



Causes of Temporal Variation in the Arrival of Asian Open Bill Stork Population: A Case Study of Kulik Wildlife Sanctuary, West Bengal, India

Piyal Basu Roy¹ and Radha Sah²

¹Department of Geography, Alipurduar College, West Bengal, INDIA

²Zoological Society of Assam, Cotton College, Guwahati-781001, Assam, INDIA

Available online at: www.isca.in

Received 24th February 2013, revised 4th March 2013, accepted 16th March 2013

Abstract

The paper is an attempt to identify the causes and pattern of temporal variation of Asian Open Bill Stork (*A. oscitans*). To understand the status of environmental health of a habitat, the trend of arrival, food and habitat of bird population play innovative role and proper analysis of that has indicated that flood in the river Kulik very adjacent to Kulik Wildlife sanctuary is the foremost cause of temporal variation in the arrival of Asian Open Bill bird population. Apart from the flood, the changing climate, deforestation and anthropogenic factors are also responsible for decline in their arrival. Therefore, such analysis or approach of study does not only reveal the temporal qualitative change experienced by that habitat but also signify the impact of that on influx of bird population along with other species.

Keywords: Kulik wildlife sanctuary, Asian open bill stork, temporal change.

Introduction

The Asian Open Bill Stork (*Anastomus oscitans*) is a resident colonial breeder. It is a large wading bird of order Ciconiiformes and family Ciconiidae. These birds usually migrate to the lower part of Himalayan ranges and spent about six months for the purpose of breeding that is from July to December. Kulik wildlife Sanctuary is the largest abode of Asian Open Bill population in the world and claim to be the second largest bird sanctuary in Asia. Ornithologically, this bird sanctuary is the largest "Herony" of open Bill storks as per Bird Life International and Wetland International. The herony is the place where various species of water birds breed or roost symbiotically. It is defined as the habit of nesting colonially¹.

It is mainly greyish white with glossy black wings, tail and the adults have the beak with a narrow gap formed by the arched upper mandible and recurved lower mandible. The mandibles do not meet except at the tip, and for this reason this species of stork is known as Open Bill Stork. Young birds are born without a gap in the bill and this structure is thought to be an adaptation that aids in handling their main prey of snails (the main diet is *Pila globosa*). For this reason, it is commonly known as Samukh (snail) khol¹. The cutting edges of the mandible have a fine brush like structure that is thought to give them better grip on the shells of snails. The mantle is black and the bill is horn-grey. The short legs are pinkish to grey, reddish prior to breeding. Non-breeding birds have a smoky grey back instead of white. Young birds are brownish-grey and have a brownish mantle^{2,3}. Although mostly resident within their range, they make long distance movements in response to weather and food availability. They are usually found in flocks but single birds are not uncommon⁴.

The climate change of an area influences the bird population and also the biodiversity of that area. The changes of bird population in any specific locality can be utilized to measure the dynamicity of the ecosystem. Suitable parameters must be devised to understand the eco-health of any habitat. The number of birds has strong link with biodiversity of an area that acts as potential indicator of environmental quality⁵. Good indicators are specialized in their habitat needs, thus reacting rapidly to changes. Asian Open Bill Storks (*A. oscitans*), have been considered to be the most useful indicator of environment health because they are ecologically versatile and live in different type of habitats^{6,7}. The usual foraging habitats are inland wetlands and are only rarely seen along river banks and tidal flats. Birds may move widely in response to habitat conditions. Young birds also disperse widely after fledging. The species is very rare in the Sind and Punjab regions of Pakistan, but widespread and common in India, Sri Lanka, Burma and Thailand⁸. In India it is mainly found in Bharatpur Bird Sanctuary, Rajasthan and Kulik Bird Sanctuary, West Bengal in their breeding time.

Quantitative and qualitative changes in their environment, usually effects the bird population. Usually, they are not the indicator of the primary cause of this change⁹. Birds most often respond to secondary changes brought about by the primary causes. Generally, birds are quite consistent in their habitat preferences¹⁰. Often the changes in the abiotic regime of an ecosystem, or cause variables, may be overlooked, be too subtle, or be of no interest to be monitored directly¹¹. Bird watching and monitoring of its population is necessary for several purposes of describing environmental conditions. Birds count is required to examine habitat issues or environmental threats¹².

