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EFFECTS OF METEOROLOGICAL FACTORS ON WATER BIRDS FLUCTUATION IN POINT CALIMERE WILDLIFE SANCTUARY, SOUTHERN INDIA.

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ABSTRACT

We investigated the annual population fluctuations of waterbird density in the Great Vedaranyam Swamp of Point Calimere Wildlife Sanctuary, Southern India between 2004 and 2006. Totally 47 species of waterbirds were recorded between 2004 and 2006 in Point Calimere Wildlife Sanctuary. The metabolism, physiology and behaviour of aquatic organisms are directly related to the temperature of the aquatic environment. The variations in maximum temperature were significant across different years ($F= 63.97$; $P<0.001$) as well as months ($F= 70.11$; $P< 0.001$). The variation in minimum temperature showed the significant differences among years ($F= 26.63$; $P<0.001$) and also among months

(F= 49.55; P< 0.001) of the study period. The variations in rainfall were significant across different years (F= 2.47; P= 0.086), while the monthly variations were not significant (F= 8.70; P< 0.001) , during the study period. The variations in dry humidity were not significant among years (F= 3.20; P <0.042), while the monthly variations were significant (F= 12.98; P< 0.001) during the study period. The variations in wet humidity were not significant among years (F= 1.79; P= 0.168); but the monthly variations were significant (F= 6.21; P<0.001) during the study period. The variations in humidity did not show significant differences among the years (F= 0.68; P= 0.509) during the study period. On the other hand the monthly variations during the study period were significant (F= 22.94; P<0.001). To sum up, the variations in the meteorological variables viz., maximum and minimum temperature (°C), rainfall (mm), dry and wet humidity (%) and humidity (%) showed significant differences across months and on the other hand, only the maximum and minimum temperature and dry humidity showed significant yearly variations.

Keywords; water birds, Greater Flamingo, Humidity, Rainfall and Temperature.

I. INTRODUCTION

Knowledge of the species composition and diversity of migrant shorebirds is essential in the development of management and conservation strategies (Davis and Smith, 1998). These wetlands are especially important as wintering areas for water birds. Also, an appreciable number of bird species migrate annually from breeding sites in arctic Siberia via India to wintering grounds in Australia (Sampath and Krishinamurthy, 1989; 1990, Thiyagesan and Nagarajan, 1997) and these areas are critical for the continuance of migration and, ultimately, for the survival of many shorebirds (Myers, 1983). The Point Calimere (a Ramsar Site) Wildlife Sanctuary of Tamilnadu, Southern India is rich in avifaunal diversity. A total of 257 species of birds have been recorded from the Sanctuary of which 119 are water birds and 138 are landbirds (Ramsar Site Report, 2002). The wetlands of Point Calimere Wildlife and Birds Sanctuary are among the best feeding grounds for migratory waterbirds in the world (Balachandran, 2006). India. Hydrological features of the wetlands such as temperature (Sathe *et al*., 2001), water depth (Vijayan *et al*., 1990), pH (Nagarajan and Thiyagesan, 1996), dissolved oxygen (Wetzel and Likens, 1979), salinity (Sumathi *et al*., 2008) were regarded as the factors that could influence water bird species richness, diversity and density through their effects on the various aspects of floral and faunal composition of wetlands ecosystems.

II. STUDY AREA

Point Calimere Wildlife & Bird Sanctuary is located along the Palk Strait in three districts of Tamil Nadu: Nagapattinam, Tiruvarur and Thanjavur. The Point Calimere Wildlife and Bird Sanctuary is rich in both resident and migratory species of birds It lies in between 79.399 E & 79.884 E longitudes and 10.276 N & 10.826 N latitudes, covering an area of 38,500 hectares from Point Calimere in the east to Adirampattinam

in the west. The entire swamp belt is about 30km long and 9km wide. In total, it has an area of about 349 km^2. The Point Calimere Wildlife Sanctuary which was declared as a Ramsar Site on 19th August 2002. Bio-geographically this Ramsar Site is a mix of salt swamps, mangroves, backwaters, mudflats, grasslands and tropical dry evergreen forest. It was first identified as an area of high significance in the conservation of birds by the renowned ornithologist late Dr. Salim Ali in 1962 (Ali 1963). A total of 257 species of birds have been recorded from the sanctuary of which 119 were water birds and 138 landbirds (Ramsar Site Report 2002). . The extensive mud flats of swamp area have many variations of water quality depending upon the season, during monsoon time the whole swamp area experience wide variation of water quality depending upon the seasons. The swamp area is covered by fresh water in monsoon.

