



Ecological investigations of Shahwadi Wetland

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Abstract

The wetlands form important repositories of aquatic biodiversity. The diverse ecoclimatic regimes extant in the country resulted in a variety of wetland systems ranging from high altitude cold desert wetlands to hot and humid wetlands in coastal zones with its diverse flora and fauna. There are many important lakes and wetlands in Ahmedabad including Kankaria lake and Vastrapur Lake. The Nalsarovar wetland and Thol lake in the outskirts of Ahmedabad city are very important spots for migratory birds coming from different parts of the world and hence, attracts large number of tourists. However, many small and big wetlands are also present in and around the city which has not received due attention and hence, have suffered badly in the increased age of industrialization and urbanization. One such wetland is Shahwadi wetland which is situated in the heavily industrialized Narol area of Ahmedabad city. This study was undertaken to understand the ecological richness and importance of this region and highlight its degrading condition. It was found that this wetland harbors a good number of migratory birds and local birds, but is in highly degrading condition due to the negligence of local people residing in the periphery and the industries running nearby. Hence, it is imperative that appropriate conservation measures be taken for its successful conservation and rejuvenation.

Key-Words: Ahmedabad, Biodiversity, Conservation, Ecology, Wetland

Introduction

The wetlands are defined as 'lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water (Mitsch & Gosselink, 1986). The value of the world's wetlands are increasingly receiving due attention as they contribute to a healthy environment in many ways. Natural wetlands in India consists of the high altitude Himalayan lakes, followed by wetlands situated in the flood plains of the major river systems, saline and temporary wetlands of the arid and semi-arid regions, coastal wetlands such as lagoons, backwaters and estuaries; mangrove swamps; coral reefs and marine wetlands, and so on (Prasad *et al*, 2002). It is estimated that freshwater wetlands alone support 20 per cent of the known range of biodiversity in India (Deepa & Ramachandra 1999). Wetlands are often described as "kidneys of the landscape" (Mitsch & Gosselink 1986). They perform numerous valuable functions such as recycle nutrients, purify water, attenuate floods, maintain stream flow, recharge ground water, and also serve in providing drinking water, fish, fodder, fuel, wildlife habitat, control rate of runoff in urban area, buffer shorelines against erosion and recreation to the society (Prasad *et al*, 2002).

The interaction of man with wetlands during the last few decades has been of concern largely due to the rapid population growth - accompanied by intensified industrial, commercial and residential development further leading to pollution of wetlands by domestic, industrial sewage, and agricultural run-offs as fertilizers, insecticides and feedlot wastes. The fact that wetland values are overlooked has resulted in threat to the source of these benefits.

Gujarat state is regarded as the 'Wetland state' of India and consists of 834 wetlands of which 438 are coastal and 393 are inland. The coastal and inland wetlands cover about 92.3% and 7.7% of the total wetland areas respectively. The Nal Sarovar and Thol Lake Bird Sanctuary are two important wetlands which are situated in the northern part of Gujarat state. Both the sanctuaries are visited by a number of migratory birds and have a diverse species composition (Sejal *et al*, 2006). The Thol Lake Bird Sanctuary is a man made shallow water reservoir with open water area whereas the Nal Sarovar Bird Sanctuary is a natural lake known as a typical and a largest natural fresh water reservoir in Gujarat state (Patel & Dharaiya, 2008). Ahmedabad city is practically the largest city of Gujarat state and has been an important centre of development in the state since long time. It is bestowed with numerous

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natural and man-made wetlands which range in different sizes. On one hand, the man-made wetlands like Kankaria Lake and Vastrapur Lake add charm to the beauty of the city and are important tourist attractions, whereas on the other hand many wetlands such as Nikol Lake, Chandlodia Lake, Vastral Lake and the focal wetland of this study, Shahwadi, are affected by various anthropogenic factors from their catchment region and hence, are found to be heavily polluted and degraded. This study was carried out with the main objectives of documenting the ecological richness of Shahwadi wetland by recording the floristic and avifaunal diversity, highlighting the problems associated with it and emphasize on the conservation and restoration of this wetland.

