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# ASSESSMENT OF DISTRIBUTION PATTERNS OF WETLAND BIRDS BETWEEN UNPOLLUTED AND POLLUTED PONDS AT RATANPUR, DISTRICT BLASPUR, CHHATTISGARH, INDIA

**DEVENDRA SINGH PORTE[a1] AND SEEMA GUPTA[b]**

[ab]Department of Zoology, Govt. Nagarjuna P.G. College of Science, Raipur, Chhattisgarh, India

## ABSTRACT

**The study was designed to enumerate wetland bird's diversity and distribution in the unpolluted and polluted ponds of Ratanpur, Bilaspur district, Chhattisgarh. An avian census was carried out, using distance sampling point count method for consecutive two years (2013-2014). The study area harbored a total of 4572 wetland bird individuals of 29 species belonging to 07 orders and 12families. The unpolluted ponds represented by the good number of avian diversity and populations as they situated away from city area so, it less affected by human interference and pollutions hence the interference or disturbance do not have direct impact on the ecosystem that existing in this particular site. So, the majority of migratory bird species visits this area throughout the year, especially during the winter season. Whereas, in case of polluted ponds the disturbance due to various activities such as alteration of agricultural and anthropogenic practices by human settlement, hunting, garbage dumping, immersion of idol during festival time and vehicle washing activities etc. were very high and has adverse affect on the avian population. We observer that the polluted ponds were generally occupied by residential wetland avian species which sometimes filled by other wetland species just for searching the food during rainy season because, these polluted ponds becomes refresh for some extent that's allow the other birds to occasionally visit. Our result shows that the polluted ponds were less occupied by the wetland bird as compared to the unpolluted ponds. Thus we concluded that the ecological condition has direct impact on the occurrence, diversity and distribution of wetland birds.**

**KEYWORDS:** Ratanpur, Wetland Birds, Unpolluted, Polluted, Diversity, Distribution.

Avi-fauna are one of the associations of food chain in environment (Ali, 2004). They feed on various harmful insect and pests. Thus they support the farming system and human beings. Several avian species are important scavenger which helps to make clean surroundings. Birds supports the pollination in plants, therefore, they contribute a vital role in fruit-production along with dispersion of seeds. Morally we have no right as human being to make perilous environment for the other species of natural world that have the same right to exist with nature as much as human society. In current years a vast concern has been observed on the hazards of various environmental pollutions which occurring by the side effect of fast industrialization. Although, people should be understand that the present development should turn into future's destruction (BNHS, 2006).

Migration of avian species is the strongest among all ornithological observable facts in addition to their unclear mystery in the earth. Each year millions of avifauna take to air and set out long flight with the intention of a specific target, sometime across the sea and continents (BNHS, 2006; Kathiresan, 2000). India being a megadiversity centre harbours 1,200 species of avi-fauna which contributes to 13 percent of the world avian species (Fornemann *et al*., 2001). Wetlands are the most important ecosystems which is helpful for improving water quality (Melesse et *al*., 2006; Melesse *et al*.2007). The association between habitat composition and gathering of wetland bird is centered on habitat extension property on the population structure (Riffel *et al*., 2001; Dugan, 1990). Furthermore, wetlands offers habitat for wild life and gathering place to encourage recreation (Ali and Ripley, 1983).Wetlands are fundamental environment for avifauna because of their habitat assortment and high efficiency have led to rising concern about the impact of their loss (Gracia *et al*., 1997). Wetlands are generally known as delicate ecosystems with varied attributes with a unique bird species. (Burger, 1985). Wetlands are extremely important because they supply as critical breeding, performance and wintering grounds for large group of world widely important avian species (Kristen and brander, 1991).

As highly increasing urbanized and industrialized practices, wetland ecosystems are exposes to natural and man-induced transformations

[1]**Corresponding author**

through physical, chemical and vigorous processes. Anthropogenic pollution on water bodies are more severe increasingly, wetland birds whose existence is in wetlands are at high risk of danger. An exponential enhances in developement and an anthropogenic activity has led to extensive ecological contamination worldwide (Sayadi *et al*., 2010). Pollution in wetlands is not only declining the water quality, which has harmful pressure on the hydrophytes and animals openly or obliquely but, also create a reduction in the range of several avian species, leading the biodiversity in wetlands decline. Avian fauna in several cases demonstrate to be more receptive to ecological contaminants than other vertebrates (Furness, 1993). Alterations of wetlands make threat to the avian species and its conservation even though the impacts differ with definite land use type (Brambilla *et al*., 2011). Land destruction at the local scale can also unenthusiastically affect the diversity and composition of wetland avian species (Guadagnin *et al*., 2005) and land cover alteration change the avian distributions locally and regionally (Jetz *et al*., 2007). Ratanpur is a famous tourist-place of Chhattisgarh state. Therefore, in recent few years the human encroachment and other developmental activities are become elevated in this particular area causing habitat loss and fragmentation due to pollutions and disturbances of wetland by means of the anthropogenic activities. Then also the wetlands of Ratanpur harbour a variety of wetland birds along with a good amount of migratory avian species. Therefore, detail study on avifuna and their ecology is essential to conserve them. Hence this study was taken up to measure the wetland birds between unpolluted and polluted wetlands of the study area.

## MATERIAL AND METHODS

### Study Area

The study area i.e., Ratanpur is a Nagar Panchayat belongs to Bilaspur district, Chhattisgarh, India. It is located about 25 Km away from Bilaspur in the way of Ambikapur road and famous for his historical and religious importance. The area of this town is about 44.24 sq km. Geographically, it is spreads between $85^{o}17'$E longitude and $22^{o}3'$N latitude which is situated at the elevation of 306 m (1004ft) from the sea level. The study area includes a small town with a good numbers of ponds, forests and agricultural fields. The water bodies of this area play important role not only for irrigation purposes but also flourishing wetland birds within the area. At present study we selected ten ponds on the basis of their ecological conditions in respectively, unpolluted or sacred ponds (viz. Bairagban, Bikma, Dulahara, Gireejaban, Jagannathand and Maharaiya pond) and polluted ponds or filled by garbage and unnecessary anthropogenic practices (viz. Bhedimuda, Kaira, Krishnarjuni and Ratneshwar pond). All of the selected ponds were perennial and located under the area of Ratanpur Nagar Pnachayat.

