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Original Article

A Comparative Account of the Impact of the Urban Development on Plant and Wetland Dependent Bird Population along the Two Arms of an Ox-Bow Lake, Motijheel, in Murshidabad District

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Abstract

In this study the impact of the urban development on plant and wetland dependent bird population is compared between the two arms of the lake exposed to similar types of climatic and edaphic conditions but different anthropogenic pressure. Disturbances, specially that caused by human recreational activities, is a threat to water-birds, particularly since many recreational activities may be increasing in intensity and distribution. Wetlands plants provide important bird habitats and birds use them for breeding, nesting, and rearing young. Both wetland plants and water-birds are under intense pressure from human activities such as land claim, habitat destruction, pollution, hunting and recreation. As the wetland habitats are drained or altered, the ability of these areas to sustain bird populations decreases. The present investigation is a comparative study of the change in aquatic plant pattern and consequent displacement of the bird population vis-à-vis urban development on the two arms of an ox-bow lake Motijheel (24° 9′ 42" N, 88° 16′ 33" E) of Murshidabad district, West Bengal, India. Along one arm of the ox-bow lake there is rapid urbanization whereas along the other arm there is little human activity. Total 67 bird species were available along one arm of the ox-bow lake where there is less anthropogenic pressure. However only 31 bird species were found along the other arm of the lake where there is urban development. 32 angiosperms were found to be associated with the water birds but many of them were not found in equal proportion along the two arms of the Motijheel Lake.

Keywords: Aquatic Plants; Wetland-Dependent Bird Populations; Urban Development; Ox-Bow Lake .

Introduction

Urbanisation is a major development challenge exerting awesome pressure on social, economic and environmental sustainability (Pickett et al., 2001). Even though cities are considered as the 'engines' of economic development, failure to manage the impacts of rapid urbanization provides a threat to the health of human beings, as well as environmental quality and urban productivity (Leitmann *et al,* 1992).

Urbanisation impacts wetlands in numerous direct and indirect ways. For example, construction reportedly impacts wetlands by causing direct habitat loss, suspended solids additions, hydrologic changes, and altered water quality. Indirect impacts, including changes in hydrology, eutrophication, and sedimentation, can alter wetlands more than direct impacts, such as drainage and filling. Studies have shown that negative effect on wetland species and ecosystem functioning can be expected in such areas due to human activities (Ehrenfeld, and Schneider, 1991; Morris, 1991).

The risk of impact of recreational human activities to wild-ranging breeding birds of prey is a topic commonly addressed in environmental impact assessments (Martínez *et al.,* 2003), owing to the dramatic worldwide increase of human access to the countryside during recent decades. It is generally agreed that disturbance, especially that caused by recreational activities, is a threat to water-birds, particularly since many recreational activities may be increasing in intensity and distribution (Ward

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1990).

Impacts on wetland hydrology and water quality can, in turn, affect wetland vegetation. Horner (1989) stated that emergent zones in Pacific Northwest wetlands receiving urban runoff are dominated by an opportunistic grass species, *Phalaris arundinaceous*, while non-impacted wet lands contain more diverse groupings of species. Vegetation plays an important role in providing nest sites and nesting materials for many species of water birds.

The degradation and loss of inland wetlands and species has been driven by infrastructure development (such as dams, dikes, and levees), land conversion, water withdrawals, pollution, overharvesting, and the introduction of invasive alien species. Dams, diversions and river regulation have reduced flooding to wetlands (Kingsford 2000), altering their ecology and causing the reduction in distribution and abundance of wetland dependent species.

Wetlands are the most productive ecosystems due to habitat diversity and productivity, characterized by shallow water overlying waterlogged soil, interspersed submerged and emergent vegetation. These wetland habitats are dominated by a variety of aquatic vegetation (such as; emergent, submerged, reed beds and grasses) which are suitable habitat for fish, amphibians, reptiles and invertebrates (Rajpar *et al,* 2010). Wetlands are critical habitats for water dependent bird species. The diversity of vegetation and food resources play a significant role in the distribution and diversity of water birds and indicated where and how they used the particular habitat. These habitats are facing rapid degradation due to anthropogenic activities that affect the water birds distribution by changing their habitats. Water bird species exhibit a wide variation in habitat preference across the different wetland ecosystems depending on vegetation structures and composition, richness of food resources, occurrence of surrounded landscapes, protection from predators and harsh weather.

