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Distribution and Diversity of Coastal Birds with Special Emphasis on the Foraging Behaviour of *Tringa totanus* in Andaman and Nicobar Islands

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Abstract

The present study on shorebirds was carried out from 6 stations (06° 51 to 11° 39′ N 92° 41′to93° 55′ E) in South Andaman and Great Nicobar of Andaman and Nicobar Islands during December 2017 to February 2018. A total of 48 wetland bird species are observed in the studyarea. 17 of them are found to be residents, and the rest are found to be migrants. Order Charadriiformes has the highest mean abundance in South Andaman (1301.0) than Great Nicobar (869.3). *Tringa totanus* (common redshank) is the most common wader found near the mudflats.). It uses almost all types of foraging techniques and the most preferred one is the tactile hunting technique. It is also seen that time of the day or the tidal period does not affect the foraging behavior of shorebirds, but the active foraging occurs during low tide (ebbing tide and low tide peak). It was observed that shorebirds in this study forage more in wetlands, marsh areas, sandy or rocky beaches, or any tidal mudflats. Thus, it has been observed that Sippighat, Garacharma, and Gandhi Nagar stations have more wetlands with enormous quantity of invertebrates thus drawing a large numberof birds which makes it easy for them to forage and feed on them Considerable populations of endemicbirds such as Sunda Teal and Lesser whistling duck is been decreasing at a faster rate which might be due to habitat loss by the human settlement. The Andaman Teal has been considered globally endangered due to constant human interference leading to habitat destruction.

Key words: *coastal birds, foraging behaviour, Tringa totanus, Andaman and Nicobar Islands*

Introduction

India is one of the biodiversity-rich countries in the world having 4 biodiversity hotspots; theWestern Ghats, the Himalayas, the Indo-Burma region, and the Sundaland (Venkatraman and Sivaperuman, 2018). It is the home for different groups of organisms. The avifaunal groups, such as thecoastal and marine birds widely exist all around the world in marine ecosystems from coastal areas to open seas (Oro and Abraín, 2000).

Shorebirds are among the world's most spectacular avian migrants. They are major trait of coastal and estuarine ecosystems and are the subjects of encompassing conservation efforts throughout their range and distribution. Shorebirds are primarily flocking foragers and are very gregarious (Duffy, 1983). Most species of marine birds wander in water thus referred to as waders. Some species nest in remote, high regions that migrate over 16000 km. Many species undertake long annual migrations crossing the equator or in some cases moving around the earth (Daniel and Somane, 1975). Many shorebirds display migratory patterns and often migrate before breeding season. An Arctic tern takes the farthest journey and also takes trans-equatorial trips, both from south to north and vice versa (Egevang et al., 2010). They are highly pelagic and feed primarily on a wide variety of marine organisms (Morris, 1996).

They are commonly found in marshlands, swampy areas, and tidal mudflats to scrounge or forage for food such as insects or crustaceans and possess unique morphological and physiological adaptations to meet their different requisite.

A great deal of research has been carried out on bird population dynamics, foraging behavior etc. Information

on coastal birds of India is limited and is largely confined to the protected areas like the Southern and Eastern Coast of India. Study on shore birds in Andaman and Nicobar Islands startedby Blyth (1845), Hume (1874) and Butler (1899). A number of surveys on Avifauna from Andaman and Nicobar Islands were conducted by the Zoological Survey of India mostly concentrated on the diversity and distribution of the shorebirds (Pande, 2007). This entails the need for continued protectionand conservation in this tropical island ecosystem because of the occurrence of many threatened species.

Materials and methods

Study Area

The study on shorebirds was carried out from six study sites located in South Andaman and GreatNicobar of the Andaman and Nicobar Islands (Fig. 1).

Station 1: Garacharma

This sampling site is located at 11° 37′ 29.66″ N to 92° 42′ 23.24″ E. It is a tidal mudflat spreading across 700 meters with a lining of mangroves that forms a feeding abode for wintering birds.

