

## POPULATION ECOLOGY OF GIANT CLAMS

### Abstract:

Giant clams are the largest living bivalves, with its distribution confined to a narrow geographical area within the coral reefs of the Indo-Pacific region. In India, Giant clams are found only in Lakshadweep Is. and Andaman & Nicobar Is. These ecologically and economically important species are listed as 'Vulnerable' in the IUCN Red List of Endangered Animals and also under Appendix II of CITES. Over the years, overexploitation of these clams has led to their extinction from several areas of the world, alarming the need for their conservation in its natural habitat.

Of the five species of Giant clams occurring in Indian waters, three species of Giant Clams *Tridacna maxima*, *T. squamosa* and *Hippopus hippopus* are included in the Schedule I of Indian Wildlife (Protection) Act 1972, while the other two species are not included over lack of information about the occurrence and population dynamics of these species.

When nothing was known about the ecology and biology of these species in India, BNHS was the first to study these organisms and has been doing so for the past 10 years in Lakshadweep Is. and for the past 1 year in Andaman & Nicobar Is. While ecology and population dynamics for *T. maxima* of Lakshadweep Is. has been extensively studied over the past decade providing valuable insight about this endangered species, a baseline data is being created for *T. squamosa*. Over the past one year we are collecting data for base line studies of the Giant clam population of Andaman & Nicobar Is. With *T. crocea* dominating this region, we have only recently confirmed the presence of *T. gigas* and *H. hippopus* from Andaman & Nicobar Is. which demands further studies of these clam population.



Giant clams, belonging to the family Tridacnidae, are the largest living bivalves which can grow over a metre in length. They have a narrow range of geographical distribution and occur exclusively within the tropical reefs of the Indo-Pacific region. These clams are biologically important, as they filter large amounts of water containing harmful waste nutrients like ammonia and expel clean water to the environment; while the symbiotic zooxanthellae found within its mantle tissue produces oxygen during photosynthesis. They are highly worth and in huge demand for their adductor muscle, shells as decorative souvenirs and in aquarium trade, thus making them economically important too. Despite all the 10 species of giant clams in the world being listed under Appendix II of CITES and nine of the ten species listed as 'Vulnerable' in the IUCN Red List of Endangered Animals, reflecting the global concern of the possible extinction of giant clams as a whole and prohibiting unrestricted trade between countries, giant clams are constantly found in seafood stores and prized in the aquarium trade. Overexploitation of this valuable and multi-faceted resource has led to the decline of natural population throughout its geographic distribution and ecologically extinct in some areas.

Lakshadweep Is. and Andaman & Nicobar Is. are the only regions in India, where giant clams are existent. BNHS was the first to study the ecology and population dynamics of Giant clams in India. The study being carried out at Lakshadweep Is. for the past 10 years has shed enormous insight into the ecology and population dynamics of the species *T. maxima*.

It was observed that *T. maxima* primarily occur in shallow waters in the Lakshadweep Archipelago, and that moderate intensity brown mantle colour is super dominant among these populations, camouflaging in the ambient habitat. *T. maxima* occurred in low densities ultimately resulting in lower new recruits, as recruitment is adult density dependent and needs between 20 to 80 adult clams per hectare for successful recruitment. Also, recruitment was seen mostly near lagoon entrances thereby suggesting requirement of strong currents. These clams grow at a slow annual rate of 8 – 11 mm in the juvenile stage with growth becoming slower and stochastic with age.

*T. maxima* are niche selective species. *Porites lutea* flats are most favoured for the settlement of juveniles and prefer live coral substrate with dead coral tops as an ideal site to anchor themselves. Deeper embedment is another crucial factor for the survival of adults especially in light of high wave surge during the monsoon. Thus any removal of these massive corals would have a catastrophic impact on *T. maxima* population as evident from the Minicoy Island population of *T. maxima*. While bulk of the habitat available for the species is sub-optimal, optimal habitats are scarce as this species is specialized to a narrow range of reef canopy with ~ 90% of the population utilizing substrate at an elevation of 0.2 - 0.6 m from the sea floor. Mortality in juveniles was found to be another factor highly influencing the giant clam populations. Studies on convict Surgeonfish (*Acanthurus triostegus*), a main table fish for locals and the single most dominant browser inside lagoon waters, are being carried out to assess the role of this species in maintaining microhabitat for new recruits, the most crucial part of *T. maxima* life cycle. Giant Clams play a crucial role in lagoon ecology by releasing zooxanthellae packed faeces, thus releasing large amount of organic matter in to the lagoon waters and being boring clams, *T. maxima* plays important role as bioeroders.

Giant clams are highly vulnerable for rise in sea temperature, in the events like El Niño, which needs to be monitored continuously. Dredging activities for channel maintenance and sand disposal is another threat to these clams that must be carefully planned and executed, as disposal of dredged sand inside lagoon can lead to substrate clogging. Opening of new channels through breaking of reef crest significantly altered the lagoon ecology in Minicoy

Island which has not only affected *T. maxima* population, but also the coral community as well. Care needs to be taken that such incident is not repeated elsewhere.

*T. maxima* grows up to 300 mm in size, but a few large individuals growing up to 500 mm are known from certain areas of the world, however we recorded a significantly large number of individuals growing up to 500 mm, which is an interesting finding of the present study. *T. maxima* is a key indicator species in coral reefs due to its selective ecological requirements, with long life span of over 100 years, which suggests that long term monitoring of its populations can be used as a tool to monitor changes in the reef environment.

This project work has led to the development of the first and one of its kind concept of co-managed Marine Protected Area (MPA) where local community and government co-manage and together protect the reef. From the past one year, studies are being carried out on the Giant clam *T. squamosa* in Lakshadweep Is.

Giant clam population of Andaman & Nicobar Is. is being studied for the past one year now; the main hurdle being the large geographical area, most of which is not easily accessible. Studies so far suggest the dominance of *T. crocea* in these islands, though *T. maxima* and *T. squamosa* have also been observed but in very low densities. *T. crocea* primarily occur in intertidal area followed by shallow waters with blue mantle colour observed to be dominant among this species. The clams preferred dead boulder corals for their attachment and growth.

With low recruitment, high mortality, low adult density and niche selectivity, the *T. maxima* population in Lakshadweep Archipelago can be considered critical. Mariculture of Giant clams is also being explored for reintroduction of these species in regions where populations are dismal. BNHS is undertaking a systematic assessment of the ecology and population dynamics of these highly threatened species with utmost priority to conserve these animals and their habitats.