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Distribution, Status and Current Trends in The Population of Nicobar Megapode in The Nicobar Group of Islands

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Abstract

In this paper, we present the current status and distribution of Nicobar Megapode in the Nicobar group of Islands. The study has been carried out in the Nicobar group of Islands.

Key words: Megapode, Nicobar, Population, Status, Conservation

Introduction

The Megapodes are a fascinating group of ground dwelling birds that use environmental heat sources rather than body heat to incubate their eggs (Jones and Birks, 1992; Jones et al., 1995). Megapodes belong to the family Megapodidae under the order Galliformes including 22 species in seven genera that are broadly classified as scrub fowls (Megapodius, Eulipoa, Macrocephalon) and brush-turkeys (Alectura, Aepypodius, Leipoa, Talegalla). Generally, megapodes occur in moist tropical forests of oceanic islands and use coastal areas for their breeding. The conservation of these habitats is crucial for the survival of megapodes (Jones et al., 1995). The Nicobar Megapode, sometimes called Nicobar scrub fowl, is an endemic bird species to the Nicobar group of Islands. There are two subspecies recognized in the Nicobar Islands namely, *Megapodius nicobariensis nicobariensis* Blyth, 1846, from the north of the Sombrero channel in the Nancowry group of islands and *Megapodius nicobariensis abbotti* Oberholser (1919), to the south in Great Nicobar Islands. This species was not reported in Car Nicobar (Oberholser, 1919; Abdulali, 1965; 1967; Ali and Ripley, 1969; 1980; 1983 and 1998; Sivakumar, 2007). The Nicobar Megapode is listed as Vulnerable in the IUCN red list (Bird Life International, 2021) and stated Schedule-I in the Wildlife Protection Act (1972) of India.

The Nicobar megapode was the worst affected species in the Nicobar Islands with more than 850 incubation mounds in the Great Nicobar, Little Nicobar, and adjoining islands, and about 300 incubation mounds in the Nancowry group of islands were lost during the tsunami 2004, which is estimated to be 70% of a decline in their population since 1994 (Sankaran, 2005 and Sivakumar, 2007; 2010). Apart from this, high vulnerability to climate change, habitat degradation, hunting, anthropogenic pressure, and deficient coverage of a protected area on the habitats of this species have been reported as major threats for the Nicobar Megapode yet (Sivakumar, 2010; Radley et al., 2018). This study focused on the status and probable trends of megapode population in the Nicobar Islands together with habitat models to find and evaluate the impacts on the viable habitats of the Nicobar Megapode.

Study area

The Nicobar group of Islands is an archipelagic chain in the eastern Indian Ocean. Nicobar group is located south of Port Blair, and about 150 km north of Aceh on Sumatra, and is separated from Thailand to the east by the Andaman Sea. The Nicobar group is located 1,300 km southeast of the Indian subcontinent, across the Bay of Bengal. The Indira Point (Lat. 6.756378°N; Long. 93.827765°E) is the southernmost point of Great Nicobar Island and lies about 150 km north of Sumatra, Indonesia. UNESCO has declared the Great Nicobar Island as one of the World Network of Biosphere Reserves in the year 2013 (UNESCO, 2013). The extent of the Nicobar group of Islands is 1,841 km^2 and comprises three distinct groups, namely, Northern group, Central group, and Southern group (Table 1 and Fig. 1; Plate 1).

Table 1. Survey details in different part of Nicobar group of islands

Sl. No.	Location (Island)	Total area (km^2)	No. of Transects	Length surveyed (km)	No. days spent for field survey
1	Great Nicobar	887.1	26	102.8	110
2	Kondul	1.46	2	1	3
3	Little Nicobar	135.3	6	4.35	12
4	Menchal	0.63	1	0.85	5
5	Treis	0.32	1	1.50	1
6	Meroe	0.87	1	1.74	1
7	Nancowry	46.1	4	5	8
8	Camorta	117.15	4	6.76	4
9	Trinket	12.01	2	2.31	2
10	Katchal	138.07	4	6.05	9
11	Teressa	84.91	11	14.89	17
12	Bompoka	9.06	3	7.01	5
13	Tillangchang	14.19	4	5.84	3
		1447.17	**69**	**160.1**	**180**

