

31

Ecological challenges of Island Biodiversity

Grinson George

FRA Division,, Central Marine Fisheries Research Institute, Kochi-682 018

Introduction

Imagine people with same brain, same thinking, same analytical ability, same appearance, and same disease resistance. There can be a total collapse of the system if there is no diversity existing among the community. The community will be subjected to extreme events such as mass extinction and collapse even with a small disease challenge. If a similar scenario in agro biodiversity the agricultural system may break and collapse completely with no scope for advancement, any identity and uniqueness. Hence, diversity is a must for stability, sustainability and further improvement.

Major role of Biodiversity can be listed as follows:

Ecological Role: All species provide at least one function in an ecosystem. Each function is an integral part of regulating the species balance, species diversity and species health.

Economic Role: Food (Crops, fishes); Goods (timber, paper, medicines); Recreation (Wildlife tourism, trekking, bird watching) and related activities where a commercial interest is active.

Scientific Role: -Useful genes for transgenesis; Study of evolution and related aspects

The ocean constitutes 99% of all habitable space (biosphere) on our planet (Fig.1). Is it really the case that terrestrial biodiversity exceeds that of the sea so considerably? An investigation into the publications pertaining to ocean/ marine biodiversity indicates a different picture. There are very few observations and records pertaining to marine biodiversity which is published in par with the terrestrial counterpart.

In this chapter there is a description on the ecological challenges faced by the island biodiversity with special emphasis to Andaman and Nicobar Islands (ANI). The Andaman and Nicobar islands comes under the humid tropics with an average rainfall of about 3000mm. Out of the total

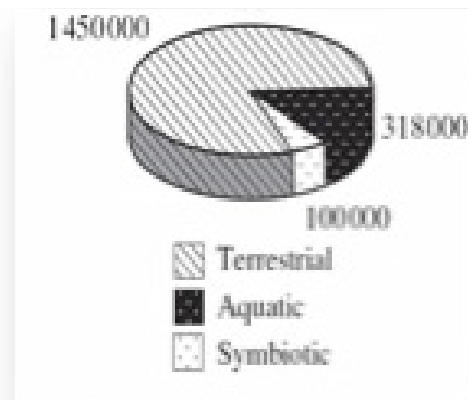


Fig. 1 : Species richness in different environments

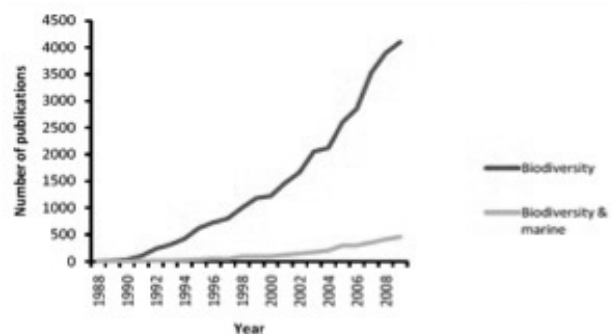


Fig. 2: Articles published on biodiversity since 1988 ('Biodiversity' and 'marine' used as keyword in web science)

geographical area of 8249 km² only 6%, i.e. 50,000 ha at present is under agriculture.

Flora of Andaman & Nicobar Island

2426 species of angiosperms, 8 species of gymnosperm, 300 species of medicinal plants, 130 species of orchids and 150 species of fruits and vegetables around 10 species of oil

yielding plants and 34 species of mangroves

Fauna of the Islands

215 species of butterflies, 68 species of birds, 1434 species of fishes, 300 species of corals and 120 species of sponges

Agricultural Biodiversity

A continuum from cultivated biodiversity to wild biodiversity

1. Cultivated or 'planned' biodiversity: -Crops, Livestock, Fisheries
2. Associated biodiversity: -Supports agricultural production through nutrient cycling, soil formation, pest control, pollination, etc. (eg: Microbes, Butterflies)
3. Additional or other biodiversity: -Occurs within the agricultural ecosystem (eg: Rodents, Frogs, and Snakes)
4. Wild biodiversity: -Outside agricultural ecosystems: wild plants

90% of world food supply comes from 20 species of plants and 14 species of domesticated animals. But there is a need to conserve the genetic resources as they are key for crop improvement and selection studies.

