

Population trend of wintering terns at a stop-over site in Central Asian Flyway with special reference to the decline of Sandwich Tern

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Abstract: Because tern species are nomadic, changes in their populations can be mistaken for local colony shift or vice versa. As a result long-term observations on tern populations are needed in order to understand fluctuations in population trends. Given this need, we evaluated the population trends of wintering tern species at a stop-over site in the Central Asian Flyway, the Kadalundi-Vallikkunnu Community Reserve (KVCR), from 2005 to 2012 along the South-West coast of India. A total of ten tern species were identified, with some exhibiting fluctuations in their abundances. Sandwich Terns (*Thalasseus sandvicensis*), despite their status as a regular visitor in KVCR in 1989, declined sharply in abundance in the reserve, but increased in two adjacent locations, the Kannur and Manjeswaram beaches. These findings suggest that Sandwich Terns shifted their foraging ground from KVCR to adjacent habitats. Possible reasons for this shift include displacement of Sandwich Terns by the increasing abundance of Common Terns (*Sterna hirundo*) and Little Terns (*S. saundersi*), the lack of potential prey species availability, increased anthropogenic disturbance, and increased predator presence in the reserve.

Key words: India, Kadalundi-Vallikkunnu Community Reserve, Sandwich Tern.

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Introduction

Many colonial seabird species evaluate their future habitats (breeding and feeding grounds) before making final site selection decisions. This exploratory behavior enables colonial birds to gather information on habitat quality (e.g., predator abundance, foraging opportunities) and disturbances in order to optimally select a site (Fijn *et al.* 2014). Owing to disturbances and deterioration in

habitat quality, many habitats have been abandoned (sometimes transiently) by seabird populations around the world (Cadiou *et al.* 1994; Dittmann *et al.* 2007; Ratcliffe *et al.* 2000; Stienen 2006; Votier *et al.* 2011). Thus, seabirds may serve as ecological indicators of habitat quality.

Terns are one group of seabirds that assess the quality of their habitat and make selections accordingly (Fijn *et al.* 2014). Being colonial in nature, the abandonment of a habitat or even a

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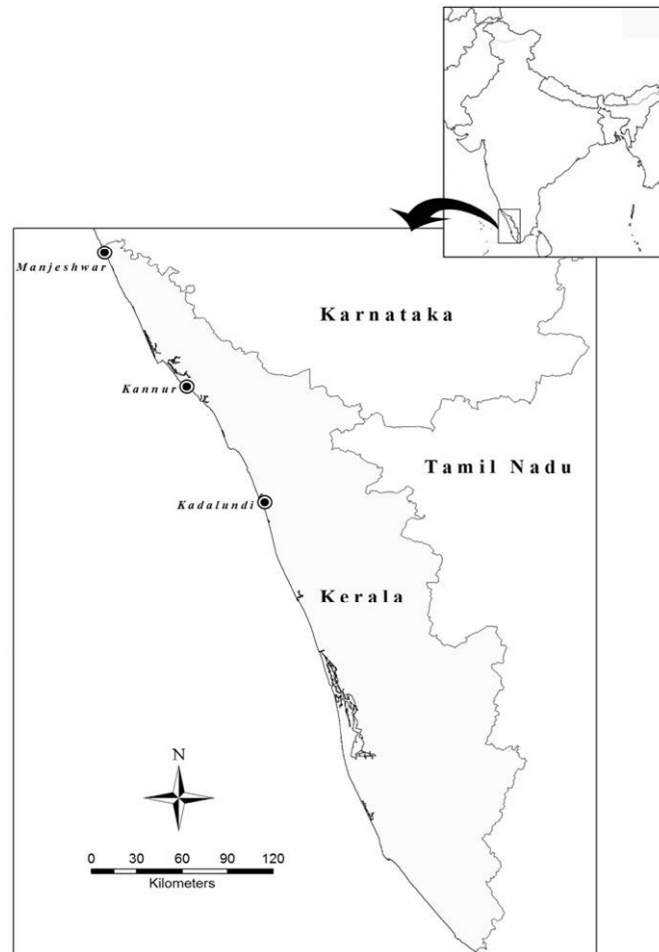


Fig. 1. Map of the three study areas located in southwest India.

Table 1. Location details of three important wintering grounds of Sandwich Tern in northern Kerala.