Methods

Transect Survey

Nicobar megapode's elusive nature and cryptic behavior makes it hard to sight adequately for the population estimation studies. But the nest mounds built by them are stationary and persistent for years with higher fidelity. Active nest mounds represent the monogamous breeding pairs of Nicobar megapodes using them (Jones et al., 1995). Thus, counting the number of active mounds can be appropriate estimation of the number of breeding pairs present in the study area (Dekker, 1992; Sankaran, 1995c; Sivakumar and Sankaran, 2003). Transects were laid along the coastal regions as well as in the inland forests of 13 islands. The length and number of the transects varied with respect to the size of the respective island surveyed. This study was conducted from April 2020 - March 2022 to estimate the number of active mounds present on each island. In each transect three observers were conducted the survey by covering 1 km per hour. The coastal habitat is a highly suitable area for the nest building for megapode (Sivakumar, 2000). Hence, the survey along coastal regions was conducted from the shoreline to a 100 meters distance. The area of these belts was considered for the density calculation. The density of mounds within 100 meters from shore was calculated by dividing the number of mounds present by the area covered with the 100 m belt. We considered a range from minimum one breeding pair to maximum two breeding pairs using an active mound to arrive at the number of breeding pairs present in the study area.

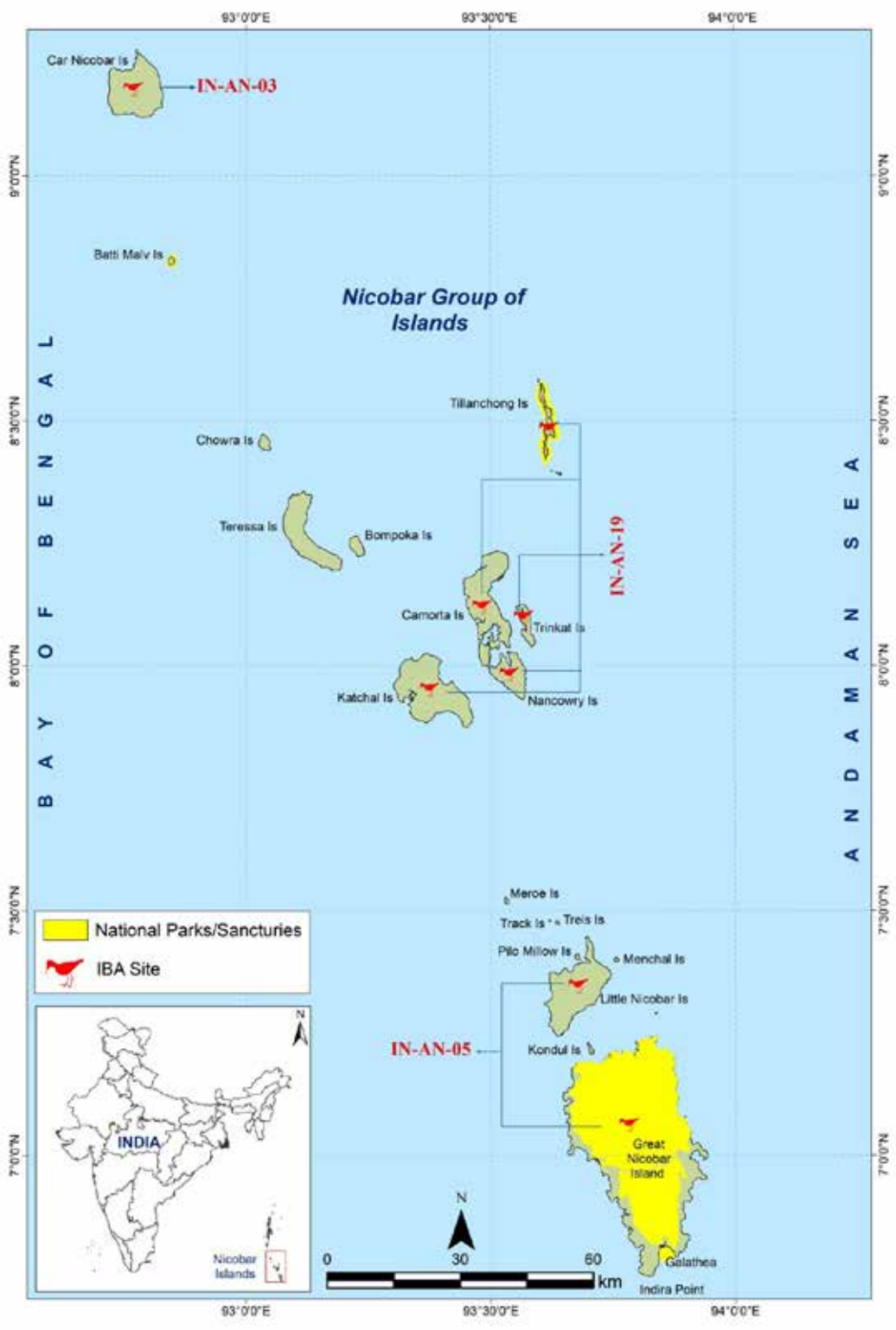

Fig. 1. Map of the study area

Mound ecology

Mound nests can be considered as a typical component in the spatial preferences for breeding. Thus, assessment of the attributes of the mound in terms of dimensions of the mound, type of mound, proximity to the shoreline, *etc*., were also recorded as covariates during the study. Location, altitude, and proximity to the shoreline for each mound were recorded using a GPS device (Garmin, Montana 680). Every mound was then given a unique identity for future identification and properly photographed using a digital camera (Nikon D750 and Nikon P900). The conical structure