

(III)

PELICAN (*PELICANUS PHILIPPENSIS*) MIGRATION LINKED TO MONSOON WIND DIRECTION

Introduction

Pelicans (*Pelicanus philippensis*), long distant migrant birds arrive between October and December to South East Coast wet lands of South India Viz. Nelapattu bird sanctuary (Nellore District) Uppalapadu (Krishna District) Vedamthangal sanctuary, Tamil Nadu (Balachandran, 1995; Nanda Kumar *et al.*, 2010; 2012). A five year study was conducted choosing Nelapattu Bird sanctuary as model study being one of the biggest pelicanary. Sharma and Raghaviah (2002) showed relationship between rainfall and pelicans of Nelapattu. Further detailed exploration was made by Nanda Kumar *et al.* (2009) for three years from 2006 to 2009 on rainfall amounts and pelican numbers showing statistical I association (Nanda Kumar *et al.*, 2012). Several navigation causes are suggested for migratory activity of long distant birds from feeding grounds to breeding grounds and vice-versa. But no attempt was made or literature is very very meagre on linking migration of pelicans to wind direction and pattern during vigorous monsoon activity of South India. Whether this seasonal wind direction during monsoon is one of the major facilitative factor for inducing migration is being examined. Nelapattu bird sanctuary was chosen as model for study. It is reported that pelicans arrive from South East Asian Countries and were spotted in Thailand, Philippines, Indonesia, Sumatra, Vietnam Myanmar, Cambodia (Scott, 1989; Kosel, 1999; Avian web.com, 2012). Satellite weather maps showing clear wind direction from South East of Bay of Bengal and North East Asia to South India coastal areas during October – December and in reverse direction i.e. from South East Coast towards North East and towards east of Bay of Bengal (April/May/June) is presented. The satellite weather maps are retrieved for the period from 2009 to 2013, the rain fall amounts, wind directions, and pelican numbers are recorded choosing Nelapattu bird sanctuary as study site and is discussed below.

Material and Methods

The long distant migrant bird was identified as *Pelicanus philippensis* which alight, roost and breed in Nelapattu bird sanctuary (Nanda Kumar *et al.*, 2009 a, b; 2012). The pelican numbers were counted between 5.00 PM and 6.30 PM in the bird sanctuary using binoculars monthly wise (October – December and April – June) (Nanda Kumar *et al.*, 2009 a, b; 2012). Rainfall amounts along South coastal wet lands was measured at

Vijayawada, Kavali, Nellore, Chennai and its mean value is taken as monsoon rains are spread south coastal wet land areas and not localised. Rainfall amounts were noted from India Meteorological Department as reported early (Nanda Kumar *et al.*, 2009 b; 2012). The satellite weather maps published by Indian Meteorological Department, (Imd. Gov. in and weather – Forecast. Com. Maps / India retrieved and published by www.sakshi.com was adopted and reported early (Nanda Kumar *et al.*, 2009 b; 2012). The use of INSAT weather maps and its advantages were well explained (Nanda Kumar *et al.* (2001; 2008; 2009 a, b, c; 2012).

Results and Discussion

The pelican numbers, arrival dates, wind direction and rain fall amount is given in Table 1. for the years 2006-13. The figure delineates the satellite weather map with wind direction during north east monsoon i.e. October to December and also reversed wind direction during April/May for five years (2009-13). One map each is chosen as representative map among 90 maps (October to December 60 maps (April/May). In this context it is very apt to refer research work of Tucker and Schmidt-Koenig (1971) in different context. They affirmed that birds during flying choose air speeds (velocity) and direction that minimise their power expenditure. Based on these observations it is opined that the long distant migratory birds pelicans might also make use and override wind direction and its velocity for flight with less expenditure of energy. The present work gets support from Tucker and Schmidt-Koenig (1971) who affirmed by studying flight speeds of birds in relation to energetics and wind direction. This might be applicable in the case of pelican migration to South East Coast wet lands of India. It is opined that similar migratory pattern is also applicable to long distant migratory birds other than pelicans too. This may be the secret behind very long distance ranging thousands of kilometres migration of migratory birds with least energy expenditure. Substantial supporting evidence also comes from the work of Balachandran (2012) who have shown in different context the migratory route of bar headed goose through satellite tracking which showed a route from South East Coast to North East of Indian Peninsula in May / June. These months i.e. May and June satellite weather maps showed wind direction from South East to North East direction (Fig. 1) The map shows wind direction beyond Bay of Bengal and toward South East Asia. A valid point to note. Evidently pelicans vacate

