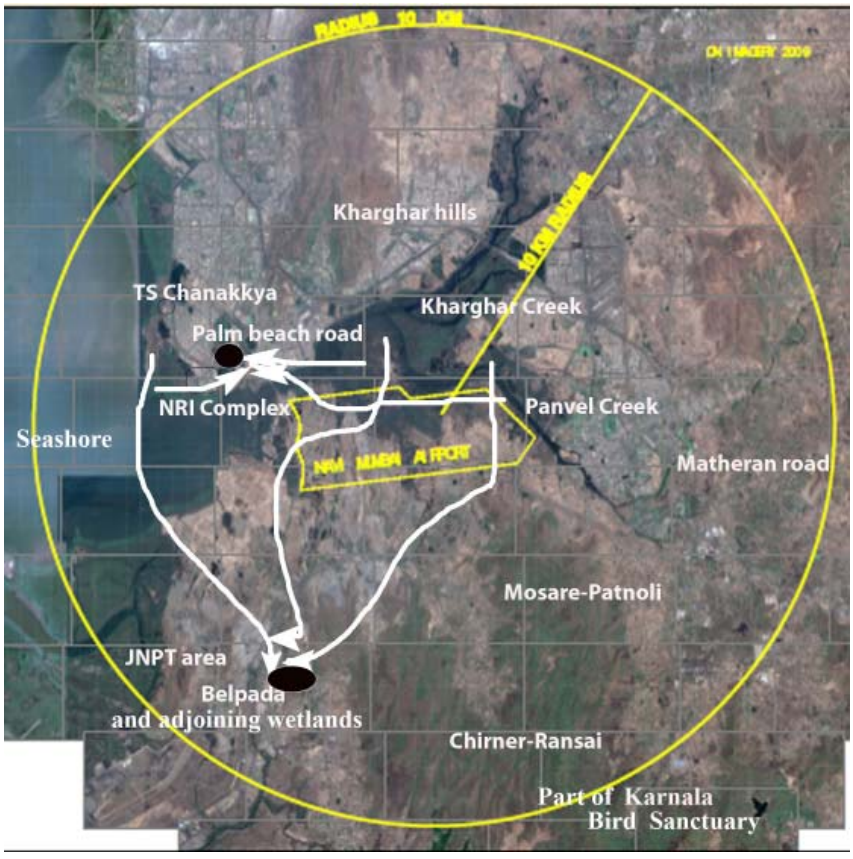
During the arrival period of migratory birds, between October and November, the maximum species count (up to 50 species) at NRI and TSC Wetlands was recorded, out of which some species, such as Northern Pintail *Anus acuta*, Common Teal *Anas crecca*, Northern Shoveller *Anas clypeata* were observed for short period of one week. The sudden increase in the population of migratory birds, especially waders, was observed. The population increased from a few hundreds to a few thousands for species including Lesser Sandplover *Charadrius mongolus,* Greater Sandplover *Charadrius leischenaulti,* Curlew Sandpiper *Calidris ferruginea* etc. during arrival (October-November and during the departure period (April-May). This indicated that some populations used these wetlands as a stopover site.

Very few migratory bird species were recorded during monsoon, between July and September, the resident, overwintering and the early migrants were observed in the study area. The overwintering and early-migratory populations of the flocking water-birds were seen congregating in shallow water pools in the grasslands and paddy fields near human habitation, instead of inland wetlands with high water level up to two meters, and the seashore which was rarely exposed in monsoon. This suggests that birds may get attracted to the temporary water pools, formed during the monsoon, in the vast open patch of land of the proposed site of NMIA.

The birds were observed congregating in the shallow waters, and population of congregating birds in different roosting areas changed seasonally**.** It would be interesting to study the long term impact of rapidly changing environment on the birds in the study area. Such kind of a bird movement within airport influence zone would be a concern for air safety in the future.

