Project report on

IMPACT OF SPECIAL ECONOMIC ZONE (SEZ) ON BIRDS IN URAN, MAHARASHTRA

BY

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SUBMITTED TO MUMBAI UNIVERSITY

UNDER THE GUIDANCE OF

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WWF for a living planet

Certificate

This is to certify that the project work entitled '**Impact of SEZ on Birds in Uran**' is a bonafied piece of work carried out satisfactorily under my guidance by **Ms. Thakur Kamini Narendra Savita,** a candidate for the post graduate (Masters in Science) examination in Environment Sciences conducted by the Institute of Science, Mumbai under **The University of Mumbai**.

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10th March, 2010.

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CERTIFICATE

This is to certify that Mr / Miss **Thakur Kamini Narendra Savita,** Exam Seat No. _____ a student of MSc-II Environmental Science, Institute of Science, Mumbai has successfully completed the project tiled **"Impact Of Special Economic Zone (SEZ) On Birds In Uran, Maharashtra''** as prescribed by the University of Mumbai for the academic year 2009-2010.

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Declaration

I, Ms. Thakur Kamini Narendra Savita, hereby declare that the dissertation entitled, "Impact of Special Economic Zone (SEZ) on birds in Uran, Maharashtra" submitted to the Institute of Science, Mumbai, in partial requirement for the fulfillment of the Masters Degree in Environmental Science, University of Mumbai, is a bonafide record of the work done by me under the supervision and guidance of Dr. Goldin Qudros , Education Officer & Interim State Director, World Wilde Fund For Nature-India, Maharashtra State Office, Mumbai, during the period from May ' 09 to Dec ' 09 and no part of this has formed the basis for the award of any degree, diploma or other similar titles of other organizations or university.

Thakur Kamini Narendra Savita

Abstract

SEZ, or a Special Economic Zone, is like a foreign territory within a country. SEZ is governed by a special set of rules to facilitate foreign direct investment for export-oriented production. These are free trade zones and customs authorities do not supervise them. In Uran 2587 hectares of land comes under NMSEZ and JNPT-SEZ project. This area includes large patch of Uran wetlands which had very rich biodiversity. Uran is popular for its amazing bird diversity.

Present study was carried out to determine the impact of SEZ projects on bird diversity along the Uran wetlands. During the study 20 hectares area was observed as sub sample out of 204 hectares by using line transect method from July to December 2009. The total 96 of birds species were recorded, which included 57 of water and water dependent bird species and 39 of terrestrial birds species both were recorded within the transect and in flight. 17 species of birds were observed common to all the four transects, of which eight were terrestrial birds, seven water and two water dependant birds. The diversity of bird's was maximum in transects three and four while the density was maximum in transects two followed by transect three. On comparing monthly variations highest density and diversity were observed in the month of September which was the peak of monsoon. In the month of November reclamation activity started which caused damage to the ecosystem to a large extent and this lead to reduction in density and diversity of both water and terrestrial birds.

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1. Introduction

India is one of the oldest civilizations in the world with a kaleidoscopic variety and rich cultural heritage. It has achieved all-round socio-economic progress during the last 62 years of its Independence. India has become self-sufficient in agricultural production and is now one of the top industrialized countries in the world and one of the few nations to have gone into outer space to conquer nature for the benefit of the people. It covers an area of 32, 8,263 sq. km, extending from the snow-covered Himalayan heights to the tropical rain forests of the south. As the 7th largest country in the world, India stands apart from the rest of Asia, marked off by the Great Himalayas in the north, it stretches southwards and at the Tropic of Cancer, tapers off into the Indian Ocean between the Bay of Bengal on the east and the Arabian Sea on the west.

Lying entirely in the northern hemisphere, the mainland extends between latitudes 8° 4' and 37° 6' north, longitudes 68° 7' and 97° 25' east and measures about 3,214 km from north to south between the extreme latitudes and about 2,933 km from east to west between the extreme longitudes. It has a land frontier of about 15,200 km. The total length of the coastline of the mainland, Lakshadweep Islands and Andaman & Nicobar Islands are 7,516.6 km.

India is one of the most populated countries in the world, second after China. With a workforce of more than 440 million, a huge pool of English-speaking graduates and a fast-growing economy, the need for employment opportunities has increased drastically. From the 1950s to the 1980s, India followed socialist-inspired policies. Since 1991, the nation has moved towards a market-based system. The policy change in 1991 came after an acute balance of payments crisis, and the emphasis since then has been to use foreign trade and foreign investment as integral parts of India's economy. With an average annual GDP growth rate of 5.8% for the past two decades, the economy is among the fastest growing in the world. It still contains the largest concentration of poor people in the world, and has a higher rate of malnutrition among children under the age of three (46% in year 2007) than any other country in the world. India being a populated country with increasing demand for employment the government has regularly come up with several policies to provide employment. Among these the Special Economic Zone (SEZ) Act of 2005 is the most recent one.

2. Concept of SEZ ?

The concept of free zone/special zone has existed for many years the oldest one started out as the Special Zone in the year 1830 in Gibraltar. Typically, special zones are regions designated for economic development oriented towards attracting the FDI and export promotion, both fostered by special policy incentives. These also include Export Processing Zone (EPZ). An EPZ provides institutional umbrella in an underdeveloped region. It is a specifically delineated duty free enclave and shall be deemed to be a foreign territory for the purposes of trade operations, levy of duties and tariffs.

Thirty years ago, 80 EPZs in 30 countries generated barely $6 billion in exports and employed about 1 million people. In 2006, 3,500 SEZs operated in 130 countries and accounted for over $600 billion in exports and 66 million direct jobs.

India is the first country in Asia to recognize the effectiveness of the EPZ model in promoting exports. The first EPZ was set up in Kandla in Gujarat as early as in 1965. It was followed by the Santacruz export processing zone in Mumbai which came into operation in 1973. The EXIM Policy has introduced a new scheme since April 1, 2000 for establishment of SEZs in different parts of the country. The SEZs are permitted to be set up in public, private, joint sector or by the State Governments with a minimum size of land areas prescribed for different categories of SEZs. An Act of parliament, the SEZ Act 2005 was enacted for the establishment, development and management of the SEZs in India with a view to promote exports and other matters connected therewith. The Act came into effect on June 23, 2005 and has clearly laid down legal backup for establishment of SEZs. This Act has provision to convert the existing EPZs into SEZs and allows extension of all concessions and other benefits applicable under this act to the enterprises in the zones. The SEZ rules came into force with effect from February 10, 2006.

SEZ is almost a self contained area with high class infrastructure for commercial operations as well as residential inhabitation. In other words, SEZs have evolved and transformed from the original concept of industrial estates, which were focused on manufacturing for export purposes. It is believed that SEZs could stimulate infrastructure development through forward and backward linkages not only within the zones but also facilitate economic development in the peripheral areas.

The minimum area of land prescribed for multi-products SEZ is 1000 Ha. Small states like Jammu & Kashmir, Goa and the Union Territories do not have sufficient barren land stretches to develop multi-product SEZs. Therefore, the minimum land requirement has been prescribed at 100 Ha for these regions. The reduced land requirement is applicable for sector specific SEZs also. Specific products where India has a comparative advantage, the minimum land requirement has been reduced further to 10 hectare. As per the Government regulations, more than one crop agricultural land area, which falls within the area for acquisition for the SEZ should not exceed 10 per cent of the total land area of the SEZ. The barren land available in India is either reserved for forests or for coastal zone. If these lands acquired for the purpose of development of SEZs, it may create environmental imbalances (Lakshmanan, 2006). Some stretches of such barren land are surrounded by agricultural land. If acquired and developed into SEZs, such land areas may adversely affect the agricultural production and even in some cases, severely affect the livelihood of the common man.

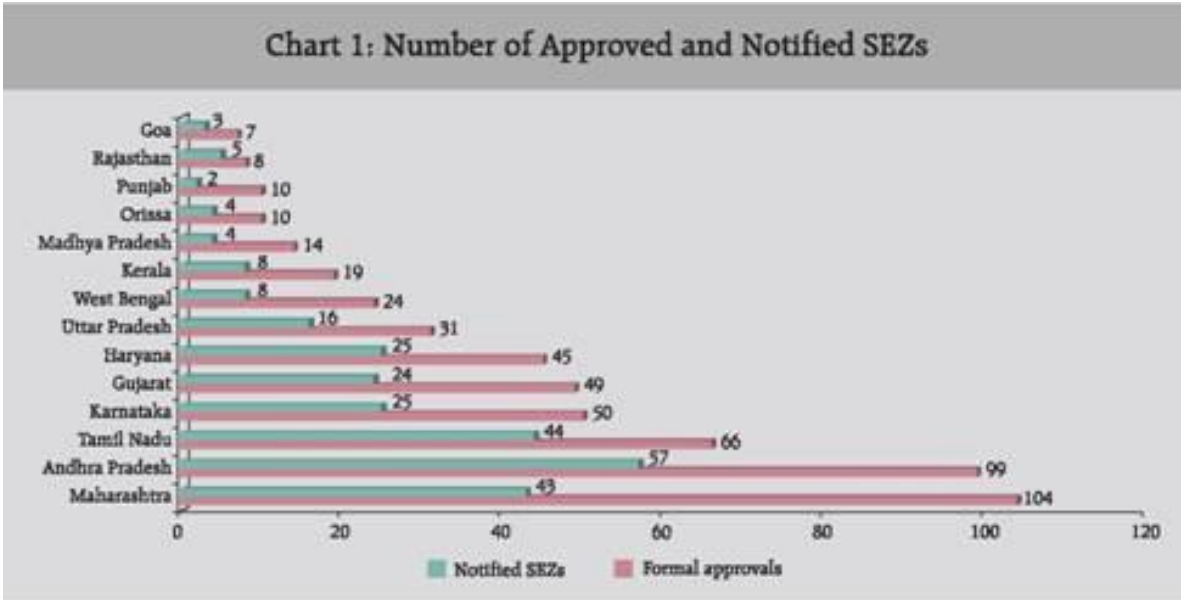
The three states that cornered the maximum number of approvals were the coastal states of Maharashtra, Andhra Pradesh and Karnataka (followed closely by Tamil Nadu). Of the 103 projects that have been notified, as of May 1, 2007, 80% are in coastal states. Of these, three are large multi-product port-based SEZs.

Coastal areas and the communities that live there have always been vulnerable, as coastlines are frontiers of a country and have always been considered strategic, from an economic as well as a political standpoint. The 9 million fish-workers living along India's 7,517 km coastline are well aware of the unpredictable nature of the sea. But they are at a loss to understand the behaviour of a government that appears bent on endangering both the coastline, the lives and livelihoods of people who live along it.