Station 2: Sippighat

This site is located at 11° 36′ 34.80″ N to 92° 41′ 08.38″ E. One kilometer of a stretch from Sippighat is dominated by mangroves and influenced by the tidal influx which forms a perfect feeding ground forshorebirds.

Station3: Ograbraj

This sampling site is located at 11° 39′ 20.46″ N to 92° 39′ 54.12″ E. It is a tidal mudflat having a stretchof one kilometer with dense emerging vegetation that serves as a feeding ground for shorebirds.

Station 4: Campbell Bay jetty

This site is located at 7° 00′ 01.14″ N to 93° 55′ 53.70″ E. It has a stretch of sandy and rocky shore on opposite sides.

Station 5: Gandhinagar

This sampling site is located at 06° 53′ 38.24″ N to 93° 53′ 51.97″ E. It is very vast and open marshland serving as a feeding and breeding ground for a massive number of birds.

Station 6: Shastri Nagar

This site is located at 06° 51′ 26.99″ N to 93° 53′ 39.05″ E. It is a completely sandy beach area.with a rocky area at the end.

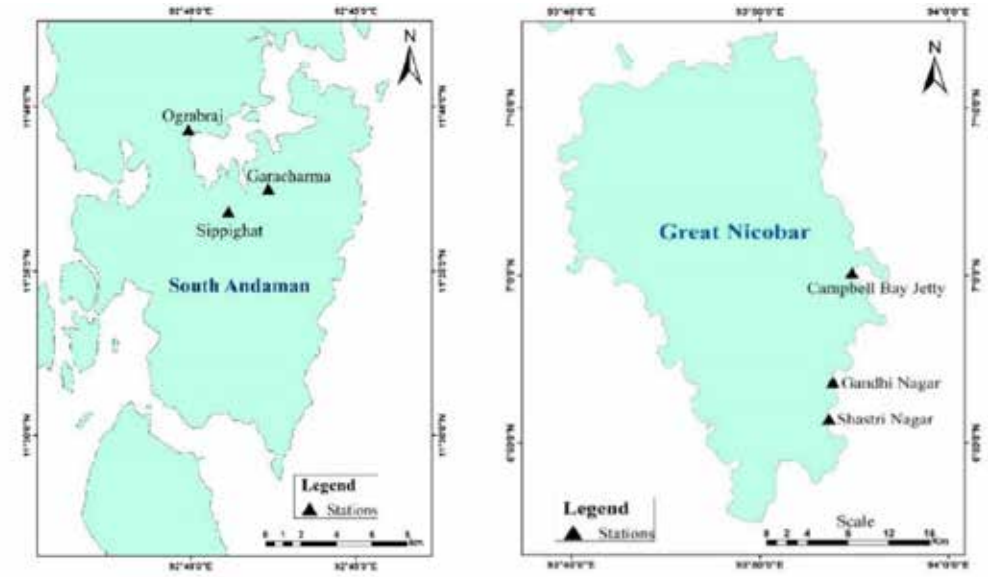

Fig.1. Map showing the study sites in South Andaman and Great Nicobar Island

Methodology

Morphometric and behaviour details of shore birds were collected from December 2017 to February 2018. The behaviour features of birds was observed from dusk till dawn (time lapse of 4 hrs) providing a list of behaviour aspects pertaining to different orders. The birds were identified by direct observation techniques using a binocular (Olympus 8□40 DPS I) and documented by using a camera (Canon-700D). Total count and point count methods were used for the frequency calculation over a period of time.

Morphological characters were observed, noted while taxonomical identification was done following Grimmett et al. (2014). Characters such as shape, size, plumage, etc. were noted during the study period.All data collected were fed for statistical analysis. Univariate and multivariate analyses were performed to determine the avian community by using the statistical software PRIMER (version 5). Bray-Curtis similarity matrix was performed on square root transformed abundance data.

Statistical Analysis

Species richness(S), Number of Individuals (N), Margalef's diversity index (d) Shannon-Weiner indices (H', J) carried out to measure the taxonomically and phylogenetically to know the relation between species in a sample. Bray-Curtis Similarity Index was carried out to find out the similarity coefficients, calculated between every pair of samples.

