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FERRUGINOUS DUCK (*AYTHYA NYROCA)* POPULATION IN WETLANDS OF JALPAIGURI: THE ROLE OF HUMAN INTERFERENCES AND ENVIRONMENTAL FACTORS

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Abstract

Jalpaiguri district (between 26° 16' and 27° 0' North latitudes and 88° 4' and 89° 53' East longitudes) of West Bengal, India is situated mainly in the Tista river basin and is known for its rich wildlife. There are a number of small and medium sized (< 200 hectares) wetlands, mainly cut off meanders, in this area and those wetlands host wintering population of Ferruginous duck *Aythya nyroca.* This study was conducted for last fifteen years (1999 to 2013) to observe the population dynamics of Ferruginous duck in this area and to find out factors affecting their distribution. To identify those environmental characteristics which were predictive of the number of waterbirds in each wetland, eight independent variables, viz. area, depth, water level fluctuation, bank coverage by emergent vegetation, coverage of water by submerged vegetation, coverage of water surface by floating vegetation, vegetative heterogeneity and distance from the nearest wetland were sampled during this period. Other than those environmental factors, different types of human interferences (fishing, agricultural activitiy, recreational activities and hunting,) were also accounted to find its effect on waterbird population. In spite of global decline in number of Ferruginous duck, during these fifteen years, the number of Ferruginous duck increased steadily in this region. However, all the environmental factors that affect this duck population positively have been deteriorated during this period and in the same time period the human interferences increased considerably. The only negative thing that has been decreased during this period is direct human interferences like hunting. But in between 2001 and 2011, human population in this area has been increased by 13.87%. It appears that increased literacy rate (in 2011 were 73.25 compared to 62.85 in 2001) and awareness programme has played a vital role in reducing such direct human interferences. The result of this study implies the need for basic education for the conservation of wildlife and upon this foundation awareness programmes may act more effectively for conservation or restoration of wetlands.

Keywords: Ferruginous duck, population dynamics, human interference, Jalpaiguri

1 INTRODUCTION

Ferruginous duck, *Aythya nyroca*, is a shy and secretive diving duck and widely distributed in Asia, Africa and Europe. During the first quarter of the 20th century, it was described as one of the most plentiful Anatidae species over a great part of its range. Since then, it has undergone a large, long-term decline globally (Ali & Ripley, 1978; Perennou et al., 1994; Callaghan, 1997; Lopez & Mundkur, 1997; Grimmett et al., 1999; Islam, 2003; Robinson & Hughes, 2003a; Robinson & Hughes 2003b; Petkov & Kutsarov 2007). Although the species is regularly recorded in 77 countries and in at least 26 others as a vagrant (Robinson & Hughes, 2006), on the IUCN Red List of Threatened Animals it has been listed as 'Near Threatened'. Also it has been documented as a priority species on four prominent international Conservation treaties: European Union Bird Directive, Bern Convention, Bonn Convention and African-Eurasian Migratory Waterbird Agreement (Bird Life International, 2000; Robinson & Hughes, 2003b). There is an international concern about its population decline and range contraction (Robinson & Callaghan, 2003). The primary reasons for its decline are habitat degradation and loss and hunting for local consumption (Callaghan, 1997; Robinson & Hughes, 2003a; Robinson & Hughes 2006). Its general value as indicator (Petkov, 2006) of over-exploitation and loss of biodiversity in its migration range are the main reasons to follow the population trend of the species. Understanding the gravity of situation Bird Life International and The Wildfowl & Wetlands Trust have jointly adopted an 'International Single Species Action Plan for the Conservation of the Ferruginous Duck' in the year 2006 and the action plan will be revised in 2015. However, it is very difficult to take effective conservation measures unless adequate data on the population dynamics of the species on its entire range are available.

The species is a winter visitor to the Indian subcontinent, where human induced pressures on its population are particularly intense (Grimmett et al., 1999; Muzaffar 2003; Islam, 2003). But not very authentic data about number of the species from India is available (Robinson & Hughes, 2006). To meet this lacuna this study is designed to record population dynamics of ferruginous duck in some wetlands of

Jalpaiguri district of West Bengal, India. Also the purpose of this study was to quantify statistically the wetland characteristics that were playing major role for the presence or absence of the Ferruginous Duck in this region during the wintering period.