	Kadalundy-Vallikkunnu Community Reserve	Kannur coast	Manjeshwaram coast
Latitude – Longitude (Degree decimals)	11.127 & 75.827	11.8689 & 75.3524	12.7224 & 74.8792
Protection status	Community Reserve	Non-protected coastal area	Non-protected coastal area
Major wetland type	Mangrove, mudflats and sandy beach	Rocky area, 20 meter away from sea shore. About 50 meters long, scattered rocks are major habitats	Sandy beach with scattered rocks
Prominent threats	Sand mining, coir retting, indiscriminate fishing, poultry waste dumping, developmental activities such as construction of over- bridges	Developmental activities, particularly, construction of resorts and residents	Sand mining, dumping of domestic, poultry and other slaughter houses wastes.
Extent of wetland area	8 hectare	1.5 km long of sandy beach with rocks	1.5 km long of sandy beach with rocks
Observation period	2005–2012	2008–2012	2008–2012

Table 2. Abundances of terns in KVCR between 2005 and 2012.

Species	2005–2006	2006–2007	2007–2008	2008–2009	2009–2010	2010–2011	2011–2012
Caspian Tern	5	4	10	1	2	2	0
Common Tern	0	27	1104	577	161	121	33
Gull-billed Tern	0	0	62	3	6	4	3
Little Tern	14	720	971	610	588	292	200
River Tern	0	0	16	14	2	1	1
Sandwich Tern	7	4	1	1	3	2	0
Sooty Tern	0	0	0	3	3	0	0
Whiskered Tern	1	0	16	88	10	8	5
Large Crested Tern	0	0	0	0	23	0	80
Lesser Crested Tern	0	0	0	0	97	142	67

transient colony shift by terns will result in complete absence of the species from a given location. However, because terns are nomadic and frequently shift colony locations (Stienen 2006) it is difficult to determine population trends and evaluate the impact of disturbances on their populations. As a result real population declines could be mistaken for local colony shifts. Hence, there is a need for long-term observations on tern populations in order to understand if populations are changing in numbers or simply locations.

Despite the fidelity shown by tern populations to their natal colonies, significant fluctuations do occur in their congregations. These fluctuations are apparently linked to changes in numbers at adjacent colonies (Lloyd *et al.* 1991). Even though some fluctuations cannot be attributed to any specific cause, a primary reason for many colony shifts is increasing predation pressure (Noble-Rollin & Redfern 2002; Ratcliffe *et al.* 2000; Stienen 2006).

On the west coast of India previous works on tern populations are mostly short term sighting reports (Ali and Ripley 1987; Ambedkar 1985; Lal Mohan 1986). However, Kurup (1991a) assessed the population fluctuation of terns for a three year period. Apart from few RAMSAR sites (for instance Kole Wetlands, Thrissur), periodic assessment in the west coast of India on the abundance of waterbirds is usually done only once a year (through the Asian Waterbird Census), and monitoring during the wintering months (February) is not conducted. Apart from these occasional surveys, a long term monitoring and assessment of tern populations in the west coast of India is lacking. Though such assessments are lacking, we noted an alarming decline in the Sandwich Tern (personal observation) at the Kadalundi-Vallikkunnu Community

Reserve (KVCR), in spite of their status of being a '*regular visitor in good numbers*' (Kurup 1991b). Given the lack of knowledge about tern populations in this region of the world and our observation of potential declines in Sandwich Terns, our goal was to assess the abundance and population trends of terns in a wintering ground along the west coast of India.

Methods

The reserve (KVCR) is located in the southern part of India (11°7'28"–11°8'01"N and 75°49'36"–75°50'20"E), at the mouth of the River Kadalundi (Table 1) that drains into Arabian Sea on the West Coast of Kerala. Before entering the sea, River Kadalundi divides into two channels encircling a small island. Because the reserve encompasses the Kadalundi estuarine wetland and is in the coastal region, it is an important wintering and stopover site for birds migrating through the southwestern India (Aarif *et al.* 2014; Uthaman & Namasivayan 1991). Furthermore, the reserve contains three types of potential habitats for avian settlements: 1) raised sandbars; 2) scattered patches of mangroves; and, 3) mudflats (Aarif *et al.* 2014). Besides the reserve, we also considered two regional locations that house terns, the Kannur and Manjeswaram sand beaches. These beaches are located on the southwest coast of India about 150 km and 300 km north of the reserve, respectively. Both these beaches are characterized by rocky areas away from sea shore (Table 1).