of the mound was considered for estimating its volume. Hence, the volume of the mound was derived from the formula for the volume of the cone = $1/3\Pi r^2h$. Respective measurements were recorded from the mound such as height of the mound, basal circumference, basal length, and basal width (Sivakumar and Sankaran, 2003) using a measuring tape (50 Meter). Based on accompanying vegetation mound nests were classified into three major types as Living – nests that were mounded around or abutment with a live tree or any plant community, Dead – Nests associated with deadwood logs, Dead & Living – Nests present with both live tree communities and decaying plant materials and Open - Nests mounded openly on the forest floor (Dekker, 1992; Sankaran, 1995c; Sankaran and Sivakumar, 1999; Sivakumar, 2000).

While breeding, Nicobar megapodes were observed to be involved in mound nest activities such as visit, pit digging, egg-laying, raking, covering, pits-filled, and random activities by Sivakumar and Sankaran (2003). These are direct and indirect evidence show that the megapode utilized the mound. If similar activities or traces were observed from a mound nest, then that nest was considered an active mound. If the soil condition was relatively hard and compact and growth of vegetation was present over the mound, then that was considered as an inactive nest.

Results

The Megapode nests were checked for activity by observing bird activities on the mounds. Total of 162 active and 33 inactive mounds were recorded from all the islands. The number of active mounds was higher than the inactive mounds on all the islands except Little Nicobar (Pulopanja). Highest number of mounds about 76 mounds (64 active and 12 inactive mounds) were found in the Great Nicobar Island followed by Bampoka Island (41 mounds), Teressa Island (33 mounds) (Table 2 and Fig. 2; Plate 2-4).

Table 2. Showing active, inactive mounds observed in each island

Islands	Active	Inactive	Total
Great Nicobar	64	12	76
Kondul	2	1	3
Little Nicobar	4	2	6
Menchal	1	0	1
Treis	1	0	1
Meroe	2	1	3
Nancowry	1	0	1
Kamorta	7	0	7
Trinket	5	1	1
Katchal	1	0	6
Teressa	35	3	38
Bompoka	31	10	41
Tillangchang	8	3	11
Grand Total	162	33	195