2 METHODS

2.1 Study Area

This study was conducted during the period of 1999 to 2013 in five wetlands of Jalpaiguri district, West Bengal, India. Jalpaiguri district (between 26° 16' and 27° 0' North latitudes and 88° 4' and 89° 53' East longitudes) is situated mainly in the Tista river basin and is known for its rich wildlife. 6.67% (41520 ha) of district geographic area is wetland (SAC, ISRO, 2010). The rivers from the hills flow down to this region meandering resulting numerous lakes many of which are ox-bow lakes and cut-off meanders. Due to abrupt change in gradient of the region numerous riverine wetlands have also been formed. Many of those wetlands host wintering population of Ferruginous duck *Aythya nyroca.*

Initially, for this study, wetlands were selected where Ferruginous duck was spotted at that time or where the habitat was suitable (Green, 1998b) for wintering ferruginous duck. Selected five wetlands were (i) Gajoldoba Beel (26°45'44.87"N 88°35'50.16"E), (ii) Domohani Beel (26°34'05.88"N 88°45'56.80"E), (iii) Dharala Kura (26°34'08.10"N 88°47'36.69"E), (iv) Gosaierhat wetland (26°41'22.55"N 88°59'16.29"E), and (v) Torolpara Bhatakhana (26°29'06.29"N 88°42'30.80"E).

2.2 Data Collection

For each wetland, following qualitative and quantitative data were collected once in a year: (1) area of waterbody at winter (AW) – maximum water logged area with mudflats during December; (2) water depth (WD) – Average depth of the wetland during December measured with a stick near or around the central part of the wetland; (3) water level fluctuation (WLF) – maximum difference in depth of water recorded in consecutive two days; (4) bank coverage by emergent vegetation (BV) – percentage of the wetland bank covered by emergent vegetation; (5) coverage of water by submerged vegetation (SV) – percentage of submerged vegetation as detected by random sampling from ten spots in each wetland; (6) floating vegetation (FV) – percentage of water surface covered by hydrophytic vegetation like Eichornia crassipes, Nymphea odorata, Nymphaea pubescens, Nymphoides cristatum, Wolffia arrhiza, Jussiaea repens, Neptunia natans, Hygrophila polysperma, Trapa natans etc., considered typical and widespread in Ferruginous Duck habitats; (7) Vegetative heterogeneity (VH) – presence of different types of vegetation like emergent on shallow water, emergent on mudflat, floating, aquatic plants like *Typha elephantina* at high land at different parts of the wetland, etc.; and (8) distance from the nearest wetland (DNW).

Vegetation coverage was determined by visual observation on the spot and assigned in five classes; 0–20%, 21–40%, 41-60%, 61-80% and 81-100% coverage. Vegetative heterogeneity was ascertained with number corresponding to types of vegetation.

Other than those Habitat parameters, different types of human interferences (fishing, recreational activities, agricultural activities and hunting,) were also recorded to find its effect on ferruginous duck population. Data for fishing were collected on morning (between 0600 – 0700 hrs) and afternoon (between 1600 – 1700 hrs) period when intensity of such activities was maximum and such data were pooled together to calculate number of persons present in such activities per hectare area per hour. Data for agricultural activities were collected during 0900 – 1000 hrs and calculated the number of persons busy with agricultural activities per hectare area per hour.

Numbers of persons engaged in recreational activities were counted during afternoon hours (1500 – 1600 hrs) and computed persons engaged in such activities per hectare area per hour. For collecting data on hunting methodology involved interviews with a cross-section of the local people, the organisation of Panchayat, and focus group discussions. For that lot of time was spent with local inhabitants around those wetlands and after mutual trust building recorded their information. Focus group discussions were organized at evening to obtain direct first-hand information through spontaneous responses from the respondents, most of whom were poorly educated. Even during the entire study period I was in touch with few of them by telephone to get relevant information on time. Data on hunting was recorded as number of incidents per year because every single incident of hunting always affected the whole birdlife of the wetland immediately.

Bird count was done once in a month starting from November to February between sunrise and 10:00 h and between 15:00 h and sunset, using binoculars (Olympus 10 × 50). Survey of birds began from vantage points, wherefrom most of the surface area and edge was visible. Then walked around the perimeter of the wetland to flush and identify any unseen birds. Additionally, I walked through the emergent vegetation zone and approached the inaccessible part of the wetlands by boat to count all birds seen within the wetlands. For a particular season, maximum number of birds that was counted in a single counting session of that season was considered for analysis.