The SEZ issue is being highlighted as a farmers' issue, with a rehabilitation policy being worked out for those who will lose their land. But with 80% of approved SEZs in coastal states, what about the thousands of fisherfolk who will lose livelihoods based on the sea, estuaries and coastal systems? Allowing SEZs often means land acquisition and conversion of land use with no commensurate benefits to the affected population and a loss of their livelihoods.

With the announcement of SEZ rules and other concessions provided by the Government, about 700 firms/companies applied for setting up of SEZs, of which 552 have been given formal approval, of which 274 SEZs have been notified. The functional SEZ units provided employment to about 3.63 lakh persons, of which SEZs operated by the Government

provide about 54 per cent of the total employment. Investors have shown much interest in establishment of SEZs in the developed states like Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka and Gujarat. Though maximum approvals to set up SEZs were granted in Maharashtra (104), only 43 have been notified as of December 2008. Some of the major SEZs in Maharashtra are planned along the coastal wetlands.



Graph 1: Number of approved and notified SEZs

3. What are Wetlands?

The Ramsar Convention on Wetlands of International Importance IUCN (1971) defined wetlands as; "Areas of marshes, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including area of marine water the depth of which at low tide does not exceed six meters." Wetland ecosystem is highly productive zone showing the presence of number of detritivores and herbivores which take an important position in food chain and web of the ecosystem (Patole V M *et al.,* 09). They are fragile ecosystems that are susceptible to changes; even with little change to the composition of their biotic and abiotic factors. Wetland plants and animals have developed many morphological, anatomical and physiological characteristics which allow them to inhibit the wetland environment. Wetlands provide home for a huge diversity of wildlife such as birds, mammals, fish, frogs, insects and plants (Buckton, 2007).Thus wetlands help in maintaining biodiversity of flora and fauna.

3.2. Importance of wetlands:

The functional properties of a wetland ecosystem clearly demonstrate its role in maintaining the ecological balance. Gopal (1995), further stated that all wetlands perform certain functions and hence have importance in ecology. Wetlands have the capacity to retain excess water during heavy rainfall that would otherwise cause flooding. By retaining flood flows, they maintain a constant flow regime downstream, preserving water quality and increasing biological productivity for both aquatic life as well as human communities of the region. Wetlands may contribute to the recharge of groundwater aquifers and provide the habitat for a variety of species of plants and animals confined to these areas. They also support a much larger number of organisms which utilize wetlands for shorter period at some stage of their life cycle. Wetland vegetation plays a major role in erosion control, which in turn contributes to shoreline stabilization and storm protection. Apart from this, the socio-economic values through water supply, fisheries, fuel wood, medicinal plants, livestock grazing, agriculture, energy resource, wildlife resource, transport, recreation and tourism, and so forth, are significant

3.2. Classification of wetlands

The wetlands include a wide spectrum of habitat characteristics such as hydrological regimes, water quality and soil, nature and diversity of their biota. Wetlands also occur in different shapes and sizes from less than one hector to hundreds of square kilometers in area. As per Gopal (1995) various classification schemes for wetlands have employed a few to large number of criteria. Scott in (1989) proposed a simple classification of wetland which is used in Ramsar Convention. It simply gives 22 types of wetlands which are listed in Table 1.

Table 1. Wetland type initially recognized by the Ramsar Convention

1.	Shallow sea bays and straits (under 6m at low tide)
2.	Estuaries, deltas
3.	Small offshore island,
4.	Rocky sea coasts, sea cliffs
5.	Sea beaches (sands, pebbels)
6.	Intertidal mudflats, sand flats
7.	Mangrove swamps, mangrove forest
8.	Coastal brackish and saline lagoons and marshes
9.	Salt pans (artificial)
10.	Shrimp ponds, fish ponds
11.	Rivers, streams- slow flowing (lower perennial)
12.	Rivers, streams- fast flowing (upper perennial)
13.	Oxbow lakes, riverine marshes
14.	Freshwater lakes and associated marshes (lacustrine)
15.	Freshwater ponds (under 8 ha), marshes, swamps (palustrine)
16.	Salt lakes, saline marshes (inland drainage system)
17.	Water storage reservoirs, dams
18.	Seasonally flooded grasslands, savanna, palm savanna
19.	Rice paddies
20.	Flooded arable land, irrigated land
21.	Swamp forest, temporarily flooded forest
22.	Peat bogs

3.3.Distribution of wetlands in India

India is blessed with numerous rivers and streams. By virtue of its geography, varied terrain, and climate, it supports a rich diversity of inland and coastal wetland habitats. Indian wetlands are mostly associated with river systems distributed from the cold, arid zone of Ladakh, and the warm, arid zone of Gujarat-Rajasthan to the tropical monsoon of central India and the wet, humid zone of the Southern Peninsula. There are 67,429 wetlands in India, covering about an area of 58.2 million hectares (Prasad *et al.*, 2002). Out of these,

2,175 wetlands are natural, covering about 1.5 million hectares, and 65,254 wetlands are man-made, occupying about 2.6 million hectares. According to Forest Survey of India, mangroves cover an additional 6,740 sq km. Their major concentrations are Sunderbans, Andaman, and Nicobar Islands, which holds 80% of the country's mangroves. The rest are in Orissa, Andhra Pradesh, Tamilnadu, Karnataka, Maharashtra, Gujarat, and Goa.

The total costal wetland areas in Maharashtra have been estimated to be 1567km2 (Jagtap *et al.*, 2001) and is given below in Table 2:

Table 2: Extent (km2) of coastal wetlands under various categories from Maharashtra

Category	Area (km2)
Estuarine	738.13
Mudflat	471.44
Beach/spit	119.65
Shoals	1.20
Mangroves	146.40
Marsh	12.10
Mudflat with vegetation	8.20
Lagoons	8.60
Dunes	42.40
Salt pans	19.50

According to Jagtap *et al* (2001) the mangrove cover in Maharashtra is estimated to be 146 km2. Along Mumbai there is a good mangrove cover in Thane, Panvel, Karanja and Dharamtar creek complex in the Raigarh and Thane district. In addition to the mangrove mudflats the city is also blessed with several fresh water bodies. Tulsi, Powai and Vihar are the only known lakes, however according to a recent study by WWF-India there are 69 exisiting lakes out of the total 129 lakes of several sizes Rasal *et al.*, (2009).

4. Purpose of study

I have been observing Uran since my childhood and recently have come across some disturbing changes causing severe damage to the ecosystem. As discussed earlier Uran wetlands served as home to a huge diversity of wildlife such as plants, fish, frogs, reptiles, insects, birds, mammals, and many other organisms.

Uran is frequented by many nature lovers for bird watching. Recently, water birds have gained interest as indicators of wetland quality and as parameters of restoration success and regional biodiversity (Kumar *et al*., 2009). According to Pawar *et al.*, (2007) entire coastal belt of Uran is under heavy process of urbanization due to the number of industries settled on the coastal line of Uran.

Under the project of Navi Mumbai Special Economic Zone (NMSEZ) and Jawaharlal Nehru Port Trust - Special Economic Zone (JNPT-SEZ) reclamation activity of wetlands in Dronagiri and JNPT had started. Most of the area was reclaimed and about 9 feet wall was constructed around the acquired land for the Reliance NMSEZ. Anthropogenic activities involving development projects have most often resulted in depletion of coastal resources, destruction of critical habitats, disruption of ecosystem processes and loss of biodiversity (Vijay *et al*, 2005).

According to Jagtap *et a.,l* (2001), erosional changes were predominantly noticed on the southern bank of Thane creek, along the banks of Panvel Dharamtar creek complex, so the subsidence and recession of coastal wetlands, by natural or anthropogenic causes are of immediate concern. Many areas demarcated for development of SEZs also happen to be fragile ecosystems. These are the coastal areas, whose dynamic ecological nature and productivity are yet to be fully studied and appreciated (Manju Menon, 2006). Corroborating with the above views, a similar situation is forseen for Uran due to the reclamation and development activities leading to degradation of the natural and healthy wetland ecosystem. This would ultimately affect the flora and fauna of the region including the livelihood of the local people.

The maintenance of biodiversity forms a keystone of sustainable development and hence is emerged as one of the central tenets of the world conservation movement. Being an environment enthusiast and student of environmental science my occasional visits to this area prompted my interest to study the Uran mudflats. My aim and objective behind this study is to protect the natural habitat of the birds in Uran while documenting the qualitative

and quantitative data of bird diversity (both residential and migratory) found in the wetlands of Uran, which are on the verge of vanishing.

4.1.SEZ in Uran

Maharashtra was the first State to formulate a state level SEZ policy in 2001 and soon after that CIDCO proposed an SEZ spread over 3,800 hectares of land in Navi Mumbai region. Now named the Navi Mumbai SEZ (NMSEZ), it comprises of Dronagiri, Kalamboli, Ulwe and a regional park zone. NMSEZ is conceived and developed as a futuristic business hub and global gateway for trade, commerce, industry, service and tourism to India. It is also India's first SEZ in public private partnership, a joint venture with CIDCO, a Maharashtra government undertaking.

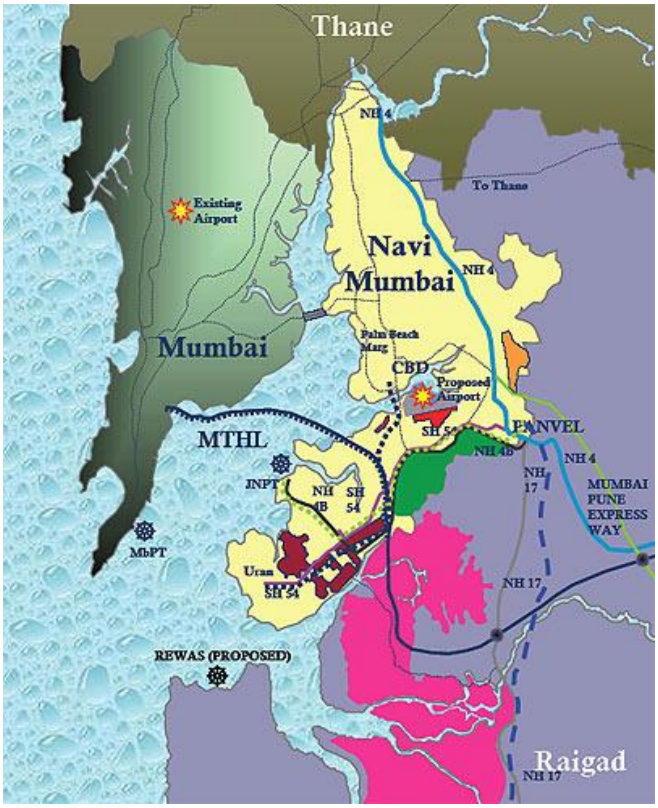
The area that comes under NMSEZ is planned over four nodes which are as follows