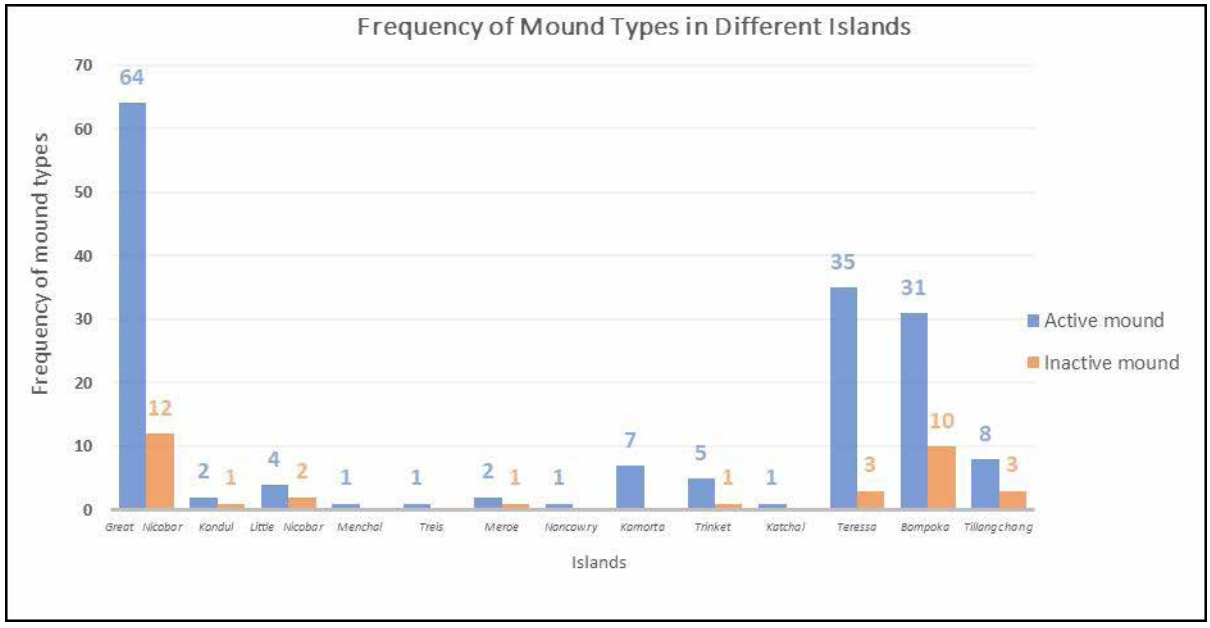

Fig. 2. Frequency of mounds observed in each island in the present study

From the present study, highest decline of active mounds > 95% was recorded in Trinket and Little Nicobar and > 80% in Nancowry and Menchal to the 2006 survey. Whereas Kondul, Bompoka and Teressa showed an increase in the number of active mounds. The comparative analysis from the present study shows that the number of active mounds declined about 59% from the 2006 survey and about 86% from the 1994 survey. This shows a further decline in the number of active mounds > 15% in the past fifteen years (**Table 3**).

Table 3. Comparative account of estimated number of Nicobar Megapode Mound in Nicobar group of Islands

Sl. No.	Location	Estimated No. of active mounds				Estimated No. of breeding pairs			
		1994[1]	2006[2]	2015–2018	Present study	1994[1]	2006[2]	2015-2018[3]	Present study
	M. n. abbotti (Great Nicobar & Little Nicobar group of islands)								
	Great Nicobar	515	203	97	64	1030–1803	203–406	97–194	128–256
	Kondul	11	1	4	2	22–39	1–2	4–8	4–8
	Little Nicobar	311	82	18	4	622–1089	82–164	18–36	8–16
	Pillo Milo	0	0	0	0	0	0	0	0
	Meroe	1	2	3	2	2–4	2–4	2–6	4–8
	Treis	4	3	0	1	0	0	0	2–4
	Trax	3	0	0	0	6–11	0	0	0
	Menchal	2	6	1	1	8–14	6–12	2–4	2–4
	Total	**849**	**297**	**123**	**74**				