Material and Methods

The Shahwadi wetland is situated in the Narol area of Ahmedabad city (Figure 1). The climate of the region consists of three main seasons viz. summer, monsoon and winter with the temperatures being extremely harsh in summer and to a lesser extent in the winter seasons. This area harbors many small and big industries and the wetland is surrounded by many houses most of which are inhabited by the workers of the nearby industrial setups. Our team carried out a survey for recording the floristic diversity in and around the wetland and also recorded the birds visiting the wetland during the months of March to May in the year 2010. The identification of plants was done with the help of flora (Cooke, 1958 and Shah, 1978). The photographic evidences were also collected from the study region. The water and soil samples were also collected in triplicates from the wetland and investigated upon for few parameters to determine the current condition of the wetland. The secondary literature resources related to Shahwadi and other wetlands available were also referred and reviewed.

Results and Discussion

It was observed in the study that the vegetation in and around the wetland was in a highly degraded condition mainly due to encroachments in the catchment area and destructive logging of plants. The floristic diversity in the study area included altogether 24 plant species belonging to 23 genera and 17 families (Table-1). Some notable plant species in the study area are depicted in Figure 2. The herbs were found to be dominant in the area with 8 species followed by climbers with 7 species, shrubs with 5 species and only 4 species of trees. The low number of trees can be probably due to their uncontrolled logging for various purposes by the people residing in the vicinity of the wetland. Among the plant families Capparadaceae was dominant with the representation of 3 species followed

by families Amaranthaceae, Asclepiadaceae, Boraginaceae and Mimosaceae being represented by 2 species each. Remaining plants families were represented by single plant species. The characteristic aquatic vegetation of lakes and ponds was found to be absent in Shahwadi wetland.

The birds play a key role in the ecosystem and benefit humans by providing important ecosystem services such as regulating services by scavenging carcasses and waste, by controlling population of invertebrates and vertebrate pests, by pollinating and dispersing the seeds of plants; and supporting services by cycling nutrients (Croll et.al., 2005) and by contributing to soil formation (Post et al., 1998). In spite of the highly degraded condition, Shahwadi wetland was found to be an abode for various birds. The avifaunal diversity in the area included altogether 11 different species of birds which are mentioned in Table 2. Some of the notable birds recorded in the wetland are depicted in Figure 3. Most of the birds recorded were either resident or resident cum local migratory species. Of all the birds recorded, the cormorants were found in highest density in the wetlands. The waders (marsh birds) in the area such as Pond Herons, Red Wattled Lapwing and Cattle Egrets were found to be wading through the shallow waters of the pond and intermediately roaming along the dry margins of the wetland. These small birds prefer shallow muddy banks of pond and close by small water spots (Mohan and Gaur, 2008). The trees of *Azadirachta indica*, *Acacia nilotica* and *Prosopis* sp. were found to be serving as shelters for the common birds such as crows and sparrows.

Of late the water quality management of natural and man-made water bodies has gathered attention of the researchers and hence, numerous studies have been carried out highlighting the quality of water in these ecosystems through analysis of various parameters. In the current study, five parameters were taken into account viz. pH, chloride content, calcium and magnesium hardness and total hardness. The mean values of these parameters are depicted in Figure 4. The pH values of the water in the pond and the soil were found to be almost same. The chlorides constitute approximately 0.05% of the earth's crust and the chloride concentrations between 1 and 100 ppm are considered to be normal in freshwater which may be due to geological formations and other natural reasons (Hunt et al. 2012). However, in case of the water and soil samples of Shahwadi pond, we found the chloride content to be as high as 214.33 ppm and 198.20 ppm respectively. This high concentration of chlorides in the soil and water can be attributed to the prolonged

sewage discharges by the surrounding residential settlements and inflow of industrial effluents into the pond. Another important factor affecting the quality of water is the degree of hardness which is usually defined as the content of calcium and magnesium ions. The total hardness values recorded for the water and soil samples of Shahwadi pond are 80.33 mg/L and 91.33 mg/L respectively. As per Kannan (1991), the water hardness up to 60 mg/l consider as soft water. 61-120 mg/l consider is moderately hard water from 121-180 mg/l as hard water and above 180 mg/l as very hard water. Hence, it can be deciphered that the water of Shahwadi pond was moderately hard which was mainly again due to the uncontrolled inflow of sewage into the water.

