International Journal of Advanced Research and Development
ISSN: 2455-4030, Impact Factor: RJIF 5.24
www.advancedjournal.com
Volume 2; Issue 3; May 2017; Page No. 76-80

River Yamuna: Virtual drain that supports avian life

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Abstract
Rivers is India has cultural, religious, social as well as economic importance. One such river is mythological river Yamuna which is a major tributary of the holy river Ganga. Pollution in this river has been well documented (Jain 2004, Paliwal *et al* 2007) especially through its stretch from Delhi. In this study we tried to document the dependence of birds on the river and Najafgarh Drain and sampled the variety of wetland birds found in this region. We identified at least 47 species of water birds in the wetlands of the region. Due to rapid urbanization we have been losing our aesthetic wealth, and the major cause is pollution, discharge of untreated water and encroachment along its stretch. Several policies and strategies should be made on grass root level to decrease the level of pollution in this holy river.

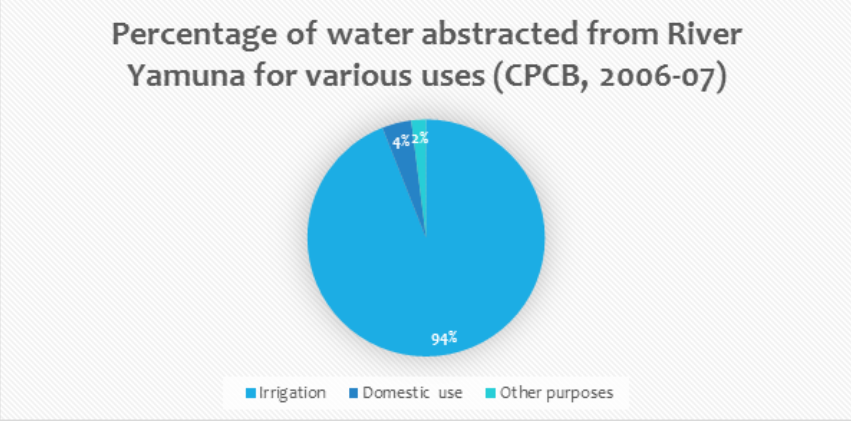
Keywords: pollution, waterbirds, Yamuna, najafgargh drain, conservation.

Introduction

According to the Central Pollution Control Board (CPCB) the water of river Yamuna falls under category "E" which makes it suitable for using it either for industrial activities i.e. for cooling or for recreations completely ruling out the possibility of underwater life which supports other terrestrial lifeforms. The river Yamuna, the largest tributary of the Holy River Ganga, has a length of 1,376 k and cross over major cities of India including Delhi, Agra, Faridabad, and Haryana. It originates from the Yamunotri Glacier of Uttar Kashi in Uttaranchal) and has a catchment area of 3, 66, 223 km^2. Although the river is polluted almost throughout its journey in plains but maximum of pollution occurs during its journey through Delhi region which contributes about 79% of total pollution load (Upadhyay *et. al* 2011). The main sources of pollution in NCT are:

1. Rapid migration in Delhi leading to increase in population and poor sanitation practices;
2. Untreated wastewater from drains;
3. Untreated wastewater from industries;
4. Agricultural runoffs (undetected and untreated pesticide residues leave a toxic mark all across the river)
5. Dead body dumping, solid waste dumping and animal washing.
6. Religious activity and immersion of idols.

In the Himalayan stretch of river Yamuna the quality water is good and henceforth meet the water quality standards until Tajewala barrage in Yamuna Nagar, Haryana. The river Yamuna enters Delhi near Palla village and subsequently impounded by Wazirabad barrage. There is another barrage Okhla barrage 22 km downstream of Wazirabad barrage. It is this segment of Delhi that is considered most polluted in the whole stretch of Yamuna which receives untreated wastewater from seventeen Drains. 94% of the water from the river is used for irrigation purposes, 4% for the domestic purposes and 2% for other uses.



