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J. Exp. Zool. India Vol. 22, No. 1, pp. 209-214 2019 | www.connectjournals.com/jez | *ISSN 0972-0030*

HABITAT DEPENDED ON COASTAL AVIAN FAUNAL CHARACTERISTICS OF TUTICORIN, GULF OF MANNAR

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(Accepted 23 October 2018)

ABSTRACT : A study was conducted during the period January to December 2013 to assess the habitat and season wise variation in the density and diversity of coastal avian fauna of Tuticorin coast. Data were collected on a bi-monthly basis during the low tide and high tides at two artificial habitats like fly ash-laden dyke of Tuticorin Thermal Power Station (TTPS) and an evaporation pond of a salt pan. The diversity and density of coastal birds were comparatively higher at TTPS dyke than the salt pan pond. 12 species of coastal birds with a total count of 5111 individuals were sighted at TTPS dyke whereas ten species with a total number of 784 birds were reported from salt pan. Lesser Crested Tern was the most frequently observed bird with a mean density of 198.1±71.2 ind.count^{-1} at the TTPS dyke whereas Curlew Sand Piper was the dominant bird with a mean density of 20.42±4.7 ind.count^{-1} at the salt pan. Both the seasonal and tidal variation in the density of coastal birds sighted at two stations were not statistically significant (P>0.05). Because of the increased diminishing of natural wetland habitats in Tuticorin due to industrialisation, the study indicated the suitability of artificial habitats either for feeding or roosting of coastal birds in the region.

Key words : Avian fauna, density, habitat, tide, salt pan.

INTRODUCTION

Coastal birds are an integral part of the marine ecosystem, as they provide insights into ecosystem process and functions at various trophic levels. As a top predator, their long lifespan and migratory behaviours make seabirds as cost-efficient environmental samplers (Montevecchi *et al*, 1997; Piatt *et al*, 2007; Parson *et al*, 2008). Natural and artificial coastal wetlands serve as the primary habitat for migratory and resident species of coastal birds entirely or during a specific part of their life (Velasquez, 1992; Masero *et al*, 2000). There are 273 species of coastal birds have been reported from various wetland ecosystem in India (Ali and Ripley, 1983).

The bird congregations are affected by various factors such as food availability, the area of wetland (Paracuellos, 2006) and abiotic changes in the wetlands (Jaksic, 2004; Lagos *et al*, 2013). The coastal bird population has been dramatically impacted by the alterations and damages of the natural coastal wetlands (Goss-Custard *et al*, 1977; Goss-Custard and Moser, 1988). Hence, artificial wetlands also provide important feeding and roosting area for shorebirds as alternate foraging habitat (Pe´rez-Hurtado and Hortas, 1991).

Considerable information is available on the avian population of different parts of south India. Areas like Point Calimere (Ali, 1986; Ali and Hussian, 1982; Ali and Sugathan, 1985); Pitchavaram (Sampath and Krishnamurthy, 1990); Chilika (Hussian *et al*, 1984) and Pulicat Lakes (Vaithainathan and Pandian, 2012) have been extensively studied. Apart from the reports on the diversity of the avian fauna of wetlands of Tuticorin region (Sherly Cross *et al*, 2015), not much information is available on the population characteristics of coastal birds of Tuticorin. This manuscript will give insight into habitat and season wise variations in the diversity and density of coastal avian fauna of Tuticorin coast.

MATERIALS AND METHODS

The study was conducted during the period January to December 2013. Data were collected on the coastal avian faunal characteristics of two different artificial habitats of Tuticorin coast. Habitat-1 was the fly ash-laden dyke of Tuticorin Thermal Power Station (TTPS) - Lat. 8047'.380'N; Long. 078011'.161'E, in which, the fly ash deposition has filled up more than half of the portion of the dyke. The habitat-2 was an evaporation pond of a salt pan complex nearer to Karapad Bay -Lat.

8045'.912'N; Long. 078009'.669'E. Trips were conducted to these two habitats in the early morning hours on a bi-monthly basis during the low and high tides to assess the impact of tides on the avian faunal constituents.