Table 3: NMSEZ distribution

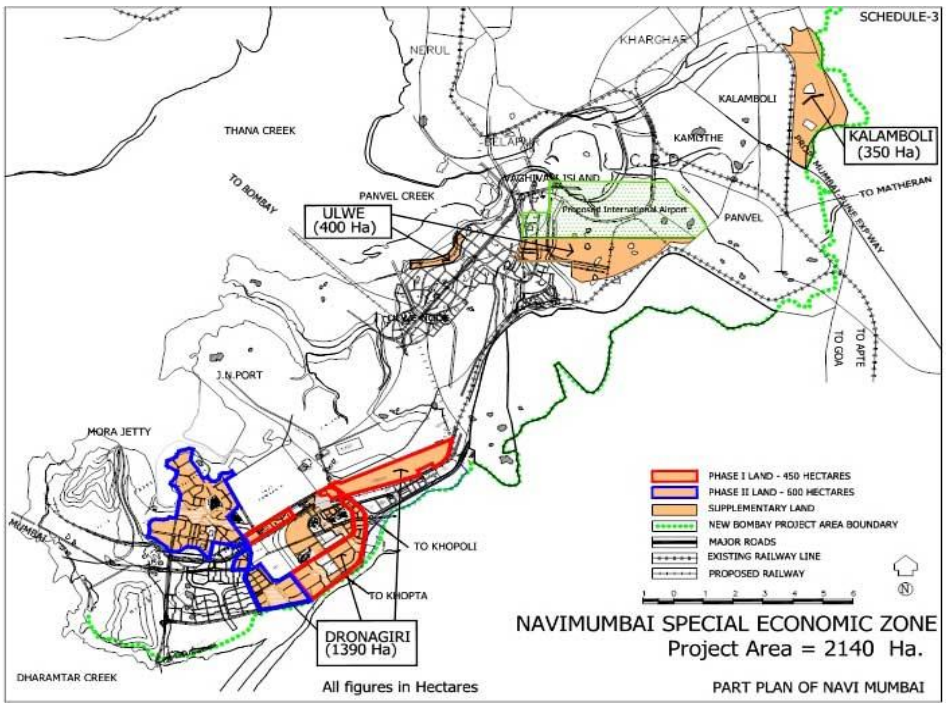
Node title	Area covered (in hectars)
Dronagiri node	1287.41
Kalamboli node	282.25
Ulwe node-1	72.94
Ulwe node -2	497.40

The Dronagiri zone is spread over an area of 1,777 ha and is located at the southern tip of Navi Mumbai (Map1 & 2). The site is located to the east of Uran town, and is bound by the Karanja Creek on the south-east. Residential areas are located to the west and north-west of the zone, while the JNPT port area and township are located towards the north of the zone. The zone is adjacent to the JNPT port, and is located farthest from the central business districts of Belapur, Nerul and Vashi. Due to its proximity to the port, this zone is ideal for port-based industries.

Along with the NMSEZ Union government-run Jawaharlal Nehru Port Trust (JNPT), India's biggest container port, plans to set up a port-based SEZ/export processing zone (EPZ) on 1,200 ha of land at the port. Jawaharlal Nehru Port, which started commercial operations in 1989, had acquired 2,500ha of land for its long-term requirements (Map 3). Out of this, 1,300 ha have been utilized so far for port-related activities



Map 1: SEZ around Navi Mumbai



Map 2: NMSEZ project areas

5. Materials and Methods

The present study was conducted along the JNPT Town Ship that was a wetland area (Map 4) with mangrove vegetation that was used as saltpans by the locals who also used the place to fish for their livelihood. The total area covered was 204 hectares behind JNPT town ship was studied from May to the December 2009. For the convenience in study the 204 hectare was divided into four transects each of approximate 50,000 sq m area as shown in Map 4 and described below.

Transect 1:

- This transect starts from the compound wall of the JNPT property, few meters away from Phunde village (N18°53.644'; E072°.809') and covers 500m distance along the road, end at (N18°53.879'; E72°58.084')
- Previously this area was a very good wetland, but in the month of May almost all the area was reclaimed by dumping mountain soil
- There were very few patches that contained water

Transect 2:

- This transect starts from a small old mandir on the east side of the road (N 18°53.997'; E 072°58.182') and covers 500 m distance along the road
- This area was also partially reclaimed in the month of May but was in better condition to hold the water
- There were few saltpans to the west of the road and traditional fishery was also done by the locals in this area
- From the month of November reclamation has started in this area

Transect 3:

- This transect starts from the entry road of JNPT township (N 18°54.494'; E 072°58.439') and ends near Nhava Sheva police station (N 18°54.722'; E 072°58.618) The JNPT township is demarcated at a distance of 30 meters from the line in this transect.
- This area had good wetlands but some of the part to the west of the road was dumped with the construction waste and the existing mangroves burnt.
- In month of November reclamation has started in this region

Transect 4:

- This transect stars from the place near the Nhava Sheva police station (N 18°54.827'; E 072°58.621') Covers the 500m distance parallel to the railway line up to (N 18°54.650'; E 072°58.550')
- This area covers both terrestrial as well wetland habitat which are in undisturbed condition
- There is a fresh water pond which used for fishing activity
- There is railway line and nala along the transect on one side

The materials and methods used to study the density and diversity of birds is as follows.

5.1.Materials used:

1. Maps obtained from CIDCO and NMSEZ
2. Geographical Positioning System – Garmin 60.
3. Binoculars - 10 x 50 X
4. Camera Cannon SX 10 IS
5. Datasheets
6. Field guides – Book of Indian Birds by Salim Ali and Birds of the Indian Sub continent by Richard Grimmett, Carol Inskipp and Tim Inskipp.

5.2.Methods used:

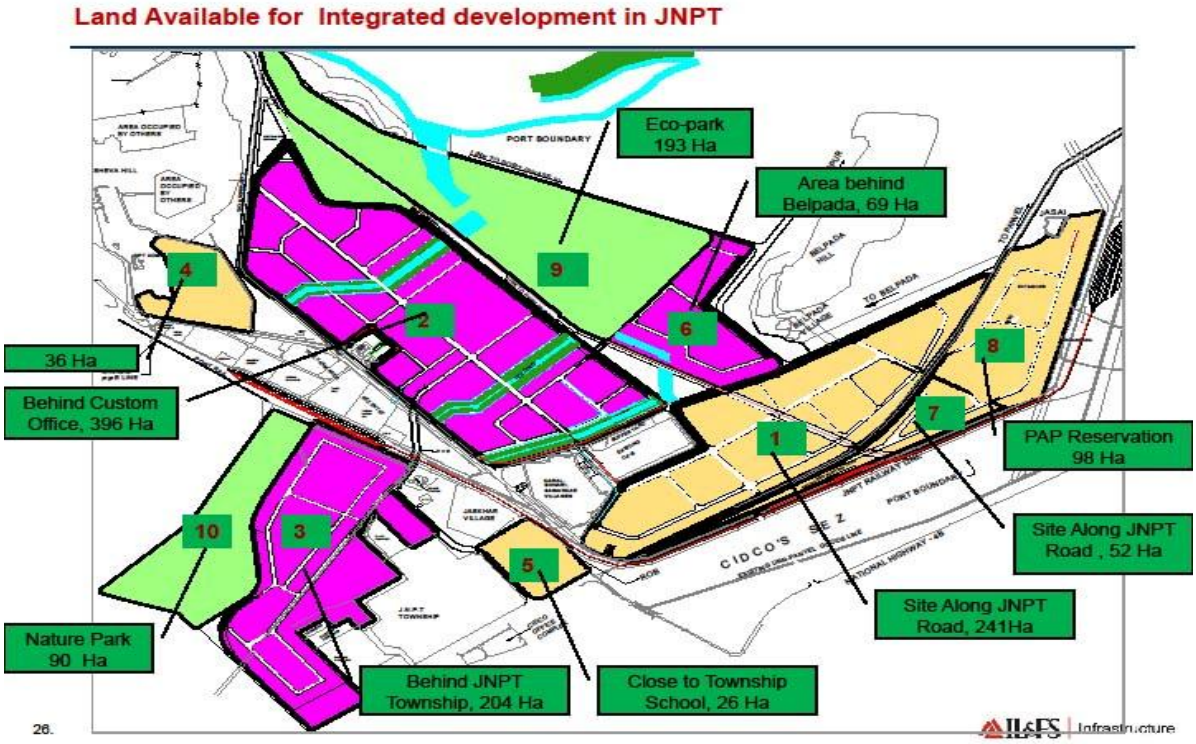
1. Collection of Secondary data from -

   Tahesil office Uran; City and Industrial Development Corporation (CIDCO) office, CBD-Bellapur, Navi Mumbai; Navi Mumbai Special Economic Zone office, Bellapur, Navi Mumbai; Trustee, JNPT board, Uran
2. Population estimation method for birds

   To estimate the density and diversity of birds Line Transect method was used described by Javed and Kaul (2002). The transect length was 500 m and the width was 100 m. Multiple visits were made every month to record the birds.
3. Standard statistical methods were employed to analyse the data wherever needed.

Table 4: Line transect data sheet

Date:			**Transect no:**				**Habitat:**	
Start time:			**Time end:**			**Lat:**		**Long:**
Sr.no.	**Bird species**	**Time**	**Number**	**Perpendicular distance**			**Activity**	**Remark**



Map 3: JNPT Port-SEZ area

Map 4: Study area

6. Observations

Uran wetlands are basically saline and are fringed with mangroves, this ecosystem provide a good habitat for a variety of flora and fauna. During the study important flora along the study area were recorded which is given in Table 5. The flora included mangroves, mangrove associates and terrestrial plants. Total 21 floral species were found, out of which nine are mangroves including two front mangroves and seven back mangroves. Four species of mangrove associates were found. Eight terrestrial plant species including the *Gloriosa superba* i.e. Glory lilly, which is an endangered plant species according to IUCN criteria were observed. The healthy mangrove ecosystem serves as a nursery for variety of organisms. During investigation on the basis of visual observations some benthic fauna was recorded (Table 6). Benthic fauna included two species of crustacean fish, 10 fin fishes, six gastropods and polychaetes. Along the wetland region 21 reptile species were also recorded which are listed in Table 7. In addition there were frequent sightings of Indian Mongoose and the Indian Jackal. Presence of all these organisms indicates the healthy habitat of Uran wetlands that support a very rich biodiversity which harbors great variety of avian fauna.