III. MATERIALS AND METHODS

3.1. Study Period and Seasons

Data were collected from January 2004 to December 2006. Four seasons namely Post-monsoon (January-March), Summer (April-July), Pre-monsoon (August and September) and Monsoon (October-December) of three successive years were classified to analyze the data.

3.2. Climatic Variables

Maximum and minimum temperature, rainfall, dry humidity, wet humidity and humidity were collected from the weather station of Chemplast (Chemical and Plastics Limited) in Point Calimere.

3.3. Temperature

Surface water temperature was measured by using hand held centigrade (°C) thermometer in all three stations 5cm below the surface water. Atmospheric temperature was measured 1m above the water surface. Bottom (mud) temperature was measured at 3.5cm deep in the mud **(**Danell and Sjoberg, 1982).

3.4. Meteorological Factors of Point Calimere

The variations in the maximum and minimum temperature (°C), rainfall (mm), dry and wet humidity (%) and humidity (%) across different months and seasons of the study period between 2004 and 2006 .

V. RESULT

4.1. Monthly Variations

4.2. Maximum temperature (°C)

Maximum temperature varied between 27.5 ± 0.27°C (in January) 2004 and 36.2 ± 0.28°C (in April 2006) during the study period. During 2004, maximum temperature was lowest in January with a mean value of 27.5 ± 0.27°C and highest in April with a mean value of 33.3 ± 0.11°C. Maximum temperature level was minimum in November with a value of 28.6 ± 0.45°C and maximum in May with a value of 34.0 ± 0.14°C during 2005. During 2006, maximum temperature ranged between 29.3 ± 0.25°C in January and 36.2 ± 0.28°C in April. The variations in maximum temperature were significant across different years ($F= 63.97$; $P<0.001$) as well as months ($F= 70.11$; $P< 0.001$) (Table.1).

4.3. Minimum temperature (°C)

Minimum temperature at the study area ranged between 24.1 ± 0.25°C (in January) 2006 and 29.4 ± 0.37°C (in April 2006) during the study period. During 2004, minimum temperature was minimum in January with the mean value of 25.3 ± 0.44°C and maximum in April with the mean value of 29.5± 0.15°C. In 2005, Minimum temperature was lowest in November with a value of 24.6 ± 0.22°C and highest in August with the value of 28.7 ± 0.21°C. During 2006, minimum temperature varied between 24.1 ± 0.25°C in January and 29.4 ± 0.37°C in April. The variation in minimum temperature showed the significant differences among years ($F= 26.63$; $P<0.001$) and also among months ($F= 49.55$; $P< 0.001$) of the study period. (Table 1)

4.4. Rainfall (mm)

There was no rainfall in, April and July in all the three years and also during February 2004, May 2005 and 2006. In all the three years of study, rainfall was lowest in January 2004 with the value of 0.1 ± 0.10mm and highest in October 2004, 2005 August 2006 with the value of 21.4 ± 6.47mm. During 2004, rainfall level ranged between 0.1 ± 0.10mm in January and 21.4 ± 6.47mm in October. In 2005, rainfall level was minimum in March with the value of 0.1 ± 0.08mm and maximum in November with a mean value of 17.6 ± 6.69mm. During 2006, rainfall varied from 0.1 ± 0.10mm in August to 18.9 ± 5.96mm in November. The variations in rainfall were significant across different years ($F= 2.47$; $P= 0.086$), while the monthly variations were not significant ($F= 8.70$; $P< 0.001$) during the study period. (Table 1),

