Gap Analysis in Andaman and Nicobar Islands, India: Recent Experiences

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Background

In a landmark judgment, the Supreme Court of India ordered the 'consolidation of protected area system' in Andaman and Nicobar Islands (ANI) comprising seven National Parks and 99 Wildlife Sanctuaries covering an area of 1217.12 km^2 on land and 349.04 km^2 in surrounding territorial sea and representing 19.65 per cent of the total geographical area of ANI. Consolidation of protected area system essentially meant conducting a gap analysis to establish an ecologically representative network of PA. The task was assigned to the Wildlife Institute of India, a research and training institution of the federal government, in the field of wildlife and protected area management.

Introduction

The Andaman and Nicobar Islands (ANI) (total 349 islands; area=8249 km^2) are an internationally acknowledged biodiversity hot spot[i], off the Indian mainland and lying isolated in the Bay of Bengal. ANI encompasses a very high degree of endemicity in all taxa, especially in plants, reptiles, fishes and corals and bears close biogeographical affinities with Myanmar, Indonesia and South-East Asia. 86 per cent area of the ANI exists as legally notified forest. The area, design and distribution of PAs however does not cover the range of biological diversity present in ANI. The PAs in ANI have been established in an ad hoc manner considering either the remoteness or inaccessibility of the area or influenced by the presence of some charismatic species (e.g., Narcondum Island Sanctuary for Narcondum Hornbill). In other words, the existing PA system planning in ANI is inadequate to meet the criteria of comprehensiveness, representativeness and management.

The present gap analysis study was undertaken to establish a logical and scientific basis of protected area planning to conserve the representative samples of biological diversity both in island's landscape as well as the surrounding seascape. The identification of gaps was based on the level of protection offered to different vegetation/ land cover types, biologically rich zones and localities of conservation importance for birds and sea turtles within PA system in ANI. The study adopted a combination of "coarse filter" and "fine filter" approaches by using two different conservation priority setting methodologies. Spatial outputs from two biodiversity priority setting methodologies *viz.,* the Biodiversity Characterization at Landscape Level[ii] (BCLL) and the Important Bird Areas[iii] (IBAs) was used in the identification of gaps. The BCLL methodology scales priority areas of conservation utilizing remote sensing, landscape matrices and field data in GIS domain. IBAs is a globally acknowledged priority setting approach of BirdLife International that aims to identify protect and where appropriate, manage a minimum network of sites important for the long-term viability of bird populations[iv]. IBAs have therefore been used to indicate the gaps in the coverage of restricted range bird species in ANI.

Methodology

Vegetation/ land cover types both in terrestrial landscape and near shore seascape were mapped using IRS IC LISS III and Landsat TM satellite data. Biological richness mapping was carried out using Spatial Landscape Modelling (SPLAM) package integrating vegetation map derived landscape parameters, *viz.,* fragmentation, patchiness, porosity, interspersion and juxtaposition with road and settlement buffers to estimate disturbance index. Different biological richness levels were computed by integrating disturbance index with physical (*i.e.,*

terrain complexity), ecological (*i.e.,* species diversity), phytosociological (*i.e.,* species endemism, rarity and threatened) and economical (*i.e.,* species importance value) parameters[v]. Distribution of identified 19 IBAs was assessed in terms of protection to the 18 restricted range bird species within PA. The turtle nesting sites distribution data (based on direct sightings over last 15 years) were converted into point data (~143) records using literature citations. The current PAs were examined with respect to adequacy in surface area or size and distribution. The PAs polygon data were spatially overlaid on vegetation types/land use map, biological richness map, IBAs and turtle nesting sites point coverage using Arc View 3.2a GIS software. Area statistics and ecological representation in existing PA network was examined.

