

## Introduced herbivores and their management in the Andaman Islands\*

Introduced species, i.e. species transported beyond their natural range by human modes, have been increasingly recognized as a major threat to biodiversity conservation in India. The negative impact of non-native species, that become invasive by establishing and spreading over new territory, has received management attention in recent years. The issue of invasive species has been discussed at the national level alongside classical conservation challenges such as human–wildlife interactions<sup>1</sup>. Though faunal invasions in particular have been understudied and unmanaged (with the exception of feral goats and giant African snails) in India, there has been widespread global success in managing such species, especially on islands. Invasive mammals, especially rats, feral cats, and herbivores, have been the focal target of management action and feasibility studies.

In India, very few studies have been carried out on invasive mammals and these have been restricted to the Andaman Islands. As these studies have focused on invasive herbivores and have demonstrated a degree of impact on native biodiversity in small islands, a conference was convened to discuss the collective knowledge regarding invasive herbivores and their management in the Andaman archipelago. The objective of the conference was to initiate a discussion on the state of knowledge of invasive herbivores in the Andaman Islands and to consider management strategies for these species. Management authorities, scientific and academic institutions, environmental NGOs, one animal welfare organization and students participated in the conference held on the 21 and 22 February 2015, in Port Blair,

Andaman and Nicobar Islands. The participants comprised representatives of the Department of Environment and Forests (DoEF), Zoological Survey of India (ZSI), Botanical Survey of India (BSI), Centre for Island Agricultural Research Institute (CIARI), Bombay Natural History Society (BNHS), and Jawaharlal Nehru Rajkeeya Mahavidyalaya (JNRM). This meeting report is based on the proceedings of the conference<sup>2</sup>.

Presentations on invasive herbivores and their impact on native flora and fauna of the Andaman Islands were made, based on which a consensus emerged that invasive species are a threat to the Islands' biodiversity. It was acknowledged that evidence of impacts primarily comes from studies on introduced chital (*Axis axis*) and feral elephants (*Elephas maximus*) and that there are gaps in research documenting impact of invasive species. The participants agreed upon a need to initiate action, based on a feasibility study, on specific invasive species in select areas in the Islands. The feasibility study was suggested to consider all available options of mitigating the impact of invasive species and take into account local and national scientific knowledge, legal framework and logistical considerations. Participants felt that there was a need to consider the problem of invasive species holistically, with long-term investments in capacity building and research.

### Chital

Chital, introduced into the Islands around 1914–1930s, have been studied to elucidate their negative impact on the understory, on understory-dwelling reptiles and on forest structure. N.P.M. reported that an experiment with eight enclosures, across three islands, failed due to cyclonic damage. As it is difficult to maintain such chital-free fences, and the fact that even a single breach of the area by chital can undo months of monitoring, all-weather fencing and an island removal experiment was suggested. It was also suggested to explore the possibility

of capture and relocation of chital from the study area, as per the provisions of the Wildlife (Protection) Act, which can yield quantifiable data on chital-free area. Such experiments, of removing invasive herbivores from islands elsewhere in the world, have been largely successful and have provided information on the actual impact.

### Elephant

Feral elephants are restricted to one island in the archipelago – Interview Island. The impact of this population has resulted in an alteration of the forest structure. K.R. informed that population abundance data remains uncertain, as different studies have provided varying results. It was mentioned that as elephants are confined to a particular island without the possibility of spreading, there may not be impact on the Islands as a whole. Cautioning that the population may be at the bottom of a cyclic fluctuation and can grow in the future, Rauf Ali (Foundation for Ecological Research, Advocacy and Learning) stated that possibilities to remove the elephants may be explored. K.R. noted that translocation to mainland and subsequent domestication was not feasible looking at the remoteness of the island and cases of human–elephant conflicts in the mainland. Captive elephants, used for forestry purposes, were not within the ambit of the discussion.

