Species

ISSN 2319 – 5746 EISSN 2319 – 5754

ANALYSIS

Diversity and temporal variation of migratory water birds of some selected wetlands from eastern India

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Publication History
Received: 23 February 2015
Accepted: 16 March 2015
Published: 25 March 2015

Citation
Shubhasree Ganguly. Diversity and temporal variation of migratory water birds of some selected wetlands from eastern India. *Species*, 2015, 13(40), 42-50

ABSTRACT

Distribution of migratory water birds was conducted in six major wetlands of Eastern India. Temporal variation is studied thoroughly in each of the selected wetlands.

Key words: Migratory birds, temporal variation.

1. INTRODUCTION

The Southern part of West Bengal of Eastern India comprises of a gentle gradation from lateritic tracts (tracts consisting of iron rich soils) on the west through an alluvial tract in the central portion. Entire tract is characterized by wetlands of various characteristics. These wetlands host migratory birds of various species.

Six wetlands such as Tilpara reservoir, Bakreswar reservoir, Tank1, Tank2 and Tank3 of Birbhum district and Purbasthali of Burdwan district have been studied for the present work. Five wetlands of Birbhum lie in the lateritic zone and Purbasthali is in the alluvial zone. All these wetlands of Eastern India have been visited several times in the span of last few years. During the visit to these wetlands, water bird counts of migratory types have been performed.

A detailed survey of water birds is conducted in six major wetlands mentioned above. The survey was conducted from 1999 to 2010 to ascertain the trend of changes of the migratory birds in these wetlands. Purbasthali which is also known as Chupi Char lies on the banks of a large oxbow lake created by the Ganges River.

Among the five wetlands of Birbhum, Bakreswar Reservoir has been the result of a barrage erected across Bakreswar River to ensure constant water supply for cooling the Bakreswar Thermal Power Units. Tilpara Reservoir was the result of a barrage built across the River

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Mayurakshi. It is situated 4 km north-west of Suri and 10 km north-east of Bakreswar Reservoir and it was the result of a barrage built across the River Mayurakshi. Ballavpur Tank 1 is located on the northern boundary of the Ballavpur Wildlife Sanctuary, and in the recent years it is becoming more and more favourable site for the population of birds. Ballavpur Tank 2 is situated adjacent to the north western boundary of Ballavpur Wildlife Sanctuary. Ballavpur Tank 3 is situated adjacent to the western boundary of Ballavpur Wildlife Sanctuary. This is the largest water body of the sanctuary.

2. MATERIAL AND METHODS

The present study commenced as early as in the winter of 1999.The observations on assemblage of different migratory avian species are furnished along with their frequency. The observations of the migratory birds were undertaken by using a telescope (3 PT /20X Russian telescope) covering known compartments of particular wetlands. This is done by selecting markers at fixed distances permitted by the viewing field of telescope. The placement of marker was done according to width of viewing lens, the distance which it could cover. Normally a vantage point was selected from which the entire wetland could be covered by rotating the telescope. Birds are counted in each view and summed up as the total count. White and yellow ringed bamboo staffs are used as markers as far as possible. In case of very large distances prominent trees are also used as the marker trees .Particularly this is required in case of Bakreswar reservoir and Purbasthali wetland. Usually all five wetlands of Birbhum district were covered on the same date of each visit. Hence there is no possibility of any double count. Moreover, the month of count always remained during January when maximum congregation takes place. Birds were identified by following the methodology of (Grimmet et al., 2001) and (Ali and Ripley, 2001).

During the long span of time through which these six wetlands were studied it was observed that these wetlands did not host the avian population every year. As for example in Tank2, there was no avian population in the year 2010 due to mist netting necessitated for the prevention of bird flue. Another example is the Bakreswar reservoir in which regular avian congregation started from the year 2004 only.