Table 5: Important flora (Mangroves and Mangrove associates)

Sr. no	Scientific name	Common name	Type	Transect			
				I	II	III	IV
1	*Avicennia marina marina*	Grey mangrove	FM	+	+		+
2	*Avicennia marina acuticima*		FM				+
3	*Sessuvium portulacastrum*	Sea purslane	BM			+	
4	*Salvadora persica*	Miswak	BM	+	+	+	+
5	*Acanthus illicifolius*	Sea Holy	BM		+	+	+
6	*Suaeda fruticosa*		BM	+		+	+
7	*Aeluropes repens*		BM	+	+	+	+
8	*Derris trifoliate*		BM	+		+	+
9	*Ipomoea carnea*	Besharam	BM			+	
10	*Typha angustata*	Ramban	MA			+	+
11	*Pongamea pinnata*	Karanj	MA				+
12	*Clerodendron inerme*		MA			+	+
13	*Zizyphus mauritiana*	Ber	MA		+	+	+
14	*Tamarix trouppi*		T				+
15	*Pithecollobium dulce*	Jungle gilebi	T	+	+	+	+
16	*Abelmoshus monitot*		T				+
17	*Gloriosa superba*	Glory Lilly	T				+
18	*Seseame orientale*	Wild til	T				+
19	*Acacia nilotica*	Indian babul	T	+	+	+	+
20	*Acacia auriculiformis*	Australian acacia	T				+
21	*Parkinsonia aculeata*		T				+

FM- Front mangrove; BM- Back mangrove; MA- Mangrove associates; T- Terrestrial flora

Table 6: Checklist of Aquatic fauna

Sr. no	Fin fish	Crustacean fish	Gastropods
1	Boi	*Scylla sereata*	*Cerithideopsilla djadjaviaensis*
2	Cat fish	*Varuna literata*	*Telescopium telescopium*
3	Prawns		*Neris species*
4	Tilapia		*Onchidium species*
5	Guppy		*Melampus scyeleheocis*
6	Snake head fish		
7	Gobi		
8	Barbs		
9	Snake eel		
10	Pipe fish		

Table 7: Checklist for Reptiles in Uran wetlands and around

Sr. No	Common name	Scientific name
1	Indian rat snake	*Ptyas mucosus*
2	Brahminy worm snake	
3	Checkered keelback	*Xenochrophis piscator*
4	Forstern cat snake	
5	Indian rock python	*Python molurus*
6	Cobra	*Naja naja*
7	Russells viper	*Daboia russelii*
8	Common trinket	*Elaphe helena*
9	Kukri snake	*Oligodon arnensis*
10	Vine snake	*Ahaetulla nausuta*
11	Dog faced snake	*Cerberus rhynchops*
12	Glossy marsh snake	
13	File snake	
14	Banded racer	*Argyrogena fasciolatus*
15	Buffstriped keelback	*Amphiesma stolata*
16	Sand boa	
17	Common wolf snake	*Lycodon aulicus*
18	Indian Monitor lizard	*Veranus bengalensis*
19	Chameleon	
20	Garden lizard	
21	Brahminy skink	

6.1.Avifauna

Good climatic conditions, ideal habitat and copious food availability make Uran a very important spot near Mumbai for many species of wetland birds. Uran wetlands served as nesting, feeding, breeding and wintering grounds by different species of both local as well as migratory birds (Shivkar, 2004). 151 species of birds with migratory, resident and breeding populations have been recorded on several internet blogs. Out of which 79 were water & water dependent birds and 72 were terrestrial birds (Table 8).

Newton (1995) is of the opinion that birds are ideal bio-indicators and useful models for studying a variety of environmental problems. Mumbai region has 350 species of birds of which around 44 species are shorebirds (Survashis, 2007). According to Survashis (2007), Alibaug, Datiware, Gorai shoreline, Kelve shoreline, mangroves and creek of Malad, mudflats, mangrove patches and creek of Navi Mumbai, Sewri, Uran and Nhava-Sheva wetlands are the hot spots for birds in and near Mumbai region. The Sewri Bay and Thane Creek have been declared as an Important Bird Area (IBA) by the Bombay Natural History Society (BNHS) and Birdlife International in 2004.

During the present study total 96 bird species were recorded of which 57 are water and water dependant birds and 39 terrestrial birds (Table 8). The birds found mostly use mangrove and mudflat ecosystem for feeding, roosting and nesting purpose. In comparison with the previous bird list one can observe drastic reduction in the number of bird species. Eurasian Curlew a Near threatened species of bird that was recorded earlier was not observed during the present study.

According to Menon (2006), many areas demarcated for development of SEZs also happen to be fragile ecosystems. These are the coastal areas, whose dynamic ecological nature and productivity are yet to be fully studied and appreciated. The importance of the coasts was legally established when the Coastal Regulation Zone Notification (CRZ) was drawn up in 1991 under the Environment Protection Act, 1986. The CRZ notification lays down norms for safeguarding the sensitive coastal ecology, recognizing that these areas form the livelihood base of thousands of traditional communities. The reduction in the diversity of birds during the present study, shows the impact of the encroachment in CRZ I region of Uran. This is despite the rules laid by the Government of India regarding acquiring of land for SEZ and even stating the consequences. Unfortunately, the notification was amended in mid-2002 to allow for the establishment of SEZs, defying the very spirit of the law.

Table 8 : Comparison of birds sighted during the present study with the earlier records.

Sr no	Water birds	Scientific name	Status	IUCN criteria	Present study
1	Brahamini Shelduck	*Tadorna ferruginea*	W	Lc	+
2	Lesser wistling duck	*Dendrocygna javanica*	B	Lc	+
3	Eurasian wigeon	*Anas falcata*	W		
4	Garganey	*Anas querquedula*	W	Lc	+
5	Northern shovler	*Anas clypeata*	W	Lc	+
6	Cotton pigmy goose	*Nettapus coromandelianus*	B	Lc	+
7	Spot-billed duck	*anas poecilorhyncha*	B	Lc	+
8	Gadwal	*Anas strepera*	W		
9	Little grebe	*Tachybaptus ruficollis*	B	Lc	+
10	White breasted kingfisher	*Halcyon smyrnensis*	B	Lc	+
11	Pied kingfisher	*Ceryl rudis*	B		
12	Common kingfisher	*Alcedo atthis*	B	Lc	+
13	Water cock	*Gallicrex cinerea*	B		
14	Common coot	*Fulica atra*	B	Lc	+
15	Common moorhen	*Gallinula chloropus*	B		
16	Baillon's crake	*Porzana pusilla*	I		
17	Ruddy brested crake	*Porzana fusca*			
18	White breasted water hen	*Amaurornis phoenicurus*	B	Lc	+
19	Purple swamphen	*Porphyrio phoenicurus*	B	Lc	+
20	Painted snipe	*Rostratula benghalensis*	B	Lc	+
21	Common snipe	*Gallinago gallinago*	W	Lc	
22	Blacktailed godwit	*Limosa limosa*	W	NT	+
23	Bartailed godwit	*Limosa lapponica*	W		
24	Whimbler	*Numenius phaeopus*	W		
25	Eurasian curlew	*Numenius madagascariansis*	W	NT	
26	Spotted redshank	*Tringa erythropus*	W		
27	Common redshank	*Tringa totanus*	W	Lc	+
28	Common greenshank	*Tringa nebularia*	W	Lc	+
29	Marsh sandpiper	*Tringa stagnatilis*	W	Lc	+
30	Green sandpiper	*Tringa ochropus*	W	Lc	+
31	Common sandpiper	*Actitis hypoleucos*	W	Lc	
32	Temminck's stint	*Calidris temminckii*	W		
33	Little stint	*Calidris minuta*	W		
34	Curlew sandpiper	*Calidris ferruginia*	W		
35	Ruff sandpiper	*Philomacus pugnax*	W	Lc	+
36	Wood sandpiper	*Tringa glareola*	W	Lc	+
37	Pied avocet	*Recurvrostra avosetta*	W	Lc	+
38	Black winged stilt	*Himantopus himantous*	B	Lc	+
39	Red wattled lapwing	*Vanellus indicus*	B	Lc	+

40	Phesant tailed jacana	*Hydrophasianus chirurgus*	B	Lc	+
41	Small pratincole	*Glareola lactea*	B	Lc	+
42	Pasific golden plover	*Pluvialis fulva*	W		
43	Kentish plover	*Charadrius alexandrinus*	W		
44	Little ring plovers	*Charadrius dubius*	B	Lc	+
45	Heuglin's gull	*Larus heuglini*	W		
46	Brown heded gull	*Larus brunnicephalus*	W	Lc	+
47	Gull billed tern	*Gelochelidon nilotica*	W	Lc	+
48	Caspian tern	*Sterna caspia*	I		+
49	Little tern	*Sterna albifrons*	W	Lc	+
50	Whiskered tern	*Chlidonias hybridus*	W	Lc	+
51	Cinnamon bittern	*Ixobrichus sinensis*		Lc	+
52	Intermediate egret	*Mesophoyx intermedia*	B	Lc	+
53	Little cormorant	*Phalacrocorax niger*	B	Lc	+
54	Little egret	*Egretta garzetta*	B	Lc	+
55	Greater egret	*Casmerodius albus*	B	Lc	+
56	Cattle egret	*Bubulcus ibis*	B	Lc	+
57	Indian pond heron	*Ardeola grayii*	B	Lc	+
58	Purple heron	*Aidea purpurea*	B	Lc	+
59	Grey heron	*Ardea cinerea*	W	Lc	+
60	Greater flamingo	*Phoenicapterus ruber*	P	Lc	+
61	Lesser flamingo	*Phoenicapterus minor*	P	NT	+
62	Oriental white ibis	*Threskiornis melanocephalus*	B	NT	+
63	Glossy ibis	*Plegadis falcinellus*	P	Lc	+
64	Eurasian spoonbill	*Platalea leucoroda*	B	Lc	+
65	Painted stork	*Mycteria leucocephala*	B	NT	+
66	Asian open billed stork	*Anastomus oscitans*	B	Lc	+
67	White stork	*Ciconia ciconia*	B		
68	Black crowned night heron	*Nycticorax nycticorax*	B	Lc	
69	Western reef egret	*Egretta gularis*	F	Lc	+
70	Citrine wagtail	*Motacilla citreola*	W	Lc	+
71	Eurasian marsh harrier	*Circus aeruginosus*	W	Lc	+
72	Brahminy kite	*Haliastur indus*	B	Lc	+
73	White bellied sea eagle	*Haliaeetus leucogaster*	B		
74	Barn swallow	*Hirundo rustica*	W	Lc	+
75	Wire tailed swallow	*Hirundo smithii*	B	Lc	+
76	Red rump swallow	*Hirundo daurica*	B	Lc	+
77	White eared bulbul	*Pycnonotus leucotis*	B	Lc	+
78	Osprey	*Pandion haliatetus*	W		
79	White wagtail	*Motacila alba*	W		+