Results

A total of 48 wetland bird species are observed in both island groups. 17 out of 45 are found residents and the rest are found to be migrants (Table 1). Greater and lesser sand-plovers, common redshank, whimbrel, and curlew are found to be the most common species found in both groups of islands. The abundance of birds varied marginally in the South Andaman and Great Nicobar group of islands. The number of Species was highest in Sippighat of South Andaman (S=40) and lowest at Shastri Nagar of Great Nicobar (S=19; Table 2. Even the density of shorebird species showed a similar trend having a high density at Sippighat and the lowest at Shastri Nagar.

Margalef's diversity index was recorded as highest in Sippighat (5.0) and lowest in Shastri Nagar (2.9). The Shannon Weiner diversity index was estimated for the comparison of the ambiguity of the different species of birds between different groups of islands. The diversity was recorded high (H´=2.9) at Sippighat and the least at Shastri Nagar (H´=2.0). The actual diversity to the maximum possible diversity is estimated by the equitability index. Three stations of South Andaman shared the evenness with Gandhi Nagar of Great Nicobar (0.8). Other three stations of Great Nicobar shared the evenness with Garacharma of South Andaman (0.7).

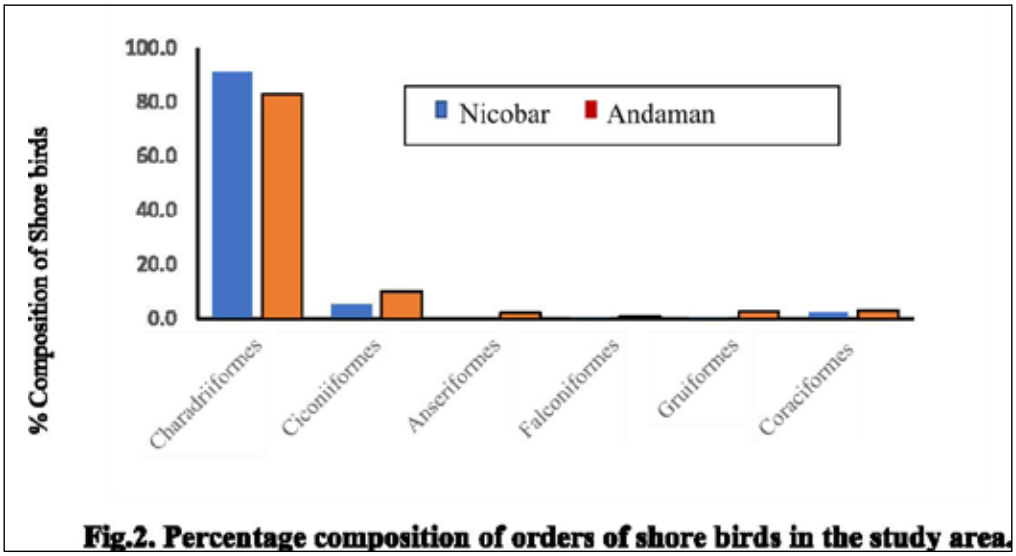

Fig.2. Percentage composition of orders of shore birds in the study area.

Charadriiformes (91.2) are small to medium-large birds and showed highest abundance among the 6 orders of birds recorded in both the Andaman and Nicobar group of islands while Anseriformes comprises the ducks, geese, and swans showed very low abundance (Figs 2, 3 & 4). In Charadriiformes, Nicobar displayed the highest percentage of distribution compared to Andaman (82.67).