3. RESULTS

Tables showing the major migratory bird count of all the wetlands under study are as follows:

Table 1

Bird count of Tilpara wetland

	1999	2003	2004	2005	2006	2007	2008	2009	2010
Greylag Goose	37	495	606	208	2	152	0	102	0
Bar-headed Goose	18	5	28	6	0	8	0	80	137
Ruddy Shelduck	32	0	20	0	6	0	84	40	0
Eurasian Wigeon	230	93	903	474	250	206	620	200	300
Falcated Teal	0	0	0	0	1	0	0	0	0
Gadwall	480	858	1518	883	370	700	690	400	500
Common Teal	180	322	383	592	160	180	438	300	600
Northern Pintail	170	85	1583	910	200	140	368	300	400
Garganey	68	12	182	130	48	28	18	20	0
Northern Shoveler	32	38	0	152	10	16	0	0	20
Red-crested Pochard	540	572	1826	694	640	670	1586	1500	2500
Common Pochard	90	20	0	72	0	30	0	20	50
Tufted Duck	440	328	125	82	380	408	842	300	0
Ferruginous Pochard	0	46	66	176	70	224	70	10	24

Table 2

Bird count of Bakreswar wetland

	2004	2005	2006	2007	2008	2009	2010
Greylag Goose	102	102	76	150	0	2	0
Bar-headed Goose	0	0	0	0	24	34	140
Ruddy Shelduck	50	48	46	73	486	150	300
Eurasian Wigeon	98	98	70	0	68	200	300
Falcated Teal	0	0	0	0	0		0
Gadwall	390	384	250	310	480		300

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Common Teal	190	188	60	250	0	120	200
Northern Pintail	720	708	370	462	180	300	400
Garganey	54	54	0	0	0		0
Northern Shoveler	28	28	0	0	0		20
Red-crested Pochard	12	16	30	14	1800	600	800
Common Pochard	0	0	0	0	0		0
Tufted Duck	52	52	40	80	2200	550	800
Ferruginous Pochard	36	36	20	30	0	30	20

Table 3

Bird count of Tank1 of Ballavpur Sanctuary wetland

	2006	**2007**	**2008**	**2009**	**2010**
Greylag Goose	30	0	0	0	23
Bar-headed Goose	0	0	0	0	0
Ruddy Shelduck	0	0	0	0	0
Eurasian Wigeon	0	12	4	0	0
Falcated Teal	0	0	0	0	0
Gadwall	150	308	180	36	40
Common Teal	0	0	0	0	10
Northern Pintail	60	262	0	0	8
Garganey	4	0	0	0	0
Northern Shoveler	0	4	2	0	4
Red-crested Pochard	20	22	22	2	6
Common Pochard	0	0	0	0	0
Tufted Duck	0	0	0	0	0
Ferruginous Pochard	6	8	0	0	0

Table 4

Bird count of Tank2 of Ballavpur Sanctuary wetland

	2008	**2009**
Greylag Goose	246	478
Bar-headed Goose	0	0
Ruddy Shelduck	0	0
Eurasian Wigeon	0	0
Falcated Teal	0	0
Gadwall	76	100
Common Teal	0	0
Northern Pintail	94	150
Garganey	0	0
Northern Shoveler	0	0
Red-crested Pochard	0	0
Common Pochard	0	0
Tufted Duck	0	0
Ferruginous Pochard	0	14

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Table 5

Bird count of Tank3 of Ballavpur Sanctuary wetland

	1999	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Greylag Goose	450	520	640	811	750	32	580	680	380	80	320
Bar-headed Goose	0	0	0	0	0	0	0	0	0	0	0
Ruddy Shelduck	0	0	0	0	0	0	0	0	0	0	0
Eurasian Wigeon	0	0	6	0	16	62	0	12	18	8	6
Falcated Teal	0	0	0	0	2	0	0	0	0	0	0
Gadwall	330	380	270	180	850	700	250	460	630	400	200
Common Teal	280	0	550	520	900	0	220	350	480	720	500
Northern Pintail	1100	2600	1050	2732	2500	0	800	3000	1200	3200	1800
Garganey	46	120	16	53	350	138	30	18	36	0	46
Northern Shoveler	8	12	6	14	8	36	18	8	26	0	8
Red-crested Pochard	0	0	4	4	0	0	0	0	12	0	0
Common Pochard	12	10	2	12	30	0	4	8	6	0	0
Tufted Duck	56	42	60	18	43	16	70	20	48	4	12
Ferruginous Pochard	36	22	14	31	72	10	52	32	28	12	4