Overall, it was observed through the study that the Shahwadi wetland was in a degraded condition (Figure 5) and contained polluted water mainly because of the factors such as continuous discharge of domestic sewage, activities such as washing clothes, cattles, vehicles, bathing and cleaning and discharge of chemical effluents from the industrial units located in the nearby areas. However, the presence of a reasonably good number of birds in the area justifies its ecological importance and presses the need for its restoration and conservation. It is recommended to provide proper drainage facilities for the domestic and industrial discharges and try to increase some plantations around the water body for its beautification. The fencing of the pond would restrict the encroachments by the local people and also curb the pollution causing activities. Biological treatment procedures can also be considered for improving the water quality of the pond. It is also highly required to create awareness among the local people for sensitizing them about the importance of environment and ecology and including them for conservation of the same.

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References

1. Mitsch W. I. and Gosselink I. G. (1986). Wetlands, Van Nostrand Reinhold Publishers, New York.
2. Prasad S. N. , Ramachandra T. V., Ahalya N., Sengupta T., Alok Kumar, Tiwari A. K., Vijayan V. S. and Lalitha Vijayan (2002). Conservation of wetlands of India – a review, Tropical Ecology, 43 (1): 173-186.
3. Deepa, R. S. and Ramachandra T. V. (1999). Impact of Urbanization in the Interconnectivity of Wetlands, Paper presented at the National Symposium on Remote Sensing Applications for Natural Resources: Retrospective and Perspective (XIX-XXI 1999), Indian Society of Remote Sensing, Bangalore.
4. Sejal P., Shingala P., Dave S. M. and Dharaiya N. (2006). A comparative study of the avifaunal composition in two bird sanctuaries of Gujarat, Proceedings of XXI Gujarat Science Congress.
5. Patel S. and Dharaiya N. (2008). Marsh Bird Community Index of Biotic Integrity: A key to study an ecological condition of Wetlands, Proceedings of TAAL 200: The 12th World Lake Conference.
6. Cooke T. (1901-1908). The flora of the Presidency of Bombay, Vol.-I & II, London, (B S I reprinted 1958, Vol. I-III, Calcutta).
7. Shah G. L. (1978). Flora of Gujarat State, I & II, S P University, Vallabh Vidhyanagar.
8. Croll D. A. et. al. (2005). Introduced predators transform subarctic islands from grassland to tundra, Science, 307: 888 – 899.
9. Post D. M. et al. (1998). The role of migratory waterfowl as nutrient vectors in a managed wetland, Conservation Biology, 12: 910 – 920.
10. Mohan D. and Gaur A. (2008). Avian diversity around Jajiwal pond – A natural wetland, Proceedings of Taal2007: The 12th World Lake Conference, 542-546.
11. Hunt M., Herron E. and Green L. (2012). Chlorides in fresh water, URIWW 4, College of Environmental Sciences, The University of Rhode Island.
12. Kannan K. (1991). Fundamentals of Environmental pollution, S. Chand & Company Ltd., New Delhi.