4.5. Dry humidity (%)

In all the three years of study, dry humidity varied from 26.3 ± 0.68% (in November 2006) to 31.4 ± 0.12% (in April 2004). During 2004, dry humidity level was lowest in February with the value of 26.8 ± 0.46% and highest in April with the value of 31.4 ± 0.12%. Dry humidity ranged between 26.5 ± 0.46% in November and 30.7 ± 0.16% in August 2005. During 2006, dry humidity was minimum in November with a value of 26.3 ± 0.68% and maximum in August with a mean value of 30.7 ± 0.24%. The variations in dry humidity were not significant among years ($F= 3.20$; $P <0.042$), while the monthly variations were significant ($F= 12.98$; $P< 0.001$) during the study period. (Table.1)

4.6. Wet humidity (%)

Wet humidity level was lowest in January 2004 (24.3 ± 0.44%) and highest in April 2004 (27.4 ± 0.49%) during the study period. During 2004, wet humidity varied from 24.3 ± 0.44% in January to 27.4 ± 2.0.49% in April. Wet humidity was minimum in February with a mean value of 24.4 ± 0.22% and maximum in September with a mean value of 27.2 ± 0.16% in 2005. During 2006, wet humidity ranged between 24.7 ± 0.55% in February 2006 and 26.1 ± 0.52% in September and October. The variations in wet humidity were not significant among years (F= 1.79; P= 0.168); but the monthly variations were significant (F= 6.21; P<0.001) during the study period. (Table 1)

4.7. Humidity (%)

Humidity level varied between 65.3 ± 2.29% (in February 2004) to 87.5 ± 1.59% (in November 2006) during the study period. During 2004, humidity was lowest in February with a mean value of 65.3 ± 2.29% and highest in October with a mean value of 85.2 ± 1.43%. Humidity ranged between 68.7 ± 1.40% in February and 86.3 ± 1.48% in November 2005. During 2006, humidity was minimum in March with a mean value of 71.3 ± 0.87% and maximum in November with a mean value of 87.5 ± 1.59%. The variations in humidity did not show significant differences among the years (F= 0.68; P= 0.509) during the study period. On the other hand the monthly variations during the study period were significant (F= 22.94; P<0.001) (Table 1) .

V. DISCUSSION

Burger (1984) emphasized that year, time of the day and day length are temporal factors that could affect shore birds which influence the total amount of feeding time or type of feeding behaviour. According to Barruel (1973) there is never an entirely stable population, even if seasonal fluctuations resulting from births are taken into account. In normal condition the variations from one year to another are always slight, but in exceptional circumstances, such as an unusually hard winter, produce considerable modification to the populations. Weller (1979) had also stated that wetland species especially birds seem to have adapted to natural instability of their substrate by population shifts on either a year-to year or long term basis. Seasonal variations in water bird population, abundance and diversity had been reported for other wetlands in different parts of India as well (Hussain *et al*. 1984, Ali 1986, Vijayan 1986, 1988; Sampath and Krishnamurthy 1993). To sum up, the variations in the meteorological variables viz., maximum and minimum temperature (°C), rainfall (mm), dry and wet humidity (%) and humidity (%) showed significant differences across months and on the other hand, only the maximum and minimum temperature and dry humidity showed significant yearly variations.

Table 1: Monthly[a] variations in different meteorological factors of the study period (2004-2006) at the swamp of Point Calimere Wildlife and Bird Sanctuary, Tamilnadu, Southern India. Values are Mean ± 1 SE.