The Pearson's Correlation Coefficient (r_p) was used for the simple relationship analyses between the variables. Forward stepwise multiple regression analysis was done with the number of Ferruginous duck as dependent variable and the habitat and human interference related parameters of the wetlands having simple significant relationship with the number of Ferruginous duck in the wetlands as independent variables.

3 RESULTS AND DISCUSSION

Of the five sites three, *viz*. Gajoldoba Beel, Domohani Beel and Dharala Kura are basically cut off meander; whereas Gosaierhat wetland is a natural marsh inside a territorial forest (Moraghat Range) and Torolpara Bhatakhana is a waterlogged at the site of an abandoned brickyard. Gajoldoba Beel being a barrage side wetland attains constant vigilance from state owned Irrigation Department. In spite of being situated inside a territorial forest, public access in Gosaierhat wetland was a common feature till 2004 and only after its transformation as Eco-park in 2004; Forest Department made all necessary arrangements for its protection on regular basis. NGOs and Forest Department conducted few awareness programme in the vicinity of Gajoldoba Beel and Gosaierhat wetland to protect birds. However, no such awareness programme was observed around Domohani Beel, Dharala Kura and Torolpara Bhatakhana, having open access to all with no protective measures of any form. Only during 2012 local people under active cooperation of some NGOs raised voice against the decision of Jalpaiguri Municipal authority to use the Torolpara Bhatakhana wetland as a dumping ground. Since then local people are very much concerned about this wetland and its birds.

At the beginning (1999) of this study Ferruginous duck was spotted only from Gajoldoba Beel, Domohani Beel and Torolpara Bhatakhana. No Ferruginous duck was observed at Dharala Kura and Gosaierhat in 1999. Over the fifteen years period (1999 to 2013) almost a steady increase in number of ferruginous duck has been observed in all these wetlands (Figure 1). Slight decrease in number of Ferruginous duck in a particular year in comparison to previous year and again increase in number in subsequent years may be due to local shifting from one wetland to a contiguous wetland. Sudden decline in number of Ferruginous duck in a country or in some wetlands has been reported in many studies (Petkov, 2000; Petkov, 2003). However, decrease in number in any particular year at one or two wetlands of this study seems not to be an overall reflection of population decline in this region because total number of Ferruginous duck consistently increased in these five wetlands during the study period. From 1999 to 2013 overall increase in Ferruginous duck number in these five wetlands was about 154%.

All these wetlands satisfied the basic characteristics of a habitat preferred by Ferruginous duck having well structured mosaic vegetation with floating and submerged vegetation and mudflats with depth of water less than 3m (Cramp & Simmons, 1977; Green, 1998a; Green, 1998b; Zogaris & Handrinos, 2003; Petkov, 2004; Petkov, 2012). During this course of time, however, habitat characteristics (AW, WD, WLF, BV, SV, FV, VH and DNW), those are indicative of Ferruginous duck population, did not varied significantly (Table 1). Fluctuation in area and depth in each year was mainly due to rainfall differences in the corresponding year. But loss of area due to agricultural conversion was evident in Domohani Beel (2% loss), Torolpara Bhatakhana (4.6% loss) and Dharala Kura (5.5% loss). Because of its connection with the barrage, water level fluctuation (WLF) was recorded on regular basis from Gajoldoba Beel only, not from any other wetlands. All other habitat characteristics remained almost same during this fifteen years span. Selection of specific habitat by Ferruginous duck is the reason of its restricted and shrinking distribution (Green, 1998b; Robinson, 2003; Petkov & Kutsarov, 2007; Petkov, 2012). Result of this study thus clearly demonstrates that habitat characteristics of these wetlands are still quite suitable for Ferruginous duck but wetland loss due to agricultural conversion may be a threat in future being a common practice in India and elsewhere (Lee Footee et al., 1996; Prasad et al., 2002; Crosby & Chan 2006).