Fig. 1: Google Maps image showing the location of Shahwadi wetland

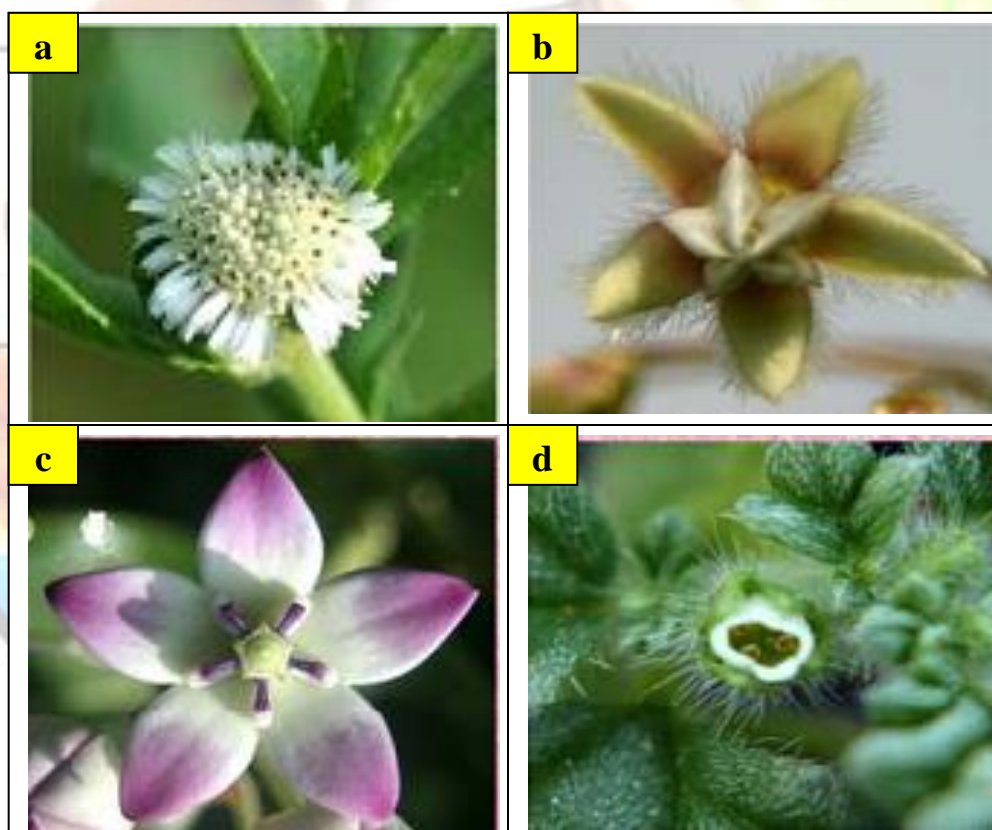


Fig. 2: Some notable plant species in the study area (a) *Eclipta alba*; (b) *Pergularia daemia*; (c) *Calotropis procera* and (d) *Coldenia procumbens*