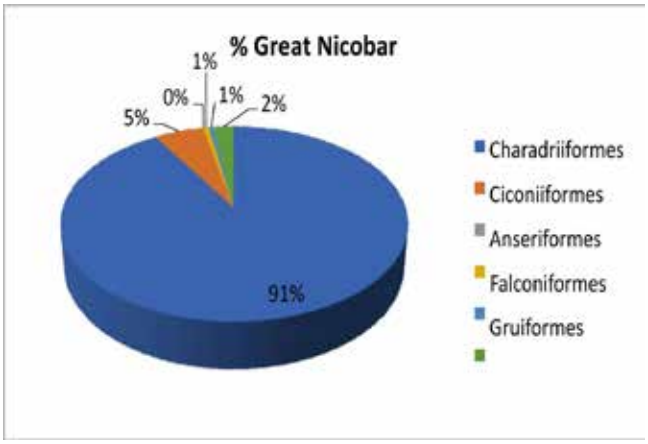

Fig.3. Percentage composition of orders of shore birds in the Great Nicobar

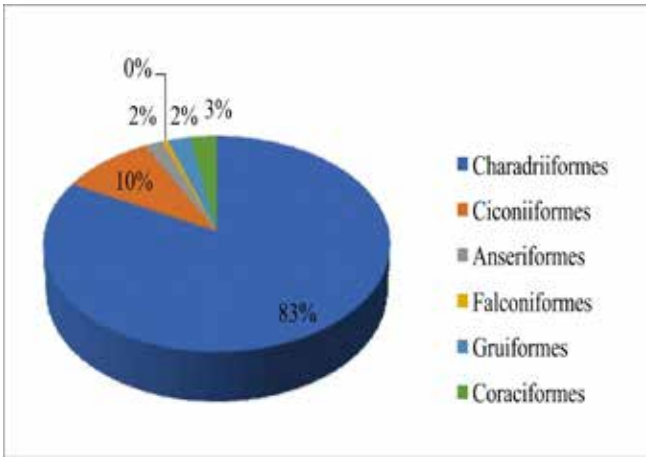

Fig.4. Percentage composition of different order of coastal birds in South Andaman

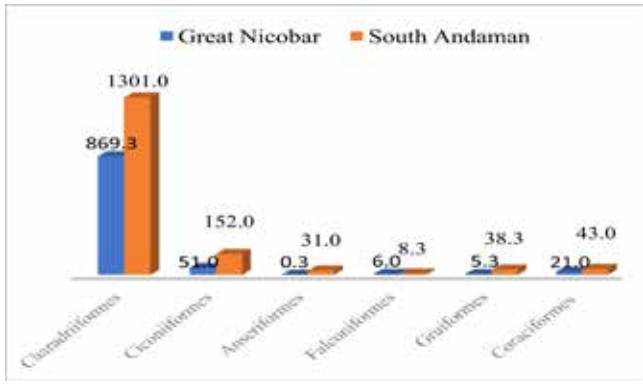

Fig.5. Mean abundance of shore birds in the study area

The mean abundance of the orders of birds between South Andaman and Great Nicobar was represented for comparison. Order Charadriiformes has the highest mean abundance in South Andaman (1301.0) compared to Great Nicobar (869.3). Charadriiformes had the highest abundance of shore birds and the least abundance was noted for Falconiformes (Fig.5). Shore birds found were *Tringa totanus, Actitis hypoleucos, Numenius phaeopus, Numenius arquata* were recorded more in south Andaman. While therare migrants viz. Swinhoe's snipe (*Gallinago megala),* Terek Sandpiper (*Xenus cinereus),* Ruddy turnstone (*Arneria interpres)* that were seen only in Great Nicobar. A rare migrant which belongs to the family Burhinidae i.e. *Esacus magnirostris* (Beach thick-knee) was also seen on the beach of ShastriNagar.

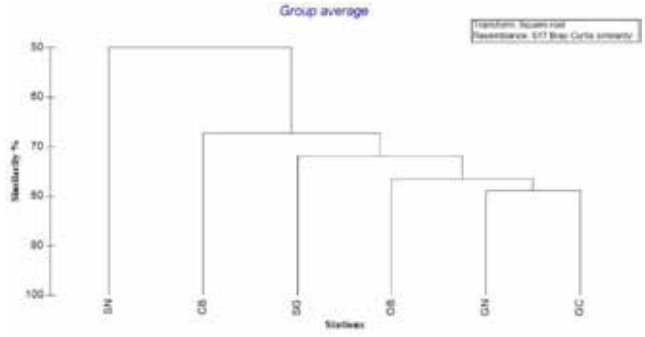

Fig.6. Dendogram showing the formation of groups in the study area

The dendrogram shows that Gandhi Nagar of Great Nicobar and Garacharma of SouthAndaman shows the highest similarity (77%) whereas Shastri Nagar varied from the rest of thestations showing 50% similarity (Fig.6).