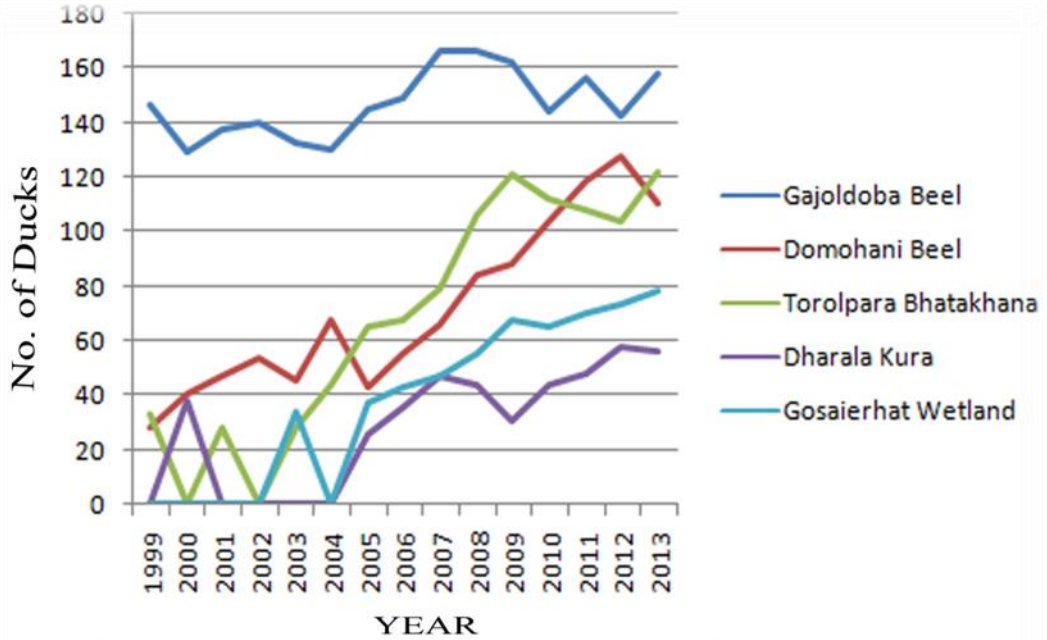

Figure 1. Number of Ferruginous duck at five wetlands during 1999 to 2013 period.

Table 1. Average habitat characteristics recorded in five wetlands during 1999 to2013 period.

Name of wetland	Area	Depth	WLF (m)	BV (%)	SV (%)	FV (%)	VH	DNW (m)
Gajoldoba Beel	107.82 (SD 0.25)	2.92 (SD 0.08)	0.92	20-40	40-60	40-60	5	55
Domohani Beel	16.18 (SD 0.11)	1.23 (SD0.03)	0	20-40	80-100	60-80	3	187
Torolpara Bhatakhana	3.16 (SD 0.04)	2.38 (SD 0.05)	0	40-60	80-100	60-80	3	150
Dharala Kura	5.32 (SD 0.02)	3.73 (SD 0.03)	0	0-20	80-100	20-40	2	2153
Gosaierhat wetland	3.42 (SD 0.18)	1.46 (SD 0.07)	0	60-80	80-100	60-80	4	1015

WLF = Water level fluctuation; BV = Bank Vegetation; SV = Submerged Vegetation;
FV = Floating Vegetation;VH = Vegetative Heterogeneity; DNW = Distance from nearest Wetland

Most common human activity in all five wetlands was fishing and magnitude of that activity increased considerably at Dharala Kura, Torolpara Bhatakhana and Domohani Beel during this study period; remained almost same at Gajoldoba Beel; and at Gosaierhat that activity was totally stopped after 2004 with the establishment of an eco-park (Figure 2.). Recreational activities, on the other hand, attained a new height from 2004 at Gosaierhat. Recreational activities recorded from Gajoldoba Beel in all the years with almost an equal intensity and in a very few occasions only from Domohani Beel but not from other wetlands (Figure 3.). Agricultural activities were recorded with almost same intensity from Domohani Beel and Torolpara Bhatakhana during the entire study period, and at Dharala Kura this activity intensified considerably after 2007. No such activities recorded from Gajoldoba Beel and Gosaierhat wetland (Figure 4.). At Gajoldoba Beel hunting has never been reported during this study period but was reported from all other four wetlands. However, magnitude of hunting steadily decreased during this study period (Figure 5.).