Birds were counted using binoculars (8×400) following the 'direct count' method (Yates and Goss-Custard, 1991; Nagarajan and Thiyagesan, 1996; Urfi *et al*, 2005). A high zoom camera (Sony HX 100V) was used for bird watching, and the birds were identified using the standard referral keys (Grimmett *et al*, 2011; Baidya *et al*, 2017). The number of individuals encountered was immediately noted in a single flock and the density was calculated. The status of the birds as Common (C), Uncommon (UN), and Scarce (S) is based on the frequency of spotting. The birds were further categorised based on the migratory pattern as suggested by Vaithanathan and Pandiyan (2012). R–Resident- (the species found throughout the year); M – Migrants or (migratory species), which is again subcategorised as (winter migratory - (WM); monsoon migratory - (MM); local migratory - (LM) and passage migratory - (PM) were the group indicated.

Analysis of Variance Test (ANOVA) was used to analyze the effect of three variables *viz*. habitat, season and tidal impact on the bird's density. The differences were considered statistically significant at 5 and 1% levels and were run by SPSS -16 software.

RESULTS AND DISCUSSION

The list of coastal birds sighted at two study areas, and their status are given in Table 1. It has found that the diversity and density of coastal birds were comparatively higher at TTPS dyke than the salt pan area. 12 species of coastal birds comprising four orders, seven families and 12 genera were noticed at TTPS dyke whereas only ten species of coastal birds constituted by three orders, six families and ten genera were reported from salt pan pond. The majority (41.7%) of the shorebirds sighted in TTPS dyke belong to the order Ciconiformes, which include large-sized fish eating waders and stork varieties followed by medium-sized Charadriformes (25%) and 16.7% each of Pelicaniformes and Falconiformes. At salt pan habitat, 50% of the birds belong to Ciconiformes, followed by 30% of Charadriformes and 20% Pelicaniformes. The presence of two near-threatened species like Painted Stork (*Mycteria leucocephala*) and Spot-Billed Pelican (*Pelecanus philippensis*) was also noticed in both the study areas.

At TTPS dyke, a total count of 5111 individuals was sighted, whereas only 784 were sighted at salt pan dyke. Mainly eight species were noticed as the frequent visitors at the TTPS dyke. The medium-sized Lesser Crested

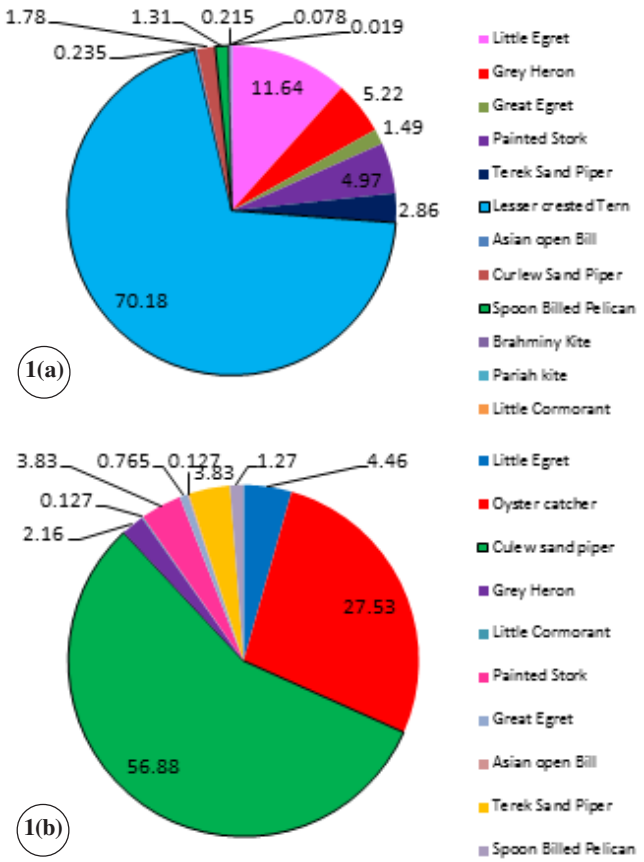

Fig. 1 : Relative percentage of coastal bird species sighted at (a) TTPS dyke (b) salt pan pond.