Table 6

Bird count of Purbasthali wetland

	1993	2000	2001	2002	2003	2004	2005	2007	2008	2009	2010
Greylag Goose	0	0	0	0	0	0	0	0	0	0	0
Bar-headed Goose	0	0	0	0	0	0	0	0	0	0	0
Ruddy Shelduck	319	0	0	0	0	0	0	12	6	22	4
Eurasian Wigeon	0	200	320	300	0	200	280	17	27	22	17
Falcated Teal	0	0	0	0	0	2	0	0	0	0	0
Gadwall	140	2300	600	400	0	700	900	600	500	350	0
Common Teal		200	500	500	0	400	300	38	18	0	0
Northern Pintail	327	3100	800	200	0	1300	1080	122	162	200	18
Garganey	3081	124	290	350	0	220	180	700	300	150	
Northern Shoveler	13	400	120	280	0	50	80	20	10	18	12
Red-crested Pochard	32		280	50	0	300	170	132	170	200	180
Common Pochard	0	0	20	20	0	22	30	0	0	0	0
Tufted Duck	0	4	42	40	0	70	120	0	0	0	0
Ferruginous Pochard	0	34	52	150	0	48	78	31	22	0	0

The diversity of the migratory birds was studied in details for several years at the following wetlands:

Table 7

Study Areas (Wetlands)

Name of wetlands	Years of study
Tilpara	9yrs (1999, 2003-2010)
Bakreswar	7 yrs (2004-2010)
Ballavpur Tank 1	5 yrs (2006-2010)
Ballavpur Tank 2	2 yrs (2009 & 2010)
Ballavpur Tank 3	11 yrs (1999,2001-2010)
Purbasthali	4 yrs (2007-2010)

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Table 8

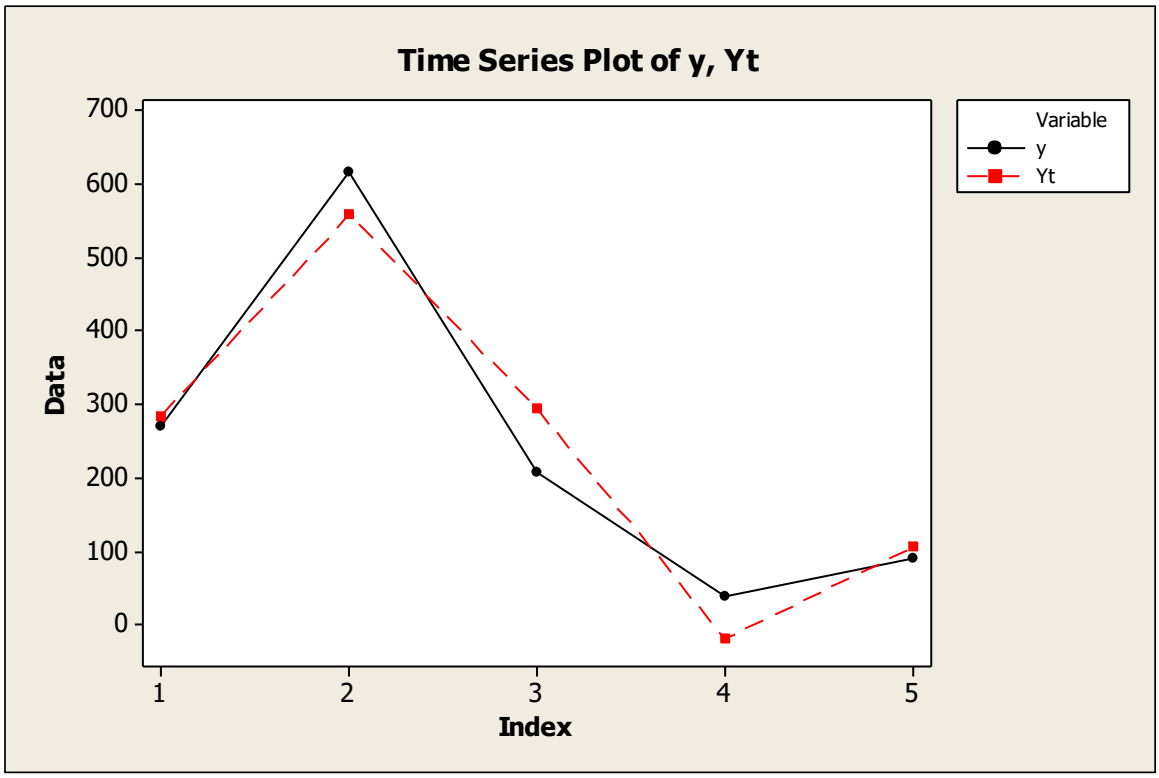
Table showing the genus, species and family of the migratory birds