Water bird density and diversity is associated with vegetation structure and composition (Bersier and Meyer, 1995; Hurlbert, 2004) i.e., vegetation structure provides loafing, foraging, nesting and refuge sites from predators and harsh weather (Rajpar and Zakaria, 2011). Detailed information on the effects of vegetation composition and cover on waterbird distribution and richness is lacking. No detailed study has been carried out to examine the effects of wetland vegetation composition on water bird distribution and richness.

Diverse mosaics of wetland habitats are important determinants of waterbird distribution and abundance at all scales from the local to the continental as many waterbird species use different habitats for feeding and breeding and must move between them to survive, reproduce and recruit (Maher and Braithwaite 1992; Haig et al. 1998; Halse et al.1998; Roshier et al.2002, 2006, 2008a & b).

Diverse mosaics of wetland habitats are important determinants of waterbird distribution and abundance. Forage quality and availability, climatic factors, and a wetland's conservation status are expected to affect the densities of wetland birds. Waterbirds use an array of habitats, ranging from sewage treatment ponds, swamps, lagoons, freshwater lakes, estuaries, rivers, dams and floodplains (Belanger and Couture 1988, Kingsford and Norman 2002).

Motijheel, an ox-bow lake, (24° 9'12'' to 24° 9'42'' North and 88° 16' 33'' to 88° 15' 13'' East) of Murshidabad district, West Bengal, India is a famous wetland and historic place. It is. The influence of urban development is compared between the two arms of the lake exposed to similar types of weather conditions but different human pressure in terms of species diversity and species composition.

Wetlands of India, estimated to be 58.2 million hectares, are important repositories of aquatic biodiversity. Wetlands and water-birds are under intense pressure from anthropogenic activities such as land claim, habitat destruction, pollution, hunting and recreation (Bell &Owen 1990, Ward 1990, Yalden 1992).

Generally the ideal wetlands have all forms of vegetation depending on the depth of the water body. It is composed of marshy, swampy, floating anchored, free floating and submerged plants as the depth progresses. The food plants in Motijheel also represented all these classes of vegetation which catered for different types of birds like waders, dabblers and divers indicating the suit-ability of the habitat for avian flora. The occurrence of food plant is was very well synchronized with a large number of migratory and resident birds in the wetland. High diversity and abundance of avian flora indicated intensive use of the wetland which was due to structural diversity of vegetation provided by broadleaved species (Mitsch and Gosselin,1986). India is one of the global hotspots for birds with over 1340 bird species (13% of world species) recorded from the country (Manakadan & Pittie 2001), of which 310 species are dependent on different fresh and salt water wetlands (Kumar et al. 2005). The conversion of wetland habitat to agricultural India is one of the

global hotspots for birds with over 1340 bird species (13% of world species) recorded from the country (Manakadan & Pittie 2001), of which 310 species are dependent on different fresh and salt water wetlands (Kumar et al. 2005). The conversion of wetland habitat to agricultural land or other commertial purpose is threatening the bird populations (Chowdhury and Nandi, 2014). According to Bird Life International (2001), the wetland of this area lies in Biome - 11 (Indo-Malayan tropical dry zone). Thirteen big fresh water wetlands, out of 23 (>100 hectare) in West Bengal, are present in different blocks of this district (Anonymous, 1990). In Bengal the large or small, permanent or seasonally waterlogged marshes are popularly known as "beel". The wetlands of this region are generally palustrine (floodplains, seasonal waterlogged, marsh), lacustrine (Lakes) and riverine types. All these wetlands are directly or indirectly connected with the different rivers like Ganga, Babla, Jalangi, Bhairab etc.

Wetlands are one of the most threatened habitats of the world. Wetlands in India, as elsewhere are increasingly facing several anthropogenic pressures. Thus, the rapidly expanding human population, large scale changes in land use/landcover, burgeoning development projects and improper use of watersheds have all caused a substantial decline of wetland resources of the country. Significant losses have resulted from its conversion threats from industrial, agricultural and various urban developments. These have led to hydrological perturbations, pollution and their effects. Unsustainable levels of grazing and fishing activities have also resulted in degradation of wetlands. The current loss rates in India can lead to serious consequences, where 74% of the human population is rural and many of these people are resource dependent. Healthy wetlands are essential in India for sustainable food production and potable water availability for humans and livestock. They are also necessary for the continued existence of India's diverse populations of wildlife and plant species; a large number of endemic species are wetland dependent.

Most problems pertaining to India's wetlands are related to human population (Prasad, S. N. *et al.* 2002). many experimental studies haveshown that disturbance, which can be equated to deterioration of habitat, canhave a considerable effect on the numbersof individuals using a site (Madsen *et al*.1995 and Hill *et al*. 1997).