80	Coppersmith barbet	*Megalamia haemacephala*	B	Lc	
81	Common hoopoe	*Upupa epops*	B	Lc	+
82	Indian roller	*Coracias benghalensis*	B	Lc	+
83	Blue tailed bee-eater	*Merops Philipinus*	W	Lc	+
84	Green bee-eater	*Merops orientalis*	B	Lc	+
85	Pied cuckoo	*Clamator jacobinus*	S	Lc	+
86	Asian koel	*Eudynamys scolopacea*	B	Lc	+
87	Greater coucal	*Centropus sinensis*	B	Lc	
88	Alexandrine parakeet	*Psittacula eupatria*	B	Lc	
89	Rose ring parakeet	*Psittacula kramara*	B	Lc	+
90	Plume headed parakeet	*Psittacula krameri*	B	Lc	
91	Rock pigeon	*Columba livia*	B	Lc	+
92	Spotted dove	*Streptopelia chinensis*	B	Lc	+
93	Laughing dove	*Streptopelia orientalis*	B	Lc	+
94	Spotted owl	*Athene barma*	B	Lc	+
95	Eurasian eagle owl	*Octus sunia*	B		
96	Barn owl	*Tyto alba*	B	Lc	
97	Black kite	*Milbus migrans*	B	Lc	+
98	Black sholderd kite	*Elanus caeruleus*	B	Lc	+
99	Crested serpent eagle	*Spilornis cheela*	B		
100	Short toed snake eagle	*Circaetus gallicus*	B		
101	Shikra	*Accipiter badius*	B	Lc	+
102	Montages harrier	*Circus pygargus*	W		
103	Oriental honey buzzard	*Pernis potilorhyncus*	B	Lc	
104	White-eyed Buzzard	*Butastur teesa*	B	Lc	
105	Steppe eagle	*Aquila nipalensis*	W		
106	Booted eagle	*Hieraaetus pennatus*	W		
107	Peregreen falcon	*Falco peregrinus*	B		
108	Pallid harrier	*Cicus macrourus*	W		
109	Long legged buzzard	*Buteo rufinus*	I		
110	Common kestrel	*Falco tinnunculus*	W		
111	Red necked falcon	*Falco chicquera*	B		
112	Long tailed shrike	*Lanius schach*	B	Lc	+
113	House crow	*corvus splendens*	B	Lc	+
114	Jangle crow	*Corvus macrorhynchos*	B	Lc	+
115	Eurasian golden oriole	*Oriolus oriolus*	B	Lc	+
116	Black hooded oriole	*oriolus xanthornus*	B	Lc	
117	Black drongo	*Dicrurus macrocercus*	B	Lc	+
118	Blue throat	*Luscinia brunnea*	W		
119	Ashy drongo	*Dicrurus leucophaeus*	W	Lc	

120	Indian robin	*Saxicolcoides fulicata*	B	Lc	
121	Oriental magpie robin	*Copsychus saularia*	B	Lc	+
122	Desert wheater	*Oenanthe deserti*	I		
123	Brahminy starling	*Sturnus pagodarum*	B	Lc	
124	Rosy starling	*Sturanus roseus*	W	Lc	+
125	Asian pied starling	*Sturanus contra*	W	Lc	+
126	Common myna	*Acridotheres tristis*	B	Lc	+
127	Jangle myna	*Acridotheres fuscus*	B	Lc	
128	Red whiskered Bulbul	*Pycnonotus jocosus*	B	Lc	+
129	Red vented bulbul	*Pycnonotus cafer*	B	Lc	+
130	White browed fantail	*Rhipidura aureola*	B	Lc	
131	Ashy prinia	*Prinia socialis*	B	Lc	+
132	Plain prinia	*Prinia inornata*	B	Lc	+
133	Common tailor bird	*Othotomus sutorius*	B	Lc	+
134	House sparrow	*Passer domesticus*	B	Lc	+
135	Purple rump sunbird	*Nectarinia zeylonica*	B	Lc	+
136	Purple sunbird	*Nectarinia asiatica*	B	Lc	
137	Oriental skylark	*Alauda gulgula*	B	Lc	+
138	Rufous tailed lark	*Ammomanes cincturus*	B	Lc	+
139	Ashy crowned sparrow lark	*Eremopterix nigriceps*	B		
140	Indian pitta	*Pitta brachyura*	P		
141	Tickle billed flower Peaker	*Dicaeum agile*	B	Lc	
142	Zitting cisticola	*Cisticola juncidis*	B	Lc	+
143	Paddy field pipit	*Anthus rufulus*	B	Lc	
144	Baya weawer	*Ploceus philippinus*	B	Lc	+
145	Black breasted weawer bird	*Ploceus benghalensis*	B	Lc	
146	Indian silver bill	*Lonchura malabarica*	B	Lc	
147	Scaly- breasted munia	*Lonchura punctulata*	B	Lc	+
148	Black-headed munia	*Lonchura malacca*	B	Lc	+
149	Red avadavat	*Amandava amandava*	B	Lc	+
150	Common stonechat	*Saxicolatorquata*	W	Lc	+
151	Dusky crag martin	*Hirundo concolour*	B	Lc	

Key: W- winter visitor, B- breeding resident, P- passage visitor, I- Individual Records
Lc- Least concern, Nt- Near threatened

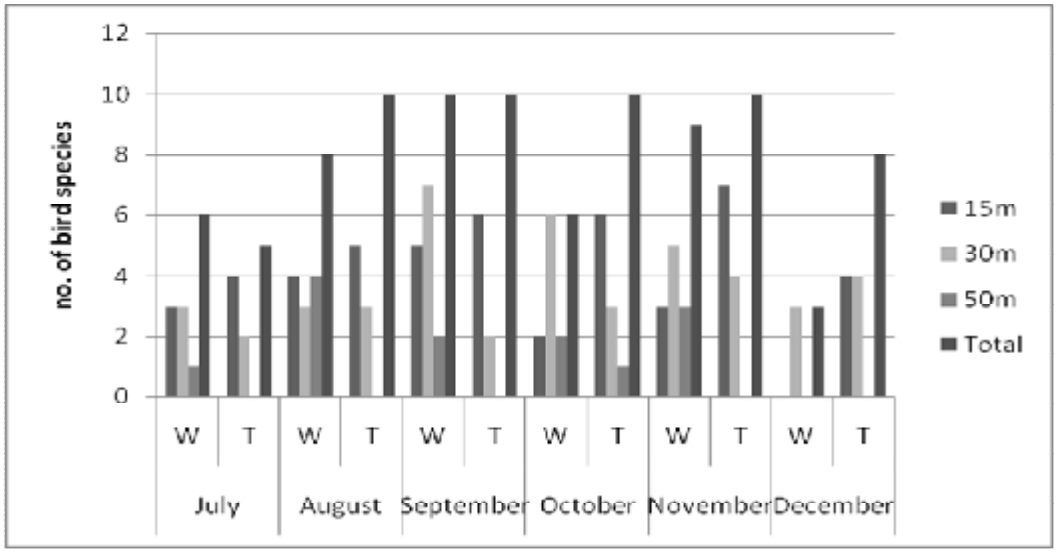
There is very little information available about the coastal birds associated with the mangroves in India (Samant, 1985). The avifauna in Uran has never been scientifically documented and hence the density and diversity of birds in the CRZ 1 of Uran mudflats was undertaken. This documentation also forms the base line data for future research.

The birds recorded in the different transects is given below, it has been observed that each of the four transects showed different characteristics depending on the availability of water and the human interference.

6.1.1. Transect 1: The first transect had 19 species of water and the Water dependant birds and 19 species of Terrestrial birds (Table 9). Most of the birds were observed within the transect and few were recorded in flight. This transect was a huge wetland and was known to support a variety of birds. As the reclamation had started in May, the maximum bird diversity was observed only during peak monsoon though there were no uncommon birds. This can be attributed to the maximum human influence.

Table 9: List of birds observed in Transect 1 during the study period.

Water and Water dependent birds	Terrestrial birds
Black wing stilt	Ashy prinia
Cattle egret	Asian koel
Citrine wagtail	Asian pied starling
Common kingfisher	Black drongo
Eurasian spoonbill	Black kite
Greater egret	Common myna
Grey heron	Common stonechat
Indian pond heron	Crested Lark
Little cormorant	House crow
Little egret	Indian roller
Western reef egret	Jangle crow
White breasted kingfisher	Long tailed shrike
White breasted water hen	Plain prinia
Marsh sandpiper	Red vented bulbul
Wagtail	Rock pigeon
Intermediate egret	Scaly- breasted munia
Brahminy kite	Spotted dove
Barn swallow	Zitting cisticola
Red wattled lapwing	Blue tailed bee-eater



Graph 2: Comparison of the diversity of water and terrestrial birds in transect 1.

- During the field study; within the range of 15m more number of terrestrial birds species were observed as compared to water bird species. The dominant terrestrial birds were Blue tailed bee eater followed by *Ashy prinia*. Whereas between the ranges of 15m to 30m more water bird species were recorded, while from 30m to 50m range very few water-birds were observed. Among the water birds Little cormorant and Indian pond heron were more in number.
- This area was almost reclaimed in May hence the number of waders found was less in comparison to the terrestrial birds. Moreover on observing at a perpendicular distance more number of birds were found within the range of 30m distance. The low occurrence of birds could also be due to the fact that the range beyond 30 m was already reclaimed.

Table 10: Variation in the bird density from July to December.

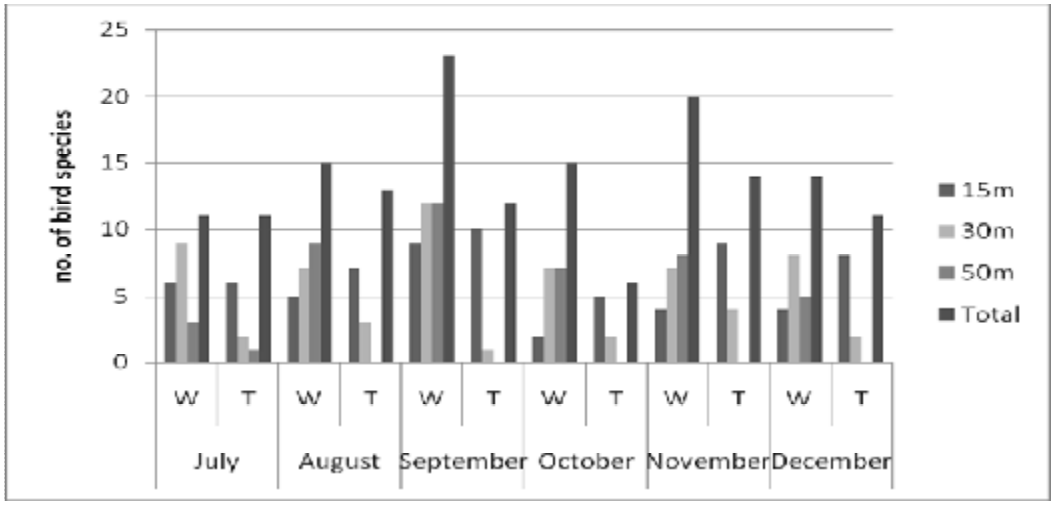
	July	Aug	Sep	Oct	Nov	Dec
15m	17	32	25	12	23	7
30m	14	15	18	23	47	9
50m	1	8	7	3	4	0
Total	45	89	75	46	98	24

- The comparison of density showed that the number of birds peaked during the months of August and November.
- In the month of December numbers of birds found were reduced drastically as reclamation activity started again.