Study Area: This study was conducted in the Kulik Wildlife Sanctuary, which is about 2 km away from the Raiganj town in

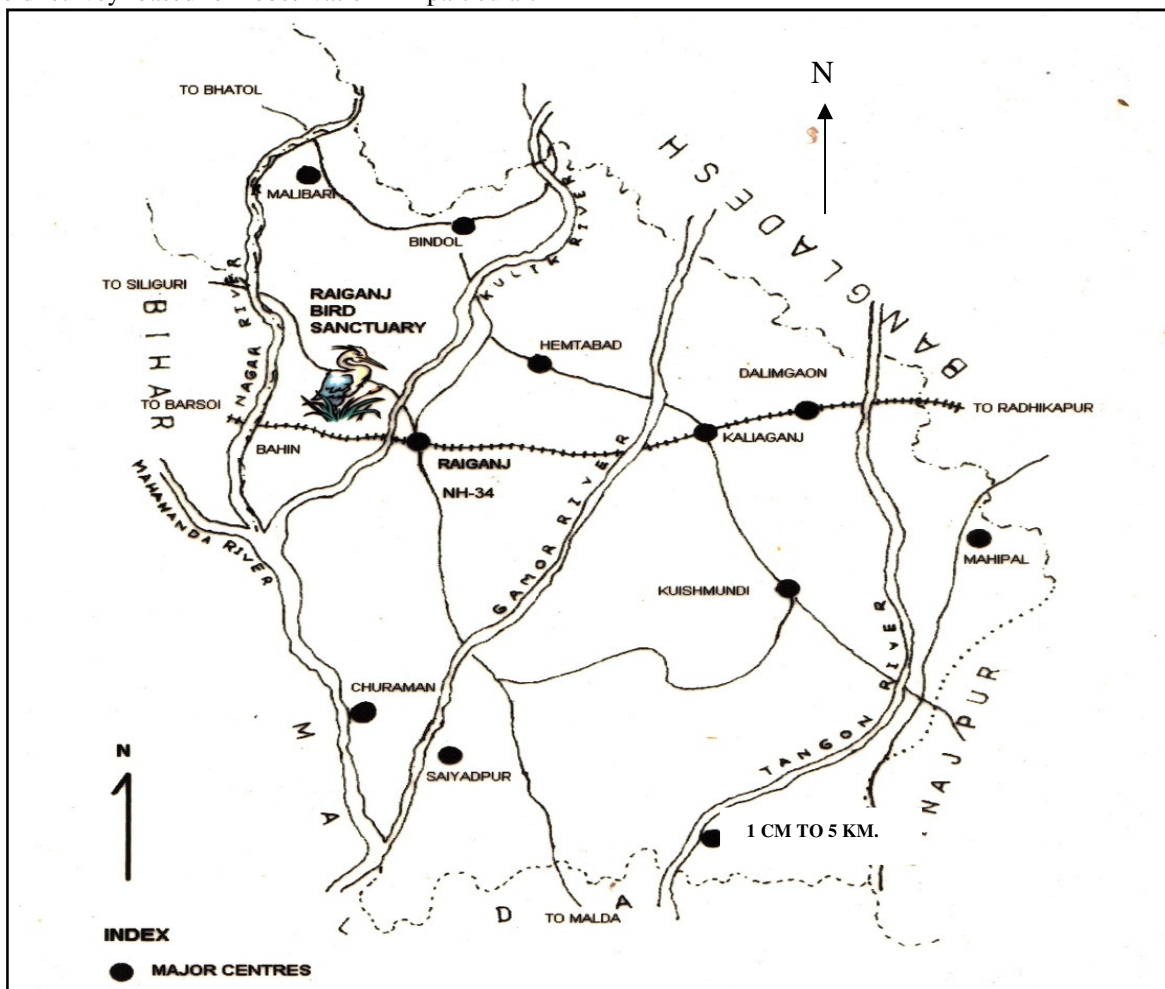
North Dinajpur District in West Bengal, India. It is situated beside the National Highway 34. The bird sanctuary is located in both the sides of N.H. 34 or Kolkata-Siliguri Highway. This Sanctuary is located along the western bank of the river Kulik between 25°35' to 25°57' N latitude and 88°07' to 88°17' E longitude. The area of this sanctuary is around 1.30 km². The core area is about 0.14 km² and the rest is buffer area. The sanctuary has a thick canopy of the deciduous trees, which provides the nesting place for Asian Open Bill Stork and other migratory birds like Black Crowned Night Heron, Great Egret, and Little Cormorant etc. The river Kulik, a tributary of Mahananda River, via the river Nagar, flows round a part of the sanctuary and acts as the boundary in its eastern and western parts. The sanctuary has a network of artificial canals connected with the river Kulik¹³. Annual precipitation range varies from 1200 mm to 1550 mm, mean winter temperature from 09°C to 23°C and summer temperature from 21°C to 25°C, and humidity more or less 75 were recorded¹⁴.