Meteorological factor	Year	Jan	Feb	Mar	Apr	May	July	Aug	Sep	Oct	Nov	Dec	ANOVA			
													Month		Year	
													F	P	F	P
Maximum Temperature (°C)	2004	27.5± 0.27	28.8± 0.32	30.6± 0.41	33.3± 0.11	31.3± 0.18	31.9± 0.21	32.8± 0.48	31.3± 0.35	29.9± 0.30	29.9± 0.36	29.9± 0.19	70.11	0.001**	63.97	0.001**
	2005	30.1± 0.19	31.2± 0.23	32.1± 0.15	33.7± 0.12	34.0± 0.14	33.8± 0.19	33.6± 0.18	32.8± 0.15	32.1± 0.26	28.6± 0.45	29.9± 0.36				
	2006	29.3± 0.25	30.5± 0.21	33.4± 0.39	36.2± 0.28	35.1± 0.17	34.5± 0.19	32.2± 0.33	32.1± 0.25	32.5± 0.56	30.2± 0.14	30.2± 0.12				
Minimum Temperature (°C)	2004	25.3± 0.44	25.8± 0.27	28.7± 0.25	29.5± 0.15	28.4± 0.15	28.6± 0.21	27.8± 0.48	27.5± 0.38	27.2± 0.28	26.3± 0.27	26.9± 0.28	49.55	0.001**	26.63	0.001**
	2005	25.9± 0.23	26.9± 0.16	28.6± 0.35	28.4± 0.25	28.2± 0.20	28.5± 0.18	28.7± 0.21	28.2± 0.14	27.8± 0.22	24.6± 0.22	24.8± 0.27				
	2006	24.1± 0.25	24.6± 0.25	26.7± 0.26	29.4± 0.37	28.1± 0.18	28.3± 0.19	28.2± 0.18	27.1± 0.26	26.6± 0.56	25.2± 0.22	25.2± 0.32				
Rainfall (mm)	2004	0.1± 0.10	0	1.1± 1.14	0	5.2± 3.41	0	0.2± 0.14	0.7± 0.45	21.4± 6.47	15.0± 5.79	2.5± 1.59	8.70	0.001**	2.47	0.086
	2005	0.1± 0.08	0.2± 0.18	0.3± 0.34	0	0	0	0.2± 0.17	0.8± 0.50	0.4± 0.20	17.6± 6.69	1.8± 1.39				
	2006	0.2± 0.06	0.4± 0.26	3.2± 3.06	0	0	0	0.1± 0.10	0.5± 0.40	11.2± 5.79	18.9± 5.96	2.1± 1.45				

Table.1 Contd…

[a]During June no data collection was done because the swamp was dry in all the years of the present study period.

*P < 0.05; ** P<0.01

Table .1 Contd…

Meteorological factor	Year	Jan	Feb	Mar	Apr	May	July	Aug	Sep	Oct	Nov	Dec	ANOVA	
													Month	Year

													F	P	F	P
Dry Humidity (%)	2004	27.3± 0.29	26.8± 0.46	29.4± 0.33	31.4± 0.12	29.9± 0.27	29.8± 0.19	30.5± 0.29	29.5± 0.35	28.4± 0.40	27.4± 0.35	27.1± 0.23	12.98	0.001**	3.20	0.042
	2005	27.9± 0.35	28.5± 0.37	29.9± 0.21	29.9± 0.36	30.1± 0.17	30.4± 0.18	30.7± 0.16	30.1± 0.20	29.9± 0.58	26.5± 0.39	28.3± 0.49				
	2006	28.7± 0.63	28.4± 0.66	28.5± 0.63	28.5± 0.59	30.0± 0.17	30.6± 0.18	30.7± 0.24	30.2± 0.10	29.1± 0.56	26.3± 0.68	28.6± 0.82				
Wet Humidity (%)	2004	24.3± 0.44	26.3± 1.26	26.0± 0.34	27.4± 0.49	27± 0.27	25.9± 0.29	26.0± 0.40	26.2± 0.34	26.4± 0.25	25.6± 0.22	24.5± 0.20	6.21	0.001**	1.79	0.168
	2005	24.5± 0.28	24.4± 0.22	26.3± 0.29	26.9± 0.32	26.7± 0.18	26.2± 0.19	26.7± 0.21	27.2± 0.16	26.6± 0.21	24.8± 0.28	25.2± 0.42				
	2006	25.3± 0.55	24.7± 0.55	24.8± 0.56	24.9± 0.53	25.5± 0.16	25.9± 0.18	26.0± 0.12	26.1± 0.48	26.1± 0.52	25.3± 0.56	25.7± 0.80				
Humidity (%)	2004	72.3± 4.18	65.3± 2.29	75.2± 0.88	75.5± 0.92	79.0± 1.44	71.9± 1.77	68.8± 1.65	73.3± 1.42	85.2± 1.43	84.9± 1.65	77.9± 1.50	22.94	0.001**	0.68	0.509
	2005	72.7± 1.32	68.7± 1.40	73.2± 1.26	73.3± 1.46	77.0± 1.50	74.0± 1.65	71.4± 1.61	79.0± 0.85	78.7± 0.93	86.3± 1.48	76.7± 0.79				
	2006	75.8± 0.82	71.8± 0.72	71.3± 0.87	72.4± 0.81	73.2± 0.85	73.3± 0.88	72.6± 1.18	77.5± 1.28	77.1± 2.04	87.5± 1.59	77.0± 1.39				

[a]During June no data collection was done because the swamp was dry in all the years of the present study period.

