Habitat use by Resident Avifauna During Monsoon at Sewri Mudflats

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ABSTRACT

Sewri mudflats in Mumbai are a unique ecosystem hosting migratory as well as resident birds. Present study was conducted to probe on the habitat use by resident avifauna during monsoon at Sewri Mudflats. Water and sediment samples collected from the study area were analysed for various parameters. Sediment sample was analysed for composition of sand, silt, clay, organic carbon, organic matter, total nitrogen and phosphorus. Water analysis indicated an increase in NO3-N, NO2-N and PO4-P. Good portion of organic matter and carbon were found in sediment sample analysis. 9 benthic faunal groups were observed in microscopic analysis of sediment. 19 species of birds belonging to 11 families were recorded at the study area.

Key words: Sewri mudflats, resident avifauna, habitat use.

Introduction:

Sewri Mudflats comprise of a unique ecosystem of a wetland surrounded by mangroves on one side and the Arabian sea on the other. Despite the high degree of pollution, the area is a winter refuge for thousands of migratory birds from as far as the Arctic Circle (Rahmani et al, 2013). But this area is also home to several residential birds. Most of the birds have specific habitat requirements from season to season, a loss of which might lead to their local extinction (Chaudhary-Pachpande, S. and Pejaver, M., 2016). Bird species in the family Ardeidae (Heron and Egrets) are found in aquatic habitats worldwide (Kushlan and Hancock, 2005). Most Heron species are highly dependent on wetlands, but some also feed on dry land. They mainly feed on aquatic prey such as fishes, amphibians and aquatic insects while some species also feed on terrestrial prey such as small mammals and insects (Kushlan and Hancock, 2005). The intertidal flora and fauna along the coastline forms an important dietary share of resident as well as migratory birds (Klassen et al., 2012). Mangroves host flocks of residential and migratory birds visiting the habitat during winter as also throughout the year. Several residential birds can be seen feeding on the aquatic fauna at the time of low tide. Benthic fauna inhabit separate niches as per their adaptability to the environment. But increase in the developmental activities in this area, might induce changes in the feeding and breeding ecology as also in the quality of water and sediment which in turn might affect the bird population residing in the study site. Shaikh and Tiwari (2012) studied the sediment quality of Sewri Mudflats, while Pawar (2013) studied the impact of anthropogenic inputs on water quality of mangrove ecosystem of Uran, Navi Mumbai and West Coast of India and deduced that industrial pollution and anthropogenic stress from the nearby areas were deteriorating the water quality of mangrove ecosystem which ultimately posed a serious threat to the mangroves. Mahapatro et al. (2009) studied the influence of monsoon on macrobenthic assemblages in the outer channel of Chilika Lagoon, east coast of India and concluded that even though monsoon did not have any drastic effect on benthic diversity, the opening of new outlet which connected the lagoon with the sea water had good effect on benthic diversity.

Review of literature shows that study of total ecology of Sewri mudflats of Mumbai has not been conducted. Hence, the present research was undertaken in the monsoon season (June-September 2017) to study the effect of rain water (being poured into this bird area from the suburban city) on ecology of Sewri mudflats.

Fig.1- Map showing location of Sewri Mudflats (19° 00’ N and 72° 86’ E coordinates in Mumbai) [www.googlemaps.com]
Materials and Methods:

- Collection of water samples: done in monsoon during high tide and low tide by immersing labeled bottles in the water at study site.
- Analysis of water samples: done for various parameters such as pH, Salinity (ppt), Dissolved Oxygen [DO] (mg/l), Carbon Dioxide (mg/l), Ammonia [NH4+ - N] (mg/l), Nitrates, Phosphates, Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD).
- Standard methods for the examination of water and wastewater, American Public Health Association (APHA), 1998 was followed for water analysis.
- Collection of sediment samples: done at the study site during monsoon with a spatula and transferred in labeled plastic bags.
- Analysis of sediment parameters: done after air drying the sediment samples, prepared soil was used to conduct tests to find out several parameters such as pH, water retention capacity, sediment colour, composition of sand, silt and clay, percentage of organic carbon, percentage of organic matter, total nitrogen and phosphorous in the sediment.
- Soil and Water Testing Methods, 1983 was followed for sediment analysis.
- Benthos testing and microscopic analysis of macro benthos: done by collecting 12 sediment samples from the study site.
- Sediment samples were sieved from a sieve of 0.5 millimeter and washed with sea water. Sieved samples were preserved immediately in 5% formalin and then stained with Rose Bengal stain.
- Stereo microscope was used to observe the benthic faunal groups.
- Bird Observation: done by 8x40 CF NIKON Binocular and photographed by NIKON D 3200 Camera during monsoon by visiting the study area every 15 days.