As observed in a study at Roebuck Bay of Australia (Rogers *et. al.* 2006), by day, the choice of the roosting site was affected by the distance from the feeding areas, and the micro-climate. The birds preferably selected nearby sites as day roosts, while during the night, birds selected safer but more distant roosts Cardiff Bay – earlier known as Tiger Bay – is one of Europes largest regenerative project through waterfront development in Wales, UK. Cardiff Bay Development Corporation (CBDC) commissioned an 'assessment of the effects of the development on roosting behaviour of water birds in the Bay' and produced alternative roosting sites within the bay to mitigate against the loss of salt marsh. The success of these measures is documented by Donald & Clark, 1991a. As a result of communal roosting, birds benefit by the increased ability to spot approaching predators, better feeding opportunity by moving to other feeding areas basis the dissemination of information' about the feeding areas (Donald & Clark, 1991b). It is repeatedly observed and recommended that the secure roosts are essential for wading birds and wildfowl. Therefore, the BNHS recommends that to the wetlands such as Belpada Lake, NRI Lake and the wetland behind TSC on Palm Beach Road are protected. These wetlands are used by the birds as high tide roosts. Birds were observed using the adjoining seashore areas as a foraging habitat. The proposed site for NMIA consists of paddy fields, marshlands, creek and a river which are used by many birds, mostly during the low tide.


Kharghar hills
TS Chanakkya
Palm beach road
Kharghar Creek
NRI Complex
Panvel Creek
Matheran road
Mosare-Patnoli
JNPT area
Belpada
and adjoining wetlands
Chirner-Ransai
Part of Karnala
Bird Sanctuary


Kharghar hills
TS Chanakkya
Palm beach road
Kharghar Creek
NRI Complex
Panvel Creek
Seashore
Matheran road
Mosare-Patnoli
JNPT area
Belpada
and adjoining wetlands
Chirner-Ransai
Part of Karnala
Bird Sanctuary

During the entire study period the survey team observed that birds used different sites in different seasons. Tide-timings and water level are found to be influential factors resulting into seasonal variations in speciescount and population at roosting and foraging sites. Roosting sites such as wetlands near DPS NRI, the proposed NMIA site, Sonari-Belpada and TSC and adjoining mangroves hold sizable populations of birds in the study area. These sites are also located near the major foraging sites such as the seashore and the creeks. Thousands of waders and water birds were seen moving in flocks across these sites to open creeks and mudflats for foraging (Narawade *et al* 2012). CIDCO states that the construction work of proposed NMIA will commence from the end of the year 2014. The present data would be useful in assessing the impact of construction activity of the airport as well as to know the status of birds in and around the NMIA area to avoid future bird hazard to the airport operations.

Measures to restrict the movement of birds in the proposed airport area

1. Monitoring the study area for a longer period before the construction begins, during the construction period as well as during the early operational period of NMIA.
2. Habitat management based on the ongoing studies to dissuade birds from the the airport area.
3. Management of the roosting areas - some sites should be managed to restrict bird movements due to rapidly developing region, especially roosting sites at Sonari-Belpada at Uran, NRI and TSC Wetlands in the Palm Beach Road area.
4. Development of a system for proper disposal of garbage, especially plastic waste which is observed to attract birds.
5. Strict implementation of Wildlife Protection Act to stop hunting and trapping.
6. The extent and spread of stone quarries and construction work should be strictly regulated and this work, especially blasting should be minimized in winter.
7. Control on stray dogs, especially in the winter, at the sites used by the water-birds for congregation.
8. Landfilling activities should be regulated strictly, especially at the important bird sites such as wetlands of the Sonari-Belpada and Palm Beach Road area.

Conclusion

BNHS' study shows the high risk of bird strikes at the proposed NMIA, therefore out of concern for human life, the Society suggests measures to avoid the bird strikes. BNHS recommends that the proposed NMIA site and adjoining areas should be made unattractive for the birds. One cannot, however, neglect the need of conservation offsets. Therefore developing bird sanctuaries on the coast and in the mangroves, away from the influence of air traffic is highly recommended. BNHS would like to carry out such studies to explore potential areas which can be developed as bird sanctuaries outside the airport influence region.Carrying regular bird surveys in and around the proposed site of NMIA is important to study the bird movements, habits and population.

Acknowledgement

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Annexure I: List of birds observed in study area

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 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-heron *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 striata*	W	IV	LC	R	Uran
15.	Chestnut Bittern *Ixobrychus cinnamomeus*	W	IV	LC	R	Ballaleshwar Lake
	Family Ciconiidae					
16.	Painted Stork *Mycteria leucocephala*	W	IV	NT	R	Sonari-Belpada, Kopar, NRI, TSC 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.	Black-headed Ibis *Threskiornis melanocephalus*	W/C	IV	NT	R	All wetlands and mangroves
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 roseus*	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.	Greylag Goose *Anser anser*	W	IV	LC	M	Sonari-Belpada
26.	Ruddy Shelduck *Tadorna ferruginea*	W	IV	LC	M	Jasai, Sanjivani School, Sonari-Belpada
27.	Northern Pintail *Anas acuta*	W	IV	LC	M	Sonari-Belpada
28.	Common Teal *Anas crecca*	W	IV	LC	M	Sonari-Belpada
29.	Indian Spot-billed Duck *Anas poecilorhyncha*	W/C	IV	LC	R	All
30.	Mallard *Anas palatyrhynchos*	W	IV	LC	M	NRI