M. n. nicobariensis (Nancowry group of islands)

Nancowry	60	7	2	1	120–210	7–14	2–4	2–4
Katchal	69	9	2	5	138–242	9–18	2–4	10–20
Kamorta	20	7	2	7	40–70	7–14	2–4	14–28
Tillanchang	10	27	0	8	20–35	27–54	0	16–32
Trinket	8	26	4	1	16–28	26–56	4–8	2–4
Teressa	119	9	5	35	238–417	9–18	5–10	70–140
Bompoka	26	13	15	31	52–91	13–26	15–30	62–124
Total	**312**	**98**	**30**	**88**				

1 - Sankaran (1995); 2 – Sivakumar (2006); 3 - Sivaperuman et al., (2022) Sivaperuman *et al*. (Present study)

The covariates such as elevation of mound location (W = 0.419, $p < 0.05$), volume of mound (W = 0.191, $p < 0.05$), distance from shore (W = 0.853, $p < 0.05$) and canopy cover (W = 0.899, $p < 0.05$) are normally distributed in Shapiro-Wilk (W) test for normality.

Mounds were sighted at several elevations from the mean sea level with an average of 24.40 ± 3.30 meters ranging from a minimum of 1 m to a maximum of 429 m elevation from the mean sea level. In the present study, maximum number of nests were found within 20 meters from the shoreline and 83.77% of the sightings were observed within 40 meters from the shoreline. The distance from the shoreline to the mound nests was significantly different across the islands (Chi-Square Tests, $\chi^2 = 220.9$, $p < 0.05$) (Fig. 4).

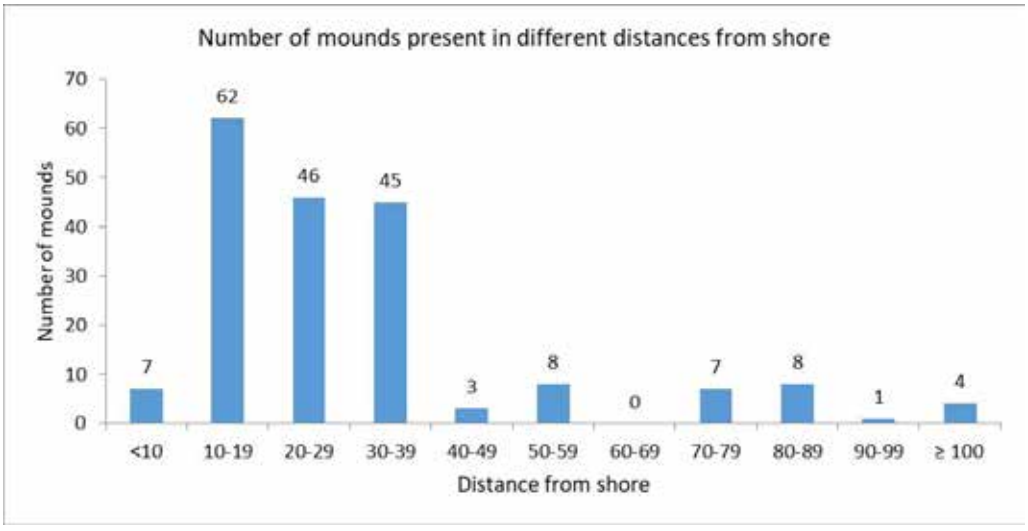

Fig. 4. Frequency of distances from the shore to mound nests

Mound abundance and relative mound density in coastal habitat

During the present investigation, five major types of habitats were identified in the Nicobar group of islands namely Littoral & beach forest, Coconut plantation, Forest, Tropical evergreen forest and Rubber plantation. Littoral & beach forest had highest number of both active and inactive mounds and Rubber plantation had the least number of one inactive mound which was < 0.5-meter cube in volume and it had no active mound (Fig. 5).