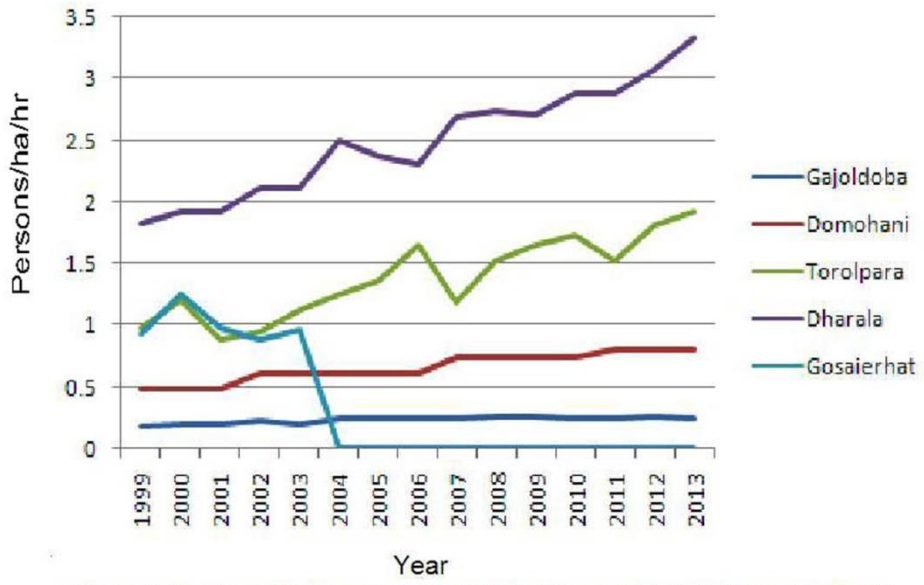

Figure 2. Number of persons engaged with fishing recorded at different wetlands.

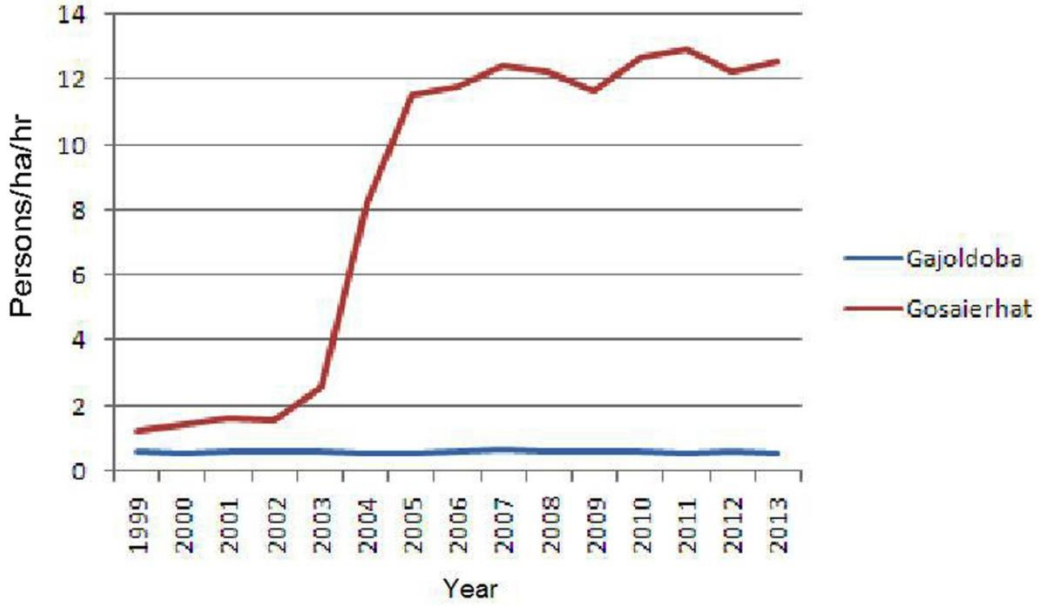

Figure 3. Number of persons busy with recreational activities at different wetlands.

It is clear from Pearson's correlation coefficient (Table 2) that no human induced activity affected life of Ferruginous duck significantly at Gajoldoba Beel. Controlled fishing and recreational activities, common of this wetland, probably did not affect the birdlife very much. But preponderance of these activities in restricted zones of the wetland and some habitat characteristics like deeper water, water level fluctuation, lesser submerged and floating vegetation (Table 1) may be the reasons (Petkov, 2006) behind lesser per hectare bird number at Gajoldoba Beel. In all other four wetlands number of Ferruginous duck was significantly and negatively correlated with hunting Table 2). Ferruginous duck number was positively and significantly correlated with fishing activities at Domohani Beel, Torolpara Bhatakhana and Dharala Kura, but significant negative correlation exists at Gosaierhat wetland. The positive correlation between fishing and bird number at Domohani Beel, Torolpara Bhatakhana and Dharala Kura seems to be purely artificial because such activities was mostly restricted to that part of wetland where Ferruginous duck does not forage or rest. Similarly recorded positive significant correlation between bird number and agricultural activities at Domohani Beel and Dharala Kura, and between bird number and recreational activities at Gosaierhat wetland seems to be artificial. Forward stepwise regression analysis clearly identified hunting (-0.86; t-value -4.08; p-value <0001; S 9.55; r^2 22.30; adjusted r^2 20.99) as the key variable explaining steady increase in Ferruginous duck number in four wetlands during the study period.