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Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
31.	Garganey *Anas querquedula*	W	IV	LC	M	Sonari-Belpada
32.	Northern Shoveller *Anas clypeata*	W/C	IV	LC	M	Kharghar Creek, Belpada
33.	Comb Duck *Sarkidiornis melanotos*	W	IV	LC	R	Dastan Phata
34.	Lesser Whistling-duck *Dendrocygna javanica*	W	IV	LC	R	Dastan Phata, Belapur pond, Sonari-Belpada, Palm Beach raod
35.	Cotton Teal *Nettapus coromandelianus*	W	IV	LC	R	Dastan Phata, Belapur pond
36.	Gadwall *Anas strepera*	W	IV	LC	M	Belpada
37.	Eurasian Wigeon *Anas penelope*	W	IV	LC	M	Belpada
	Family Accipitridae					
38.	Black-winged Kite *Elanus caeruleus*	All	I	LC	R	All areas
39.	Black Kite *Milvus migrans migrans/govinda*	All	I	LC	R	All areas
40.	Brahminy Kite *Haliastur indus*	W/P	I	LC	R	Sonari-Belpada, Dastan Phata
41.	Black-eared Kite *Milvus (migrans lineatus*	W	I	LC	M	Sonari-Belpada
42.	Shikra *Accipiter badius*	All	I	LC	R	All areas
43.	White-eyed Buzzard *Butastur teesa*	F	I	LC	R	Jasai, Uran
44.	Oriental Honey-buzzard *Pernis ptylorhynchus*	F	I	LC	R	Mosare
45.	Common Buzzard *Buteo buteo*	F	I	LC	R	Ransai, Chirner
46.	Long-legged Buzzard *Buteo rufinus*	F	I	LC	R	Mosare
47.	Western Marsh Harrier *Circus aeruginosus*	W	I	LC	M	All areas
48.	Crested Serpent-eagle *Spilornis cheela*	F	I	LC	R	Ransai, Mosare
49.	Changeable Hawk-eagle *Nisaetus cirrhatus*	F	I	LC	R	Ransai
50.	Short-toed Eagle *Circaetus gallicus*	GS	I	LC	R	Chirner road
51.	Booted Eagle *Hieraaetus pennatus*	F	I	LC	M	Mosare
52.	Greater Spotted Eagle *Aquila clanga*	F	I	LC	M	Sonari-Belpada, Mosare
53.	Indian Spotted Eagle *Aquila pomarina*	W	I	VU	R	Sonari-Belpada
54.	White-bellied Sea-eagle *Haliaeetus leucogaster*	W	I		R	Uran
	Family Falconidae					
55.	Common Kestrel *Falco tinnunculus*	GS	IV	LC	R	Chirner road
56.	Peregrine Falcon (Shaheen) *Falco peregrinus perigrenator*	W	IV	LC	R	Uran
	Family Pandionidae					
57.	Osprey *Pandion haliaetus*	W/C	I	LC	R	Kharghar Creek, Sonari-Belpada
	Family Phasianidae					
58.	Rain Quail *Coturnix coromandelica*	P	-	LC	R	Chirner
59.	Red Spurfowl *Galloperdix spadicea*	F	-	LC	R	Kharghar hills
60.	Jungle Bush-quail *Perdicula asiatica*	F	-	LC	R	Ransai, Chirner Road
61.	Indian Peafowl *Pavo cristatus*	F	I	LC	R	Nere
62.	Painted Francolin *Francolinus pictus*	GS	-	LC	R	Taloja
63.	Grey Francolin *Francolinus pondicerianus*	GS	-	LC	R	Taloja