### Goat

A population of feral goats is found on Barren Island, whereas its eradication on Narcondam Island may have been successful, given that no signs were observed on the island in 2013 (S. Manch Sirish, Pers. Commun.). Introduced goats in island systems are known to affect biodiversity. The attendees were apprised that management of feral goats on islands worldwide has been highly successful. While the impacts of goats on the two islands of the Andaman archipelago have

\*The conference titled 'Introduced herbivores and their management in the Andaman Islands' was organized by one of the authors (N.P.M.) in collaboration with CSIR-CCMB Laboratory for Conservation of Endangered Species, the Andaman and Nicobar Islands' Environmental Team and the Department of Environment and Forests, Andaman and Nicobar Islands.

not been studied, the conservation dividends of management are expected to be high, based on global knowledge. A survey to verify the success of the earlier eradication programme on Narcondam Island and a study to assess the status of feral goats of Barren Island followed by formulation of a strategy to remove goats from the island were proposed. It was anticipated that such a programme would require little effort to be legally compliant.

### Cattle

Feral cattle are known to occur on Long Island and parts of South and Middle Andaman Islands. K.R. reported a perceived high abundance of cattle in these areas. Though the impact of these cattle has not been quantified in the archipelago, large introduced herbivores could cause high amount of biomass removal and degradation of forests. Management of these populations might be difficult in areas with settlements, but is expected to yield positive results of recovery of ground vegetation.

### Barking deer and hog deer

Barking deer and hog deer are among the remaining introduced herbivores in the Andaman Islands. Though hog deer is rarely sighted, barking deer is perceived to be present on North, Middle, South Andaman Islands and small offshore islands. In the absence of knowledge about their distribution and impact, the management of these populations was not a priority among the participants.

Apart from introduced herbivores, many other introduced species present in

the Islands were mentioned. Among birds, attention was drawn to common myna (*Acridotheres tristis*), house crow (*Corvus splendens*) and house sparrow (*Passer domesticus*), all of which have established populations in the Islands. P. T. Rajan (ZSI) informed the gathering of the economic impacts of the introduced carnivorous tilapia fish *Oreochromis* sp. and its rapid spread. N.P.M. cited the example of a recent invasion of the Indian bullfrog (*Hoplobatrachus tigerinus*) which is spreading through human inhabited parts of the islands and could have a highly negative economic and ecological impact. Pet trade was identified as the source of many recent introduced species by Francis Xavier (JNRM). The giant African snail (*Achatina fulica*) was mentioned as a ubiquitous invertebrate invasive species.

The deliberations elucidated the fact that many of the introduced invasive species in the Andaman Islands were protected under the Wildlife (Protection) Act, 1972, which applies to the whole of India. Invasive herbivores such as chital are protected under schedule III of the Act while an invasive amphibian such as the bullfrog is under schedule IV. Although the Act grants powers to the Chief Wildlife Warden to manage scheduled animal populations, it was felt that the legal implications need to be thoroughly considered prior to management decisions.

The participants unanimously agreed on the need to adopt a long term and holistic view of managing invasive species in the Islands. To this end, constitution of a biosecurity agency with the mandate of preventing introductions and managing existing introduced populations was

proposed. As the Islands are connected to the mainland by water and air ways, screening of imports for introduced species becomes necessary. Representatives of the Central Island Agricultural Research Institute informed the gathering that a biosecurity agency was being set up by the organization to prevent and quarantine potential agricultural introductions.

Local support and awareness were considered to be critical to invasive species management. As many invasive species can have direct economic impact on local livelihoods, an increased level of awareness on potential and existing invasive species would aid in prevention of further spread of such species.

Overall, the conference recognized the impacts of introduced invasive herbivores and invasive species in general as a threat to the biodiversity of the Andaman Islands. A joint management exercise focusing on a few invasive species in selected areas of the Islands, in consultation with regional and national scientific institutions and subject experts was proposed.

1. Kaushik, M. and Mungi, N., *Curr. Sci.*, 2015, **108**, 1039–1040.
2. Mohanty, N. P., Andaman and Nicobar Islands' Environmental Team, Andaman & Nicobar Islands, 2015.

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