6.1.2. Transect 2: The reclamation activities in this transect also started in May but the transect had a better diversity of water birds compared to the transect one i.e. 26 water birds and 21 terrestrial species both recorded within the transect and in flight (Table 11). In this transect the near threatened bird species Black tailed godwit was observed in large numbers. The water bird species dominated till the month of October, in the following months the terrestrial birds started to dominate, this was mostly due to the increase in reclamation activities.

Table 11: List of birds observed in Transect 2 during the study period.

Water and Water dependent birds	Terrestrial birds
Blacktailed godwit	Common myna
Cattle egret	Common stonechat
Common greenshank	House sparrow
Common kingfisher	House crow
Eurasian spoonbill	Jangle crow
Glossy ibis	Long tailed shrike
Greater egret	Oriental magpie robin
Greater painted snipe	Plain prinia
Grey heron	Red vented bulbul
Gull billed tern	Rock pigeon
Indian pond heron	Rose ring parakeet
Little cormorant	Scaly- breasted munia
Little egret	Spotted dove
Little tern	Spotted owl
Spot-billed duck	Zitting cisticola
White breasted kingfisher	Lark
Gull	Blue tailed bee-eater
Marsh sandpiper	Ashy prinia
Ruff sandpiper	Asian pied starling
Wood sandpiper	Baya weawer
Green sandpiper	Black kite
Intermediate egret	
Brahminy kite	
Eurasian marsh harrier	
Red wattled lapwing	
Black winged stilt	



Graph 3: Comparison of the diversity of water and terrestrial birds in transect 2.

- In 2nd transect the number of waders and terrestrial birds were almost equal in the first two months which changed during the peak of monsoon. This increased number was due to the migration of birds however with the increase in reclamation activities and drying up of the wetland in November the water birds reduced.
- There were six species of water birds that were dominant i.e. Black winged stilt > Ruff sand piper > Black tailed godwit > Marsh Sand piper > Eurasian Spoon bill > Little cormorant. Among the terrestrial birds Jungle crow was the only dominant bird.
- Contrary to the first transect the species of water birds were observed more within the range of 30m to 50m. while the terrestrial birds were found within the range of 0m to 30m. Over all maximum bird diversity and density was observed between 15 to 50 m from the transect line.

Table 12: Variation in the bird density from July to December.

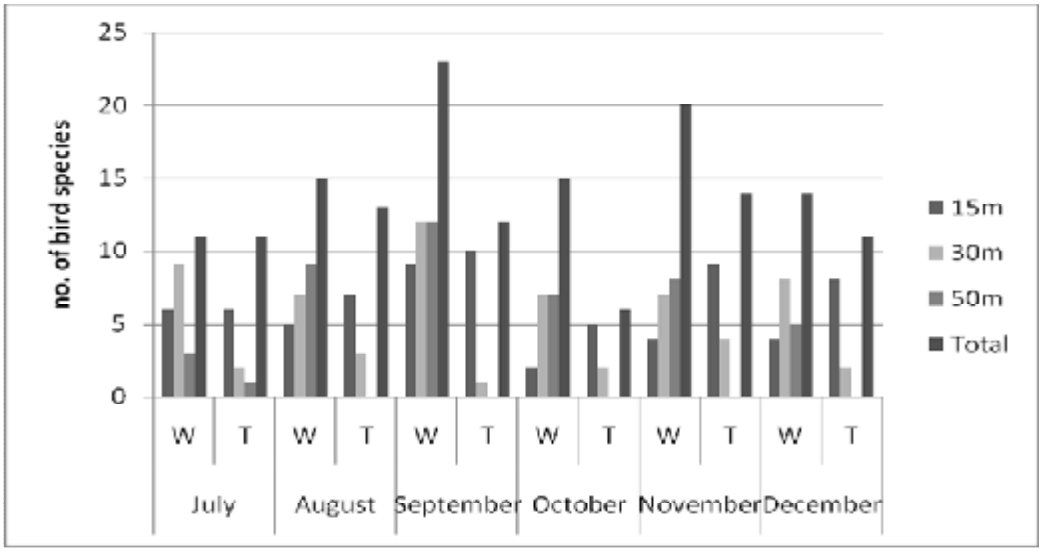
	July	Aug	Sep	Oct	Nov	Dec
15m	10	37	177	20	26	11
30m	6	20	917	627	110	76
50m	1	16	237	353	45	1
Total	41	94	1391	1022	191	93

- Large flocks of waders were observed till the end of October
- In December almost all the area was reclaimed, only few patches remained with water which had a few waders in it (Table 12).

6.1.3. Transect 3: The third transect had the maximum species of water birds i.e. 46 species while the terrestrial birds were represented by 20 species, including the in flight birds (Table 13). The water birds included the near threatened species like Black tailed godwit, Oriental white ibis and Painted stork. This was despite the fact that the mangroves in the region were burnt and a lot of construction rubble was also dumped. This transect had two peaks one in September due to monsoon coupled with the bird migration and the second peak was observed in November when the other regions were reclaimed at a much faster pace. The terrestrial bird species also increased in diversity from July to December.

Table 13: List of birds observed in Transect 2 during the study period.

Water and Water dependent birds		**Terrestrial birds**
Asian open billed stork	Little ring plovers	Ashy prinia
Black winged stilt	Oriental white ibis	Asian pied starling
Blacktailed godwit	Painted stork	Baya weawer
Brahamini Shelduck	Phesant tailed jacana	Black drongo
Cattle egret	Pied avocet	Black-headed munia
Cinnamon bittern	Purple heron	Common myna
Common coot	Purple swamphen	Common stonechat
Common greenshank	Rock pigeon	Green bee-eater
Common redshank	Rose ring parakeet	House crow
Common kingfisher	Spot-billed duck	House sparrow
Eurasian spoonbill	Gull	Indian roller
Glossy ibis	River tern	Jungle crow
Greater egret	Marsh sandpiper	Laughing dove
Greater flamingo	Ruff sandpiper	Long tailed shrike
Greater painted snipe	Brown headed gull	Oriental magpie robin
Grey heron	Wagtail	Plain prinia
Gull billed tern	Wood sandpiper	Purple rump sunbird
Indian pond heron	Common sandpiper	Red vented bulbul
Lesser wistling duck	Green sandpiper	Lark
Little cormorant	Intermediate egret	Blue taileded bee-eater
Little egret	Eurasian marsh harrier	
Wire tailed swallow	Red rump swallow	
Barn swallow	Red wattled lapwing	



Graph 4: Comparison of the diversity of water and terrestrial birds in transect 3.

- The number of terrestrial bird species observed was more within the range of 15m, while the diversisty and density of water birds were recorded more between the range of 15 to 50m distance, but maximum up to 30 m.
- During the study in terms of density none of the terrestrial birds were dominant but were sporadic in their occurrence. However among the water birds despite the high diversity only three species showed higher population density, they are Black winged stilt > Ruff sand piper and black tailed godwit.

Table 14: Variation in the bird density from July to December.

	July	Aug	Sep	Oct	Nov	Dec
15m	28	32	117	10	26	20
30m	69	31	356	83	114	46
50m	23	24	181	143	30	86
Total	93	114	761	264	202	147

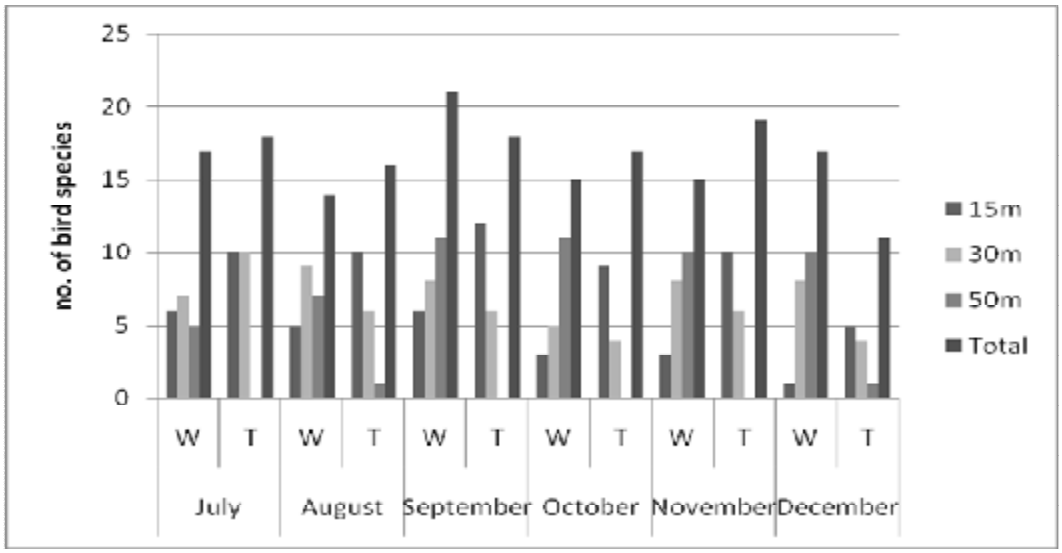
- In the third transect birds were observed in large numbers because of presence of water grasses and reeds. As migration started from September the density of waders also increased in this area from September to October
- From November reclamation started at an accelerated pace along the entire Uran mudflat and water also dried up in most of the areas which lead to reduction in the number of waders. However the transect held substantial amount of water and supported a large density of bird population.

6.1.4 Transect 4: Of the entire Uran mudflat the fourth transect has a combination of both freshwater and marine water. The region has a unique fresh water impoundment that further facilitated the bird diversity. The region had water grasses, reeds and mangroves along its stretch. In this transect the number of in flight and the settled birds included a total of 36 water birds and 32 terrestrial bird species (Table 15). Except for September and December this transect had more diversity of terrestrial birds than the water birds. This transect had the presence of the near threatened bird species Oriental white ibis and the black tailed godwit. The white eared bulbul and the Cinnamon bittern was also observed in this transect only. The diversity and density in this transect was stable till November but increased only in December compared to the other transects that suffered due to reclamation.