Annexure I: List of birds observed in study area

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
	Family Turnicidae					
64.	Barred Buttonquail *Turnix suscitator*	P	-	LC	R	Chirner
65.	Yellow-legged buttonquail *Turnix tanki*	P	-	LC	R	Chirner
	Family Gruidae					
66.	Demoiselle Crane *Grus virgo*	W		LC	M	Belpada
	Family Rallidae					
67.	White-breasted Waterhen *Amaurornis phoenicurus*	W/C	IV	LC	R	Dastan Phata, Pargaon
68.	Purple Swamphen *Porphyrio porphyrio*	W	IV	LC	R	Dastan Phata, Pargaon
69.	Common Moorhen *Gallinula chloropus*	W	IV	LC	R	Belapur pond, Dastan Phata
70.	Eurasian Coot *Fulica atra*	W	IV	LC	R	Belapur pond, Dastan Phata
71.	Slaty-breasted Rail *Gallirallus striatus*	W/C	IV	LC	R	Kharghar Creek, Panvel Creek
72.	Ruddy-breasted Crake *Porzana fusca*	W/C	IV	LC	R	Kharghar Creek, Panvel Creek
73.	Brown Crake *Porzana akool*	W/C	IV	LC	R	Chirner, Uran
	Family Jacanidae					
74.	Bronze-winged Jacana *Metopidius indicus*	W	IV	LC	R	Belapur pond, Dastan Phata
75.	Pheasant-tailed Jacana *Hydrophasianus chirurgus*	W	IV	LC	R	Belapur pond, Dastan Phata
	Family Rostratulidae					
76.	Greater Painted Snipe *Rostratula benghalensis*	W	IV	LC	R	Sonari-Belpada, Dastan Phata
	Family Charadriidae					
77.	Red-wattled Lapwing *Vanellus Indicus*	ALL	IV	LC	R	All areas
78.	Lesser Sand Plover *Charadrius mongolus*	W/MD	IV	LC	M	All mudflats in study area
79.	Greater Sand Plover *Charadrius leschenaulti*	W/MD	IV	LC	M	Behind NRI Complex
80.	Little Ringed Plover *Charadrius dubius*	W/MD	IV	LC	R	All wetlands
81.	Pacific Golden-Plover *Pluvialis fulva*	W/MD	IV	LC	M	TS Chanakya, Panvel Creek
82.	Kentish Plover *Charadrius alexandrines*	W/MD	IV	LC	M	All wetlands
83.	Grey Plover *Pluvialis squatarola*	W/MD	IV	LC	M	Sonari-Belpada, wetlands of Palm Beach Road area
	Family Scolopacidae					
84.	Common Snipe *Gallinago gallinago*	W	IV	LC	R	Sonari-Belpada, Dastan Phata
85.	Common Redshank *Tringa totanus*	W/MC	IV	LC	M	All (congregation at Kharghar Creek)
86.	Wood Sandpiper *Tringa glareola*	W/MC	IV	LC	M	All wetlands
87.	Common Sandpiper *Tringa hypoleucos*	W/MC	IV	LC	R	All wetlands
88.	Common Greenshank *Tringa nebularia*	W/RS	IV	LC	M	Seashore of Palm Beach Road, Sonari-Belpada
89.	Terek Sandpiper *Xenus cinereus*	W/MC	IV	LC	M	Kharghar Creek, Kopar
90.	Green Sandpiper *Tringa ochropus*	W/MC	IV	LC	M	Sonari-Belpada
91.	Marsh Sandpiper *Tringa stagnatilis*	W	IV	LC	M	All wetlands (more at Belpada)
92.	'Western' Black-tailed Godwit *Limosa limosa*	W	IV	LC	M	Sonari-Belpada, Sanjivani School