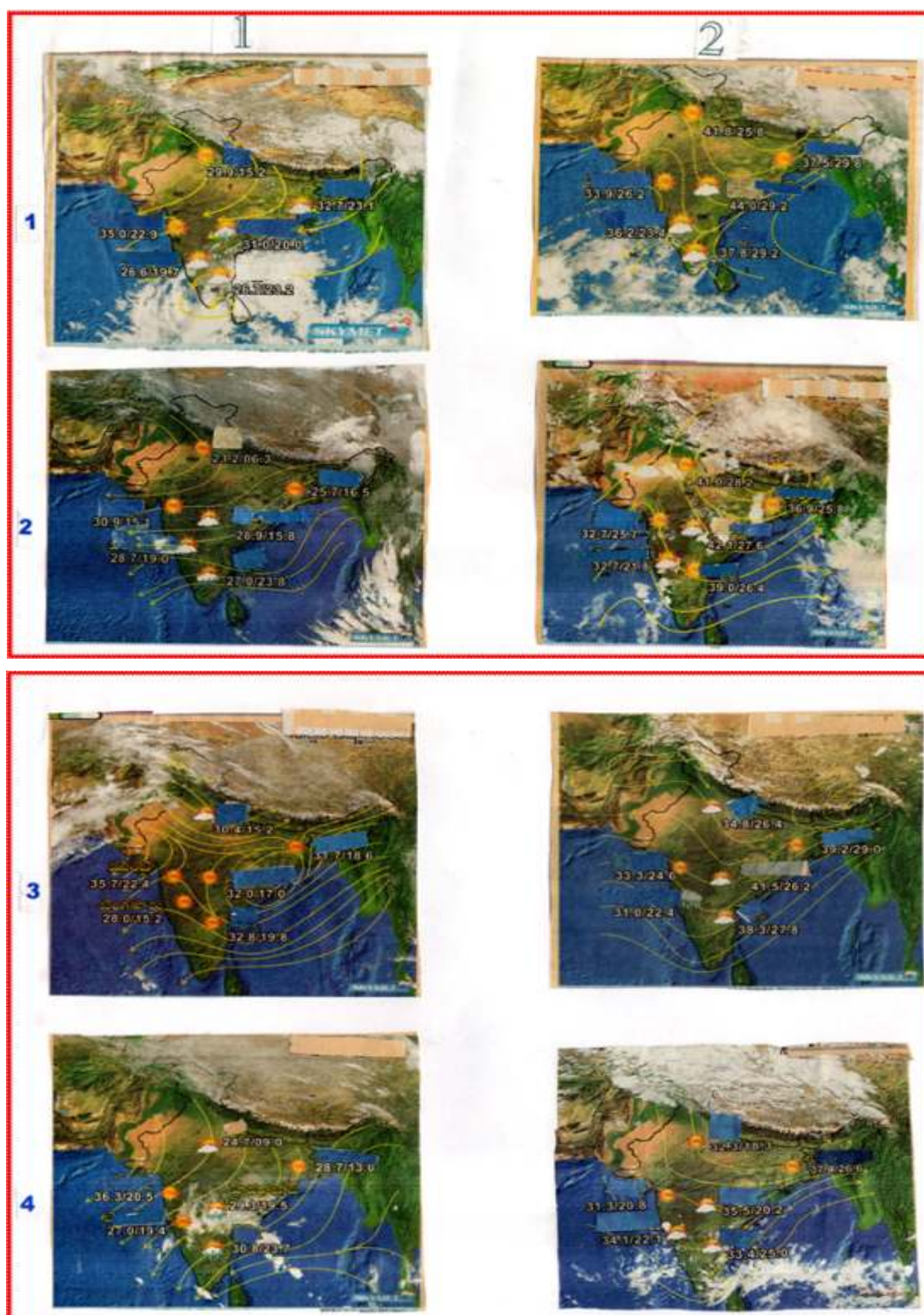


Fig 1: The vertical row 1 represents INSAT weather map showing direction of wind indicated by arrows from North East and Eastern side of Bay of Bengal towards South Coastal regions of Indian Peninsula during November-December for the years 2009 to 2013. The vertical row 2 represents INSAT weather map showing direction of wind in the opposite direction indicated by arrows from South East Coastal regions towards North East and East of Bay of Bengal during April / May / June. The maps are model representative of above mentioned months chosen among hundreds of every day weather map. The below weather maps recorded on following dates: vertical row I and II November 7th 2009 and 13-5-2010; 15-12-2010 and 15-5-2011; 10-11-2011 and 10-5-2012; 6-12-2012 and 3-4-2013 respectively. The numerals indicate maximum and minimum temperatures (°C) clock wise New Delhi, Kolkata, Hyderabad, Chennai, Bangalore and Mumbai respectively.

Table 1: Correlation of Pelican (*Pelecanus philippensis*) migration and numbers to North East monsoon and rainfall amounts

	Premonsoon				North East monsoon season											
	September				October				November				December			
Week	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
RGTA (mm) (2006)	205.66	210.00	265	300.33	22.66	23.66	43.00	384.66	473	537	701	702	705	719	719	724
Pelican numbers	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	200	540	750	800	800	800
RGTA (mm) (2007)	443	443	452	501	1.66	2	26.33	647	728	728	751	755	766	783	871	878
Pelican numbers	Nil	Nil	Nil	Nil	200	200	200	500	500	1326	1350	1360	1360	1370	1400	1405
RGTA (mm) (2008)	241	262	268	328	0	36	182	328	328	332	372	690	714	719	719	719
Pelican numbers	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	506	542	542	542	542	632	910	964
RGTA (mm) (2009)	234	234	237	277	1.5	2	2	45	374	557	609	623	703	716	770	798
Pelican numbers	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	7	576	1008	1013	1258	1309	1340	1346
RGTA (mm) (2010)	469	497	519	537	40	50	75	93	449	543	629	661	724	767	803	803
Pelican numbers	2	2	2	2	2	170	1028	1598	1587	1579	1580	1580	1580	1586	1584	1596
RGTA (mm) (2011)	---	---	---	211	---	---	---	491	---	---	---	910	---	---	---	1150