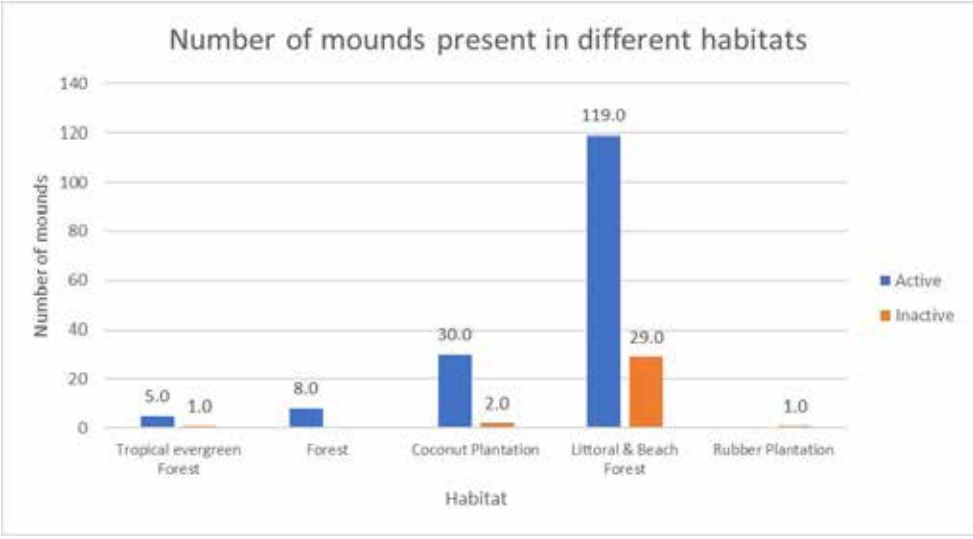

Fig. 5. Showing the number of active and inactive mounds in different Mound habitat in all the islands

Present study reveals that the Nicobar group of islands had active mound (216.30 density/km^2). Among the Islands in Nicobar group the Bampoka had a relatively high abundance and relative mound density, followed by Kondul and Teressa (Table 4). The Nancowry had the least mound density. The Nicobar megapode prefers coastal habitat than the interior forest and any other habitats may be due to its high composition of sand and sandy-loam soil (Thothathri, 1962; Saldanha, 1989; Dekker, 1992; Sankaran, 1995; Jones et al., 1995). Costal habitat of Bompoka 58.49 mounds per square kilometre, relatively 27% of the total active mounds, followed by Kondul 30.0 mounds per square kilometre and Teressa with 25.52 mounds per square kilometre (Table 4 and Fig. 6).

Table 4. Showing the estimated mound abundance and mound density in coastal regions of Nicobar group of Islands

Name of the island	No. of Transects	Area of coastal habitat (km^2)	Abundance of active mound	Mount Density
Great Nicobar	26	10.28	118.36	7.39
Kondul	2	0.10	480.30	30.0
Little Nicobar	6	0.44	220.83	13.79
Menchal	1	0.09	188.35	11.76
Treis	1	0.15	106.73	6.67
Meroe	1	0.17	276.03	17.24
Nancowry	4	0.50	32.02	2.00
Camorta	4	0.68	165.78	10.36
Trinket	2	0.23	69.31	4.33
Katchal	4	0.61	158.78	9.92
Teressa	11	1.49	408.58	25.52
Bompoka	3	0.70	936.39	58.49
Tillangchang	4	0.58	301.56	18.84
Total	69	16.01	3463.03	216.30