Annexure I: List of birds observed in study area

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
93.	Eurasian Curlew *Numenius arquata*	W	IV	LC	M	NRI Lake
94.	Ruddy Turnstone *Arenaria interpres*	RS	IV	LC	M	TSC lake
95.	Temminck's Stint *Calidris temminckii*	W	IV	LC	M	All (Large congregation at NRI lake)
96.	Little Stint *Calidris minuta*	W	IV	LC	M	All wetland areas
97.	Curlew Sandpiper *Calidris ferruginea*	W	IV	LC	M	Sonari-Belpada, Dastan Phata, Sanjivani school (congregation of 2,000 birds behind NRI Complex)
98.	Broad-billed Sandpiper *Limicola falcinellus*	W	IV	LC	M	Belpada, NRI Lake, TS Chanakya
99.	Ruff *Philomachus pugnax*	W	IV	LC	M	Sonari-Belpada, Dastan Phata
100.	Dunlin *Calidris alpina*	W	IV	LC	M	Seashore of Palm Beach Road
101.	Whimbrel *Numenius phaeopus*	W	IV	LC		Sonari-Belpada
	Family Recurvirostridae					
102.	Black-winged Stilt *Himantopus himantopus*	W	IV	LC	R	All wetland areas
103.	Pied Avocet *Recurvirostra avosetta*	W	IV	LC	M	Jasai, NRI area
	Family Laridae					
104.	Gull-billed Tern *Gelochelidon nilotica*	W	IV	LC	M	All wetland areas
105.	Caspian Tern *Sterna caspia*	W/C	IV	LC	M	Wetlands of Kamothe, Panvel, Palm Beach Road
106.	Saunders' Tern *Sterna saundersi*	W/C	IV	LC	M	Wetlands of Palm Beach Road
107.	Whiskered Tern *Chlidonias hybridus*	W/C	IV	LC	M	Wetlands of Palm Beach Road, Panvel Creek
108.	River Tern *Sterna aurantia*	W/C	IV	LC	M	Wetlands of Sonari-Belpada, Palm Beach Road, Panvel Creek
109.	White-cheeked Tern *Sterna repressa*	W	IV	LC	M	Jasai
110.	Slender-billed Gull *Larus genei*	W	IV	LC	M	NRI, TS Chanakya
111.	Brown-headed Gull *Larus brunnicephalus*	W	IV	LC	M	All wetland areas (more than 200 at DPS lake)
112.	Common Black-headed Gull *Larus ridibundus*	W	IV	LC	M	All wetland areas
113.	Heuglin's Gull *Larus fuscus heuglini*	W	IV	LC	M	Airoli
114.	Great Black-headed Gull *Ichthyaetus ichthyaetus*	W	IV	LC	M	Sea shore
	Family Rynchopidae					
115.	Indian Skimmer *Rynchops albicollis*	W	IV	VU	R	NRI area
	Family Columbidae					
116.	Rock Pigeon *Columba livia*	All/NH		LC	R	All areas
117.	Yellow-footed Green-pigeon *Treron phoenicoptera*	F	IV	LC	R	Ransai
118.	Grey-fronted Green Pigeon *Treron affinis*	F	IV	LC	R	Karnala
119.	Laughing Dove *Streptopelia senegalensis*	All	IV	LC	R	All areas
120.	Eurasian Collared-dove *Streptopelia decaocto*	GS	IV	LC	R	Uran

Annexure I: List of birds observed in study area

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
121.	Spotted Dove *Streptopelia chinensis*	All	IV	LC	R	All areas
	Family Psittacidae					
122.	Rose-ringed Parakeet *Psittacula krameri*	All	IV	LC	R	All areas
123.	Plum-headed Parakeet *Psittacula cyanocephala*	F	IV	LC	R	Ransai
	Family Cuculidae					
124.	Asian Koel *Eudynamys scolopaceus*	All	IV	LC	R	All areas
125.	Greater Coucal (Southern Coucal) *Centropus sinensis*	All	IV	LC	R	All areas
126.	Common Hawk-cuckoo *Hierococcyx varius*	All	IV	LC	R	Mosare, Ransai
127.	Jacobin Cuckoo *Clamator jacobinus*	F	IV	LC	M	Chirner, Karnala
128.	Indian Cuckoo *Cuculus micropterus*	F	IV	LC	R	Chirner, Ransai, Mosare
	Family Cuculidae					
129.	Blue-faced Malkoha *Phaenicophaeus viridirostris*	All	IV	LC	R	Mosare
130.	Sirkeer Malkoha *Phaenicophaeus leschenaulti*	All	IV	LC	R	Mosare
	Family Tytonidae					
131.	Common Barn-Owl *Tyto alba*	NH	IV	LC	R	All areas
	Family Strigidae					
132.	Spotted Owlet *Athene brama*	F/NH	IV	LC	R	Mosare, Ransai, Chiner, Karnala
133.	Indian Eagle-owl *Bubo bengalensis*	NH	IV	LC	R	Jasai
	Family Caprimulgidae					
134.	Indian Little Nightjar *Caprimulgus asiaticus*	A/GS	IV	LC	R	Ransai
135.	Indian Jungle Nightjar *Caprimulgus indicus*	F	IV	LC	R	Ransai
	Family Apodidae					
136.	Little Swift *Apus affinis*	NH		LC	R	All areas
137.	Asian Palm-swift *Cypsiurus balasiensis*	F/NH		LC	R	All areas
	Family Alcedinidae					
138.	Lesser Pied Kingfisher *Ceryle rudis*	W	IV	LC	R	Kopar, Chirner
139.	White-throated Kingfisher *Halcyon smyrnensis*	All	IV	LC	R	All areas
140.	Common Kingfisher *Alcedo atthis*	W	IV	LC	R	All areas
141.	Black-capped Kingfisher *Halcyon pileata*	W/F	IV	LC	R	Ransai
142.	Black-backed Dwarf Kingfisher *Ceyx erithaca*	F	IV	LC	M	Ransai