Algae Resources in ANI- 313 freshwater algal species belonging to 15 families; 57 marine algal species belonging to 18 families; 39 species have been found to be endemic.

Mangroves of ANI: Biodiversity and Distribution

Andaman and Nicobar Islands - endowed with about one fifth of the country's extensive and diverse mangroves. Next only to Sundarbans and Gujarat in the floristic diversity. Mangrove cover-968 sq.km; 17% of the total mangrove area in India. 34 true mangrove species belonging to 15 genera, 10 orders and 12 families have been documented - 25 fully described. Associates : 44 fully described with their vegetative states

***Sonneratia ovata* - New record for India:** - *Sonneratia ovata* was observed in less saline and muddy soils on the terrestrial margin of Radhanagar Beach, Havelock. It can be recognized by broadly ovate leaves and warty calyx that envelops the berry.

Ecology of Andaman mangroves:- Hydrographical parameters of the mangrove ecosystems across ANI have been studied. Mangrove forest with total diurnal inundation are dominated by *Rhizophora* and *Avicennia* spp. Sites that are not completely inundated comprises of *Excoecaria agallocha* and *Acanthus* spp. *Cynometra iripa* and *Heritiera littoralis* are found along the terrestrial margins above the high tide mark. Areas with more than 30‰ Salinity are dominated by *Rhizophora* spp followed by *Avicennia* spp. *Sonneratia* spp

are found in waters with salinity ranging between 2-30‰.

Impact of Tsunami on mangroves

- o The mangrove stands of Andaman were surveyed post-tsunami and the extent of damage with respect to different species were studied.

Factors contributed damage to the mangroves was:

- o Physical damage due to the pounding waves- *Rhizophora* spp, *Ceriops tagal*, *Brueguira* spp.
- o Silt deposition on the leaves - *Acanthus* spp.
- o Physiological stress due to sudden increase in salinity.
- o Permanent submergence of roots in subducted areas of South Andaman.
- o Permanent exposure of roots due to upheaval of lands in North Andaman

Further reading: Dam Roy S. and P. Krishnan (2005) Mangrove stands of Andaman vis-à-vis Tsunami. Current Science 89(11): 1800-1804.

Impact of anthropogenic activities in mangrove sites

Physico-chemical and bio-chemical characteristics of the surface and sub-surface soils of mangrove ecosystem were studied to see the soil pH and electrical conductivity which varied minimally between the disturbed and undisturbed sites. Bio-chemical parameters- Marked variations were considerably lower at the disturbed sites due to significant reductions in organic matter/ substrate levels. Microbial biomass carbon was $426 \pm 50.46 \mu\text{g g}^{-1}$ and $397 \pm 53.4 \mu\text{g g}^{-1}$ at undisturbed sites while it was $285 \pm 35.81 \mu\text{g g}^{-1}$ and $257.6 \pm 35.91 \mu\text{g g}^{-1}$ in surface and subsurface soil respectively indicating significant reduction.

Further reading: Ghoshal Chaudhuri S., R. Dinesh, T. E. Sheeja, R. Raja, V. Jeykumar and R. C. Srivastava (2009). Physico-chemical, biochemical and microbial characteristics of soils of mangroves of the Andamans: a post-tsunami analysis. Current Science 97(1): 98-102.

Economic valuation of Island Mangrove Ecosystem

Total economic value of mangrove for the A&N islands was worked out using product and market value approach. It was estimated to be over Rs. 12,000 crores, which translates to about 2 lakh worth tangible and intangible benefits to every stakeholder of the islands on an average.

Corals of A&N Islands: Biodiversity, Extent and Distribution

Coral reef area in A&N islands: 1021.5 sq.km (2004-07).