Urbanization of Motijheel to promote it as a tourist spot. Once a beautiful natural oxbow lake is now turned into a park for the tourists. One arm of the oxbow is cleared from weeds for boating. The habitat is partially changed. The study emphasize on the displacement of bird population from their natural habitat as a result of development.

Materials and Methods

25 consecutive surveys were executed from November 2012–March 2015. Bird species were observed visually using binoculars of different ranges and their photographs were taken using a Sony DSC HX 100 V camera for identification. Surveys started during the peak hours of their activity, in the morning, from 0500–1100hr and in the evening, from 1600–1800hr on a regular basis in different groups. To prepare the recorded bird list a total of 25 transects of 1km stretches were established in the study areas in both the arms. Observations were carried along each transect following Ridgely & Greenfield (2006). The identification and classification of birds followed Ali (2002). Plant specimen were collected and preserved as herbarium specimens for identification.

Observation

The left arm of the oxbow is still having some vegetation in comparison to right arm. Vegetation is integral part of an wetland that harbouring a large number of aquatic avifauna as well as birds present in the nearby tree. Eradication of so called 'weeds' may facilitate fisheries and tourism but the ecosystem will be highly disturbed. This is evident from the following observations as shown in Table 1 and Table 2:

Discussion

Wetland habitats are threatened by land clearing, climate change, drought and water resource development. It is key that wetlands are managed to maintain ecosystem health and provide habitat for a range of species. Along one arm of Motijheel, the ox-bow lake there is rapid urbanization whereas along the other arm there is little human activity. Total 67 bird species were available along one arm of the ox-bow lake where there is less anthropogenic pressure. However only 31 bird species were found along the other arm of the lake where there is urban development. 32 angiosperms were found to be associated with the water birds but many of them were not found in equal proportion along the two arms of the Motijheel Lake.

Out of 67 reported species 11 birds were observed to be eating aquatic food plants. They were Common Coot (*Fulica atra),* Common Pochard (*Aythya ferina*),

Table 1: Comparative distribution of avifauna in the left and right arms of the ox-bow lake, Motijheel (P= Present; A= Absent)