Results and Discussion:

Analysis of water parameters was conducted for samples collected at high and low tide. The mixing of drain-water run-offs and sea water is higher during the high tide and lower during the low tide. In order to take into consideration the diurnal migration of aquatic animals, and tidal cycles two different water samples were collected at high tide and at low tide for the water quality analysis. Results are in Fig. 1.

Analysis of water quality showed pH of 7.6 at high tide and 7.4 at low tide. Dissolved oxygen (DO), in the present study was found to be 6.8 mg/litre at high tide and 6 mg/litre at low tide (Fig.1) while Quadros et al. (2004) have found the average DO to be 2.44 mg/litre at the Thane creek, implying that water quality at Sewri mudflats is not hypoxic as the water of Thane creek. DO of <2.5 mg/litre results into hypoxic
conditions. But DO of the present study area supports good aquatic productivity. The PO₄-P values in the present study are 0.32 mg/litre at high tide and 0.2 mg/litre at the low tide. The increase in the phosphate value in the water of Sewri Mudflats can be attributed to rain water drained into the study area and presence of organic pollution from the suburban area. This study on water quality analysis showed that NO₃-N was 0.54 mg/litre at high tide and >3.0 mg/litre at low tide and NO₂-N was 0.16 mg/litre at high tide and >0.5 mg/litre at low tide, while Quadros et al. (2004) found out that the average Nitrate-Nitrogen (0.96 mg/litre) was minimum during monsoon as compared to other seasons at the Thane Creek. Even though the study area receives noticeable drain water run-offs from the nearby areas it is constantly under the influence of the tidal cycle of high and low tides from the Arabian Sea and hence is less affected by the monsoon.

![Sediment Analysis of Sewri Mudflats During Monsoon](image)

**Fig. 3: Sediment Analysis of Sewri Mudflats during monsoon**

Sediment sample was air dried and prepared soil sample was used for analysis of various sediment parameters as in Fig. 2. Sediment analysis showed pH of 7.5. This depicts that the sediment quality of the present study area is slightly alkaline and favourable for bird habitat. Sediment colour was blackish with organic matter 1.68% and organic carbon 0.98%, which is in accordance with the sediment pH in the present study. Sediment rich with organic matter, organic carbon and good water holding capacity (38.42%) is a favourable habitat for benthic fauna which has an important role in maintaining the balance in sediment productivity. Sediment composition analyzed for the percentage sand, silt and clay (58%, 24%, clay 18% respectively) implied the sediment structure was of sandy-silty-clayey nature (Fig. 2).

![Study of Benthos variety of Sewri Mudflats during monsoon (values in mg/L)](image)

**Fig. 4: Study of Benthos variety of Sewri Mudflats during monsoon (values in mg/L).**

Rundle (1982) found benthic invertebrates to be the primary food of water birds. Nine benthic faunal groups observed consisted of Polychaetes, Pelecypods, Isopods, Amphipods, Cirripid (Barnacles), Brachyurans, Chironomous larvae, Anthozoans and Anomuran, as shown in Fig.3. Polychaetes were the
dominating group followed by pelecypods, amphipods and isopods amongst the benthic fauna of the study area. This implies that Polychaetes are more adapted to changes in environmental conditions compared to other invertebrate fauna. It can be hence concluded that the ecological factors like temperature, salinity and total organic carbon are important for the abundance and distribution of benthic organisms. Present study shows that a modest increase in the values of NO$_3$-N, NO$_2$-N, PO$_4$-P in the water and soil with good amount of organic matter and carbon can support benthic diversity. Sediment quality showed increase in silt and decrease in clay, hence the sandy-silty-clayey nature of the sediment implied anthropogenic activities and rain-water being drained into the study area. Despite this, the study area supports good benthic diversity in accordance with increase in nitrogen, along with dissolved oxygen (DO) and organic carbon.

![Fig. 5: Habitat use by avifauna at Sewri Mudflats during monsoon](image)