Results and discussion

58 small island sanctuaries cover only 1.2 per cent area of total area of PAs in ANI. The biggest island, Middle Andaman, has no PA. Similarly, in Nicobar, there is no PA in Central Nicobar and Little Nicobar. Out of 17 natural vegetation categories, 4 do not meet the widely accepted criteria of 10 per cent representation of each type within PA. Only 9.5 per cent of the remaining patches of giant evergreen forest are found in the PA system. Three unique vegetation formations in Nicobar *viz.,* the syzigium swamps, hill-top grasslands and moist deciduous are not covered under the PA system. Evergreen forest in Nicobar has been reasonably well protected (42.41 per cent of its total area) within Campbell Bay and Galathea NPs in Great Nicobar. Mangrove forests find reasonably adequate representation in Andaman compared to Nicobar. A few big patches in Katchal, Nancowry and Kamorta islands along with some of the finest coral reef areas also remain unprotected. Despite having reasonably adequate area (42.04 percent of total area mapped) inside PAs, the largest and longest coral reef barrier formation on the West of Andaman is unprotected. The high biological richness zones of evergreen, semi-evergreen and moist deciduous forest are also poorly represented in PAs in Andaman. Eight out of 19 IBAs are not protected under PA system. Habitats of 4 globally threatened restricted range bird species also do not occur in PA system. Only 4 species found >50 per cent representation in PA system; another 4 species between 30-40% and 6 species between 30-40 per cent. 4 species (all in Nicobar) are still not represented within the PA system of which two (Nicobar Megapode and Nicobar Bulbul) are vulnerable and two (Nicobar Parakeet and Nicobar Scops Owl) are near threatened[vi]. Green Sea and Hawksbill turtle are reasonably well protected. While, Leather Sea and Olive Ridley turtle are poorly protected, particularly in Nicobar.

The study has recommended the expansion and creation of new PAs in ANI based on areas of ecological transition where the niches (*e.g*., vegetation types and biological richness areas) of species (*e.g*., birds and turtle) overlap. Protecting maximum percentage of highlighted priority localities *i.e.,* unique vegetation types, offshore habitats, biologically rich areas and bird congregation areas would certainly benefit other taxa in ANI. Our approach has examined the gaps in the conservation planning by looking at available information which needs to be further substantiated by finer scale data at species level.

Recommendations for plugging gaps in PA system

Based on this study, a comprehensive framework for PA system[vii] has been proposed, taking into account the limited resources and the extent of present and future threats in managing such areas. The study re-iterates that if conservation goal is to represent the uniqueness, diversity and rarity, then PA planning must account for biodiversity patterns, rather than be based on political and logistic considerations. In ANI, because of intra-archipelago speciation,

a network of PAs that incorporates distinctive flora, fauna and habitats in its maximum proportion in each group of islands is essential. In fact, most of the PAs in ANI presently covers a small area from the biological / ecological standpoint. Consequently, even minor perturbations in the adjoining area can affect their viability. Such off site effects include oil pollution, increasing turbidity due to soil erosion and dumping of waste materials. In order to regulate off site impacts and increasing cases of wildlife offences by foreign agencies and local people, establishment of marine protected areas (MPA) has been envisaged by grouping a set of small islands, which would enhance management effectiveness. In order to protect marine life, protection to coral reef, inter-tidal and salt marshes surrounding each island up to a specified buffer distance from terrestrial limits has been recommended for inclusion within PAs. Since, at present, fishing and tourism activities are at modest levels, the task of including marine areas within PAs does not appear to be a major impediment. Turtle species have been suggested as focal diversity element and as a surrogate for protecting off shore environment, due to their vulnerability at particular life stages. We feel that by including areas of high biological richness in the PA system their conservation status would improve. Intensive inventory at the levels of species and communities of small islands sanctuaries and surrounding offshore life is needed for examining their contribution to biodiversity representation in ANI. Setting up of a series of key quantitative targets at multiple scales is also needed for effective protected area management.

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[i] Myers et al (2000); op cit

[ii] Roy, P S and S Tomar (2000); Biodiversity characterization at landscape level using geospatial- modeling technique, *Biological Conservation* **95:** 95-109

[iii] Stattersfield et al (1998); op cit

[iv] Grimmett, R F A and T A Jones (1989); *Important Bird Areas in Europe*, International Council for Bird Preservation, Cambridge; Fishpool et al (2001); op cit

[v] Roy, P S, H Padalia, N Chauhan, Nidhi, M C Porwal, S Gupta, S Biswas, and R Jagdale (check date); Validation of geospatial Model for Biodiversity Characterization at Landscape Level -a study in Andaman and Nicobar Islands, India, *Ecological Modeling* **185**: 349-369

[vi] IUCN (2000); *Red List of Threatened Species*, IUCN The World Conservation Union, Gland, Switzerland

[vii] Anon (2005); Spatial Framework and Management Guidelines for Consolidation of Protected Area Network in Andaman and Nicobar Islands, A technical report submitted by Wildlife Institute of India to the Forest Department, ANI: 124 pp