### Data Collection

Bird watching and recording has been carried out in regular intervals during summer, rainy and winter seasons of the year, in order to cover migratory and resident species. Bird survey was conducted by using distance sampling point count method to observe the avian diversity, distribution in all the selected wetlands (n=10 ponds) for consecutive two years (2013-2014) with an aid of a pair of Binoculars (10 x 50). Distance-sampling point count method is easier and more efficient method to perform bird's surveys (Bibby *et al*., 1992; Codesido and Bilenca, 2000; Buckland *et al*., 2004). Bird survey was conducted, when birds are most active during day from 06:00 to 10:00 hrs and from 16:00 to 19:00 hrs. Field visits have been conducted twice in a week for all three seasons and field characteristics were noted down on ornithological data sheets. Photographs were taken whenever possible by using Digital Camera (Canon EOS 1100 D) with suitable zoom lens. The recorded wetland birds were identified by using standard field guides such as the help of Ali (1981), Ali and Ripley (1981, 1983, 1995), Grimett *et al*. (2001), Ali (2002), Hossain *et al*. (2004), Kumar *et al*. (2006) and Grimett *et al.* (2006). Data were stored in the form of a database in the MS Excel worksheet. The data collected during the study period were analyzed by using Biodiversity Pro (version 2) Statistical Software to calculate the various diversity indices, distributions, cluster analysis etc. by applying standard formula.

## RESULTS AND DISCUSSION

The censuses of wetland bird were performed in order to analyses the distribution pattern of wetland avifauna between unpolluted or sacred

ponds (viz. Bairagban, Bikma, Dulahara, Gireejaban, Jagannathand and Maharaiya pond) and polluted ponds or filled by garbages and unnecessary anthropogenic practices (viz. Bhedimuda, Kaira, Krishnarjuni and Ratneshwar pond). The present results of qualitative and quantitative study of wetland avifauna at Rratanpur, Chhattisgarh clearly signified that the distributions of wetland bird species were varied between unpolluted and polluted Ponds. A total of 4572 wetland bird individuals of 29 species belonging to 07 orders and 12 families were recorded during the two year of study period (2013-2014) (Table 1). The observed wetland avian species were Asian Openbill Strok (*Anastomus oscitans*), Black Crowned Night Heron (*Nycticorax nycticorax*), Black Winged Stilt (*Himantopus himantopus*), Bronze winged Jacana (*Metopidius indicus*), Cattle Egret (*Bubulcus ibis*), Chestnut Bittern (*Ixobrychus cinnamomeus*), Common Coot (*Fulica atra*), Common Kingfisher (*Alcedo atthis*), Cotton Pigmy Goose (*Nettapus coromandelianus*), Ferruginous pochard (*Aythya nyroca*), Gadwall (*Anas strepera*), Great Cormorant (*Phalacrocorax carbo*), Great Egret (*Ardea alba*), Green Sandpiper (*Tringa ochropus*), Indian Pond Heron (*Ardeola grayii*), Indian Moorhen (*Gallinula chloropus*), Lesser Whistling Duck (*Dendrocygna javanica*), Little Cormorant (*Phalacrocorax niger*), Little Egret (*Egretta garzetta*), Little Grebe (*Tachybaptus ruficollis*), Median Egret (*Mesophoyx intermedia*), Painted Snipe (*Rostratula benghalensis*), Pheasant-tailed Jacana (*Hydrophasianus chirurgus*), Pied Kingfisher (*Ceryle rudis*), Purple Heron (*Ardea purpurea*), Purple Swamp Hen (*Porphyrio porphyrio*), Red Wattled Lapwing (*Vanellus indicus)*, White Breasted Waterhen (*Amaurornis phoenicurus*) and White-Throated Kingfisher (*Halcyon smyrnensis*) respectively. During the study we observed that the unpolluted or sacred ponds were facilitated by favorable conditions or required habitats for wetland birds as they shows extreme distribution of wetland avifuana. When comparison were made between both the unpolluted and polluted ponds, it was observed that the maximum numbers of wetland birds were recorded from unpolluted ponds i.e. 4357 which occupied 29 species of wetland avifauna whereas, the polluted ponds was observed with very less number of wetland birds i.e. 215 with only 12 species of wetland avifauna. (Table 2; Figure 1).

We observed the diversity indices for wetland avian species therefore, we found that the Shannon diversity index (H'), and Shannon maximum diversity index ($H_{max}$) were found to be high in unpolluted ponds with 3.56 and 3.96 while, the Shannon diversity index (H') and Shannon maximum diversity index ($H_{max}$) were minimum in polluted ponds i.e. 1.87 and 2.44 respectively. However, the evenness index was also maximum in unpolluted ponds (2.69) than the polluted ponds (2.30). As indicated by the Shannon diversity index (H') when, we compared the seasonal diversity between both the unpolluted and polluted ponds we recorded that the winter season exhibited maximum diversity i.e. 1.32 for unpolluted ponds and 0.68 for polluted ponds which was minimum during the rainy season i.e. for 1.09 unpolluted ponds and 0.56 for polluted ponds (Table 3; Figure 2).

Although, the dendrogram of the distributions of wetland birds between unpolluted or polluted ponds clearly revealed that the unpolluted ponds were distinct and unique from the polluted ponds with respect to availability and distributions of wetland avifauna throughout the seasons. In case of unpolluted ponds the wetland bird's distribution was distinct during the winter season while the summer and rainy season was found to be similar distribution patterns. However, in polluted ponds the rainy season was unique and being distinct from other seasons whereas, the winter and summer season clustered together in order the distribution patterns (Figure3). Similarly, the rarefaction curves for distribution of wetland birds also revealed that the distribution patterns of wetland birds in unpolluted ponds were completely different from polluted pond in all season. The distributional significance was very high in unpolluted pond during the winter season. In contrast to unpolluted ponds summer and winter season was slightly similar but, winter season expressed with a specific or high distribution pattern while, in case of polluted ponds winter season overlapped the summer season but, rainy season was somewhat expressed with better in distribution patterns (figure 4).