Methodology

The entire frame of the study has been categorically built on rigorous field survey based on observation in particular. In

addition, data has been collected from the secondary sources like official documents of respective departments. However, along with it, some secondary sources of data like books and journals, etc have also been consulted to prepare the paper. The data has been collected from 1985 to 2009. The long term data is important because in maximum time, it is noticed that short term data collection is misleading or inadequate. Obtained information has been mathematically calculated to derive the results.

Habitat preferences of Asian Open Bill Storks (*A. oscitans*): As stated earlier, Asian Open Bill Storks (*A. oscitans*), usually forages in inland wetlands and are only rarely seen along river banks and tidal flats. Due to presence of river Kulik in Kulik Wildlife Sanctuary, it becomes an abode for the Asian Open Bill population. The population of Asian Open Bill along with other migratory birds like little Cormorant, Egret, Night Heron are increasing day by day in this Sanctuary. This is due to availability of nesting tree and Asian open bill is found in both the core region and the buffer region because they can tolerate human interference. This is one of the adaptive features of this bird.



Location Map of Raiganj (Kulik Bird Sanctuary)

If orders and associated families of Asian Open Bill Stork are analyzed, it comes into notice that the Asian Open Bill Stork (*A. oscitans*), that occupies highest number in the bird population in the study area comes under order ciconiiformes and ciconiidae family and reflects the healthy wetlands¹⁵.

Discussion

Migratory Birds are the key mobile links that contribute to the function of diverse eco-system. This makes migratory birds prime witnesses to global climate change¹⁶. The rhythmic patterns of arrival of birds in Kulik Wildlife Sanctuary are phenomenal as well as very much seasonal. The following table shows trend of arrival of Asian Open Bill Stork in the study area.

It is found that there is positive growth that is 65% in the Asian Open Bill Stork population of the study area in the year 1989, if compared with the total number of these birds in 1985. But in the year 1993, there is negative growth in Open Bill population

that is 45.89% if compared with the total number of their arrival in 1989. But, there is positive growth that is 42.82% in bird population of the study area in the year 1997, if compared with the total number of their arrival in 1993. There is again a positive growth that is 81.66% in bird population of the study area in the year 2001, if compared with the total number of these species in 1997. In the year 2005, there is negative growth in bird population that is 8.37% if compared with the total number of them in 2001 (table 3). In the year 2009, there is a positive growth of 41.26% in comparison with the year 2005. It is amazing to note that there is also negative variation in the arrival of the birds, particularly in the years 1993 and 2005. The negative trend in bird population is the result of flood by the river Kulik. In the year of flood hazard, the arrival of bird's evidenced massive negative trends, except these years, the area experienced very positive trends in the arrival of those birds. Climate change as witnessed worldwide has compelled several water birds to migrate from adversely affected wetlands to other habitable wetlands for breeding¹⁷.