Tern was the most dominant and frequently observed bird (70.18%) (Fig. 1a). The Little Egret (11.64%) was the second major, and the Grey Heron (5.22%) was the third dominant birds. The Painted Stork (4.97%), Terek Sand Piper (2.86%), Curlew Sand Piper (1.78%), Great Egret (1.49%), and Spoon Billed Pelican (1.31%) etc. were noticed as the next frequent visitors to the site. Other birds like Asian Open Bill Stork, Brahminy Kite and Pariah Kite etc., were also seen on a few occasions (Fig. 1a). At the salt pan pond, six birds species were recorded as the frequent visitors. Of which Curlew Sandpiper (56.9%) followed by Oystercatcher (27.5%) were observed as the most frequent visitors (Fig. 1b). Other medium-sized birds like Little Egret (4.46%) Painted Stork (3.83%), Terek sandpipers (3.83%) and Grey Heron (2.16%) were less frequent to the salt pan pond. Birds like Great Egret, Little Cormorant, Asian Open Bill Stork and Spoon Billed Pelicans were also visited salt pan on a few occasions (Fig. 1b).

The study also indicated that coastal avian fauna in Tuticorin follows distinct habitat preference and zonation in their distribution. The dominance of smaller waders has been noticed at both the stations in the present study, indicating the suitability of these habitats either for roosting

Table 1 : List of birds and their status sighted in the study area (TTPS dyke and slat pan pond).

No.	Common Name	Scientific Name	Status	Category	IUCN Status	Occurrence at Site	
						TTPS dyke	Salt pan
1	Little Egret	*Egretta garzetta*	C	R	Least Concern	√	√
2	Grey Heron	*Ardea cinerea*	UN	LM	Least Concern	√	√
3	Great Egret	*Casmerodius albus*	C	R	Least Concern	√	√
4	Painted Stork	*Mycteria leucocephala*	UN	LM	Near Threatened	√	√
5	Asian Open Bill Stork	*Anastomus oscitans*	UN	LM	Least Concern	√	√
6	Terek Sand Piper	*Xenus cinereus*	S	WM	Least Concern	√	√
7	Curlew Sand Piper	*Calidris ferruginea*	S	WM	Least Concern	√	√
8	Lesser Crested Tern	*Thalasseus bengalensis*	C	WM	Least Concern	√	-
9	Spot Billed Pelican	*Pelecanus philippensis*	S	R	Near Threatened	√	√
10	Little Cormorant	*Phalacrocorax niger*	C	R	Least Concern	√	√
11	Oyster Catcher	*Haematopus ostralegus*	C	WM	Least Concern		√
12	Brahminy Kite	*Haliastur indus*	C	LM	Least Concern	√	-
13	Pariah Kite	*Milvus migrans*	C	R	Least Concern	√	-

C: Common, UN:Un Common, S: Scarce
R: Resident, M : Migratory, WM : Winter Migratory, MM : Monsoon Migratory, LM : Local Migratory, P : Passage Migratory.

or for feeding purpose of coastal waders. Similar observations of the dominance of smaller waders in mud flats of mangrove habitats have been reported (Prajapati *et al*, 2014). The availability of diverse macro-invertebrates in plenty of these habitats makes it attractive for the waders as a suitable feeding ground. Ramesh *et al* (2005); Gaglio *et al* (2015) indicated that area and abundance of prey organisms and water depth are essential criteria determining the congregation of birds in a habitat.

The dominance of resident species like Curlew Sand Piper and the Oyster Catchers in the salt pan areas and lesser crested tern in fly ash-laden dyke also indicated that these habitats had been utilised as feeding grounds for these birds. Pandyan *et al* (2014) also stated the dominance of Curlew Sand Piper in the salt pan area in their study and opined that the availability of chironomid larvae in the top surface sediments of salt pan areas attracts these smaller waders. These birds might have subsisted on the invertebrates larvae from top layers of the sediment using their relatively short beaks (Loyn *et al*, 2002). Moreover, these smaller coastal birds species are mostly limited in the depth range where they can feed based on their low body mass (Goss-Custard *et al*, 1977). Their high metabolic rate also might have made them to graze throughout the day (Fasola and Canova, 1993).