Table 1. List of the birds observed in the study area.

Species	CB	GN	SN	GC	SG	OB	Status
Egretta garzetta	-	+	-	+	+	+	R
Casmerodious albus	+	+	-	+	+	+	RM
Mesophoyx intermedia	+	+	-	+	+	+	RM
Egretta sacra	+	+	+	-	+	+	RM
Butroides striata	+	+	+	++	++	++	R
Ardeola grayii	-	+	-	+	+	+	R
Ardea purpurea	+	+	-	+	+	+	RM
Ixobrychus sinensis	+	-	-	-	+	+	RM
Dendrocygna javanica	-	+	-	+	++	+	R
Anas gibberifrons	-	-	-	-	+	+	R
Haliaeetus leucogaster	+	+	+	-	+	+	R
Amaurornis phoenicurus	+	+	-	+	+	+	R
Porphyrio porphyrio	+	-	-	+	+	+	R
Gallinula chloropus	-	+	-	-	+	+	RM
Porzana pusilia	-	+	-	-	-	-	M
Pluvialis fulva	+++	+++	++	+++	+++	++	M
Charadrius mongolus	+++	+++	+++	++	+++	++	RM
Charadrius leschenaultii	+++	++	++	++	+++	++	RM
Charadrius dubius	-	+	-	+	+	+	RM
Charadrius alexandrinus	+	-	+	-	+	+	RM
Hydrophasianus chirurgus	-	-	-	-	+	+	M
Gallinago megala	+	-	-	-	-	-	M
Gallinago stenura	+	+	-	+	-	+	M
Limosa lapponica	-	-	-	+	++	-	M
Numenius phaeopus	++	+++	+	++	+++	++	M
Numenius arquata	++	++	-	++	+++	++	M
Tringa totanus	+++	+++	++	+++	+++	+++	M
Tringa erythropus	-	++	-	+	++	+	M
Tringa stagnatilis	-	+	-	+	+	-	M

Tringa glareola	++	+	-	++	+	+	M
Xenus cinereus	+	-	-	-	+	-	M
Actitis hypoleucos	+++	++	++	++	+++	++	M
Arenaria interpres	+	-	-	-	-	-	M
Calidris ruficollis	-	-	+	+	+	+	M
Calidris ferruginea	+	-	+	-	+	+	M
Esacus neglectus	-	-	+	-	-	-	R
Thaasseus bengalensis	+	-	+	-	+	+	R
Chlidonias hybrida	+	+	-	-	-	-	M
Chlidonias leucopterus	-	-	-	-	+	-	M
Sterna dougallii	-	-	+	-	-	-	M
Strena sumatrana	+	-	+	-	+	+	R
Alcedo atthis	+	+	-	+	+	-	RM
Pelargopsis capensis	-	+	+	+	+	+	R
Todiramphus chloris	+	+	-	+	+	+	R
Halcyon smyrnensis	+	+	+	+	+	+	R
Halcyon pileata	-	+	-	-	-	-	R
Alcedo meninting	-	+	+	-	+	-	R
Ceyx erithaca	+	+	-	-	+	-	R

R: Resident RM: Resident Migrants M:Migrants -: absent +: rare ++: common +++: abundant

Table 2. Diversity indices of birds in the study area

Stations	S	N	d	J	H'(loge)
Campbell bay jetty	30	1416	4.0	0.7	2.4
Gandhi Nagar	32	995	4.5	0.8	2.7
Shastri Nagar	19	448	2.9	0.7	2.0
Garacharma	27	1389	3.6	0.7	2.5
Sippighat	40	2345	5.0	0.8	2.9
Ograbraj	34	987	4.8	0.8	2.8

Tringa totanus (common redshank) is the most common wader found near the mudflats (Fig.7). It usesalmost all types of foraging techniques and the most preferred one is the tactile hunting technique.