**Table 1: Shows list of wetland avian species observed in Ratanpur area during 2 years (2013-2014)**

| Sr. No. | Order | Family | Scientific Name of Species | Common Name of Species | Status at Study Area |
|---|---|---|---|---|---|
| 1 | Anseriformes | Anatidae | *Dendrocygna javanica* | Lesser Whistling Duck | W V |
| | Anseriformes | Anatidae | *Nettapus coromandelianus* | Cotton Pigmy Goose | W V |
| | Anseriformes | Anatidae | *Anas strepera* | Gadwall | W V |
| | Anseriformes | Anatidae | *Aythya nyroca* | Ferruginous pochard | W V |
| 2 | Charadriiformes | Jacanidae | *Metopidius indicus* | Bronze winged Jacana | V C |
| | Charadriiformes | Jacanidae | *Hydrophasianus chirurgus* | Pheasant-tailed Jacana | W V |
| | Charadriiformes | Charadridae | *Vanellus indicus* | Red Wattled Lapwing | N R |
| | Charadriiformes | Scolopacidae | *Tringa ochropus* | Green Sandpiper | N R |
| | Charadriiformes | Recurvirostridae | *Himantopus himantopus* | Black Winged Stilt | S V |
| | Charadriiformes | Rostratulidae | *Rostratula benghalensis* | Painted Snipe | M V |
| 3 | Ciconiiformes | Ardeidae | *Nycticorax nycticorax* | Black Crowned Night Heron | N R |
| | Ciconiformes | Ardeidae | *Bubulcus ibis* | Cattle Egret | V C |
| | Ciconiformes | Ardeidae | *Ardea alba* | Great Egret | C |
| | Ciconiformes | Ardeidae | *Ardeola grayii* | Indian Pond Heron | V C |
| | Ciconiformes | Ardeidae | *Egretta garzetta* | Little Egret | C |
| | Ciconiformes | Ardeidae | *Mesophoyx intermedia* | Median Egret | C |
| | Ciconiformes | Ardeidae | *Ardea purpuria* | Purple Heron | R |
| | Ciconiformes | Ardeidae | *Ixobrychus cinnamomeus* | Chestnut Bittern | C |
| | Ciconiformes | Ciconiidae | *Anastomus oscitans* | Asian Openbill Strok | M V |
| 4 | Coraciiformes | Alcedinidae | *Alcedo atthis* | Common Kingfisher | C |
| | Coraciiformes | Alcedinidae | *Ceryle rudis* | Pied Kingfisher | C |
| | Coraciiformes | Alcedinidae | *Halycon smyrmensis* | White- Throated Kingfisher | C |
| 5 | Gruiformes | Rallidae | *Gallinula chloropus* | Indian Moorhen | N R |
| | Gruiformes | Rallidae | *Porphyrio porphyrio* | Purple Swamp Hen | C |
| | Gruiformes | Rallidae | *Fulica atra* | Common Coot | N R |
| | Gruiformes | Rallidae | *Amaurornis phoenicurus* | White Breasted Waterhen | R |
| 6 | Pelecaniformes | Phalacroracidae | *Phalacrocorax carbo* | Great Cormorant | R |
| | Pelecaniformes | Phalacroracidae | *Phalacrocorax niger* | Little Cormorant | V C |
| 7 | Podicipediformes | Podicipedidae | *Tachybaptus ruficollis* | Little Grebe | W V |

W V= Winter Visitor, S V= Summer Visitor, M V= Monsoon Visitor, V C= Very Common, C= Common, N R= Not Rare, R= Rare

**Table 2: Assessment of distribution of wetland bird between unpolluted and polluted ponds at Ratanpur, Chhattisharh during 2013-2014.**

| S. No. | Common name | Scietific name | No. of individual Species | | Total no. of individual Species |
|---|---|---|---|---|---|
| | | | Unpolluted ponds | Polluted Ponds | |
| 1 | Common Kingfisher | *Alcedo atthis* | 65 | - | 65 |
| 2 | White Breasted Waterhen | *Amaurornis phoenicurus* | 185 | - | 185 |
| 3 | Gadwall | *Anas strepera* | 11 | - | 11 |
| 4 | Asian Openbill Strok | *Anastomus oscitans* | 292 | 2 | 294 |
| 5 | Great Egret | *Ardea alba* | 76 | - | 76 |
| 6 | Purple Heron | *Ardea purpurea* | 117 | - | 117 |
| 7 | Indian Pond Heron | *Ardeola grayii* | 550 | 42 | 592 |
| 8 | Ferruginous pochard | *Aythya nyroca* | 16 | - | 16 |
| 9 | Cattle Egret | *Bubulcus ibis* | 731 | 75 | 806 |
| 10 | Pied Kingfisher | *Ceryle rudis* | 20 | - | 20 |
| 11 | Lesser Whistling Duck | *Dendrocygna javanica* | 133 | 10 | 143 |
| 12 | Little Egret | *Egretta garzetta* | 62 | 4 | 66 |
| 13 | Common Coot | *Fulica atra* | 64 | - | 64 |
| 14 | Indian Moorhen | *Gallinula chloropus* | 74 | - | 74 |
| 15 | White- Throated Kingfisher | *Halcyon smyrnensis* | 74 | 2 | 76 |
| 16 | Black Winged Stilt | *Himantopus himantopus* | 32 | - | 32 |
| 17 | Pheasant-tailed Jacana | *Hydrophasianus chirurgus* | 34 | 10 | 44 |
| 18 | Chestnut Bittern | *Ixobrychus cinnamomeus* | 355 | 19 | 374 |
| 19 | Median Egret | *Mesophoyx intermedia* | 38 | 2 | 40 |
| 20 | Bronze winged Jacana | *Metopidius indicus* | 303 | 4 | 307 |
| 21 | Cotton Pigmy Goose | *Nettapus coromandelianus* | 42 | - | 42 |
| 22 | Black Crowned Night Heron | *Nycticorax nycticorax* | 283 | 5 | 288 |
| 23 | Great Cormorant | *Phalacrocorax carbo* | 2 | - | 2 |
| 24 | Little Cormorant | *Phalacrocorax niger* | 102 | - | 102 |
| 25 | Purple Swamp Hen | *Porphyrio porphyrio* | 310 | - | 310 |
| 26 | Painted Snipe | *Rostratula benghalensis* | 26 | - | 26 |
| 27 | Little Grebe | *Tachybaptus ruficollis* | 61 | - | 61 |
| 28 | Green Sandpiper | *Tringa ochropus* | 80 | - | 80 |
| 29 | Red Wattled Lapwing | *Vanellus indicus* | 219 | 40 | 259 |
| **Total of all wetland birds** | | | **4357** | **215** | **4572** |