Table 15: List of birds observed in Transect 2 during the study period.

Water and water dependent birds	Terrestrial birds
Black winged stilt	Ashy prinia
Blacktailed godwit	Asian pied starling
Cattle egret	Baya weawer
Cinnamon bittern	Black drongo
Citrine wagtail	Black kite
Common coot	Black sholderd kite
Common redshank	Black-headed munia
Common kingfisher	Common hoopoe
Cotton pigmy goose	Common myna
Eurasian spoonbill	Common stonechat
Garganey	Common tailor bird
Glossy ibis	Crested Lark
Greater egret	Eurasian golden oriole
Grey heron	Green bee-eater
Indian pond heron	House crow
Lesser wistling duck	Jangle crow
Little cormorant	Laughing dove
Little egret	Long tailed shrike
Little grebe	Oriental magpie robin
Northern shovler	Plain prinia
Oriental white ibis	Purple rump sunbird
Pied avocet	Red avadavat
Purple heron	Red vented bulbul
Purple swamphen	Red whiskered Bulbul
Spot-billed duck	Rock pigeon
Whiskered tern	Rosy starling
White breasted kingfisher	Scaly- breasted munia
Caspian tern	Shikra
Marsh sandpiper	Spotted dove
Ruff sandpiper	Pied coocku

Brown headed gull	Blue tailed bee-eater
Intermediate egret	Zitting cisticola
Eurasian marsh harrier	
White eared bulbul	
Wire tailed swallow	
Red wattled lapwing	



Graph 5: Comparison of the diversity of water and terrestrial birds in transect 4.

- The terrestrial bird species diversity and density was found to be more in range of 0m to 30m and there were no terrestrial bird species beyond the range of 30m. The dominant ones included Red Avadavat > Baya weaver and Jungle Crow.
- However, water birds were more in density and diversity between the range of 15m to 50m and evenly distributed. Very less water birds were observed within 15m distance. The most dominant water birds were Black winged Stilt > Garganey and Black tailed godwit.
- This area was still in good condition till December and provided good habitat for both terrestrial and water birds in terms of density and diversity (Table 16.).

Table16: Variation in the bird density from July to December.

	July	Aug	Sep	Oct	Nov	Dec
15m	127	44	53	16	26	11
30m	58	55	81	21	52	33
50m	17	27	54	189	73	232
Total	204	152	210	238	187	340

6.1.5. Avifauna observed beyond the transects

During the study 18 species of birds were observed in locations other than the transects all of which were wetland birds (Table 17). The Greater flamingos, Lesser flamingos, Painted stork, Oriental White ibis, Gargeny teal, Northern shovellers, Brown headed gull were observed in large flocks but were rarely observed in the transects.

Table 17: List of birds observed beyond the study transects

Sr. no.	Bird species
1	Black-tailed godwit
2	Black-winged stilt
3	Brahminy shellduck
4	Brown headed gull
5	Eurasian spoonbills
6	Gargeny
7	Greater egret
8	Greater flamingo
9	Grey heron
10	Gull
11	Gull-billed tern
12	Lesser flamingo
13	Northern shoveller
14	Oriental white ibis
15	Painted stork
16	Pied avocet
17	Purple heron
18	Purple swamphen
19	Small pratincol

Seven species of birds listed in Table 18, were also observed during the study period. Four of these were water birds, two terrestrial and one water dependent bird. The flight ranged from six feet to 30 feet in height. However none of them settled in or around the study transects.

Table 18: List of birds observed only in flight.

Sr. no.	Bird species
1	Brahminy kite
2	Little tern
3	Painted stork
4	Gull billed tern
5	Pied cuckoo
6	Rosy starling
7	Small pratincole

7. Discussions

During investigation it was observed that among the four transects, the diversity of bird's was maximum in transects three and four while the density was maximum in transects two followed by transect three (Table 19 and Graph 6). This was mainly due to the fact that the birds had some refuse before the reclamation in the second and third transect. The transect one had poor density and diversity of birds and can be attributed to degradation of natural habitat at the beginning of the study in the month of May. This affected the availability of food in wetlands and that caused drastic reduction in number of waders.

Over all 17 species of birds were observed common to all the four transects, of which eight were terrestrial birds, seven water and two water dependant birds. The Marsh sand piper was the most dominant bird with high density and observed in all the transects. This was followed by Little Cormorant > Jungle Crow > Indian Pond Heron > Ashy Prinia. However, density wise black winged stilt was the most dominant one followed by Ruff Sand piper > Black tailed godwit > Marsh sand piper > Eurasian Spoon Bill > Little Cormorant > Garganey > Jungle Crow > Indian Pond heron and Ashy Prinia. From this observation it was clearly evident that the birds with high population density completely avoided the first transect corroborating the earlier inference.

Reclamation started along the second and third transect from mid of the November which caused disturbance and destruction to a large extent to the natural wetland ecosystem. This encroachment affected the density and diversity of birds. Due to less water availability most of the migratory birds were concentrated at one corner of the wetland, where water was available to support large number of birds

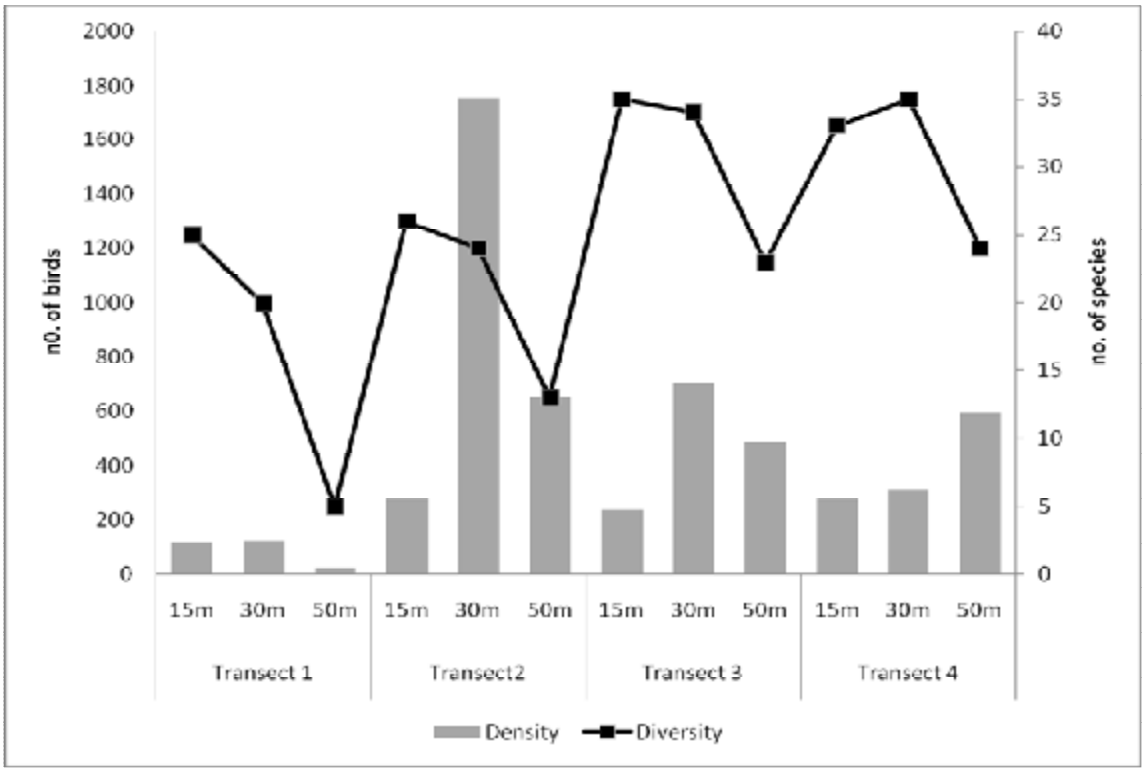
Till end of the December almost all area along with the second and third transect was reclaimed, only area along the fourth transect was in condition to support the habitat. Because of the availability of water as well as food large numbers of birds were concentrated to the fourth transect. However, due to the reduction in space the density and diversity showed a reduction as is observed from the monthly variations in Density and diversity of birds from the study area (Graph 7).

Table 19 : Density and diversity of birds observed in the four transects at a distance of 15, 30 and 50 meters.

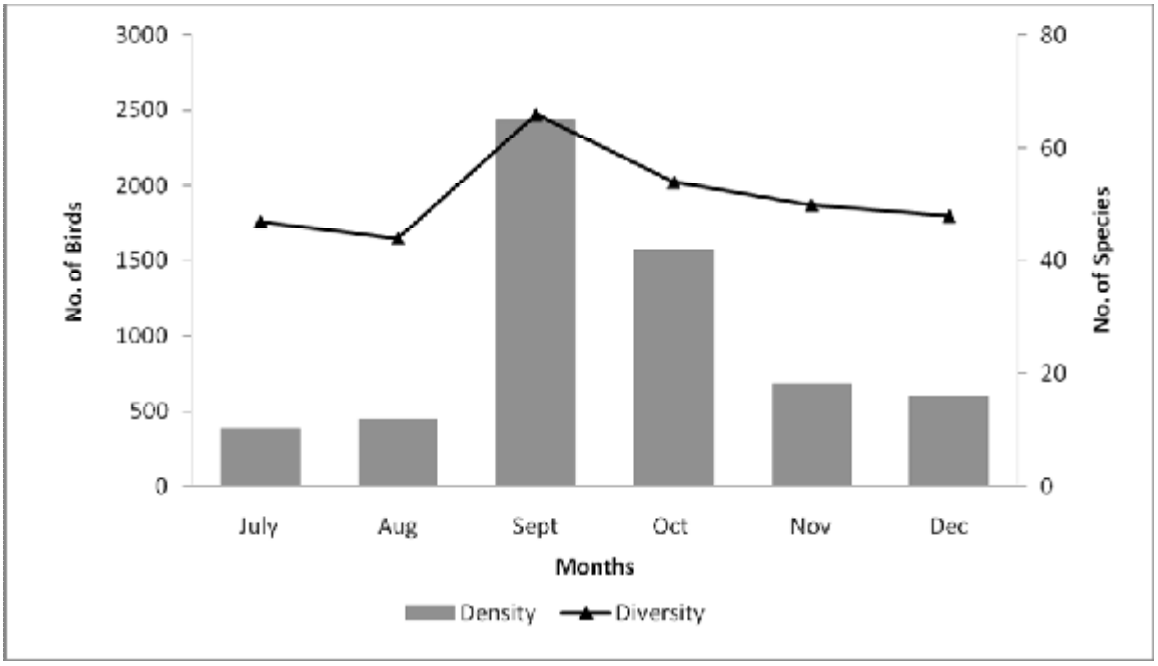
Bird species	Transect 1				Transect 2				Transect3				Transect 4				Overall
	15m	30m	50m	Total	15m	30m	50m	Total	15m	30m	50m	Total	15m	30m	50m	Total	Total
Ashy prinia	30	2		32	16			16	22			22	28	2		30	100
Asian koel	1			1				0				0				0	1
Asian open billed stork				0		1		1	2	6	8	16				0	17
Asian pied starling				0				0				0	4	11		15	15
Barn swallow		2		2				0	12			12				0	14
Baya weaver				0	1			1		1		1	20	25		45	47
Black drongo	1			1				0	5	4	1	10	1	2		3	14
Black kite				0			1	1				0				0	1
Black sholderd kite				0				0				0		1	1	2	2
Black winged stilt				0	72	408	201	681	3	194	153	350		38	96	134	1165
Black-headed munia				0				0				0	43	15		58	58
Blacktailed godwit				0		275	150	425	2	115	20	137		20	82	102	664
Blue Tailed bee-eater		41		41		3		3		2		2	1			1	47
Brahamini Shelduck				0				0			10	10				0	10
Brown headed gull				0				0				0			50	50	50
Caspian tern				0				0				0				0	0
Cattle egret	2	8	3	13		4	1	5	5	34	21	60	3	1	2	6	84
Cinnamon bittern				0				0	1	1		2	4			4	6
Citrine wagtail		3		3				0				0		3		3	6
Common coot				0				0		2		2		2	9	11	13
Common greenshank				0	2			2	2	3		5				0	7
Common hoopoe				0				0				0	2	1		3	3
Common kingfisher		1		1		2		2		1		1		5		5	9
Common myna	2	8		10	7			7				0				0	17
Common redshank				0		9		9		2		2				0	11
Common stonechat	5	1		6	4			4	2			2	1			1	13
Common tailor bird	1			1				0				0	2			2	3
Cotton pigmy goose				0				0				0			13	13	13
Eurasian golden oriole				0				0				0		6		6	6
Eurasian marsh harrier				0				0		1		1				0	1