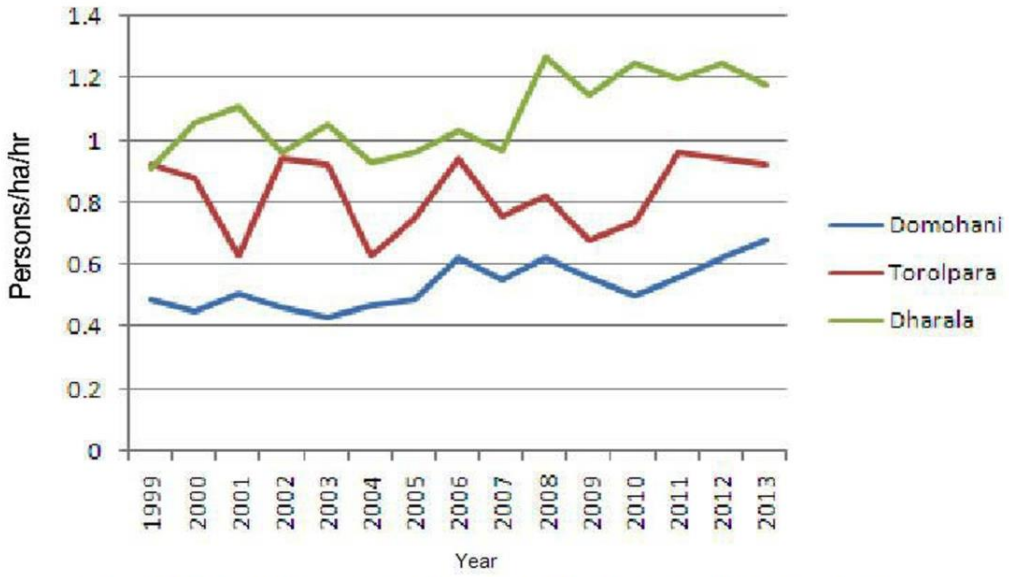

Figure 4. Number of persons engaged with agricultural activities at different wetlands.

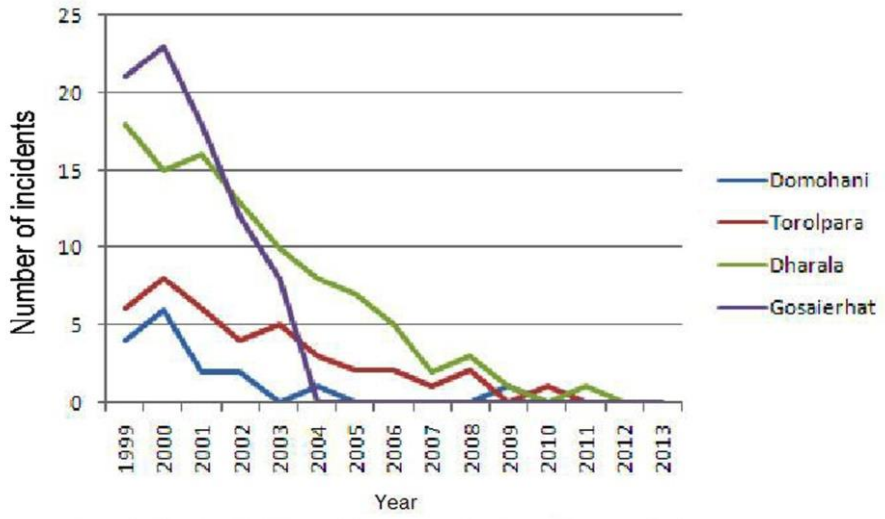

Figure 5. Number of incidents of hunting recorded from different wetlands.