Najafgarh drain which was once called Sahibi River serves as an important habitat for various resident and migratory birds. More than 150 resident birds and a large number of wintering waterfowls such as Black-winged Stilt, Wagtails, Redshanks, and Sandpipers can be easily seen at the banks of the drain. Despite of its unclean and polluted water Najafgarh drain is one of the important bird habitats in Delhi. Especially Najafgarh Jheel that receives its water from run-off from

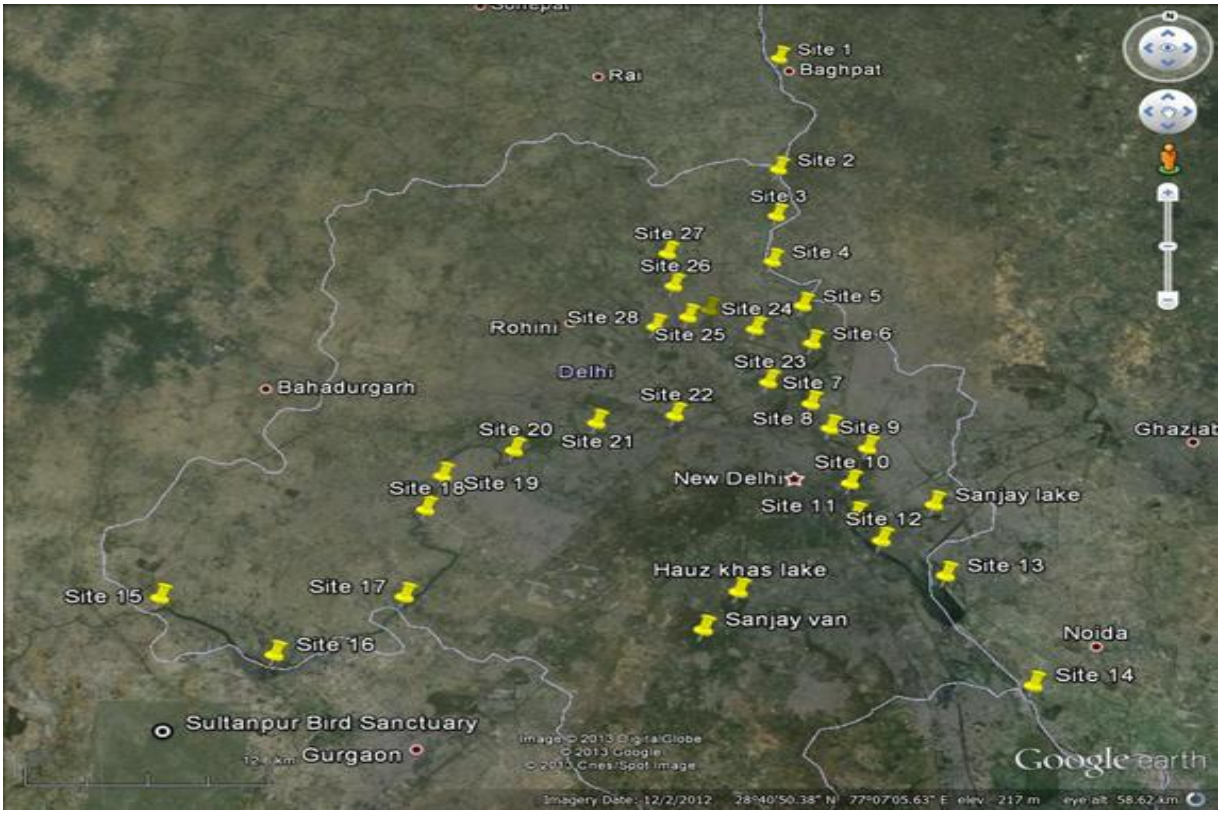
accompanying agricultural fields and rainwater is paradise for may waterbirds. A variety of migratory species was sighted throughut its stretch from Najafgarh jheel until it meet river Yamuna in wazirabad.

Wetland ecosystems are part of our natural wealth. A recent assessment of the monetary value of our natural ecosystems estimated them at US$ 33 trillion*. This reflects the many crucial functions of wetlands such as flood Control, groundwater recharge, shoreline stabilization and protection from storm, sediment and nutrient retention and export, climate change mitigation, water purification, reservoirs of biodiversity, wetland products, recreation and tourism, cultural value and many more. It is no accident that river valleys and their floodplains have been the focus of human civilizations for over 6,000 years – and that many other wetland systems have been equally critical to the development and survival of human communities.

The multiple roles of wetland ecosystems and their value to humanity have been increasingly understood and documented in recent years. This has led to massive expenditures to restore lost or degraded hydrological and biological functions of wetlands. Yamuna and Najafgarh drain is one such example, inspite of being such a polluted river it still harbours a wide variety of avian life across its stretch through the Delhi region. In this study we tried to document various species of birds that are dependent on these waterbodies for foraging, nesting and simply cheating cold winters of the north.

Methodology

Bird survey was carried out during the months of February to March 2013 by Point transects method (Bibby et.al. 1992). At this time of the year during winters, bird activity is considerably heightened thereby facilitating easy detection. Every point transect was for 10 mins duration during which every water bird species was penned down on clear sky days from 5AM to 7AM. This survey was done over using randomly placed 4 point transect on each site on the banks of various water bodies and the number of species found within 50m from a point of observation was noted down using a simple binocular.