**Table 3: Diversity Indices polluted and unpolluted ponds Ratanpur, Chhattisharh during 2013-2014.**

| Study sites | Unpolluted ponds | | | Overall | Polluted ponds | | | Overall |
|---|---|---|---|---|---|---|---|---|
| | Summer | Rainy | Winter | | Summer | Rainy | Winter | |
| Total no. of individuals (*N*) | 1145 | 1119 | 2093 | 4357 | 72 | 55 | 88 | 215 |
| Shannon *H'* | 1.14 | 1.09 | 1.32 | 3.56 | 0.62 | 0.56 | 0.68 | 1.87 |
| Shannon (*H max*) | 1.32 | 1.23 | 1.41 | 3.96 | 0.84 | 0.69 | 0.90 | 2.44 |
| Shannon ( *J'*) | 0.86 | 0.89 | 0.93 | 2.69 | 0.73 | 0.80 | 0.76 | 2.3 |

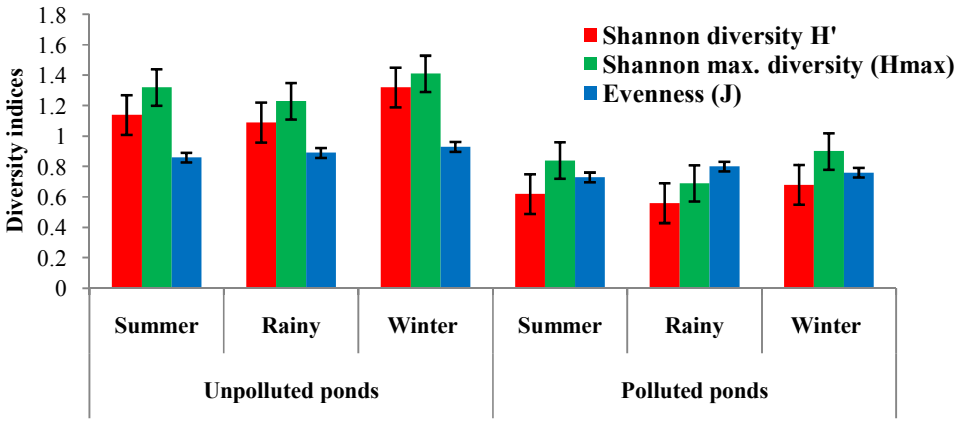


**Figure 2: Diversity index (H), maximum diversity index ($H_{max}$) and evenness index (J) of wetland birds in different season between unpolluted and polluted ponds of Ratanpur, Chhattisgarh.**

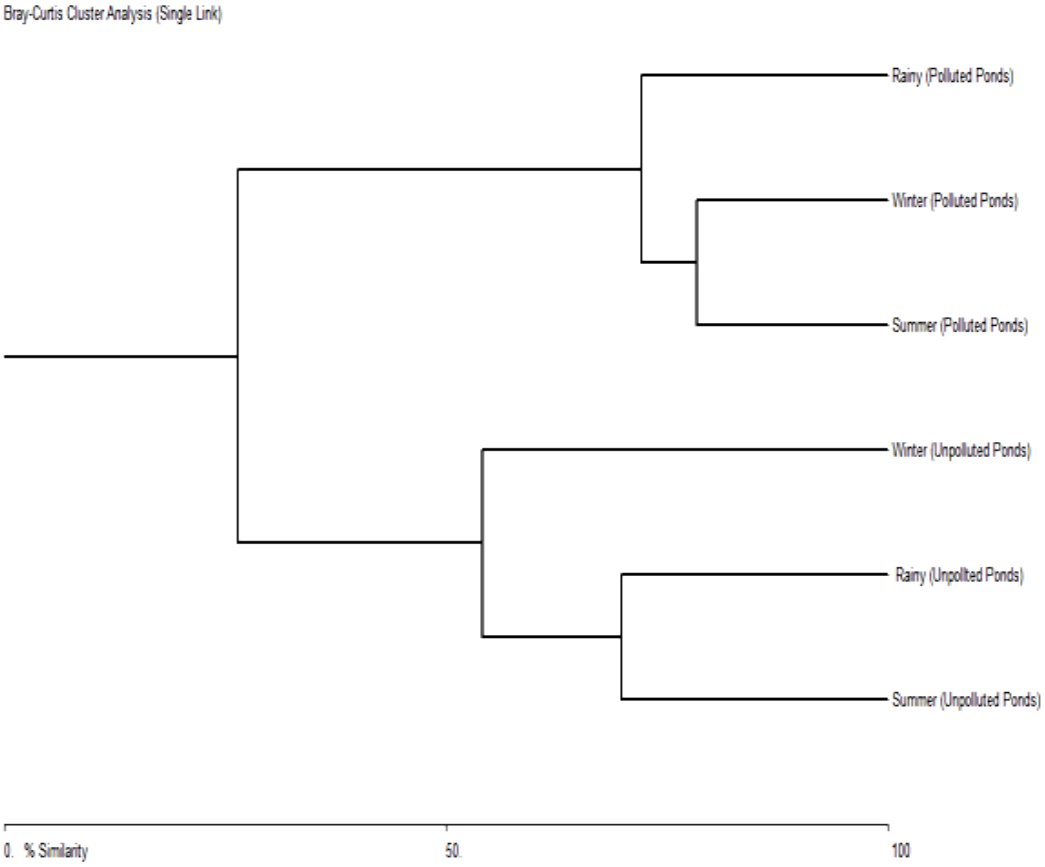


**Figure 3: Cluster analysis dendrogram illustrating season wise distribution patterns of wetland birds between polluted and unpolluted ponds at Ratanpur, Chhattisgarh.**