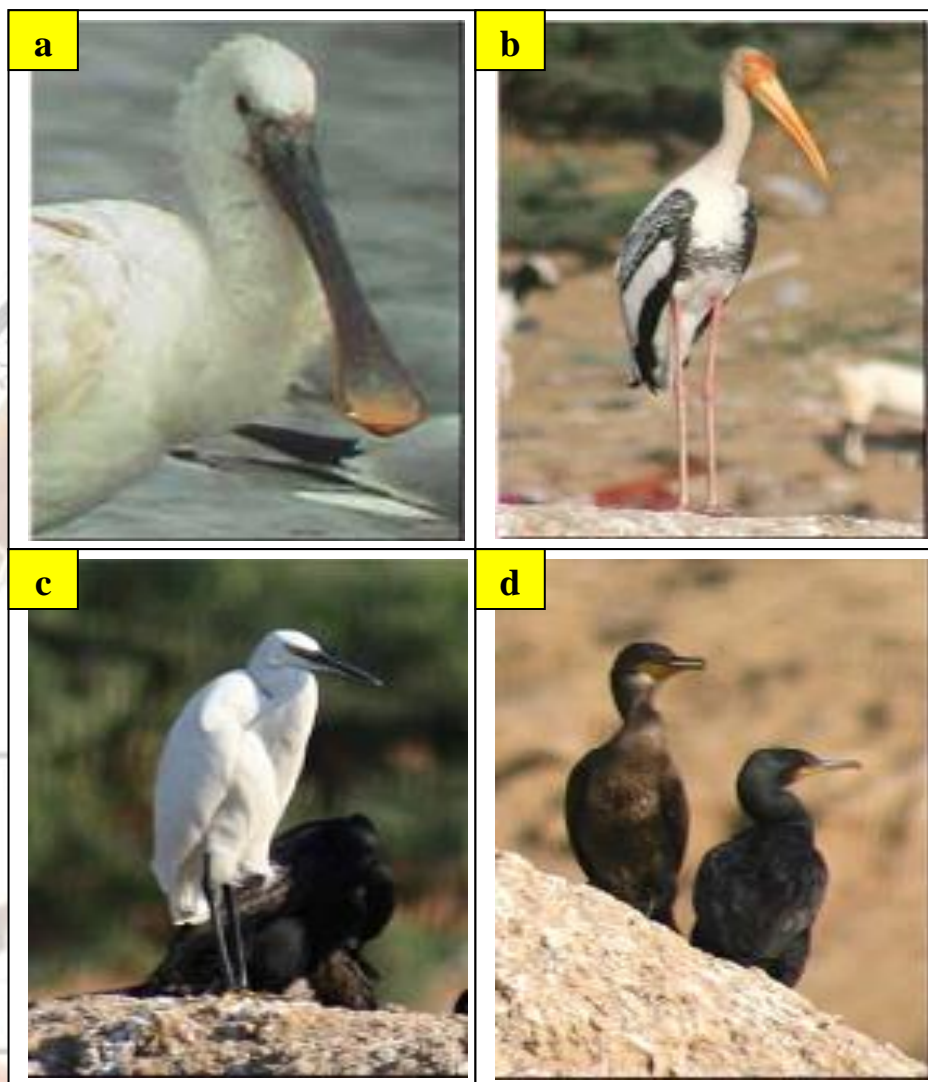


Fig. 3: Some notable birds in the study area: (a) *Eurasian spoonbill*; (b) *Painted stork*; (c) *Egret* and (d) *Cormorants*