Migratory birds	Genus	Species	Family
Greylag Goose	Anser	anser	Anatidae
Bar-headed Goose	Anser	indicus	Anatidae
Ruddy Shelduck	Tadorna	ferruginae	Anatidae
Eurasian Wigeon	Anas	penelope	Anatidae
Falcated Teal	Anas	falcata	Anatidae
Gadwall	Anas	strepera	Anatidae
Common Teal	Anas	crecca	Anatidae
Northern Pintail	Anas	acuta	Anatidae
Garganey	Anas	querquedula	Anatidae
Northern Shoveler	Anas	clypeata	Anatidae
Red-crested Pochard	Rhodonessa	rufina	Anatidae
Common Pochard	Aythya	ferina	Anatidae
Tufted Duck	Aythya	fuligula	Anatidae
Ferruginous Pochard	Aythya	nyroca	Anatidae

Time series variation (temporal variation) is studied thoroughly in each of the selected wetlands. In case of Tank-1 of Ballavpur Wildlife Sanctuary and Tilpara (Birbhum), if the following cubic trend can be considered as the dominant component of time-series variation (evident from graphical presentation), the trend is performing better among the polynomial trends.

Figure 1

Time Series Plot of Tank 1



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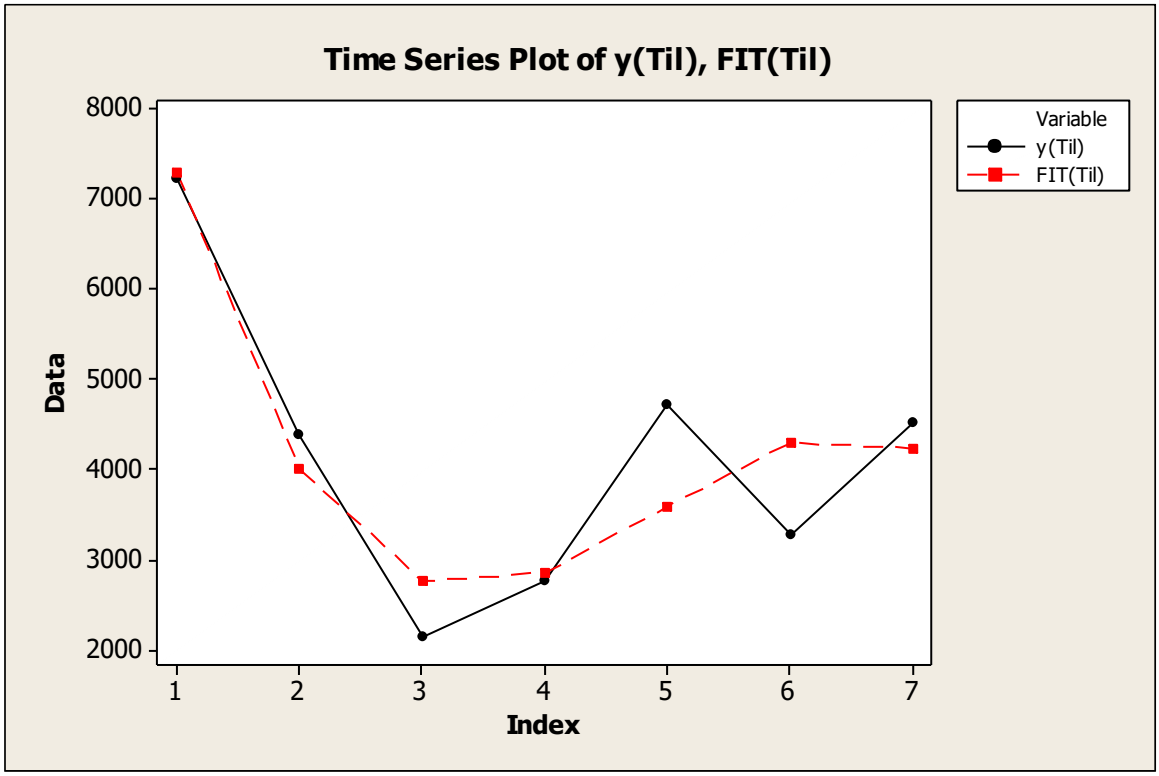
Polynomial Regression Analysis: y (Tank1) versus t (origin 2006 (t=0))