The seasonal fluctuations in the density of major birds sighted at the TTPS dyke is given in Fig. 2 (a,b,c,d). At the dyke, the majority of the birds like Lesser Crested Tern, Little Egret, Grey Heron, Terek Sand Piper, Curlew Sand Piper etc., were found congregated more during high tide than the low tide. Lesser Crested Tern was more dominant during the period January to May and was sighted even up to the most top count of 600 ind.count^{-1} with the highest mean density of 198.1±71.23 ind.count^{-1} during high tide (Table 2). During the low tide time, they sighted at a maximum density of 500 ind.count^{-1} and the mean density was 100.83±44.13ind.count^{-1}. The second dominant bird the Little Egret was prevalent more during March, April, November and December and was sighted with the highest density of 150 ind.count^{-1} during March. The mean density was 33.174±11.5 ind.count^{-1} and 17.9±5.5 ind.count^{-1} during high tide and low tide, respectively (Table 2). The Grey Heron was frequently observed during January to April with the highest density of 52 ind.count^{-1} during the low tide of July. The mean density was highest of 12.42±2.6 ind.count^{-1} during the high tide. Painted Stork was noticed at the highest density of 42 ind.count^{-1} during September and the distribution indicated less influence of tidal fluctuations. The mean density was 10.6±3.6 ind.count^{-1} each at both high and low tides respectively. Great Egret was sighted in unusual high numbers of 32 ind.count^{-1} with the most top mean density of 3.92 ind.count^{-1} during the low tide. A unique high congregation of Asian Open Bill Stork and Spot Belled Pelican at a higher density of 67ind.count^{-1} each was noticed during December months. Both the seasonal as well as high tide and low tide variation in the density of all avian species sighted at TTPS dyke was statistically insignificant (P>05).

In the salt pan area, the dominant two coastal bird species, Curlew Sand Piper and Eurasian Oyster Catcher were found congregated more during high tide. The

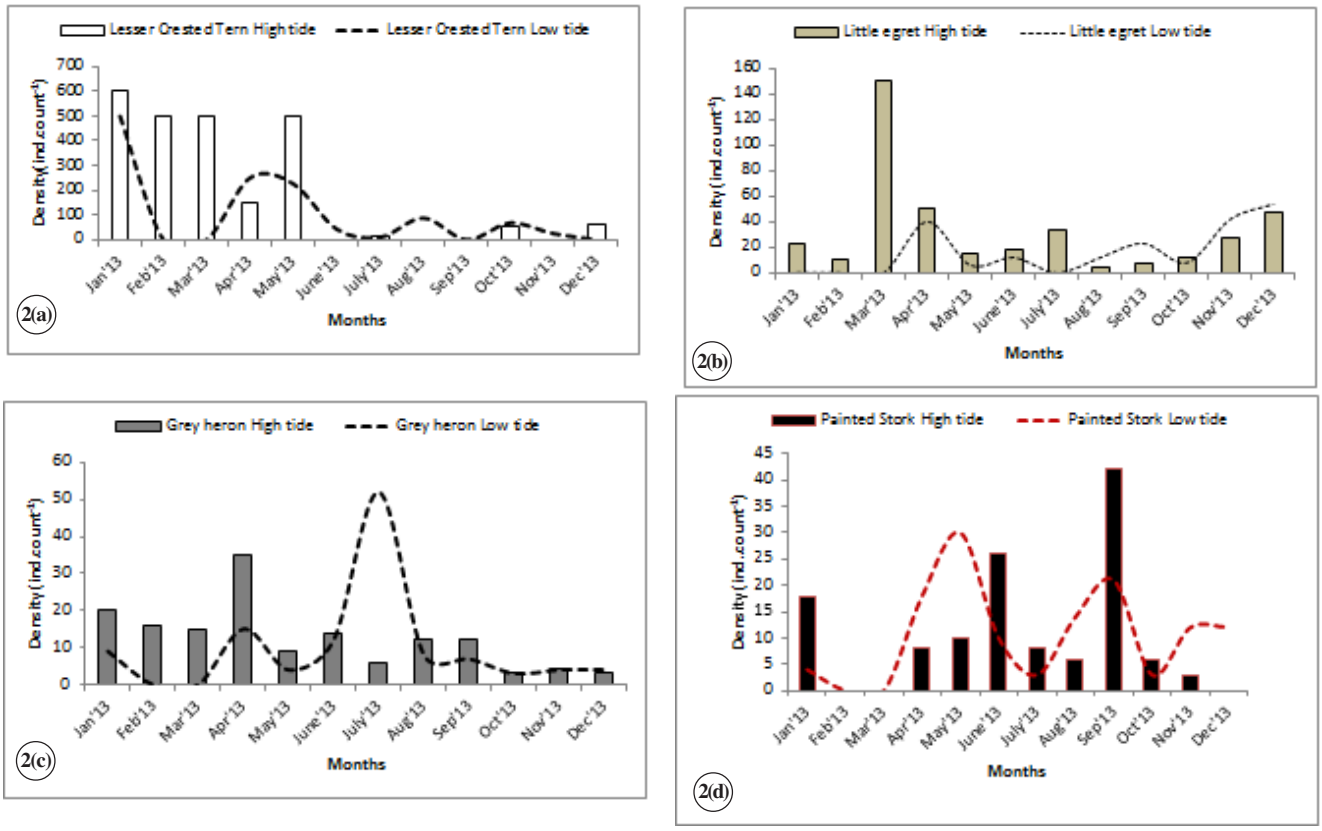

Fig. 2 : Seasonal variations in the major coastal avian fauna sighted at TTPS dyke (a) Lesser Crested Tern; (b) Little Egret; (c) Grey Heron and (d) Painted Stork.