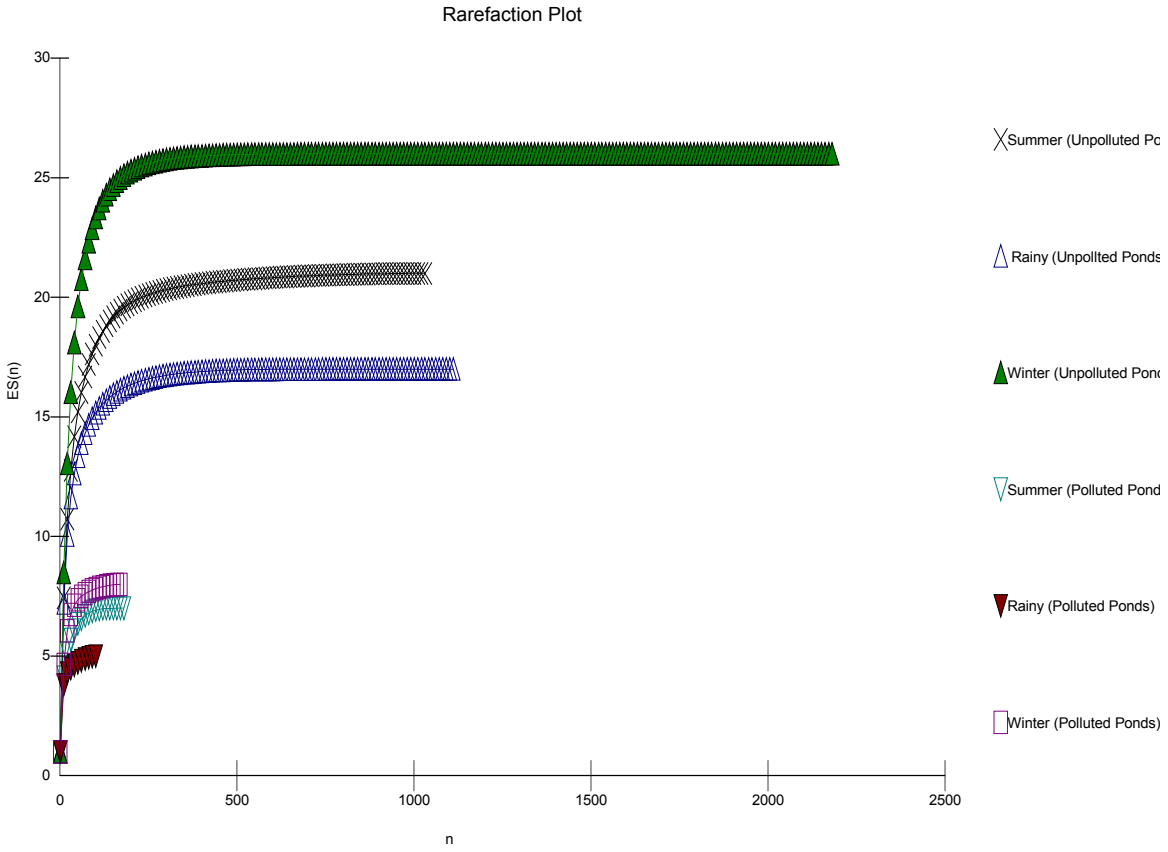


**Figure 4: Rarefaction curves for the season wise distribution patterns of wetland birds between polluted and unpolluted ponds at Ratanpur, Chhattisgarh.**

Unpolluted wetland maintained higher wetland bird density and diversity than polluted ones. The developmental processes and anthropogenic activities affect the habitat structure of an area which in turn affects natural property for instance water, wetlands and biodiversity (IPCC, 2001; Gibbard *et al*., 2005). Land use and land cover alterations are associated to atmospheric change, biodiversity defeat and pollution (Waltert *et al*., 2004; Ellis and Pontius, 2011). Thus, dreadful conditions of the surroundings, which unenthusiastically impact ecosystem processes and function, particularly alteration of wetlands to irrigated fields, symbolized the noteworthy challenges to biodiversity (Sharma *et al*., 2007). Additionally, the water balance of the wetlands is conquered by rainwater and surface inflow, which are receptive to climate transformation. The change in the wetland ecological balance has harmful consequences on the survival of wetland depended avifauna. Therefore, the wetland bird species diversity, abundance and distribution might have distorted in wetlands and the surrounding vicinity (Olaka e*t al.*, 2010).

Moreover, now a day's several crop and vegetable farmers released chemicals (fertilizers, pesticides, weedicides, insecticides etc.). Hence this might have reduced food of wetland birds (viz., fishe, crabs, frogs etc.) which adversely affects wetland birds and other life forms of aquatic ecosystem (Birdlife International, 2012). The avifauna has been used to point out the change in ecological situation (Oster, 1978; Reed *et al*., 2011). This paper aimed to collect information from local community around the wetland areas of Ratanpur and observe the impacts of ecological changes on diversity, distribution of wetland birds of the area. Variation in habitat stipulation may also cause alteration in diversity, distribution, composition and of bird species (Caziani