The regression equation is
y (Tank1) = 284.4 + 706.0 t - 513.4 t**2 + 81.42 t**3

S = 120.360 **R-Sq = 93.0%** R-Sq (adj) = 71.9%

Here R-Sq = 93.0% which means R-Sq value is very high.
R-Sq= Measure of usefulness/ efficacy of a fitted model.

Figure 2
Time Series Plot of Tilpara



Polynomial Regression Analysis: y (Til) versus t (origin 2004 (t=0))

The regression equation is
y (Til) = 7299 - 4546 t + 1370 t**2 - 116.1 t**3

S = 985.174 **R-Sq = 82.7%** R-Sq (adj) = 65.4%

Here R-Sq = 82.7% which means R-Sq value is moderately high.

In case of Bakreswar and Tank-3 of Ballavpur Sanctuary (Birbhum), from the graphical presentation of bird counts over time (shown below), it is evident that the cyclical fluctuations with cycles approximately of 3 years, is dominating in time-series variation and hence the trend values determined by the method of mathematical curve can hardly catch the pattern of the movement of data. However, in this context, moving average method of trend determination with periods same as the cycles (of cyclical fluctuations) can to some extent is able to represent the

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pattern of available bird count data. Unfortunately this method, unlike the method of mathematical curve fitting is not applicable for future prediction.