Result and Discussion

Banks of Yamuna and its adjoining wetlands are one of the most important bird sites in Delhi. Several waders such as Painted Stork, Wooly-necked Stork, Asian Open bill, Grey Heron and Purple Heron can be seen in the vicinity of Yamuna, which comes here for foraging. Flocks of Ducks and Goose which includes Bar-headed Goose, Grey lag Goose, Ruddy Shelduck, Common Shelduck, Spot-billed Duck are common sightings. Winter visitors like Black-winged Stilt, Common Teal, Yellow wagtail, White wagtail, Citrine Wagtail, Northern Shoveler, Wood Sandpiper, Spotted Sandpiper, Spotted Redshank and Black-tailed Godwits are seen near the bank of Yamuna and nearby wetlands in large numbers. Most of these winter visitors come from icy northern and central Asia to the Indian subcontinent, to protect themselves from the cold in their country of origin. Okhla Bird Sanctuary: Okhla Barrage, located at the point where river Yamuna leaves the territory of Delhi and enters the neighboring state of Uttar Pradesh, is one of the most 'Important Bird Area' on the river Yamuna (Urfi, 2003). The wetland at Okhla attracts a large number of wintering waterfowls every year. A total of 302 bird species have confirmed records from the site (Urfi, 2003) which includes species facing variable risk of extinction. Some of

the birds at Okhla Bird Sanctuary are important from the point of conservation. e.g., *Critically endangered*: White-rumped Vulture, Indian Vulture; *Vulnerable*: Baikal Teal, Baer's Pochard, Sarus Crane, Sociable Lapwing, Indian Skimmer, Pallas's Fish Eagle, Lesser Adjutant, Bristled Grass bird, Finn's Weaver; *Near Threatened*: Ferruginous Pochard, Black-bellied Tern, Grey-headed Fish Eagle, Darter, Black-headed Ibis, Painted Stork, Black necked Stork. The Uttar Pradesh (U.P.) side of Okhla has already been declared a bird sanctuary. This Sanctuary comes under the Irrigation Department. The aquatic vegetation of this stretch of River Yamuna has been described by (Gopal and Sah 1993). A total of 47 species of wetland bird species were recorded from the 32 sampling sites. These birds belonged to 17 different families. Some of the near threatened category like Ferruginous Duck (*Aythya nyroca*), Oriental Darter (*Anhinga melanogaster*) and Painted Stork (*Mycteria leucocephala*) was also recorded. Some migratory species like Tufted Duck (*Aythya fuligula*), Greater Flamingo (*Phoenicopterus roseus*) and Ruff (*Philomachus pugnax*) were also rare and exciting sightings during the survey.

Table 1: The list of the birds sighted during the survey

Common Name	Scientific Name	IUCN Status
Anatidae		
Knob-billed Duck	*Sarkidiornis melanotos*	LC
Gadwall	*Anas strepera*	LC
Eurasian Wigeon	*Anas penelope*	LC
Indian Spot-billed Duck	*Anas poecilorhyncha*	LC
Northern Shoveler	*Anas clypeata*	LC
Ferruginous Duck	*Aythya nyroca*	N. TH
Tufted Duck	*Aythya fuligula*	LC
Podicipedidae		
Little Grebe	*Tachybaptus ruficollis*	LC
Phoenicopteridae		
Greater Flamingo	*Phoenicopterus roseus*	LC
Ciconiidae		
Painted Stork	*Mycteria leucocephala*	N. TH.
Woolly-necked Stork	*Ciconia episcopus*	LC
Threskiornithidae		
Glossy Ibis	*Plegadis falcinellus*	LC
Red-naped Ibis	*Pseudibis papillosa*	LC
Ardeidae		
Indian Pond Heron	*Ardeola grayii*	LC
Eastern Cattle Egret	*Bubulcus coromandu*	LC
Grey Heron	*Ardea cinerea*	LC
Purple Heron	*Ardea purpurea*	LC
Great Egret	*Ardea alba*	LC
Intermediate Egret	*Egretta intermedia*	LC
Little Egret	*Egretta garzetta*	LC
Phalacrocoracidae		
LittleCormorant	*Microcarbo niger*	LC
Indian Cormorant	*Phalacrocorax fuscicollis*	LC
Great Cormorant	*Phalacrocorax carbo*	LC
Anhingidae		
Oriental Darter	*Anhinga melanogaster*	N. TH.
Rallidae		
White-breasted Waterhen	*Amaurornis phoenicurus*	LC
Purple Swamphen	*Porphyrio porphyrio*	LC
Common Moorhen	*Gallinula chloropus*	LC
Eurasian Coot	*Fulica atra*	LC
Recurvirostridae		
Black-winged Stilt	*Himantopus himantopus*	LC
Charadriidae		
River Lapwing	*Vanellus duvaucelii*	LC
Yellow-wattled Lapwing	*Vanellus malabaricus*	LC
Red-wattled Lapwing	*Vanellus indicus*	LC
Jacanidae		
Bronze-winged Jacana	*Metopidius indicus*	LC
Scolopacidae		
Common Redshank	*Tringa totanus*	LC
Common Sandpiper	*Tringa glareola*	LC
Wood Sandpiper		LC
Ruff	*Philomachus pugnax*	LC