and Derlindat, 2000; Laurent, 1973). At present study we carried out an avian survey to record the distribution patterns of wetland birds on the wetlands of Ratanpur which was completed on selected perennial ponds which were further categorized as unpolluted or sacred pond and polluted ponds. We found that during the winter season the unpolluted ponds showed the maximum diversity and distribution by the adding of several migratory avian species viz., Asian Openbill Strok (*Anastomus oscitans*), Black Winged Stilt (*Himantopus himantopus*), Common Coot (*Fulica atra*), Cotton Pigmy Goose (*Nettapus coromandelianus*), Ferruginous pochard (*Aythya nyroca*), Gadwall (*Anas strepera*), Indian Moorhen (*Gallinula chloropus*), Lesser Whistling Duck (*Dendrocygna javanica*), Little Grebe (*Tachybaptus ruficollis*) and Pheasant-tailed Jacana (*Hydrophasianus chirurgus*) respectively along with the residential species. Therefore, we concluded that the unpolluted or sacred ponds (viz. Bairagban, Bikma, Dulahara, Gireejaban, Jagannath and Maharaiya pond) were situated away from city area so, it less affected by human interference and pollutions hence the interference or disturbance do not have direct impact on the ecology that existing this particular site. So, the majority of migratory bird species visits this area in all season and these unpolluted ponds represented by the good number of avian diversity. Whereas, in case of polluted ponds (viz. Bhedimuda, Kaira, Krishnarjuni and Ratneshwar pond) we found disturbance due to various activities such as alteration of agricultural practices and anthropogenic practices by human settlement, hunting, garbage dumping, immersion of idol during festival time and vehicle washing activities etc. were very high in this area and has adverse affect and threat on the avian population. Thus, we recorded very less number of wetland birds and their diversity. We observed that the polluted ponds were generally occupied by residential wetland avian species which were become little good during the rainy season in respect to addition of some other wetland species just for searching the food during rainy season these polluted ponds becomes refresh for some extent that's allow the other birds to occasionally visit. Therefore, we accomplished that the rainy season was distinct in respect to the polluted ponds as compare to the summer and winter. Our result shows that the polluted ponds were less occupied by the wetland bird as compared to the unpolluted ponds. Thus we concluded that the ecological condition has direct impact on the occurrence, diversity and distribution of wetland birds. Land conversion and ecological changes can have considerable impacts on biodiversity and linked ecosystem services (Finlayson *et al*., 2006; Jetz *et al*., 2007; Ayenew, 2009; Gudina, 2011). The impacts of habitat destruction and overgrazing on cover, nesting grounds and food accessibility to birds causes dangerous situation for the survival of avian fauna (Hegsdijsk and Jansen, 2006; Jansen *et al*., 2007; Melesse *et al*., 2009; Mengesha *et al*., 2011). The land use changes and pollutions has direct impact on avifauna, their habitats and their breeding (Sisay, 2003; Ellott, 2006; Brambilla *et al*., 2011; Kolecˇek *et al*., 2010).

## CONCLUSION

Pollution of the environment is one of the terrible ecological disaster to which they are subjected nowadays. Nearly all of the activities of human society have produced unfavorable effects on all living forms in the biosphere. The cause of water pollutants are domestic sewage, detergents, pesticides, chemicals, dead matreials and industrial effluents through a variety of processes (Sampath and Sharam, 2003). Sustaining healthy ecosystems that can save from harm to the organisms existing within them, including humans, necessitates not only ecological planning and management, but also knowledge of how stressors vary in the atmosphere (Burger and Bowman, 2004). More and more it is essential to appreciate the outcome and effect of pollutants to evaluate the health of ecosystems and to bring early warning of alterations in the environment that might specify undesirable effects (Burger, 2002). Wetland birds populations may provide as sentinel species for natural and anthropogenic pollution problems in the surroundings. At present study we revealed the impact of ecological conditions on wetland bird populations. We discussed the impacts of pollution on the wetland birds in wetland ecosystems, and we concluded the wetland avian species as the indicators of the real situations of habitat as well as ecosystem. Migration can facilitate movable animals such as avian species to run away from harsh ecological circumstances (Rivalan *et al*., 2007). However, habitat change alters moment of

migration, breeding success, population range and distribution of avian fauna (Crick, 2004). Therefore we concluded that the wetlands of Ratanpur sustain a good number of migrants as well as residents avian fauna which revealed the availability of favorable ecological condition within the site. Therefore, we noticed that the anthropogenic and developmental measures in and around ponds are affecting remarkable threats to the wetland birds. Banned hunting, catching, fishing, deforestation and water pollution were the leading threats for wetland avian fuana (Khan and Ali, 2014). Hence, it is necessary to restore the ecological properties in order to sustain the wetland bird with in the area.

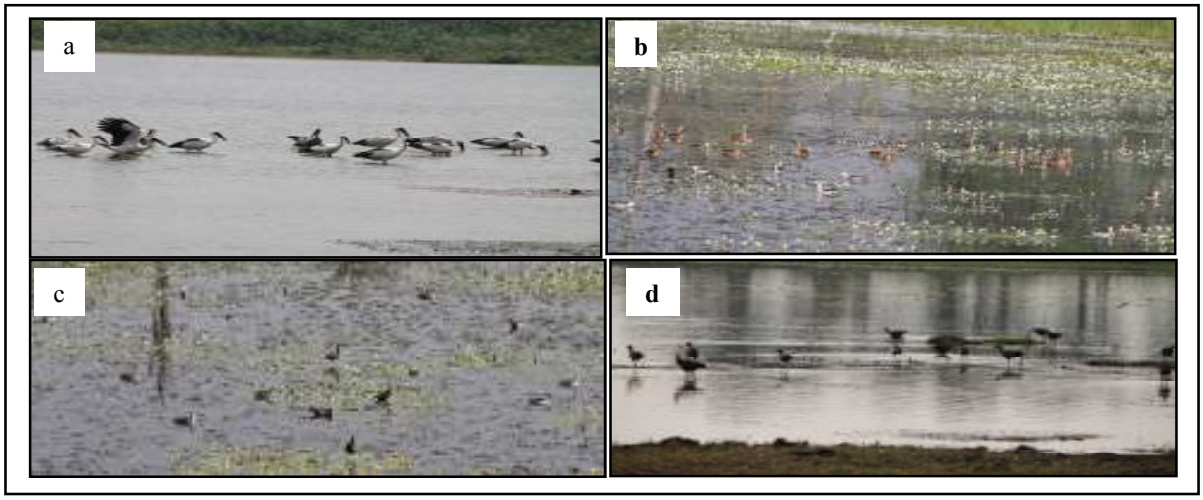


**Figure 5: Wetland birds recorded from unpolloted or sacred ponds of Ratanpur. a. Guild of Asian Openbill Stork, *Anastomus oscitans* (Boddarert, 1783); b. Lesser Whistling Duck, *Dendrocygna javanica* (Horsfield, 1821) and Cotton Pigmy Goose, *Nettapus coromandelianus* (Gmelin, 1789);c. Pheasant-tailed Jacana, *Hydrophasianus chirurgus* (Scopoli, 1786) and Bronze winged Jacana, *Metopidius indicus* (Latham, 1790); d. Purple Swamp Hen *Porphyrio porphyrio* (Zarudny & Harms, 1911).**