Figure 3

Moving Average plot for Bakreswar

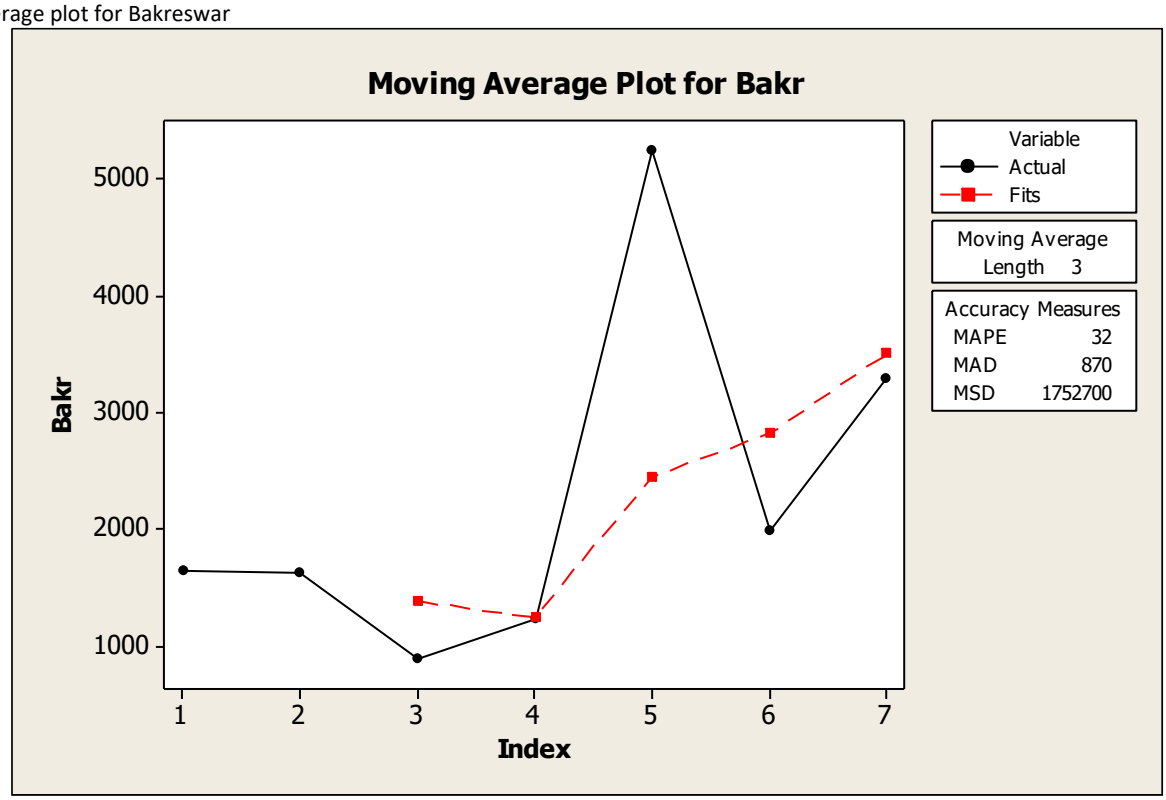

Figure 4

Moving Average plot for Tank-3

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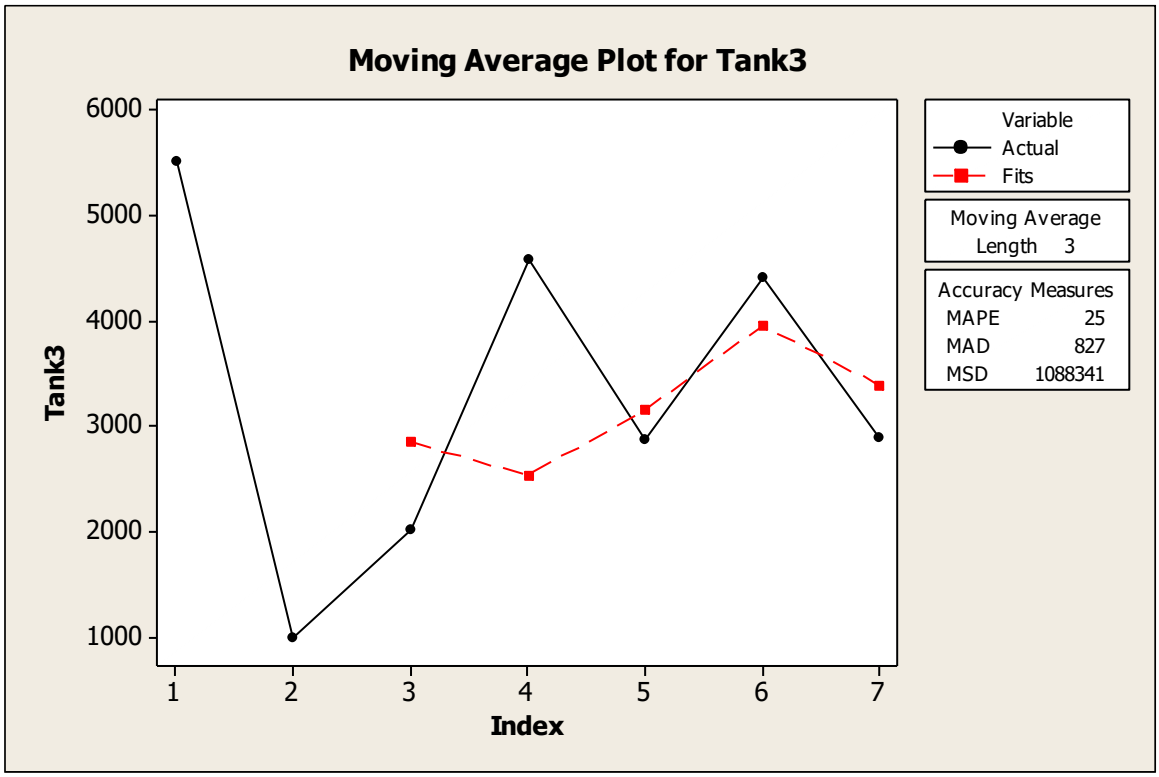

In case of Tank-2 of Ballavpur Sanctuary (Birbhum) this type of analysis is not feasible because of insufficient volume of data. In case of Purbasthali wetland, diminishing linear trend is the best fitted trend equation. Trend is the most dominant component which is evident from the graphical presentation.