Eurasian spoonbill				0		50	27	77			64	64			2	2	143
Garganey				0				0				0			120	120	120
Glossy ibis				0	18	7	10	35	4	14	4	22	1			1	58
Greater egret	2	2		4	4	5	30	39	1	3	10	14		4	16	20	77
Greater flamingo				0				0			75	75				0	75
Green bee-eater				0				0	4			4	6	5		11	15
Green sandpiper				0		4		4	4	2		6				0	10
Grey heron		1		1			1	1			5	5		3	27	30	37
Gull				0			2	2			7	7				0	9
House crow	5	10		15	11	10		21	2	3		5	2			2	43
House sparrow				0	4			4	10			10				0	14
Indian pond heron	10	10	1	21	9	22	1	32	8	14	5	27	8	15	7	30	110
Indian roller		2		2				0	1	2		3				0	5
Intermediate egret	4			4				0	10	5		15		15		15	34
Jangle crow	5	2		7	10	38		48	14			14	16	21	5	42	111
Laughing dove				0				0	4	2		6	2			2	8
Lesser flamingo				0				0		2		2				0	2
Lesser wistling duck				0				0			2	2		5	12	17	19
Little cormorant	6	5	15	26	3	13	54	70	4	6	10	20		6	6	12	128
Little egret	3	9	3	15	2	13	3	18	1	7	2	10	1			1	44
Little grebe				0				0				0		2	8	10	10
Little ring plovers				0				0		66		66				0	66
Long tailed shrike	13	4	1	18	7	2		9	11	2		13	3	3		6	46
Marsh sandpiper		5		5	52	170	170	392	20	20	12	52	1		17	18	467
Northern shovler				0				0				0			50	50	50
Oriental magpie robin				0	1			1	3	1		4	1			1	6
Oriental skylark	1			1				0				0	1			1	2
Oriental white ibis				0				0			7	7				0	7
Painted snipe				0	12	5		17	5			5				0	22
Phesant tailed jacana				0				0		22		22				0	22
Pied avocet				0				0			25	25			27	27	52
Plain prinia	8			8	6			6	4			4	4			4	22
Purple heron				0				0				0		4	18	22	22

Purple rump sunbird				0				0	12			12	14			14	26
Purple swamphen				0				0		2	8	10	8	20		28	38
Red avadavat				0				0				0	54	13		67	67
Red rump swallow				0				0	7			7				0	7
Red vented bulbul	2			2		2		2	2			2	5	8		13	19
Red wattled lapwing	3			3	12	5		17	10	5		15	9	38	7	54	89
Red whiskered Bulbul				0				0				0		2		2	2
Rock pigeon	1	2		3	2			2			4	4				0	9
Rose ring parakeet				0			2	2		4		4				0	6
Ruff sandpiper				0	17	706		723	37	150	30	217			15	15	955
Rufous tailed lark				0	1			1	4			4				0	5
Scaly- breasted munia	10			10	4			4				0	22	10		32	46
Shikra				0				0				0	1	1		2	2
Spot-billed duck				0				0		2	4	6			1	1	7
Spotted dove	1			1	1			1				0		2		2	4
Spotted owl				0		1		1				0				0	1
Western reef egret		4		4				0				0				0	4
Whiskered tern				0				0				0	2			2	2
White breasted kingfisher	2	1		3		1		1				0	3	5	1	9	13
White breasted water hen	1			1				0				0				0	1
White eared bulbul				0				0				0	4	1		5	5
White wagtail	1			1				0	2			2				0	3
Wire tailed swallow				0				0	3			3				0	3
Wood sandpiper				0				0		4		4				0	4
Zitting cisticola				0	1			1				0				0	1
Bird Density	120	123	23	266	279	1756	653	2688	243	704	487	1434	277	315	592	1184	5572
Bird Diversity	25	20	5	33	26	24	13	41	35	34	23	58	33	35	24	57	89



Graph 6: Transect wise density and diversity of birds observed during the study period.



Graph 7: Monthly variations in density and diversity of birds observed at Uran wetlands

8. Inferences

During the study the bird habitat was seen to be destroyed with out considering the importance of the fragile ecosystem. There have been geological studies indicating the fragility of Uran. Badve *et a.,l* (1997) state, that the Uran region is prone to large scale erosion due to its geological formations. Under these conditions the viability of the SEZ itself is highly questionable. According to Jagtap *et al.*, (2001) beaches, bays and estuaries are very commonly subjected to erosion. In general, the coastal wetlands have been paid very little attention from management point of view.

The increasing commercial activity along the coastlines of the country, which, according to a study conducted by the ocean engineering division of the National Institute of Oceanography, was also responsible for "shoreline erosion in the northern regions of Chennai, Ennore, Visakhapatnam and Paradip ports due to the construction of breakwaters in the respective ports" (Asher, 2007). Despite these studies there has been a blatant violation of the CRZ laws and the Uran mudflats that were know to be existing in the CRZ1 have been destroyed.

However there has been no concern to the various studies and the wetland has been destroyed which is evident from the present study. During the present study it was also noted that not only the wetland bird species have declined but even the terrestrial bird species have dwindled from 72 to 44 bird species (Table 1).

There have been several agitations and studies opposing the SEZ in Navi Mumbai (Apendix 1) but there has been no concern to the public revolt. Further the authorities have shown a total disregard to human life and the livelihood of locals. SEZ has always been considered as non polluting sector and the issue is being highlighted as a farmers' issue, with a rehabilitation policy being worked out for those who will lose their land, the focus has shifted away from communities that will lose livelihoods based on the sea, estuaries and coastal systems (Asher, 2007). Unfortunately the current legistlation plans to include the SEZ in CRZ II as per the draft CMZ notification of 2009, which will spell a death knell across the coastal bodies of the country in the name of economic growth and development.

9. **Remedial Measures**

My study focused on the impact of SEZ on birds along the Uran wetlands, however it has been a saddening experience to see most of the birds vanish from the area. However there are several examples where good political will and human endeavour can revive an ecosystem. Example, the Sultanpur Sanctuary in Haryana was protected from the destruction in the name of SEZ. Similarly, the mangroves at Pitchavaram along the east coast of India were rejuvenated with new lease of life for the birds. The Uran wetland and birds would definitely revive if given a chance. The easiest way would be to dig trenches in the reclaimed land and permit the flow of marine water.

On my behalf, I have tried to mitigate the destruction at Uran by doing the following activities.

1. Meeting several officials of CIDCO and NMSEZ (Apendix 2)
2. Written letters to the Environment Minister Mr. Jairam Ramesh (Apendix 3)
3. Brought this issue to the public eye by requesting journalist to write in News papers (Apendix 4) and cover the topic on Television (Telecast on TV9 and NMTV)

But with little support not much could be achieved. However I still do have hope of giving back Uran its past glory.

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Birds observed during the Study
Water and Water dependent
Birds

Asian open-billed stork.J...

Black winged stilt.JPG

Black-tailed godwit.JPG

Brown headed gull.JPG

Citrine wagtail.JPG

Common coot.JPG

Common greenshank.JPG

Common redshank.JPG

cotton pygmy goose.JPG

Eurasian spoonbill.JPG

Garganey.JPG

Glossy ibis.JPG

Greater & Lesser flaming...

Greater egret.JPG

Green sandpiper.JPG

Grey heron.JPG

Indian pond heron.JPG

Lesser whistling duck.JPG

Little cormorant.JPG

Little egret.JPG

Little grebe.JPG

Marsh sandpiper.JPG

Northern shoveler.jpg

Oriental white ibis.JPG

Painted storks.JPG

Pheasant tailed jacana....

Pied avocet.JPG

Purple swamphen.JPG

Red wattled lapwing.JPG

Ruddy shellduck.JPG

Ruff sandpiper.JPG

Small pratincole.JPG

Spot-billed duck.JPG

Western reef egret.JPG

White breasted waterhen...

White eared bulbul.JPG

White wagtail.JPG

Wood sandpiper.JPG

Terrestrial Birds

Ashy prinia.JPG

Baya weawer.JPG

Black drongo.JPG

Black sholderd kite.jpg

Black-headed munia.JPG

Common stonechat.JPG

Green bee-eater.JPG

Indian roller.JPG

Long tailed shrike.JPG

Oriental skylark.JPG

Pied coocku.JPG

Purple rumed sunbird.JPG

Red avadavat.JPG

Scaly- breasted munia.J...

Shikra.JPG

White breasted kingfishe...

Wetlands in Uran then

Wetlands in Uran now