Common Name	Scientific Name	Left arm	Right Arm
Purple Swamp hen	*Porphyrio porphyrio*	P	A
White-breasted waterhen	*Amaurornis ph the oenicurus*	*P*	*A*
Purple heron	*Ardea purpurea*	*P*	*A*
Indian Pond heron	*Ardeola grayii*	*P*	*P*
Pheasat-tailed jacana	*Hydrophasianus chirurgus*	*P*	*A*
Bronze-winged jacana	*Metopidius indicus*	*P*	*A*
Little Grebe	*Tachybaptus ruficollis*	*P*	*A*
Common kingfisher	*Alcedo atthis*	*P*	*P*
White-throated kingfisher	*Halcyon smyrnensis*	*P*	*P*
Pied Kingfisher	*Ceryle rudis*	*P*	*P*
Little Cormorant	*Phalacrocorax niger*	*P*	*P*
Great Cormorant	*Phalacrocorax carbo*	*P*	*P*
Little egret	*Egretta garzetta*	*P*	*P*
Cattle egret	*Bubulcus ibis*	*P*	*P*
Cotton pygmy-goose	*Nettapus coromandelianus*	*P*	*A*
Wire-tailed swallow	*Hirundo smithii*	*P*	*P*
Red-wattled lapwing	*Vanellus indicus*	*P*	*A*
Sarus Crane	*Grus antigone*	*P*	*A*
Blue-winged leafbird	*Chloropsis cochinchinensis*	*P*	*P*
Intermediate egret	*Mesophoyx intermedia*	*P*	*P*
Asian Openbill	*Anastomus oscitans*	*P*	*p*
Common Coot	*Fulica atra*	*P*	*A*
Black-headed Ibis	*Threskiornis meloanocephalus*	*P*	*A*
Grey Heron	*Ardea cinerea*	*P*	*P*
Darter	*Anhinga melanogaster*	*P*	*A*
Greylag Goose	*Anser anser*	*P*	*P*
Barheaded Goose	*Anser indicus*	*P*	*A*
Gadwall	*Anas strepera*	*P*	*A*
Mallard	*Anas platyrhynchos*	*P*	*A*
Northern Pintail	*Anas acuta*	*P*	*A*
Wood Sandpiper	*Tringa glareola*	*P*	*A*
Northern Shoveler	*Anas clypeata*	*P*	*A*
Eurasian Wigeon	*Anas Penelope*	*P*	*A*
Chestnut-tailed Starling	*Sturnus malabaricus*	*P*	*A*
Garganey	*Anas querquedula*	*P*	*A*
Pied cuckoo	*Clamator jacobinus*	*P*	*P*
Rosy Starling	*Sturnus roseus*	*P*	*A*
Ashy prinia	*Prinia socialis*	*P*	*A*
Indian Silver bill	*Lonchura malabarica*	*P*	*A*
Green bee-eater	*Merops orientalis*	*P*	*P*
Black drongo	*Dicrurus macrocercus*	*P*	*P*
Laughing dove	*Streptopelia senegalensis*	*P*	*P*
Red-vented bulbul	*Pycnonotus cafer*	*P*	*P*
Brahminy Starling	*Sturnus pagodarum*	*P*	*P*
House Crow	*Corvus splendens*	*P*	*P*
Indian Robin	*Saxicoloides fulicata*	*P*	*P*
Oriental Magpie Robin	*Copsychus saularis*	*P*	*P*
Jungle Babbler	*Turdoides striatus*	*P*	*P*
Asian Pied starling	*Sturnus contra*	*P*	*A*
Common mynah	*Acridotheres tristis*	*P*	*A*
Asain Koel	*Eudynamys scolopacea*	*P*	*P*
Black-rumped flameback	*Dinopium benghalense*	*P*	*A*
White-browed Bulbul	*Pycnonotus luteolus*	*P*	*P*
Rose-ringed Parakeet	*Psittacula krameri*	*P*	*A*
Spotted Dove	*Streptopelia chinensis*	*P*	*P*
Eurasian Golden Oriole	*Oriolus oriolus*	*P*	*A*
Hoopiee	*Upupa epops*	*P*	*P*
Common pochard	*Anas ferrina*	*P*	*A*
Paddy field pipit	*Anthus novacseelanduiae*	*P*	*P*
Duscy leaf Warbler	*Phylloscopas fuscatus*	*P*	*A*
Black Stork	*Ciconus nigra*	*P*	*A*
Blacknecked stork	*Ephippiorhynchus asiaticus*	*P*	*A*
Spoonbill	*Platalea leucocordia*	*P*	*A*
Comb duck	*Sarkidiomis melanotos*	*P*	*A*
Lesser Whistling Teal	*Dendrocygna javanica*	*P*	*A*
Blackwinged stilt	*Himantopus kimomtopus*	*P*	*A*
Red Wattled Lapwing	*Vanellus indicus*	*P*	*P*
Eastern Golden Plover	*Pluvialis dominica*	*P*	*P*

Table 2: Comparative distribution of aquatic plants in the left and right arms of the ox-bow lake, Motijheel (P= Present; A= Absent)

