Relationships of migratory water bird counts of eastern India with demographic aspects

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ABSTRACT

Distribution of migratory water birds was conducted in six major wetlands of Eastern India. Relationship of migratory water bird counts with demographic aspects has been studied thoroughly in each of the selected wetlands.

Key words: Migratory birds, modeling, demographic aspects.

1. INTRODUCTION

Six wetlands such as Tilpara reservoir, Bakreswar reservoir, Tank1, Tank2 and Tank3 of Birbhum district and Purbasthali of Burdwan district of Eastern India have been studied for the present work. All these wetlands of Eastern India have been visited several times in the span of last few years. Relationship of migratory water bird counts with demographic aspects has been found out in each of the selected wetlands.

2. MATERIAL AND METHODS

All the selected wetlands have been visited several times in the span of last few years. Purbasthali wetland of Burdwan district of Eastern India is a natural wetland which is an oxbow lake whereas the five wetlands of Birbhum district of Eastern India namely Tilpara, Bakreswar, Tank 1, Tank 2 and Tank 3 of Ballavpur Wildlife Sanctuary are manmade wetlands. During the visit to these wetlands, water bird counts have been performed in the middle of January every year. Birds were observed by using a binocular and they were identified by following the methodology of (Grimmet et al., 2001; Ali and Ripley, 2001). Relationship of migratory water bird counts with demographic aspects has been found out in each of the selected wetlands.

3. RESULTS

Year wise average number of 14 migratory water birds is shown in Table 1. Migratory birds have started coming from the year 2006 in Tank1 and in case of Tank2 of Ballavpur Wildlife Sanctuary of Eastern India, migratory birds have started coming from the year 2008. In 2010 there were no migratory birds in Tank3 due to mist netting because of bird flue.

Table 1

Year wise average of 14 migratory water birds taken over the wetlands

Year	Tilpara	Bakreswar	Tank1	Tank 2	Tank3	Purbasthali
2004	7240	1630	0	0	5521	3312
2005	4379	1612	0	0	994	3218
2006	2137	886	270	0	2024	2450
2007	2762	1219	616	0	4588	1672
2008	4716	5238	208	170	2864	1215
2009	3272	1984	38	264	4424	962
2010	4531	3280	91	0	2896	231

Demographic Modeling

Demographic data like total population and number of tourists of the years 2004 to 2010 of Purbasthali and Birbhum has been collected from Bureau of Applied Economics and Statistics department of Statistics and Programme Implementation of Government of West Bengal. Table 2 and Table 3 are showing the total population and number of tourists.

Table 2

Total Population and number of tourists of Birbhum

Total Population of Birbhum (IntcenBir)	Number of Tourists of Birbhum (tour_Bir)
3152721	17032
3199862	14819
3247709	19872
3296271	17441
3345559	14342
3395584	14217
3446357	28628

Total population of Birbhum and Burdwan of the year 2001 and 2011 has been obtained from Bureau of Applied Economics and Statistics department of Statistics and Programme Implementation of Government of West Bengal. Intercensal population estimate of the years 2004 to 2010 has been calculated by G.P. (Geometric Progression) method which is as follows:

$P_t = P_0 (P_1/ P_0)^t$ where
P_0 = Population of the year 2001
P_1 = Population of the year 2011
P_t = Population at time t.

Therefore estimated population at the year 2004 = P_t at t which is equal to 3/10 etc.

Table 3
Total population and number of tourists of Burdwan

Total Population of Burdwan (IntcenBurd)	Number of Tourists of Burdwan (tour_Burd)
7133983	8567
7215291	11526
7297526	13087
7380698	14231
7464819	8405
7549898	11297
7635946	12366

For Demographic modeling**,** yearly average number of birds of different wetlands is taken as responses and total population and number of tourists as the regressors.

Birbhum

Correlations: tour_Bir, IntcenBir

Pearson correlation of tour_Bir and IntcenBir = 0.236
P-Value = 0.611
This implies there is no multicollinearity in the covariates under Birbhum.

Regression Analysis: y (Birbhum) versus tour_Bir, IntcenBir, ...

The regression equation is
y (Birbhum) = 931769 - 1.44 tour_Bir - 0.549 IntcenBir + 0.000033 tour_Bir^2
    + 0.000000 IntcnsBir^2

Predictor	Coef	SE Coef	T	P
Constant	931769	198885	4.68	0.043
tour_Bir	-1.4439	0.4029	-3.58	0.070
IntcenBir	-0.5486	0.1205	-4.55	0.045
tour_Bir^2	0.00003276	0.00000950	3.45	0.075
IntcnsBir^2	0.00000008	0.00000002	4.50	0.046

R^2= 95.4%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	4	6662720	1665680	10.40	0.090
Residual Error	2	320378	160189		
Total	6	6983098			

Burdwan

Correlations: tour_Burd, IntcenBurd

Pearson correlation of tour_Burd and IntcenBurd = -0.365

P-Value = 0.421

This implies there is no multicollinearity in the covariates in case of Burdwan

Regression Analysis: y(Burdwan)_1 versus tour_Burd, IntcenBurd

The regression equation is

y (Burdwan)_1 = 46272 + 0.0697 tour_Burd - 0.00612 IntcenBurd

Predictor	Coef	SE Coef	T	P
Constant	46272	2876	16.09	0.000
tour_Burd	0.06972	0.03398	2.05	0.109
IntcenBurd	-0.0061240	0.0003669	-16.69	0.000

R^2 = 98.9%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	2	8120259	4060130	177.50	0.000
Residual Error	4	91494	22874		
Total	6	8211753			

4. DISCUSSION

In case of demographic modeling of Burdwan, the number of birds will significantly decrease with the increase in total population because here p (probability) value is 0.00 which is less than 0.05. Number of birds is not significantly dependent on the number of tourists even at 10% level of significance. This model can efficiently predict the bird counts from demographic perspectives as the R^2 value is 98.9% which is very high.

In case of demographic modeling of Birbhum, bird count is found to be dependent on number of tourists and total population with at least second degree polynomial. The partial regression coefficient of tour_Bir (number of tourists of Birbhum) is -1.44 which means as the number of tourist increases, bird count decreases. Similarly, it can be interpreted for other partial regression coefficient values regarding the other non-linear functions of tour_Bir. The partial regression coefficient of IntcenBir (total population of Birbhum) is -0.549 which means as the total population increases, bird count decreases. Similarly, it can be interpreted for other partial regression coefficient values regarding the other non-linear functions of total population of Birbhum. This model can efficiently predict the bird counts from demographic perspectives as the R^2 value is 95.4% which is very high.

ACKNOWLEDGEMENTS

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