We conducted waterbird surveys in KVCR during the wintering months (September to April) for a seven-year period from September 2005 to May 2012 (a total of 63 months). Counts were done

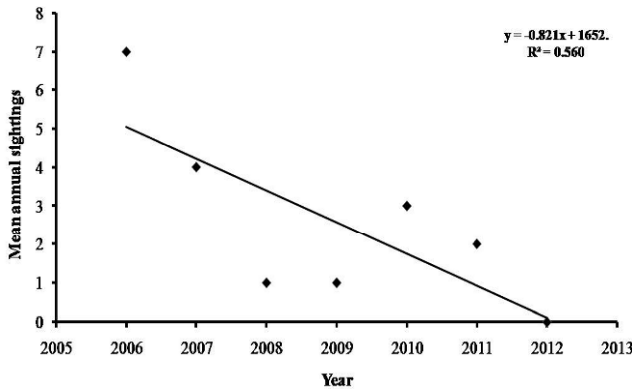


Fig. 2. Abundance trend of Sandwich Tern at KVCR during the study period (2005-2012).

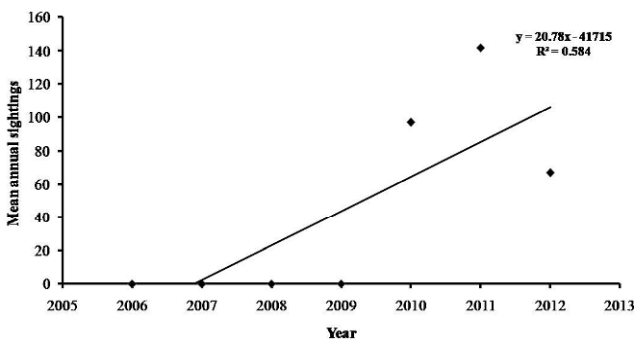


Fig. 3. Abundance trend of Lesser Crested Tern at KVCR during the study period (2005–2012).

weekly by three observers at three predetermined vantage points, one in each of the three habitat types of KVCR, resulting in 245 weekly surveys during the 63 months study period. All counts were made between 6:00 AM and 11:00 AM, using 10 × 50 binoculars. Care was taken to avoid double counting of birds. From 2008 to 2012, based on a reported increased sighting of Sandwich Terns, surveys were also conducted at Kannur and Manjeswaram beaches employing the same methodology. Weekly data were summed up to estimate annual abundance of terns in the three study sites and expressed as mean ± standard error. The variation in tern abundances were analysed using linear regression to evaluate trends over time using Microsoft Excel. A P value less than 0.1 and r^2 value greater than 0.5 were considered being significant.

Results

A total of ten species of terns were recorded from KVCR during the study period, including

Table 3. Abundance (Mean±SE) and change of selected terns in the KVCR.

Species	1985-1989*	2005-2012**	Change (%)
Whiskered Tern	65.25±6.86	18.29±11.80	-72
Little Tern	250.19±9.68	485.00±25.16	+94
Common Tern	8.04±1.04	289.00±155.03	+3495
Gull-billed Tern	1.52±.12	11.14±8.51	+633
Sandwich Tern	371.60±95.88	2.57±0.90	-99

*Mean annual sighting (from Kurup 1991a, b).

**Mean annual sighting (Current study).

Sandwich Tern, Caspian Tern, Common Tern, Gull-billed Tern (*Gelochelidon nilotica*), Saunders's Little Tern, River Tern (*S. aurantia*), Sooty Tern (*Onychoprion fuscata*) Large Crested Tern (*S. bergii*), Lesser Crested Tern (*S. bengalensis*) and Whiskered Terns (*Chlidonias hybrida*). Out of 6202 birds recorded during the study period, the most common were Little Terns (3395) and Common Terns (2023), whereas the least represented species was Sandwich Tern (10). All the tern species showed fluctuation in their abundances over the study period (Table 2). Sandwich Terns declined significantly ($P < 0.1$, $r^2 = 0.560$; Fig. 2) while Lesser Crested Tern increased significantly ($P < 0.05$, $r^2 = 0.584$; Fig. 3). No relationships were found for the other eight tern species.

Discussion

We found that tern abundances at KVCR fluctuated over the period of study. Specifically, Sandwich Tern declined while Lesser Crested Tern increased. Habitat degradation and loss have been correlated with regional population declines of Black Terns (Dunn & Agro 2009) and tern species in the eastern and mid-western United States of America have been found to relate to specific aspects of habitat suitability, including water levels, food resources, and predation pressure (Heath & Servello 2008; Maxson *et al.* 2007; Naugle *et al.* 2000; Stephens *et al.* 2015). These factors, along with tremendous anthropogenic pressure and a lack of potential prey species may be causing fluctuations in tern abundances in the KVCR (Aarif *et al.* 2014).