Table-1
Asian Open Bill Stork: Range, Habitat and Food habit

Name of Bird	Range	Major Plant species used for building nest	Food Habit
Asian Open Bill Stork <i>A. oscitans</i> Systematic position: Class- Aves Order- Ciconiiformes Family- Ciconiidae Genus- <i>Anastomus</i> Species- <i>A. oscitans</i>	Oriental realm	<i>Ficus bengalensis</i> (Bat) <i>Anthocephalus indicus</i> (Kadamba) <i>Alstonia scholaris</i> (Chhatim) <i>Barringtonia acurangula</i> (Hijal) <i>Ficus glomerata</i> (Dumur) <i>Terminalia arjuna</i> (Arjun) <i>Dalbergia sisoo</i> (Sisoo) <i>Lagerstoemia speciosa</i> (Jarul) <i>Streblus asper</i> (Seora) <i>Trewia nudiflora</i> (Pituli)	Molluscs <i>Pila globosa</i> <i>Lamellidens marginalis</i> Fishes <i>Puntius puntii</i> <i>Labeo rohita</i> <i>Clarius batracus</i> <i>Channa sp</i> Amphibians <i>Bufo melanosticus</i> <i>Rana tigrina</i> Other invertebrates

Table-2
Temporal variation of Asian Open Bill Stork

Year	Total no. of Asian Open Bill
1985	24240
1989	39996
1993	21640
1997	30908
2001	56148
2005	51448
2009	72680
Total	297060

Source: Kulik Bird Sanctuary, Official Record

Table-3
Percent Difference in Number of Asian Open Bill population between Years

1985	1989	1993	1997	2001	2005	2009	% difference of number of birds between the years					
							N1-N2/N1*	N2-N3/N2*	N3-N4/N3*	N4-N5/N4*	N5-N6/N5*	N6-N7/N6*
No. of birds observed							100	100	100	100	100	100
N1	N2	N3	N4	N5	N6	N7	65%	45.89%	42.82%	81.66%	8.37%	41.26%
24240	39996	21640	30908	56148	51448	72680						

Source: Computed by authors

From the table 2, we can calculate the rate of change in arrival of Asian Open Bill Stork in the study area can be calculated:

$$R = \frac{(P_1 - P_0)/t}{(P_1 + P_0)/2} * 100$$

Here 'R' = Rate of change is a function of mathematical relationship among the population size at one point of time (P₀) to the base population at the later point of time (P₁) and the number of years over the period (t).

Table-4

Rate of Change in Asian Open Bill Stork population from 1985-2009

Rate of change (R)	Asian Open Bill Stork
From 1985 to 1989	12.26
From 1989 to 1993	14.89
From 1993 to 1997	8.82
From 1997 to 2001	14.51
From 2001 to 2005	2.18
From 2005 to 2009	8.55

Source: Computed by authors

Temporal rate of change of Asian Open Bill Stork coming in the area under study has been calculated to understand the trend in arrival of those birds and to identify the conditions of environmental quality required for their nesting, breeding and survival. Here, the common assumption is that if the rate of change in the arrival of those species in the study area is lower, there seems to be a deficiency in environmental requirements or micro ecological imbalance and vice versa. From the table 5, if temporal trend in arrival of Open Bill Stork is analyzed it always indicates a fluctuating but positive rate of change although having lowest positive (2.18) rate of change from the year 2001 to 2005, which indicates some negative aspects related to this lower positive growth rate and practically while going into deep study, it comes into notice that those years experienced consecutive occurrence of flood which hindered the arrival of Asian Open Bill Stork because a large number of nest building trees were damaged and their foods particularly snails were washed out. Therefore, breeding of birds is affected by flooding significantly¹⁸.

Table-5

Impact of Flood on Asian Open Bill Population

Year	Asian Open Bill Stork
1992*	47052
1993**	21640
Percentage of decrease/Increase	- 4.50
1996*	36392
1997**	30908
Percentage of decrease/Increase	-7.42

* Non- Flood year, Source: Computed by authors, **Flood year

Let take a view on the impact of floods on the arrival of Asian Open Bill Stork in the area under study. As per the result derived from the table-5, it is keenly realized that there is both

positive and negative impact of flood on the bird species that coming here to breed. The overall picture reveals the severe affect of flood on the Open Bill Stork in particular with a sharp decline in their arrival in the flood years. Results show that in 1992, the Asian Open Bill Stork contributed the largest share (47052) in the distribution of total bird population in the area, but declined (21640) sharply in 1993 due to severe flood as was experienced by that area, if total arrival of them is taken into consideration. Similarly, in 1996, the bird population of Open Bill Stork was 36392, that also got reduced (30908) for arrival of flood in 1997.