Pelican numbers	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	750	Nil	Nil	Nil	1590
RGTA (mm) (2012)	---	---	---	214	---	---	---	491	---	---	---	946	---	---	---	1151
Pelican numbers	Nil	Nil	Nil	Nil	Nil	Nil	Nil	650	Nil	Nil	Nil	920	Nil	Nil	Nil	1250

RTGA (Rainfall graded total amount)

Rainfall: Mean rain amounts of Chennai, Nellore and Kavalai covering 200 km South East coast of the Bay of Bengal

Table 2: Departure of pelicans (Adults and Chicks) from Nelapattu bird sanctuary during March to May 2012 when wind direction is favourable i.e. South East to North East

Month	Date	Pelican Numbers (Adults and Chicks)
March	24 th	1900
March	27 th	1200
March	28 th	1100
April	17 th	500
April	21 st	389
April	28 th	125
May		NIL

Nelapattu Bird Sanctuary and emigrate in April / May in batches (Table 2). Interestingly Kosal (1999) reported that in May / June Ton Le Sap lake of Cambodia expands from 2500 km² to 13000 km² facilitating arrival of 431 species bird including pelicans as feeding ground and also from other south east Asian countries. Ton Le Sap is the biggest fresh water lake in South East Asia (Kosal, 1999). The

Pelican departure numbers in April / May is given in Table 2. Based on above observations it is proposed that (a) pelicans migration is facilitated by seasonal monsoon winds, their direction and pattern (b) pelican numbers depended up on rain fall amounts and graded Pelian numbers and graded rainfall as per earlier report (Nanda Kumar, 2009) (c) east to west direction in Bay of Bengal and north east to south east in November / December bring pelicans and opposite wind direction west to east in Bay of Bengal and south east to north east facilitate departure (d) physical changes ocean atmospheric dynamics over Indian ocean and Bay of Bengal seem to be predisposed factors for bird migration (e) the flight speed and energy seem to be minimised when pelicans take migratory flight during monsoon. It is well established historical knowledge that the monsoon winds were designated as "Trade winds" helpful in sea navigation for both departure and arrival which was made use by migratory birds much before humans evolved.

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