Table 2. Statistical relationship between different types of human interferences and Ferruginous duck number in a particular wetland.

Variables	Gajoldoba Beel		Domohani Beel		Torolpara Bhatakhana		Dharala Kura		Gosaierhat wetland	
	r	p	r	p	r	p	r	p	r	p
Fishing	-0.263	ns	0.887	<0.001	0.854	<0.001	0.797	<0.001	-0.744	0.001
Agricultural activities	0	0	0.701	<0.05	-0.05	ns	0.645	<0.05	0	ns
Recreational activities	0.225	ns	-0.075	ns	0	ns	0	ns	0.855	<0.001
Hunting	0	0	-0.539	<0.05	-0.897	<0.001	-0.811	<0.001	-0.765	0.001

r - Pearson's correlation coefficient; p - probability value to determine statistically significant result;
n.s. - not significant.

Presence of Ferruginous duck in all five wetlands of this study advocates that habitat of these wetlands fulfill specific needs of Ferruginous duck. And in spite of increasing human population (13.87% increase between 2001 to 2011) those specific habitat requirements remained almost intact during the long time period of this study. Ferruginous duck is very much sensitive to human interference and one of the main reasons of abandonment of wetlands by Ferruginous duck was human activities (Petkov, 2012). Fluctuation

in number of Ferruginous duck in four wetlands were direct attribute of direct human interferences like hunting as it was evident in many other studies (Callaghan, 1997; Robinson & Hughes 2003a; Robinson & Hughes, 2006; Vinicombe, 2000; Balmaki & Barati, 2006). Most of the migratory waterbirds try to avoid human infested areas and always avoid those wetlands where hunting is a frequent phenomenon (Quan, 2002; Wuver & Attuquayefio, 2006; Mohan & Gaur, 2008; Sharma & Saini, 2012). In spite of suitable habitat characteristics, Ferruginous duck avoided the wetlands of this study where incidents of hunting was frequent and when number of such incidents decreased significantly or stopped altogether they again settled to those wetlands. Thus with degraded alteration of habitat characteristics by environmental condition and/or human activities, Ferruginous duck avoid the wetlands (Green, 1998b; Robinson, 2003; Petkov, 2012) but when the condition regains they will also return back to the wetlands again.

The relation between wetlands and water birds is shaped by many factors. Many physical and biological attributes of the wetland like area, depth, and quality of water; quality of vegetation; and the presence or absence of predators are determining factors of the presence or absence of birds in a wetland. But like any other place in the world, there is a looming threat to the aquatic biodiversity of the Indian wetlands as they are often under a regime of unsustainable human pressures. Hunting is the climax of such threat for wintering ducks in a wetland and probably for this reason Ferruginous duck did not preferred four wetlands of this study when hunting was prevalent. With cessation of hunting Ferruginous duck again appeared in those wetlands; which signify that human induced alterations of physical and biological characteristics of wetlands of this region are still within limit to sustain Ferruginous duck population. Stopping of hunting is definitely a sign of awareness of people. But how this happened when no awareness campaign by state authority or NGOs was conducted near those wetlands where hunting was once prevalent? Possible answer may be the increase in literacy rate. In between 2001 (62.85%) and 2011 (73.25%) literacy rate in Jalpaiguri district increased by 10.4% and in previous ten years period that increment was over 16%. May be this increase in formal education played positively to prevent hunting and thereby assisted to conserve the birds.

4 CONCLUSIONS

In India waterbirds and their wetland habitats are under great pressure, linked to a combination of rapid economic development and increasing human population. This study represents a reliable scenario of population dynamics of Ferruginous duck in five wetlands of Jalpaiguri district, India. Presence of this potential indicator species (Petkov, 2006) dictates that wetlands of this region are comparatively healthy to sustain rich aquatic biodiversity. Only threat that had a negative impact on Ferruginous population was hunting that compelled birds to avoid wetlands in spite of other resourcefulness. But as the propensity of hunting is diminishing all through the last decade Ferruginous duck not only revisited the abandoned wetlands, their number is increasing steadily. There was no indication that hunting stopped due to active efforts of government or NGOs. The possible factor that played behind to ignite social awareness may be the increased literacy rate. So to implement measures for sustainable management of natural assets like wetland or to implement 'International Single Species Action Plan' for Ferruginous duck, priority should be given to increase literacy rate in concerned region and upon that foundation awareness programme will act more effectively.

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