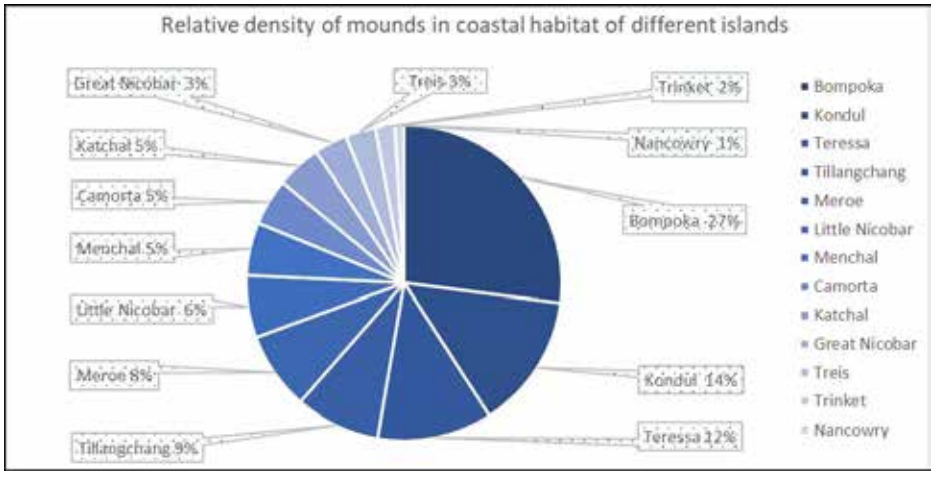

Fig. 6. Relative mound density of Nicobar megapode for each island

Mound habitat

In association with the surrounding vegetation, the mound was classified as Living, Dead, Dead & Living and Open type of mounds. Living type of mound was recorded the highest frequency of about 106 mounds in all the islands followed by Dead & Living types, 47 mounds, Death tree with 38 mounds and the open type of mound was the lowest frequency of only 4 mounds. Furthermore, the average volume of the different types of mounds was estimated. Living and Dead & Living mound were with highest mean volumes of mound about 15.3 ± 1.59 and 14.71± 4.03, respectively (Table 5 and Fig. 6).

Table 5. Mound habitat and the average volume of respective mound types in Nicobar group of Islands

Types of mound habitat	Frequency of type of Mound habitat	Average volume of mound types (m^3)
Living	106	15.3 ± 1.59
Death tree	38	8.6 ± 1.68
Dead & living	47	14.71± 4.03
Open	4	10.4 ± 5.20
Grand Total	195	13.8 ± 1.06

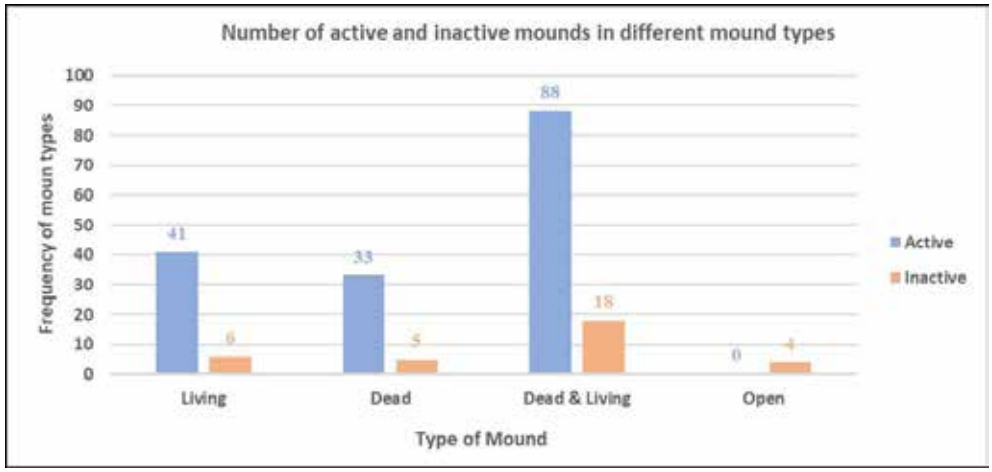

Fig. 6. Number of active and inactive mounds in different Mound habitat Nicobar group of Islands

Volume of mounds

Most of the active mounds present within 1 to 10 cubic meters in volume. There were no inactive mounds were recorded larger than 40 cubic meters. The active mounds recorded up to a volume of 80 cubic meters (Fig. 7).