Table 2 : Mean density of coastal bird species sighted at the study stations (TTPS dyke and salt pan pond).

No.	Bird name	Mean ±SE., n=12 at TTPS dyke		Mean±SE., n = 12 at Salt pan pond	
		High Tide	Low Tide	High Tide	Low Tide
1	*Egretta garzetta*	33.17±11.5	17.9±5.5	1.58±1.2	1.6±1.4
2	*Ardea cinerea*	12.4±2.6	9.8±4.05	-	-
3	*Casmerodius albus*	2.42±1.08	3.92±2.7	0.17±0.1	-
4	*Mycteria leucocephala*	10.6±3.6	10.6±2.7	-	
5	*Anastomus oscitans*	2.3±0.6	0.6±0.25	-	-
6	*Xenus cinereus*	7.3±4.09	4.9±3.4	-	-
7	*Calidris ferruginea*	30.3±9.2	-	20.4±4.7	16.8±9.04
8	*Thalasseus bengalensis*	198.08±71.2	100.8±44.13	-	-
9	*Pelecanus philippensis*	22.3±11.2	-		
11	*Haematopus ostralegus*	-	-	10.7±2.3	7.3±2.1

resident species Curlew Sand Piper was prevalent more during January to April and also during September to December (Fig. 3a). They were sighted at the highest density of 112ind.count^{-1} during January at the low tide. The mean densities were 20.42±4.7 ind.count^{-1} and 16.8±9.04 ind.count^{-1} during the high tide and low tide respectively (Table 2). Oyster Catcher, the second significant bird, was predominant during April, May, June, October and November and were sighted more during high tide with the highest density of 25 ind.count^{-1} during the high tide time of April (Fig. 3b). The average density was highest of 10.67±2.3 ind.count^{-1}. The third dominant bird the little egret was noticed only on three occasions and was sighted at the highest density of 1.60±1.3 ind.count^{-1} during the low tide. An unusual higher number of birds like Painted Stork during January and Terek Sand Piper during February at densities of 30 ind.count^{-1}and Grey Heron at a density of 15 ind.count^{-1} during May were also noticed. Other birds like Great Egret (6ind.count^{-1}). Little Cormorant, Spot-billed pelican and