Laridae		
Black-headedGull	*Chroicocephalus ridibundus*	LC
Brown-headed Gull	*Chroicocephalus brunnicephalus*	LC
Alcedinidae		
White-throated Kingfisher	*Halcyon smyrnensis*	LC
Hirundinidae		
Barn Swallow	*Hirundo rustica*	LC
Motacillidae		
Western Yellow Wagtail	*Motacilla flava*	LC
Citrine Wagtail	*Motacilla citreola*	LC
Grey Wagtail	*Motacilla cinerea*	LC
White Wagtail	*Motacilla alba*	LC
White-browed Wagtail	*Motacilla maderaspatensis*	LC

Conclusions & Recommendations

The poor water affects the birds adversely. It is therefore, important to know the water quality status for the health of the birds. Aquatic birds are largely dependent on the aquatic fauna and flora for foraging and rearing their nest. Phytoplanktons, macro- invertebrates, amphibians and fishes are important constituents of their food. Benthic flora and fauna is largely dependent on water quality.

Water quality is continuously going down in metropolitan cities, like Delhi, due to inorganic and organic pollution. Inorganic pollution involves metal contamination from industries while organic load is composed of solid wastes. Metal contamination can lead to serious problems in birds, fishes, amphibians, macro invertebrates and phyto-benthoes.

Water acidification adversely affects freshwater ecosystems without much acid neutralizing capacity. Cultural eutrophication and toxicity of ammonia nitrate and nitrite can however affect many aquatic ecosystems. In general, freshwater animals seem to be more sensitive to the toxicity of inorganic nitrogenous compounds then seawater animals, with nitrate begin less toxic than ammonia and nitrate in any case. Extensive kills of invertebrates and fishes, particularly sensitive benthic species, are probably the most dramatic manifestation of hypoxia (or anoxia) in eutrophic and hypereutrophic aquatic ecosystems with low water turnover rates. The decline in dissolved oxygen concentration can also promote the formation of reduced c, such as hydrogen sulphide, resulting in higher adverse (toxic) effects on aquatic animals.

Moreover occurrence of toxic algae can significantly contribute to the extensive kills of aquatic animals (Camargo 2006). Aquatic eutrophication also promotes pathogenic infection of *ribeiroia* in amphibians, birds, snails etc. (Johnson *et al.* 2007).

Metal contamination can also affect fish communities present in waterbodies. High salinity can lead change to change in the aquatic communities. It affects the compositions of fish and macro- invertebrate's communities (Kefford *et al*, 2004). Several amphipods and snails are sensitive while some (like isopods, leeches) are tolerant to acidification (Zischke *et al*, 1983). Hence pH also has important role in the deciding the community structure. Like pH, temperature also affects the fishes. Therefore, water quality plays an important role in deciding the fate of the community structure of the birds in the wetlands affecting the trophic structure directly or indirectly.

Water resources are diminishing not just because of large population numbers but also because of wasteful consumption and neglect of conservation. With rapid urbanization and industrialization, huge quantities of wastewater enter rivers. The volume of waste water generated (in millimeters per day) from different domestic and industrial sources. The volume of domestic wastewater generation is 1270 mi/d in Delhi (Maiti, 2005).

Dependence of the Delhi Zoo water birds on river Yamuna is very well documented (Urfi 2006). The only nesting ground of Painted Stork (Delhi Zoo) in Delhi is totally dependent on the river for foraging and feeding their young ones. Considering the pollution in the river, it is alarming situation for health of these birds and health of the overall ecosystem. Several strategies can be employed for improving the quality of water as described by (Misra 2010) like Conserve Water and Use It Effectively, Promote Wastewater Treatment & Technologies, Promote Wastewater Treatment & Technologies, Financing Wastewater Management Schemes, Recycling and Reuse of Wastewater, Improving the Sewerage System and Proper Disposal of Sewage.

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