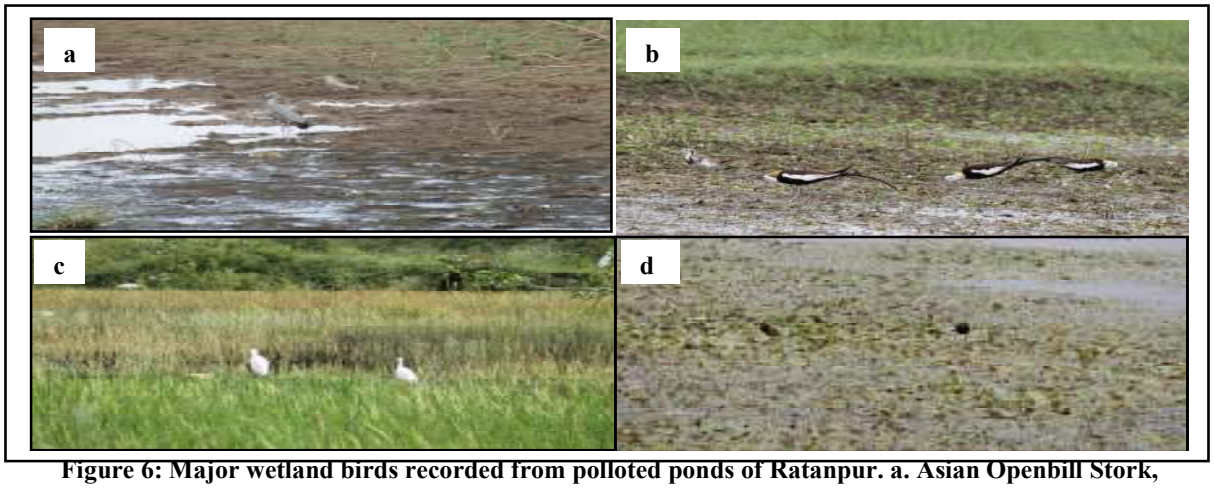


**Figure 6: Major wetland birds recorded from polloted ponds of Ratanpur. a. Asian Openbill Stork, *Anastomus oscitans* (Boddarert, 1783) and Indian Pond Heron, *Ardeola grayii* (Sykes, 1832); b. Pheasant-tailed Jacana, *Hydrophasianus chirurgus* (Scopoli, 1786); c. Cattle Egret, *Bubulcus ibis* (Boddaert, 1783); d. winged Jacana, *Metopidius indicus* (Latham, 1790).**

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## REFERENCES

Ali S. and Ripley S.D., 1981. The book of Indian birds. Bombay Natural History Society, Oxford University Press, Bombay.

Ali S., 2002. The Book of Indian birds. 13th revised edition. Bombay Natural History Society, Oxford University Press, Bombay.

Ali S., 2004. The book of Indian birds, 6th Ed, Bombay Natural History Society, India. Oxford University Press, Bombay.

Ali S. and Ripley S.A., 1983. The handbook of the birds of India and Pakistan Compact Edition, Oxford University Press, New Delhi.

Ali S. and Ripley S.D., 1995. A pictorial guide to the birds of the Indian subcontinent (2nd Edition, Reprint with corrections, 1996). Bombay Natural History Society and Oxford University Press, Mumbai.

Ayenew T., 2009. Natural lakes of Ethiopia. Addis Ababa University Press: Addis Ababa.

Bibby C.J., Burgess N.D. and Hill D.A., 1992. Bird census techniques. First Edition Academic Press, London, United Kingdom.

BirdLife International, 2012. Important bird areas factsheet: Lake Zeway. Downloaded from http://www.birdlife.org.

Brambilla M., Casale F., Bergero V., Bogliani G., Crovetto G.M., Falco R., Roati M. and Negri I., 2011. Glorious past, uncertain present, bad future? Assessing effects of land-use changes on habitat suitability for a threatened farmland bird species. Biol. Conserv., **143**: 2770–2778.

BNHS, 2006. Hornbill, Journal of Bombay Natural History Society, India. Oxford University Press, Bombay.

Buckland S.T., Anderson D.R., Burnhan K.P., Lake J.L., Borchers D.L., and Thomas, L., 2004. Advance distance sampling; estimating abundance of biological populations. pp.141–172. London, Campman and Hall.

Burger J., 1985. Habitat selection in temperate marsh nesting birds, habitat selection in birds, Cody M.L: (Ed). Academic press, New York, ISBN: 012178013, 253 -281.

Burger J., Bowman R., Woolfenden G.E. and Gochfeld M., 2004. Metal and metalloid concentrations in the eggs of threatened Florida scrub-jays in suburban habitat from south-central Florida. Science of the Total Environment, **328**:185-193.

Burger J., 2002. Food chain differences affect heavy metals in bird eggs in Barnegat Bay, New Jersey. Environmental Research Section A, **90**: 33-39.

Caziani S. and Derlindat E.J., 2000. Abundance and habitat of high Andes Flaningos in North Western Argentina. Water Birds, **23**:121-133.

Codesido M. and Bilenca D.N., 2000. Comparacioń de los métodos de transecta de fajay de conteo de puntos de radio fijo euna comunidad de aves del bosque semiárido santiagueño. El Hornero, **15**:85–91.

Crick H.Q.P., 2004. The impacts of climate change on birds. Ibis, **146**:48-56.

Dugan P.J., 1990. Wetland conservation. A review of current issues and required action. IUCN Gland, Switzerland.

Ellis E. and Pontius R., 2011. Land-use and land-cover change. In: Encyclopedia of Earth, Cleveland C.J. (ed.). Environmental Informa-tion Coalition. Washington, D. C. pp.1-20.

Ellott C.C.H., 2006. Bird population explosions in agro-ecosystems the quelea, Quelea quelea. Case history. Acta Zool Sinica, **52**: 554–560.

Finlayson C.M., Gitay H., Bellio M.G., Van Dam R. and Taylor I., 2006. Climate variability and change and other pressures on wetlands and waterbirds: impacts and adaptation. In: Waterbirds around the world, (Boere GC., Galbraith C.A, Stroud DA (eds.) The Stationery Office, Edinburgh, UK. pp. 88-97.

Fornemann A., Mangnall M., Little R., and Crowe T., 2001. Waterbird assemblages and associated habitat characteristics of farm ponds in the Western Cape, South Africa. Biodiversity and Conservation, **10**:251-270.