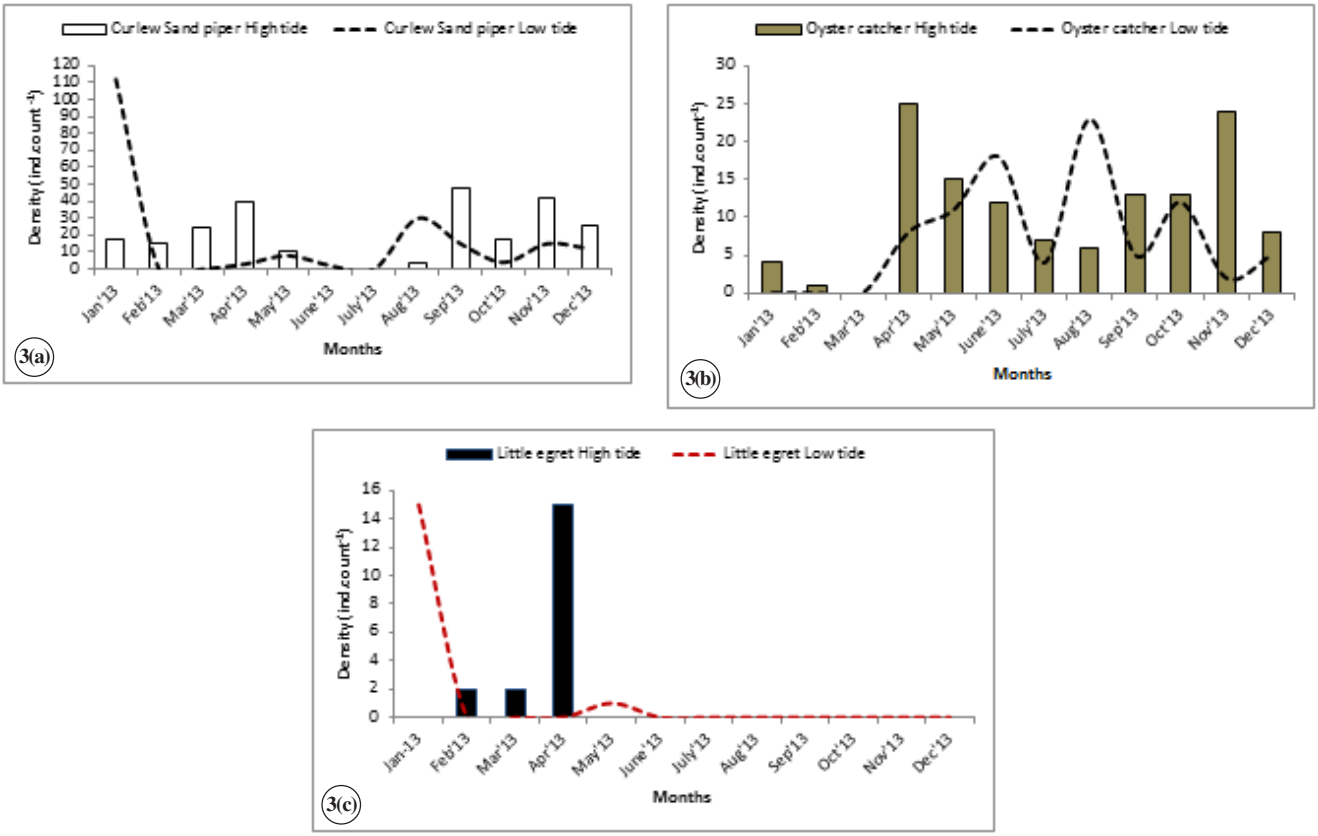

Fig. 3 : Seasonal variations in the major coastal avian faun sighted at salt pan pond (a) Curlew Sand Piper; (b) Oyster Catcher; (c) Little Egret.

Asian Open Bill Stork (one ind.count^{-1}) each were also represented the avian faunal constituent of the salt pan during the study period. None of the bird species indicated a significant seasonal or tidal variation in their density ($P<0.05$).

The dominance of most of the coastal birds was noticed during the high tide period at both stations. This behaviour might be due to the utilisation of these habitats for roosting purposes. According to Urfil (2002), coastal birds are utilising the habitats for feeding during the low tide time and for roosting purpose during the high tide time. The availability of near threatened painted stork has been noticed in the salt pan area in significant numbers during January after the northeast monsoon season, indicted the migratory behaviour of this species for nesting purpose. Urfi (2011) also pointed out the migratory response of painted stork after the monsoon for nesting purpose across large parts of India.

In the present study, distinct seasonality has been noticed in the abundance of coastal birds at both the stations. Vaithanathan and Kannan (2012) opined that the relative plenty of food, habitat condition of the species etc., which has been influenced by the seasonality of rainfall and hydrological conditions (Karr and Roth, 1971; Gaston *et al*, 2000). Gulf of Mannar is serving as one of the primary wintering grounds for migratory birds (Vaithanathan and Kannan, 2012). A few birds have been noticed on one or two occasions at both locations, which might be due to the utilisation of these habitats for resting, either during the northward migrations occur in March-June or for southward migration during July to October (Mc Neil and Burton, 1973; Hicklin, 1987).

Since birds are bio-monitors of healthy and diversified conditions of the area, the study reiterated the need for continuous monitoring of coastal birds population in Tuticorin coast and even the need for creating awareness in the coastal community towards conservation of diverse avifauna. Because of the diminishing natural feeding habitats in wetland areas, due to rapid industrialisation in Tuticorin coast, the present study also indicated the suitability of artificial habitat like salt pans, and fly ash-laden dyke as alternate feeding and roosting grounds for migratory coastal birds in Tuticorin. It also warrants the need for the proper management of this artificial habitat for preserving the avian fauna along the region.

ACKNOWLEDGEMENTS

The authors wish to express their gratitude to the Director, CMFRI, Kochi and the Scientist–in-Charge, Tuticorin for the support and facilities provided during the study.

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