Name of Plants	Family	Local Name	Left arm	Right arm
Submerged Plants				
Ceratophyllumdemersum L.	Ceratophyllaceae	Jhanji, Sheoyala	P	A
Hydrillaverticillata(L.f) Royle	Hydrocharitaceae	Kaschra, Jhanji	P	A
*Najasgraminea*Del.	Hydrocharitaceae	JalPalak	P	A
Floating Plants				
Azollapinnata R. Br.	Azollaceae (Pteridophyte)	Tara pana	P	A
Eichhorniacrassipes(Mart.)	Pontederiaceae	Kochuripana	P	A
*Lemnaperpusilla*Torr	Lemnaceae	Khudepana	P	A
NeptuniaoleraceaLour.	Fabaceae	Panijajak	P	A
*Pistiastratiotes*L.	Araceae	Tokapana	P	A
*Salvia molesta*D. Mitch	Salviniaceae (Pteridophyte)	Kopi pana	P	A
Wolffiaglobosa(Roxb.)	Lemnaceae	SujiPana	P	A
Plants with floating leaves				
*Euryale ferox*Salisb	Nymphaeaceae	Kantapadma	P	A
*Nelumbonucifera*Gaertn	Nelumbonaceae	Padma	P	A
*Nymphaeapubescens*Willd	Nymphaeaceae	Saluki	P	A
Nymphoideshydrophylla (Lour)	Menyanthaceae	Jalsweli	P	A
Partially submerged plants				
Aeschynomeneindica L.	Fabaceae	Kath sola	P	A
*Ipomoea carnea*Jacq. subsp. fistulosa (*Mart*. ex Choisy) D. F. Austin	Convolvulaceae	Dholkalmi	P	A
Phragmiteskarka (Retz.)	Poaceae	Nalkhagra	P	A
Sagittariamontevidensis Cham &Schltdl	Alismataceae	Biskachu	P	A
Semi aquatic plants				
Alternantheraphiloxeroidea(*Mart*.) Griseb.	Amaranthaceae	Barmishak	P	P
*Alternantheraparonychiodes*Saint-Hilarie	Amaranthaceae	Saltekeshut	P	A
Bacopamonnieri (L)	Scrophulariaceae	Brahmi	P	P
Canna indica L.	Cannaceae	Kalabati	P	P
Centellaasiatica (L)	Apiaceae	Thankuni	P	P
Colocasiaesculenta (L)	Araceae	Kachu	P	P
*Enhydrafluctuans*Lourerio	Asteraceae.	Helencha	P	P
Hygrophilaschulii (Buch-Ham)	Acanthaceae	Kulekhara	P	P
Ipomoea aquatic Forssk	Convolvulaceae	Kalmi	P	P
*Marsileaminuta*L.	Marsileaceae (Pteridophyte)	Susni	P	P
*Polygonumbarbatum*L.	Polygonaceae	Bekunjubaz	P	P
Polygonumhydropiper L.	Polygonaceae	Panimorich	P	P
Ranunculus sceleratus L.	Ranunculaceae	Jaldhane	P	P
*Sesbaniabispinosa*W. Wight	Leguminosae	Dhanche	P	A
*Sphenocleazeylanica*Gaertn	Sphenocleaceae	Jhilmarich	P	P

Eurasian Wigeon (*Anas Penelope),* Gadwall (*Anas strepera*), Gargany (*Anas querquedula*), Greylag Goose (*Anser anser),* Lesser Whistling-duck (*Dendrocygna javanica),* Mallard (*Anas platyrhynchos*), Northern Pintail (*Anas acuta*), Purple Swamphen (*Porphyrio porphyrio*), and Red-crested Pochard (*Rhodonessa rufina*). These are primarily the migratory birds except Common coot, Lesser Whistling-duck and Purple Swamphen.

It was also observed that 9 aquatic birds like Bar-headed Goose (*Anser indicus*), Common Coot (*Fulica atra*), Common Pochard (*Aythya ferina*), Graylag Goose (*Anser anser*), Northern Shoveler (*Anas clypeata*), Purple swamphen (*Porphyrio porphyrio*), Red-crested Pochard (*Rhodonessa rufina*), Spot-billed Duck (*Anas poecilorhyncha)* and Grey Heron (*Ardea cinerea*) foraged in early as well as late winter agriculture crops like paddy, wheat, mustard, pigeon pea, gram, green pea, sunflower and lentil in the neighboring agriculture fields. But their shelter is the aquatic plants. Wetlands plants provide important bird habitats and birds use them for breeding, nesting, and rearing young. Out of 31 birds found in the urbanized right wing 12 are aquatic. They mostly feed on fish, insects, worms and mollusks. These are the kingfisher, cormorant, erget and openbill group. The rest of the 19 birds are insect eater or feed upon the seeds of various crops.

Breeding water birds have high nutritional and energetic demands and can be expected to select foraging habitats that have a high abundance of accessible foods (Laubhan and Gammonley 2000). Gawlik, 2002, found that the feeding strategies employed by wading birds i.e. searching for high quality food rather than staying and exploiting food in declining patches influenced bird abundance and diversity. Bancroft *et al* 2002 found that while vegetation and water depth influence wading bird abundance, water depth has the greatest influence. These are key ecological variables that can be

managed for when manipulating flow regimes or creating wetland mosaic habitats From the above study it is evident that urbanization and organized fisheries are displacing birds from their natural habitat. Once this ox-bow lake, Motijheel was full of birds due presence of suitable habitat plants but now they are only restricted in the left arm which is still undisturbed. For sustainable development more data will be required.

At the regional and individual wetland scale there are several key areas where our knowledge is lacking. These include the interactions of water birds with hydrology, wetland habitat and wetland ecosystem components. Further studies along these lines will provide better understanding about the wetlands and their fragile biodiversity. Identification of key factors is critical, so that wetland management decisions can be more strategic and better informed with rigorous scientific data. The habitat variables such as aquatic vegetation composition, vegetation cover percentage and micro-climate and other key factors which affect on the distribution and richness of water bird in particular wetland habitat need to be studied.

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