Furness R.W., 1993. Birds as monitors of pollutants. In: R.W. Furness and J.J.D.Greenwood (Eds.). Birds as monitors of environmental Change. Chapman and Hall, London, pp. 86-143.

Gibbard S.G., Caldeira K., Bala G., Phillips T.J. and Wickett M., 2005. Climate effects of global land cover change S. Geophysical Research Letters. University of California, California.

Gracia C.M., Carcia R.R., Rendon M., Xaview N.F. and Lucena J., 1997. Hydrological cycle and inter annual variability of the aquatic community temporary saline lake (Fuente De Piedra, Southern Spain), Hydrobiologia, **345**: 131-141.

Grimmett R., Inskipp C. and Inskipp T., 2001. Pocket guide of the birds of the Indian sub-continent. Oxford University Press. Mumbai.

Grimmett R., Inskipp C. and Inskipp T., 2006. Pocket guide to the birds of the Indian sub-continent. Oxford University Press, New Delhi, 384 pp.

Gudina A., 2011. Integrated assessment of livelihood dependence on services provided by ecosystems along the western shoreline of Lake Zeway. MSc. thesis, Wageningen UR. p.94.

Hengsdijk H. and Jansen H., 2006. Agricultural development in the central Ethiopian rift valley. A desk-study on water-related issue and knowledge to support policy dialogue. Plant Research International B.V., Wageningen UR. pp. 5-65.

Hossain M.L., Jaman M.F. and Sarker S.U., 2004. Diversity of herpeto-mammalian fauna and their conservation issues in Hatiya Island, Bangladesh. Tropical biodiversity, **8**(2):71-78.

IPCC-Intergovernmental Panel of Climate Change, 2001. Climate Change 2001. In: The scientific basis; Third assessment report of working group I.pp.1-210,. Albritton L G, Meira Filho D.L (eds.), Cambridge University Press, Cambridge.

Jansen H., Hendsidijk H., Legesse D., Ayenew T., Hellegrs P. and Spliesthoh H., 2007. Land and water resources assessments in Ethiopian central rift valley: ecosystem for water, food and economic development in the Ethiopian central rift valley. Alterra: Wageningen. pp. 1-85.

Jetz W., Wilson D.S. and Dobson A.P., 2007. Projected impacts of climate and land use changes on global diversity of birds. PloS Biol., **5**:1211-1219.

Khan B.N. and Ali Z., 2014. Assessment of birds fauna, occurrences, status, diversity indices and ecological threats at Mangla Dam, AJK from 2011 to 2014. The Journal of Animal & Plant Sciences, **25**(3):397-403.

Kathiresan, 2000. Ministry of Environment and Forests (Govt. of India, New Delhi) 393.

Kristen S. and Brander I., 1991. The economic values of the world's wetlands. Living Waters. Amsterdam. Garay G., Johnson W., and Franklin W., Relative abundance of aquatic birds and their use of wetlands in the Patagonia of Southern Chile. Revista Chilena De Historia Natural, 64, 127-137.

Kolecˇek J., Reif J., Astny K.S. and Bejcˇek V.R., 2010. Changes in bird distribution in central European countries between1985–1989 and 2001–2003. J. Ornith., **151**: 923–932.

Kumar A., Kankane P.L. and Baqri Q.H., 2006. Geo-spatial atlas for the wetland birds of Thar Desert, Rajasthan, Zoological Survey of India, pp 202.

Laurent H., 1973. The pollution of water by detergents. Organization for Economic and Co-operation and Development.

Melesse A.M., Oberg J., Beeri Nangia V. and Baumgartner D., 2006. Spatiotemporal dynamic of evapotranspiration and vegetation at the glacial ridge prairie restoration hydrological processes, **20**(17): 1451-1464.

Melesse A.M., Nangia V., Wang X. and Mcclain M., 2007. Wetland restoration response analysis using MODIS and ground water data, Sensors, **7**:916-1933.

Melesse A., Abtew W, Dessalegne T., 2009. Evaporation estimation of rift valley lakes: comparison of models. Sensors, **9**: 9603-9615.

Mengesha G., Mamo Y. and Bekele A., 2011. Terrestrial bird community structures in the disturbed and undisturbed areas of Abijata Shalla lake national park, Ethiopia. Int. J. Biodivers. Conserv., **3**:389-404.

Olaka L.A., Odada E.O, Truauth M.H. and Olaga O.O., 2010. The sensitivity of east African rift lakes to climate change fluctuation. J. Paleolimnol., **44**:629-644.

Oster M., 1978. Birds and culture. Doubleday & Company, Inc.: New York.

Reed J.M., Elphick C.S., Leno E.N. and Zuur A.F., 2011. Long-term population trends of endangered Hawaiian waterbirds. Popul. Ecol., **53**:473-481.

Riffell S.K., Keas B.E. and Burton T.M., 2001. Area and habitat relationships of birds in Great Lakes Coastal Wet Meadows, Wetlands, **21**:492-507.

Rivalan P., Frederiksen M., Lois G. and Julliard R., 2007. Contrasting responses of migration strategies in two European thrushes climate change. Glob. Chang. Biol., **13**: 275-287.

Sampath K.E. and Sharam K.K., 2003. Quality of formation water I Tannery Belt in Dindigul, Tamilnadu, Scientist –D, Central Ground Water Board, Chennai, India.

Sayadi M.H., Sayyed M.R.G. and Kumar S., 2010. Short-term accumulative signatures of heavy metals in river bed sediments inthe industrial area, Tehran, Iran. Environ Monit Assess, **162**:465-473.

Sharma E., Bhuchar S., Ma X. and Kothyari B.P., 2007. Land use change and its impact on hydro-ecological linkages in Himalayan watersheds. Trop. Ecol., **48**: 151-161.

Sisay L., 2003. Biodiversity potentials and threats to the southern Rift Valley lakes of Ethiopia. In: Wetland of Ethiopia. Proceedings of a seminar on the resources and status of Ethiopia's wetlands. (Yilma D, Geheb K eds.), IUCN; Gland. pp.18-24.

Waltert M., Mardiastuti A. and Muhlenberg M., 2004. Effect of land use on bird species richness in Sulawesi, Indonesia. Conserv. Biol., **18**:1339-1346.