Based on the observations during this study, the choice of the diet of *Tringa totanus* was mainly observed as bivalves, worms, crustaceans, etc. It walks along the rocky shore, muddy banks of wetlands,and open mudflats during low tide pecking regularly, sometimes probing to a lesser depth to feed on worms. They forage in a sudden unpredictable way while pecking prey, they run and stop and peck theprey at once. It is also seen that time of the day or the tidal period does not affect the foraging behaviorof shorebirds, but the active foraging occurs during low tide (ebbing tide, low tide peak, and rising tide).

Discussion

A total of 48 species of birds were recorded in the present study. The most abundant species found during the study period were migratory birds i.e. *Tringa totanus* (Common Redshank) and *Charadrius mongolus* (Lesser Sand Plover). Small flocks of Ruddy turnstone (*Arneria interpres*) and Baillon's Crake (*Porzana pusilia)* were only seen once during the study period in the area of Campbell Bay Jettyand Gandhi Nagar respectively in Great Nicobar Islands. Beach thick-knee (*Esacus neglectus*) was also observed in the area of Shastri Nagar in Great Nicobar Islands (Fig.7).

Fig.7. Photographs of the migratory birds recorded in the study area

It was observed that shorebirds in this study forage more in wetlands, marsh areas, sandy or rocky beaches, or any tidal mudflats. Thus, it has been observed that Sippighat, Garacharma, and Gandhi Nagar stations have more wetness in substrates and an immense number of invertebrates thus drawing a large number of birds which makes it easy for them to forage and feed on them. Our results clearly demonstrated that shorebirds were not randomly distributed such as plovers, and sandpipers aggregate in the areas of sandy substrates adjacent to the tide mark whereas birds like Ruddy Turnstone aggregates in the areas of drier sand away from the tide mark. It has been observed during the peak low tide when the marshland exposes a large number of invertebrates more particularly worms and bivalves and due to their abundance, it serves as a perfect habitat for feeding and breeding for these migratory birds.

Due to the human settlements, the diversity of the avifaunal populations in the study area has been decreasing significantly. Considerable populations of endemic birds such as Sunda Teal and Lesser whistling duck is been decreasing at a faster rate which might be due to human disturbance. The Andaman Teal has been considered globally endangered at the sub-species level and the reason might be that it was an agricultural land prior to inundation, so there is constant interference from humans leading to habitat destruction. Species like beach thick-knee recorded in this study is near threatened according to IUCN need, continued monitoring, protection and conservation in this tropical island ecosystem. Habitat loss or degradation, hunting are the major threats to the shorebirds of these islands.The most immediate threat in the Nicobar could be the proposal to make Great Nicobar a free port andto create a dry dock and refueling base for international shipping at the mouth of the Galathea River (Vijayan et al., 2000). As a matter of fact, the sustainability and biodiversity of this island is a major concern among the birdwatcher to protect and restore this ecosystem.

Thus the result obtained in this study shows that different species of wintering bird assemblages migrating from distant areas covering thousands of kms can be considered as an important breeding ground for these birds in this archipelago.

Conclusions

The study conducted during December 2017-February 2018 identified shorebirds that were encountered in the Andaman and Nicobar islands, emphasizing the bird community habitat, morphological behavior of the shorebirds and their foraging techniques etc. It concluded that the majority of the avifauna and their community structure are mainly seasonal, with a huge number of migratory shorebird assembled from December to March

in this archipelago. Thus, the distribution of the shorebirds was found to be diverse in these islands. Further, it has been noted that the population of shorebirds is declining alarmingly all around the world mostly due to the deterioration of their habitats used for winter migration, mainly due to anthropogenic activities. Thus, there is a continuous need for their conservation management and restoration of the coastal bird population around the world in recent years and to encourage monitoring the coastal birds in India, particularly in Andaman and Nicobar Islands.

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