Annexure I: List of birds observed in study area

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
	Family Meropidae					
143.	Little Green Bee-eater *Merops orientalis*	All		LC	R	All areas
144.	Blue-tailed Bee-eater *Merops philippinus*	F/MC		LC	R	Kharghar Creek, Mosare, Belpada
145.	Blue-cheeked Bee-eater *Merops persicus*	GS/W		LC	R	Belpada & Uran
	Family Coraciidae					
146.	Indian Roller *Coracias benghalensis*	All	IV	LC	R	All areas
147.	European Roller *Coracias garrulus*	All	IV	LC	M	Uran
	Family Upupidae					
148.	Common Hoopoe *Upupa epops*	MC/GS		LC	M	All areas
	Family Bucerotidae					
149.	Indian Grey Hornbill *Ocyceros birostris*	F	I	LC	R	Mosare, Ransai
	Family Capitonidae					
150.	Coppersmith Barbet *Megalaima haemacephala*	F	IV	LC	R	Mosare, Ransai
151.	Brown-headed Barbet *Megalaima zeylonica*	F	IV	LC	R	Mosare, Ransai
152.	White-cheeked Barbet *Megalaima viridis*	F	IV	LC	R	Patnoli, Chirner
	Family Pittidae					
153.	Indian Pitta *Pitta brachyura*	F	IV	LC	R	Mosare
	Family Picidae					
154.	Eurasian Wryneck *Jynx torquilla*	F	IV	LC	R	Mosare
155.	Rufous Woodpecker *Celeus brachyurus*	F	IV	LC	R	Patnoli, Chirner
156.	Black-rumped Flameback *Dinopium benghalense*	F	IV	LC	R	Ransai
157.	Common Flameback *Dinopium javanense*	F	IV	LC	R	Ransai
158.	Yellow-fronted Pied Woodpecker *Dendrocopos mahrattensis*	F	IV	LC	R	Mosare, Nere
159.	Heart-spotted Woodpecker *Hemicircus canente*	F	IV	LC	R	Karnala
160.	Indian Pygmy Woodpecker *Dendrocopos nanus*	F	IV	LC	R	Karnala
	Family Alaudidae					
161.	Ashy-crowned Finch-lark *Eremopterix griseus*	GS	IV	LC	R	Uran
162.	Rufous-tailed Lark *Ammomanes phoenicura*	All	IV	LC	R	All areas
163.	Malabar Lark *Galerida malabarica*	ALL	IV	LC	R	All areas

Annexure I: List of birds observed in study area

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
	Family Motacillidae					
164.	Citrine Wagtail *Motacilla citreola*	W/M	IV	LC	M	All areas
165.	Yellow Wagtail *Motacilla flava*	W/M	IV	LC	M	All areas
166.	Grey Wagtail *Motacilla cinerea*	W	IV	LC	M	All areas
167.	White Wagtail *Motacilla alba*	W	IV	LC	M	All areas
168.	White-browed Wagtail *Motacilla maderaspatensis*	W	IV	LC	R	All areas
169.	Tree Pipit *Anthus trivialis*	P/GS	IV	LC	M	All areas
170.	Paddyfield Pipit *Anthus rufulus*	ALL	IV	LC	R	All areas
	Family Hirundinidae					
171.	Wire-tailed Swallow *Hirundo smithii*	All	IV	LC	R	All areas
172.	Barn Swallow *Hirundo rustica*	W	IV	LC	R	All areas
	Family Campephagidae					
173.	Common Woodshrike *Tephrodornis pondicerianus*	F	IV	LC	R	Mosare
174.	Large Cuckoo-shrike *Coracina macei*	F	IV	LC	R	Patnoli
175.	Black-headed Cuckoo-shrike *Coracina melanoptera*	F	IV	LC	R	Ransai
176.	Small Minivet *Pericrocotus cinnamomeus*	F	IV	LC	R	Mosare
177.	Orange Minivet *Pericrocotus flammeus*	F	IV	LC	R	Ransai
	Family Irenidae					
178.	Common Iora *Aegithina tiphia*	F	IV	LC	R	Ransai
179.	Gold-fronted Leafbird *Chloropsis aurifrons*	F	IV	LC	R	Ransai, Mosare
	Family Pycnonotidae					
180.	Red-vented Bulbul *Pycnonotus cafer*	All	IV	LC	R	All areas
181.	Red-whiskered Bulbul *Pycnonotus jocosus*	F/MC	IV	LC	R	All areas
182.	White-eared Bulbul *Pycnonotus leucotis*	MC	IV	LC	R	All areas
183.	White-browed Bulbul *Pycnonotus luteolus*	F	IV	LC	R	Chirner
	Family Laniidae					
184.	Bay-backed Shrike *Lanius vittatus*	All	IV	LC	R	All areas
185.	'Rufous-backed' Long-tailed Shrike *Lanius schach erythronotus group*	All	IV	LC	R	All areas
186.	Southern Grey Shrike *Lanius meridionalis*	GS	IV	LC	R	Chirner road
	Family Muscicapidae					
187.	Orange-headed Thrush *Zoothera citrina*	F	IV	LC	R	Ransai
188.	Jungle Babbler *Turdoides striatus*	F	IV	LC	R	Ransai, Mosare, Patnoli
189.	Tawny-bellied Babbler *Turdoides hyperythra*	F	IV	LC	R	Mosare, Patnoli