**Table 1: Avifaunal diversity at Sewri Mudflats during monsoon**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Common name</th>
<th>Scientific name</th>
<th>Habitat Use</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Median Egret</td>
<td><em>Egretta intermedia</em></td>
<td>Mangroves and Mudflats</td>
<td>Resident</td>
</tr>
<tr>
<td>2</td>
<td>Little Heron</td>
<td><em>Butorides striatus</em></td>
<td>Mudflats</td>
<td>Resident</td>
</tr>
<tr>
<td>3</td>
<td>Rose-ringed Parakeet</td>
<td><em>Psittacula krameri</em></td>
<td>Mangroves</td>
<td>Resident</td>
</tr>
<tr>
<td>4</td>
<td>Red-vented Bulbul</td>
<td><em>Pycnonotus cafer</em></td>
<td>Mangroves</td>
<td>Resident</td>
</tr>
<tr>
<td>5</td>
<td>Black-shouldered Kite</td>
<td><em>Elanus caeruleus</em></td>
<td>Mangroves</td>
<td>Resident</td>
</tr>
<tr>
<td>6</td>
<td>Brahminy Kite</td>
<td><em>Haliastur Indus</em></td>
<td>Mangroves</td>
<td>Resident</td>
</tr>
<tr>
<td>7</td>
<td>Rock Pigeon</td>
<td><em>Columbia livia</em></td>
<td>Mangroves</td>
<td>Resident</td>
</tr>
<tr>
<td>8</td>
<td>Oriental Magpie Robin</td>
<td><em>Copsychus saularis</em></td>
<td>Mangroves</td>
<td>Resident</td>
</tr>
<tr>
<td>9</td>
<td>House Swift</td>
<td><em>Apus affinis</em></td>
<td>Mangroves</td>
<td>Resident</td>
</tr>
<tr>
<td>10</td>
<td>Coppersmith Barbet</td>
<td><em>Megalaima haemacephala</em></td>
<td>Mangroves</td>
<td>Resident</td>
</tr>
<tr>
<td>11</td>
<td>Great Egret</td>
<td></td>
<td>Mangroves and Mudflats</td>
<td>Resident</td>
</tr>
<tr>
<td>12</td>
<td>Indian Pond Heron</td>
<td><em>Ardeola grayii</em></td>
<td>Mudflats</td>
<td>Resident</td>
</tr>
<tr>
<td>13</td>
<td>Western-reef Egret</td>
<td><em>Egretta gularis</em></td>
<td>Mudflats</td>
<td>Resident</td>
</tr>
<tr>
<td>14</td>
<td>Black-headed Ibis</td>
<td><em>Threskiornis melanopechalus</em></td>
<td>Mudflats</td>
<td>Resident</td>
</tr>
<tr>
<td>15</td>
<td>Grey Heron</td>
<td><em>Ardea cinerea</em></td>
<td>Mudflats</td>
<td>Resident</td>
</tr>
<tr>
<td>16</td>
<td>Little Egret</td>
<td><em>Egretta garzetta</em></td>
<td>Mangroves and Mangroves</td>
<td>Resident</td>
</tr>
<tr>
<td>17</td>
<td>White-throated Kingfisher</td>
<td><em>Halcyon smymnensis</em></td>
<td>Mangroves</td>
<td>Resident</td>
</tr>
<tr>
<td>18</td>
<td>Black Kite</td>
<td><em>Milvus migrans</em></td>
<td>Mangroves</td>
<td>Resident</td>
</tr>
<tr>
<td>19</td>
<td>Common Crow</td>
<td><em>Corvus splendens</em></td>
<td>Mangroves</td>
<td>Resident</td>
</tr>
</tbody>
</table>

Sediment fauna are more accessible to foraging waders when water levels are just below the surface of the soil, (Ausden, et al., 2001). Moving Gastropods, Brachyurans, aquatic invertebrates and Barnacles attached to rocky areas could be observed at the time of low tide in the study area. Table 1 shows birds belonging to families Ardeidae, Alcedinidae, Acciptiridae, Corvidae, Psittacidae, Pycnonotidae, Columbidae, Muscicapidae, Apodidae, Magalaimidae and Threskiornithidae as also their habitat use. These birds were seen feeding near the mangroves during low tide. 6 birds preferred wetlands for foraging, 8 birds preferred to feed and rest amongst the mangroves while 5 birds preferred both the habitats for feeding as well as resting. The Herons and Egrets seemed to prefer wetlands for foraging while Mangrove birds like Rose-ringed Parakeets, Coppersmith Barbets, White-throated Kingfishers, Oriental Magpie Robins, Crows and Pigeons kept to the nearby Mangroves. Raptors like the Black Kite, Black-shouldered Kite, Brahminy Kite could be observed while they hovered over the wetlands for prey and took the prey to devour in the Mangroves. House Swifts were mostly arboreal but could be seen flying over the...
wetlands as well as the nearby land area. Egrets also used the Mangroves for resting and roosting after feeding in the wetlands. White-throated Kingfisher was also sighted fishing in the wetlands and devouring the prey or resting in the mangroves.

**Conclusion:**
During monsoon Sewri Mudflats are home to diverse residential avifauna as well as benthic fauna. Values of nitrates and nitrites are comparatively higher in the water sample of the study area during monsoon than the values (Nitrates: 0.58, Nitrites: 0.05) found during pre-monsoon by Chitnis & Deb, 2018 in marshy inlet bird habitat. The sediment composition of Sewri mudflats during monsoon with good organic matter, organic carbon and water holding capacity supports the productivity of this area. Herons, Egrets, birds of prey and birds roosting in the nearby mangroves prefer this habitat for foraging and nesting. But the habitat is getting fragmented resulting in dire consequences for the birds and the ecology due to stress from developmental activities. Hence there is need to monitor and conserve this habitat.

**References:**