Comparing our results with the survey carried out by Kurup (1991a), it was evident that Common, Little and Gull-billed Terns have increased several folds whereas Whiskered and Sandwich Terns showed significant declines (Table 3). In particular, Sandwich Terns, which was noted as a common species during 1989 at KVCR (Kurup 1991b) showed a sharp decline during the present study. Large and Lesser Crested Terns were not recorded until 2009 and thereafter the wintering abundances of the Lesser Crested Tern was stable whereas that of Large Crested Tern showed fluctuations (Table 2).

Because of its high abundance in the KVCR, the Sandwich Tern is called “*Kadalundi ala*” in Kerala (in Malayalam ‘ala’ means tern). This historically high abundance was the triggering force to drive our interest in monitoring bird populations at KVCR, as more recent reports noted the absence of the species. Indeed, reports on African-Eurasian migratory water birds included Sandwich Terns and other terns in their list of birds requiring conservation action in the wintering and breeding grounds. Because, the numbers of terns at KVCR fluctuates strongly year-to-year it is critical to assess the species at multiple locations in the region. Thus, while Sandwich Terns have not been seen in high numbers at KVCR for the past seven years, they can still be seen regularly on the Kannur and Manjeshwaram beaches in northern Kerala (Fig. 4). Identifying the factors that may have led to these changes in KVCR are beyond the scope of this study, but possibilities include: (1) displacement by the increasing abundances of Common and Little Terns; (2) a shift in the foraging ground due to a lack of prey availability as a result of indiscriminate fishing or predator presence; (3) increased anthropogenic disturbance (Kurup 1991 b); and, (4) the presence of predators, such as Brahminy Kites (*Haliastur indus*), Black Kites (*Milvus migrans*), House Crows (*Corvus splendens*), Jungle Crows (*Corvus macrorhynchos*), dogs (*Canis familiaris*), cats (*Felis catus*) and people (Aarif 2008).

Prior to the declaration of the community reserve, hunting of large birds and illegal sand mining were reported as major threats to the wetland birds in the estuary (Aarif *et al.* 2011). Those activities played an important role in decreasing number in some of the wintering tern species. To mitigate these threats, several education programs have been organized in and around KVCR highlighting the conservation significance of the wetland and its biodiversity for the local people.

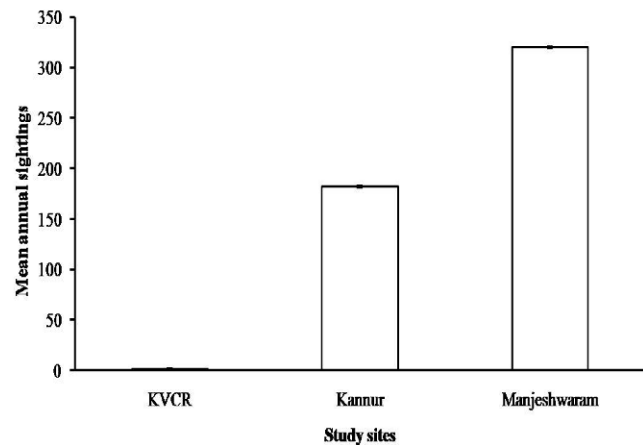


Fig. 4. Mean annual sightings of different terns along three study sites at the mouth of the River Kadalundi, Kerala.

These activities and the initiatives taken by the Ministry of Forest and Wildlife of the Govt. of Kerala lead to the formation of the KVCR in 2007. As a consequence of action, coconut husk retting (The process of soaking large bundles of coconut husks in tidal water to facilitate extraction of fibre by removing much of the cellular tissue through microbial decomposition. The fibre is then used for making natural rope) and poaching in KVCR were completely stopped. However, illegal sand mining is still occurring in the estuary, exerting tremendous pressure on the habitat and waterbirds. Furthermore, large quantities of poultry and slaughter house wastes are being deposited in this wetland and mangrove areas, which attracts predators, including dogs and raptors (Black Kite and Brahminy Kite). If this reserve is to be preserved, sand mining must be eliminated, and dumping of poultry wastes, and sewage disposal into the reserve, needs to be controlled. Further, conservation promotion programmes should focus on long-term protection of waterbirds and their habitats along the entire stretch of estuaries and coastal belt of Malabar, including the Kadalundi estuary.

One limitation of the present investigation is that it just looked at the trends of wintering terns at KVCR without considering the underlying causes. But, the inferences brought out from this study can be used as baseline information for further analysis on the status of migrant birds in the KVCR. Being an important stopover site in the Central Asian Flyway, any disturbances in KVCR may produce an impact on migrant bird population visiting the wetland.

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