Annexure I: List of birds observed in study area

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
190.	Yellow-eyed Babbler *Chrysomma sinense*		F	IV	LC	R Chirner
191.	Indian Scimitar-babbler *Pomatorhinus (schisticeps horsfieldii*	F	IV	LC	R	Chirner, Mosare
192.	Puff-throated Babbler *Pellorneum ruficeps*	F	IV	LC	R	Mosare, Patnoli
193.	Brown-cheeked Fulvetta *Alcippe poioicephala*	F	IV	LC	R	Ransai
194.	Black Redstart *Phoenicurus ochruros*	GS	IV	LC	M	Mosare
195.	Malabar Whistling-thrush *Myophonus horsfieldi*	F	IV	LC	M	Ransai
196.	Oriental Magpie-robin *Copsychus saularis*	All	IV	LC	R	All areas
197.	Common Stonechat All *Saxicola torquatus*	IV	LC	M	All areas	
198.	Pied Bushchat *Saxicola caprata*	All	IV	LC	R	Uran
199.	Isabelline Wheatear *Oenanthe isabellina*	GS	IV	LC	M	TS Chanakya
200.	Indian Black Robin *Saxicoloides fulicatus*	All	IV	LC	R	All areas
201.	White-rumped Shama *Copsychus saularis*	F	IV	LC	R	Ransai
202.	Bluethroat *Luscinia svecica*	MC	IV	LC	M	Sonari-Belpada, Kharghar Creek, Pargaon
203.	Blue Rockt-hrush *Monticola solitaries*	GS	IV	LC	M	Uran
204.	Zitting Cisticola *Cisticola juncidis*	MC	IV	LC	R	Kopar
205.	Plain Prinia *Prinia inornata*	All	IV	LC	R	All areas
206.	Ashy Prinia *Prinia socialis*	All	IV	LC	R	All areas
207.	Grey-breasted Prinia *Prinia hodgsonii*	All	IV	LC	R	Mosare
208.	Indian Reed-warbler *Acrocephalus (stentoreus bruniscens*	MS	IV	LC	M	All creeks and mangrove areas
209.	Common Tailorbird *Orthotomus sutorius*	All	IV	LC	R	All areas
210.	Lesser Whitethroat *Sylvia curruca*	GS	IV	LC	M	Uran
211.	Red-breasted Flycatcher *Ficedula parva*	GS/F	IV	LC	M	Nere
212.	Asian Brown Flycatcher *Muscicapa dauurica*	MC	IV	LC	M	Kopar
213.	White-browed Fantail *Rhipidura albicollis*	MC	IV	LC	M	Khargahr Creek
214.	Grey-headed Canary-flycatcher *Culicicapa ceylonensis*	F	IV	LC		Ransai
215.	Asian Paradise Flycatcher *Terpsiphone paradise*	F	IV	LC		Ransai, Karnala, Morbe, Chirner
216.	Tickell's Blue Flycatcher *Cyornis tickelliae*	F	IV	LC		Ransai, Karnala, Morbe
217.	Black-naped Blue Monarch *Hypothymis azurea*	F	IV	LC		Karnala, Morbe
	Family Paridae					
218.	Great Tit *Parus major*	NH	IV	LC	R	Uran