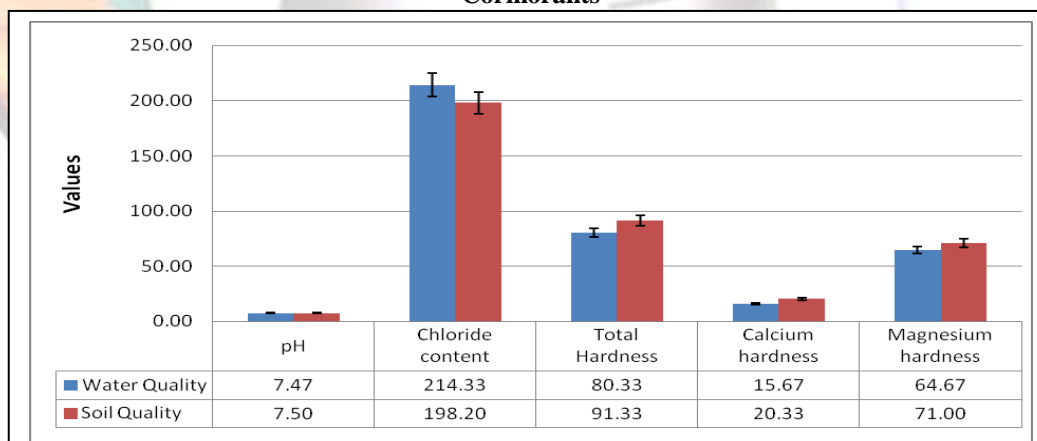


Fig. 4: Water and Soil quality analysis of Shahwadi wetland



Fig. 5: Degraded condition of Shahwadi wetland

Table 1: Plant species recorded in and around the Shahwadi wetland

BOTANICAL NAME	FAMILY	VERNACULAR NAME	HABIT
<i>Achyranthes aspera</i> L.	Amaranthaceae	Anghedi	Herb
<i>Amaranthus spinosus</i> L.	Amaranthaceae	Kantalo dambho	Herb
<i>Pergularia daemia</i> Forsk.	Asclepiadaceae		Climber
<i>Calotropis procera</i> R. Br.	Asclepiadaceae	Ankdo	Shrub
<i>Eclipta alba</i> L.	Asteraceae	Bhangro	Herb
<i>Heliotropium ovalifolium</i> Forsk.	Boraginaceae		Herb
<i>Coldenia procumbens</i> L.	Boraginaceae		Herb
<i>Maerua oblongifolia</i> Forsk.	Capparaceae		Tree
<i>Cadaba fruticosa</i> (L.) Druce	Capparidaceae	Kadhab	Climbing shrub
<i>Capparis decidua</i> Forsk.	Capparidaceae	Kera	Climbing shrub
<i>Capparis sepiara</i> L.	Capparidaceae	Kalo kantharo	Climbing shrub
<i>Ipomoea fistulosa</i> Mart.	Convolvulaceae		Climber
<i>Luffa acutangula</i> (L.) Roxb.	Cucurbitaceae	Kadvi ghisodi	Climber
<i>Phyllanthus niruri</i> L.	Euphorbiaceae	Bhoi amli	Herb

<i>Trianthema portulacastrum</i> L.	Ficoidae		Herb
<i>Gossypium herbaceum</i> L.	Malvaceae		Small shrub
<i>Azadirachta indica</i> A. Juss.	Meliaceae	Neem	Tree
<i>Cocculus hirsutus</i> (L.) Diels.	Menispermaceae		Climber
<i>Prosopis juliflora</i> (Sw.) DC	Mimosaceae	Gando bawal	Shrub
<i>Acacia nilotica</i> L.	Mimosaceae	Baval	Tree
<i>Portulaca grandiflora</i> Hk. F.	Portulacaceae		Herb
<i>Zizyphus mauritiana</i> Lam.	Rhamnaceae		Small tree
<i>Salvadora persica</i> L.	Salvadoraceae	Piludi	Shrub
<i>Clerodendron multiflorum</i> Burm. f.	Verbenaceae		Shrub

Table 2: Bird species recorded in Shahwadi wetland

SCIENTIFIC NAME OF THE BIRDS	COMMON NAME	DISTRIBUTION
<i>Phalacrocorax carbo</i> (Linnaeus)	Great Cormorant	Resident and migratory. Distributed throughout India.
<i>Phalacrocorax niger</i> (Vieillot)	Little Cormorant	Throughout Indian Union, Bangladesh, Pakistan, Sri Lanka and Myanmar.
<i>Ardeola grayii</i> (Sykes)	Indian Pond-Heron	Throughout Indian Union, Bangladesh, Pakistan, Sri Lanka and Myanmar.
<i>Bubulcus ibis</i> (Linnaeus)	Cattle Egret	Throughout Indian Union, Bangladesh, Pakistan, Sri Lanka and Myanmar.
<i>Mesophoyx intermedia</i> (Wagler)	Median Egret	Resident throughout plains of the Indian sub-continent and also in Sri Lanka, Andaman & Nicobar Islands.
<i>Mycteria leucocephala</i> (Pennant)	Painted Stork	Throughout Indian Union, Bangladesh, Pakistan, Sri Lanka and Myanmar.
<i>Platalea leucorodia</i> Linnaeus	Eurasian Spoonbill	Throughout Indian Union, Bangladesh, Pakistan, Sri Lanka and Myanmar.
<i>Vanellus indicus</i> (Boddaert)	Red-wattled Lapwing	Throughout in the Indian Union upto 1800 m in Himalayas and peninsular hills; Bangladesh, Pakistan, Sri Lanka and Myanmar.
<i>Columba livia</i> Gmelin	Blue Rock Pigeon	Throughout Indian Union, Bangladesh, Pakistan, Sri Lanka and Myanmar.
<i>Passer domesticus</i> (Linnaeus)	House Sparrow	World-wide
<i>Corvus splendens</i> Vieillot	House Crow	Throughout Indian Union, Bangladesh, Pakistan, Sri Lanka and Myanmar.