Figure 5
Time Series Plot of Purbasthali

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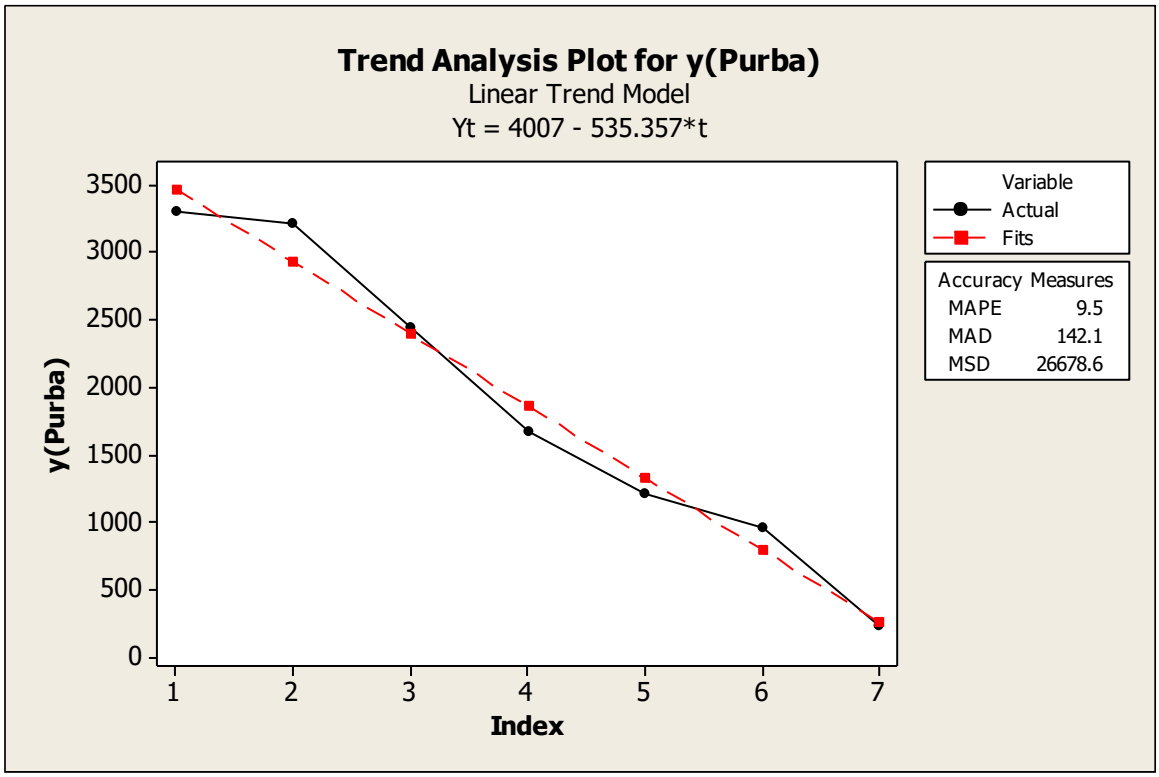

Regression Analysis: y (Purba) versus t (origin 2004 (t=0))

The regression equation is
y (Purba) = 3472 - 535.4 t

S = 193.261 R-Sq = 97.7% R-Sq(adj) = 97.3%

Here R-Sq value is very high.

If this present situation persists, it can be predicted that approximately after 6.5 years there will be no migratory birds in Purbasthali which is indeed a very alarming situation. In case of year-wise average of number of birds per each wetland, if the following cubic trend can be considered as the dominant component of time-series variation (evident from graphical presentation), the trend is performing better among the polynomial trends.