Annexure I: List of birds observed in study area

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
	Family Dicaeidae					
219.	Thick-billed Flowerpecker *Dicaeum agile*		F	IV	LC	R Ransai, Karnala, Chirner, Morbe
	Family Nectariniidae					
220.	Purple Sunbird *Cinnyris asiatica*	All	IV	LC	R	Uran
221.	Purple-rumped Sunbird *Leptocoma zeylonica*	GS	IV	LC	R	Uran
222.	Small Sunbird *Leptocoma minima*	F	IV	LC	R	Ransai
223.	Vigors' Sunbird *Aethopyga vigorsii*	F	IV	LC	R	Ransai
	Family Emberizidae					
224.	Red-headed Bunting *Emberiza bruniceps*	GS	IV	LC	M	Pargaon
225.	Black-headed Bunting *Emberiza melanocephala*	GS	IV	LC	M	Pargaon, Kharghar Creek
	Family Fringillidae					
226.	Common Rosefinch *Carpodacus erythrinus*	GS	IV	LC	M	Mosare
	Family Estrildidae					
227.	Indian Silverbill *Euodice malabarica*	P	IV	LC	R	All areas
228.	Red Avadavat *Amandava amandava*	W/MC	IV	LC	R	Sonari-Belpada, TS Chanakya
229.	Tricoloured Munia *Lonchura malacca*	MC	IV	LC	R	Kharghar Creek, TS Chanakya
230.	Scaly-breasted Munia *Lonchura punctulata*	MC/F	IV	LC	R	Kharghar Creek, TS Chanakya, Mosare
231.	White-rumped Munia *Lonchura striata*	F	IV	LC	R	Mosare
	Family Passeridae					
232.	House Sparrow *Passer domesticus*	All	IV	LC	R	All areas
233.	Baya Weaver *Ploceus philippinus*	All	IV	LC	R	All areas
234.	Black-breasted Weaver *Ploceus benghalensis*	All	IV	LC	R	All areas
235.	Yellow-throated Sparrow F/GS *Petronia xanthocollis*	IV	LC	R	Uran, Mosare	
	Family Sturnidae					
236.	Rosy Starling *Sturnus roseus*	All	IV	LC	M	Sonari-Belpada, Nhava, Kharghar Creek, Pargaon, Kopar
237.	Brahminy Starling *Temenuchus pagodarum*	GS	IV	LC	R	Uran
238.	Grey-headed Starling *Sturnia malabarica*	GS	IV	LC	R	Behind TS Chanakya
239.	Malabar White-headed Starling *Temenuchus blythii*	GS	IV	LC	R	Behind TS Chanakya
240.	Asian Pied Starling *Gracupica contra*	GS	IV	LC	R	All areas
241.	Common Myna *Acridotheres tristis*	All	IV	LC	R	All areas
242.	Jungle Myna *Acridotheres fuscus*	All	IV	LC	R	Mosare

Annexure I: List of birds observed in study area

Sr. no.	Common/scientific names	Habitat	WPA schedule	IUCN status	R/M	Sites
	Family Oriolidae					
243.	Eurapean Golden Oriole *Oriolus oriolus*	All	IV	LC	R	All areas
244.	Black-headed Oriole *Oriolus xanthornus*	F	IV	LC	R	Ransai
245.	Black-naped Oriole *Oriolus chinensis*	F	IV	LC	M	Ransai
	Family Dicruridae					
246.	Black Drongo *Dicrurus macrocercus*	All	IV	LC	R	All areas
247.	Ashy Drongo *Dicrurus leucophaeus*	F	IV	LC	R	Ransai
248.	Bronzed Drongo *Dicrurus aeneus*	F	IV	LC	M	Karnala
249.	White-bellied Drongo *Dicrurus caerulescens*	F	IV	LC	R	Ransai, Patnoli
250.	Greater Racket-tailed Drongo *Dicrurus paradiseus*	F	IV	LC	R	Ransai, Patnoli, Karnala
	Family Corvidae					
251.	House Crow *Corvus splendens*	NH	V	LC	R	All areas
252.	Jungle Crow *Corvus macrorhynchos*	All	IV	LC	R	All areas
253.	Rufous Treepie *Dendrocitta vagabunda*	F	IV	LC	R	Mosare

Annexure II: List of figures