Coral Reef Biodiversity of North Bay

About 62 species of corals falling under 26 genera are

Classical methods in fish taxonomy

Distribution of families' genera species of Scleractinian corals in India

	Gulf of Kachchh	Lakshadweep	Palk Bay- Gulf of Mannar	ANI	Total
Families	8	12	13	15	15
Genera	20	34	27	57*	60
Species	36	91	82	>300	208

observed in North Bay alone. The other reef associates include the sponges, sea anemone, echinoderms, mollusks, tunicates etc.

Coral reefs are some of the most diverse and productive ecosystems on earth but are subjected to disturbances like tropical storms, rise in temperature, microbial diseases and crown-of-thorn starfish blooms. In the Indian Ocean, the coral reefs around the Andaman Islands suffered bleaching events during 1998, 2002, 2005 and 2010. Surveys conducted in the coral reef regions of the Andaman Island revealed that 37 - 82% of the corals were extensively bleached during April and May 2010 at various sites. As the SST has direct correlation with the intensity of cyclones, there is greater likelihood of frequent and more intense cyclones in the region in the near future. There is evidence of a 5-10% increase in intensity (wind speed) would contribute to enhanced storm surges and coastal flooding.

Fishes

Elasmobranch fishery in ANI

Major gears deployed are hand-line & long-line. Hand-liners are deployed from motorized boats with a fishing duration of 7-9 days and longliners have multiday fishing with duration of 20-30 days. The major groups are in the table below:

Family	No. of Species
Carcharhinidae	20
Sphyrnidae	05
Alopiidae	01
Squalidae	01
Pristidae	03
Rhinobatidae	04
Dasyatidae	10
Rajidae	01
Myliobatidae	05

Ornamental fishes: The following are the major groups of fishes as listed based on field observations: Family:- Pomacentridae-77 spp; Labridae-64 spp, cobiidae-111 spp, Blenniidae-57 spp, Apogonidae-46 spp, Chaetodontidae-41 spp, Cirrhitidae-5 spp, pomacanthidae-20 spp, Scaridae -25 spp, Balistidae-19 spp, Ostracidae -5 spp.

Coral reef ecosystem is very delicate and fragile. In the recent years there is a surge in the trade of ornamental fishes. Indiscriminate harvesting of ornamental fishes not only endangers the survival of these species but also the reef ecosystem as a whole as ornamental fishes are important partners of the self-sustained reef ecosystem. Therefore, a better understanding and rigorous approach to develop a breeding protocol is imperative not only for sustaining the industry but also as a matter of conservation of these fishes.

Fishes-food fishes

Family-Clupeidae-26 spp, Hemirhamphidae-14 spp, Serranidae-58 spp, Lutjanidae-43 spp, Nemipteridae-22 spp, Carangidae-46 spp, Scombridae-18 spp, Xiphilidae-1spp, Istiophoridae-4 spp, Sphyraenidae-9 spp.

The oceanic location of ANI makes them ideal for the development of oceanic fisheries. The oceanic tuna resources, especially around the Bay islands are least exploited since, India does not possess the required expertise in oceanic tuna fishery. The exploratory surveys conducted by the Government of India vessels have provided ample evidence regarding the richness of tuna resources in the area. Estimated potential of tunas in the seas around the ANI is 32000 tonnes in the coastal region and 94000 tonnes in the oceanic region. The possible catch in the oceanic region by along lining is 5000 tonnes and by surface netting is 121 000 tonnes. The introduction of pole and line fishery has limitation as knowledge of the availability of suitable baitfishes is limited. The strategy should be to develop deep water pole and lining in which fishing will be made for 4-5 days using large mechanized boats with facilities for holding bait fishes alive for such duration. For assessing the actual potential for pole and line fishing, external expertise will be necessary from regions such as the Lakshadweep or Maldives, where pole and line fishing has been specialized over the years. Finally, the fishery development action plan should reckon with the preservation of the pristine condition of the islands to ensure the promotion of high-class tourism which is the other sector holding the key to the economic development of the islands.