Figure 6
Time series plot of average number of birds per each wetland

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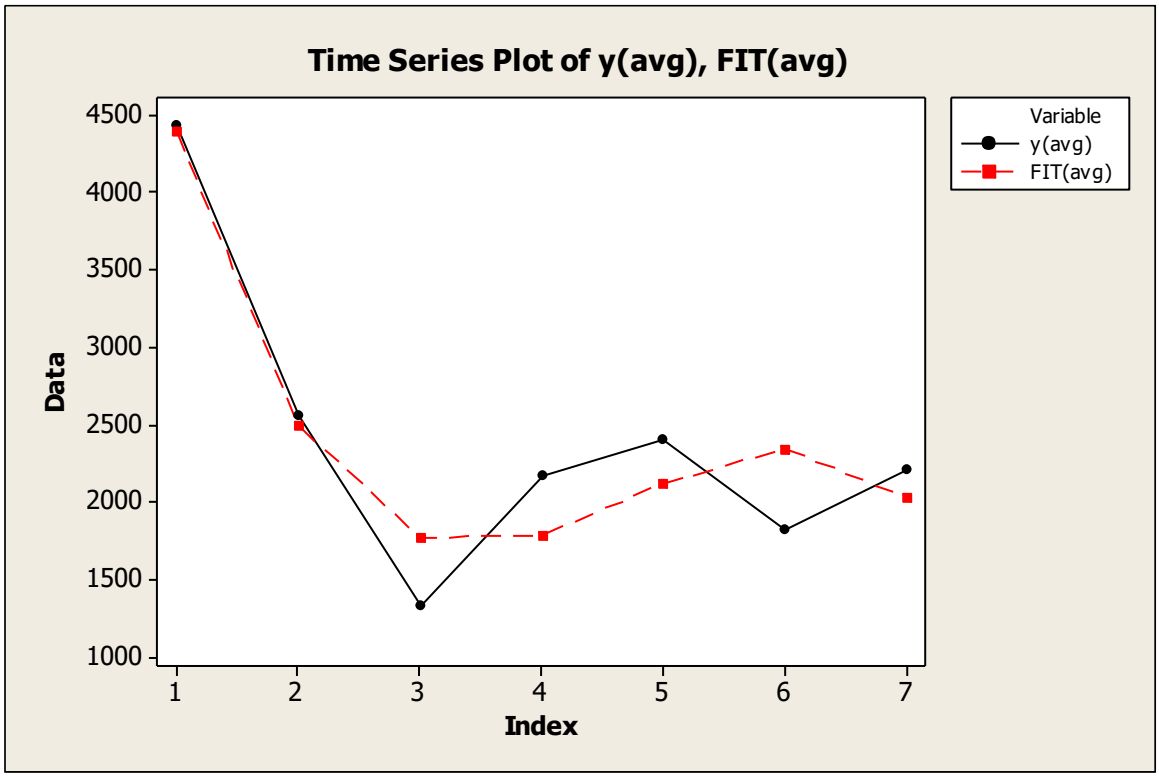

Polynomial Regression Analysis: y (avg) versus t (origin 2004 (t=0))

The regression equation is
y (avg) = 4388 - 2625 t + 799.5 t**2 - 71.27 t**3

S = 491.984 R-Sq = 87.2% R-Sq (adj) = 74.5%

Here R-Sq is quite high.

4. DISCUSSION

Among the fourteen migratory birds observed, the Bar - headed Goose is the highest flying bird. Greylag Geese and Bar - headed Geese are almost exclusively vegetarian (Ali and Ripley, 2001) whereas the other twelve species of migratory birds are almost omnivorous. Common Pochard, Tufted Duck, Ferruginous Pochard and Red-crested Pochard are the diving ducks which feed by diving beneath the surface of the water. Except these 4 pochards, all other observed migratory ducks like Eurasian Wigeon, Falcated Teal, Common Teal, Garganey etc. are the dabbling ducks which feed primarily along the surface of the water.

In case of Purbasthali wetland, diminishing linear trend is the best fitted trend equation. If the present situation persists, it can be predicted that approximately after 6.5 years there will be no migratory birds in Purbasthali wetland which is indeed a very alarming situation. This is due to extensive growth of water hyacinth and human disturbances in this particular wetland.

ACKNOWLEDGEMENTS

The author acknowledges University Grant Commission, India for financial support of this work.

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