Conclusion

Therefore, the overall result and discussion reveal that there is a keen relationship between arrival of Asian Open Bill Stork and occurrence of flood. Flood being mostly a natural phenomenon restricts the arrival of bird population particularly the breeding of Open Bill Stork. This is because of the fact that the nest building trees along with the available food, particularly snails in that micro habitat are significantly damaged and washed out. During heavy rain, nests are destroyed; many nestlings fell down and become easy prey to ground predators. So, some basic observations associated with such trends of their arrival signify that the habitable environmental quality of Open Bill Stork goes down during flood time very significantly. On the other hand, decline of certain species during non flood years resembles the anthropogenic impact on birds consisting of deforestation, drought, hunting, Poaching, killing and such other activities carried out in that sanctuary avoiding the prohibitions of those activities by the forest department in this part. Therefore, planning should be oriented considering both the physical and man-made hazards and implemented in such a way so that these barriers cannot affect nesting and breeding of those species.

References

1. Sharma A., In The Land of Asian Openbills, *Environ.*, **8(2)**, 9-61(2001)
2. Ali S. and Ripley S.D., Handbook of the Birds of India and Pakistan, Oxford University Press, New Delhi, 95-98 (1978)
3. Baker E.C.S., The Fauna of British India, Birds, Taylor and Francis, London, 333-334 (1929)
4. Blandford W.T., The Fauna of British India, Birds, Taylor and Francis, London, 377-378 (1898)
5. Kumar P., The Economics of Ecosystems and Biodiversity, Ecological and Economic Foundation, UNEP,TEEB, UK, 130-132 (2010)
6. Miller G.T. and Spoolman S.E., Living in the environment, Belmont Cengage learning, USA, 207-209 (2009)
7. Jarvinen O. and Vaisanen R.A., Changes in bird populations as criteria of environmental changes, *Holar. Ecol.*, **2**, 75-80 (1979)

8. Rasmussen P.C. and Anderton J.C., Birds of South Asia, Smithsonian Institution and Lynx Edicions, Washington, 63 (2005)
9. Morrison M.L., Bird populations as indicators of environmental changes, *Curr. Ornithol.*, **3**, 429-451 (1986)
10. Murin T. and Pfeiller, B., Bird watching in Vermont- includes a Special section for Beginners. University Press of New England, Lafayette, 3- 4 (2002)
11. Koskimies P., Waterfowl censusing in environmental monitoring: a comparison between point and round counts, *Ani.Zool.*, **26**, 201-206 (1989)
12. Pretty J., Ball A.S., Benton T., Guivant J., Lee D.R. et al., The handbook of Environment and Society, SAGE, London, 556-570 (2007)
13. Sharma A., The Asian Open-Bill Stork Thrives in the Kulik Bird. The Statesman, Daily, India, August 07, (2007)
14. Pramanik A.K., Santra K.B. and Manna C.K., Nest-building Behaviour of the Asian Open Bill Stork *A. oscitans*, in the Kulik Wild Life Sanctuary, Raiganj, India, *Our Nature*, **7**, 39-47, (2009)
15. Bhattarai B.P., Distribution and Diversity of Storks in the adjoining Areas of Chitwan National Park, Nepal, Himalayan Biodiversity of changing World. Springer, NewYork (2012)
16. Wormworth J. and Sekercioglu C.H. Winged Sentinels- Birds and climate change, Cambridge University Press, NewYork (2011)
17. Cox G.W., Birds Migration and Global Change, Island Press, USA (2010)
18. Rogers K. and Ralph T.J., Flood Plain Wetland Biota in the Murray- Darling Basin. CSIRO Publishing, Australia (2011)