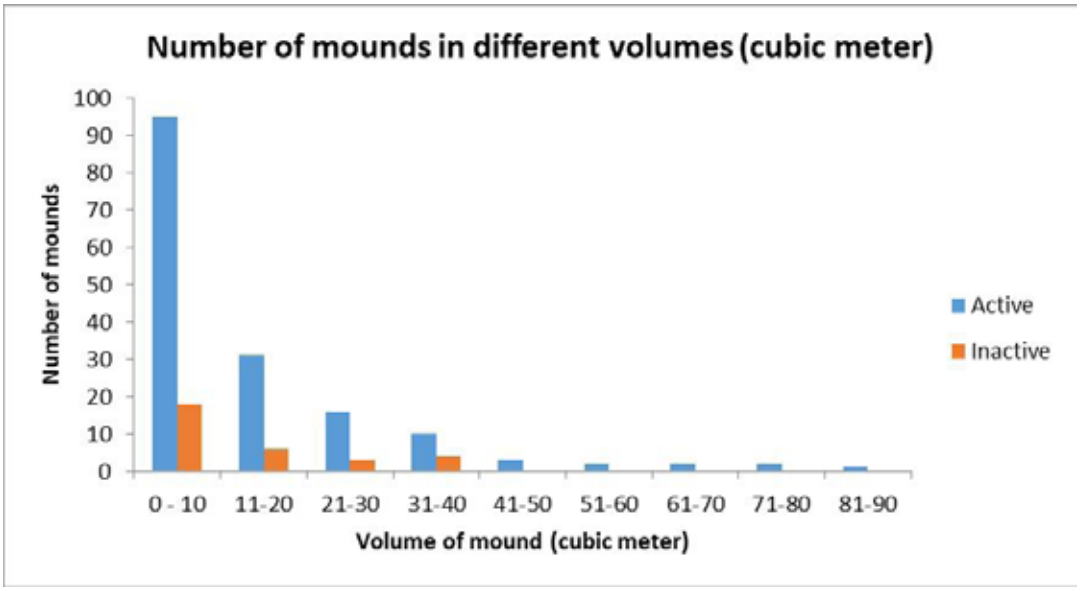

Fig. 7. Number of active and inactive mounds in different volumes in all the islands

Discussion

Tsunami in 2004 had vastly affected the suitable breeding habitats of the Nicobar megapode across the islands of Nicobar group and washed away their mounds. There were a slump number of mounds and land cover changes in the suitable habitats were recorded in a survey conducted after tsunami (Sivakumar, 2010). Thus, the tsunami had not only reduced their population, but also greatly affected their breeding grounds. But the present survey shows that the trend or changes in the number of active mounds on all the islands were not similar. The Great Nicobar has the largest land mass in the Nicobar group of islands, and it shows a decline > 68% in the number of active mounds. Meroe and Kamorta had no changes in their number, whereas there was an increase in the number of active mounds from Kondul, Bompoka and Teressa islands. Also, the changes after tsunami may be different in both the species subspecies. A detailed study is needed to understand how different habitats support the mounds in recent times, the preference of the Nicobar megapode for breeding, habitat changes. Maximum number of nests about 83.77% found within 20 meters from the shoreline and Littoral and beach forest habitat contained the highest number of both active and inactive mounds. Mounds larger than 40 cubic meters were mostly active, which may be due to larger incubation mounds are highly optimal in terms of heat balance *i.e.*, they have equilibrium temperature (Sivakumar and Sankaran, 2003; Seymour and Bradford, 1992), thus, their fidelity increases. So may mostly the larger mounds be utilized by Nicobar Megapode. This needs further study. An immediate and urgent measure is to bring the endangered status in the IUCN redlist to highlight their conservation importance, which is already recommended Sivakumar, 2010.

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Littoral & Beach forest

Littoral & Beach forest

Tropical Ever Green Forest

Tropical Ever Green Forest

Littoral Forest

Coconut Plantation

Plate 1. Habitat of Nicobar Megapode

Live Tree (Navy Dera)

Live Tree (Laful)

Open Mound (Teressa)

Dead Tree (Bompoka)

Dead Tree Mound (Galathea)

Open mound (Tillongchong)

Plate 2. Mount Habitat of Nicobar Megapode

Sand & Clay

Sand & Clay

Sandy

Sandy & Mixed

Clayey

Sand & Loam

Plate 3. Mount Type of Nicobar Megapode

Feeding-Galathea

Predators Monitoring

Walking-East West Road

Nesting-Indira Point

Night Roosting-Galathea

Resting-Galathea

Plate 4. *Megapodius nicobariensis abbotti* of Nicobar Megapode