*P < 0.05; ** P<0.01

REFERENCE

Ali, S. 1963. Point Calimere as a refuge for Wintering Shorebirds. *J. Bombay Natural History Society,* 60:458-460.

Ali, S. 1986. Studies on the movement and population structure of Indian Avifauna: Annual Report. Bombay Natural History Society, Bombay.

Balachandran, **S.** and Dasfidar, D.G. 2006. *Restoration of Point Calimere (The Great Vedaranyam Swamp), A designated Ramsar site for the Benefit of Fisheries and Migrant water birds.* Progress report, Bombay Natural History Society, Bombay.

Danell, K., and Sjoberg, K. 1982. Seasonal and diel changes in the feeding behaviour of some dabbling duck species on a breeding lake in northern Sweden. *Ornis Scand*. 13: 129-134.

Davis, C.A. and Smith, L.M. 1998. Ecology and management of migrant shorebirds in the Playa Lakes region of Texas. *Wildlife Monograph* 140: 1–45.

Hussain, S.A., Mohapathra, K. K., and Ali,S. 1984. Avifauna profile of Chilka Lake. A case for conservation. Technical Report No.4. Bombay Natural History Society, Bombay.

Myers, J.P. 1983. Conservation of migrating shore birds: staging areas, geographic bottle necks, and regional movements. *American Birds* 37: 23–25.

Nagarajan, R. and Thiyagesan, K.1996. Waterbirds population and substrate quality of Pichavaram Wetlands, Southern India. *Ibis* 138:710-721.

Ramsar Site Report. 2002. Information sheet on Ramsar wetlands (RIS). Categories approved by recommendations 4.7 of the Conference of the Contracting Parties. Extracted from http://www.wetlands.org/reports/ris/2IN015en.pdf.

Sampath, K. and Krishnamurthy, K. 1989. Birds of Pichavaram Mangroves and the adjoining coastal Environs. *J.Ecol.Sci.*6; 24-38.

Sampath, K. and Krishnamurthy, K. 1990. Birds fauna and limnology of the Koliveli tank, Tamilnadu. pp 47-48. *In* Proc. Seminar on wetland ecology and management, Bombay Natural History Society. Keoladeo National Park, Barathpur, 23-35, February 1990. 154pp.

Sampath, K. and Krishnamurthy, K. 1989. Birds of Pichavaram Mangroves and the adjoining coastal Environs. *J.Ecol.Sci.*6; 24-38.

Sathe, S., Suresh, A., Milind, K. and Hujare, S. 2001. Hyrobiological studies on two man made reservoirs form Targaon Tahsil (Maharashtra), India. Eco, *Env. And Cons*. 72: 211-217.

Sumathi,T., Nagarajan, R. and Thiyagesan, K.2008. Effect of water depth and salinity on the population of Greater Flamingo (*phoenicopterus ruber*) in Point Calimere wildlife and bird sanctuary, Tamilnadu, southern India. *J. Sci. Trans. Environ. Technov.* 2: 9-17.

Vijayan, V.S. 1986. On conserving the bird fauna of Indian wetlands. *Proc. Indian acad. Sci. (*Anim. Sci/Plant Sci.) Suppl; 91-101.

Vijayan, V.S., Lalitha, V., Sritharan, U., Ramachandran, N.K., Bhupathy, S. and Sivasubramaniyan, C. 1990. Comparative abundance of waterfowl in Keoladeo Natinal Park.Pp 115. *In*: Proc. of seminar on wetland ecology and management Bombay Natural History Society, Keoladeo Park Bharatpur, 23-25 February, 1990. 154pp.

Weller, M.W. 1979a. Wetland habitats. Pages 210-234 *In* Wetland Functions and values; the state of our Understanding(eds). Greeson. P. E., Clark, J. R. and Clark, J.E. *Am. Water Resour. Assoc.* 674pp.

Wetzel, R.G. and Likens, G.E. 1979. Limnological analysis. W.B. Sunders Co., Philadelphia.