Restoration and natural revival of clam populations at Tuticorin Bay

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Bivalves play key role in ecosystem stabilisation due to inherent filter feeding capability and clams are important components of soft bottom benthic communities. In the Tuticorin Bay, mass mortality of fishes and shellfishes was observed in Februay 2008. The probable cause for the large scale mortality has been indicated as increased levels of ammonia (Asha *et al*., 2009). A rapid survey was conducted in the bay to assess the impact on the bivalve fauna. It was observed that, the heterogeneous clam population in the bay consisting of major species like *Meretrix meretrix, Meretrix casta, Anadara granosa, Marcia opima, Donax cuneatus* and *Paphia malabariaca* were drastically affected. In all the quadrant samples (N=50) collected from the Bay, more than 95% mortality was recorded as indicated by the occurrence of empty shells of clams and gastropods like *Umbonium* and *Cerithium*. Sampling during the subsequent months to evaluate the natural revival of the clam beds indicated that the settlement of new spat was negligible and slow. The impact on the clam population also affected the clam fishery in the bay, where local villagers used to fish clams for shell.

An experiment was initiated to revive the clam population by transplanting clams from other locations in October 2008. A pen enclosure of 10 m x 10 m was erected using netlon strip of 50 cm width, 50% of which was inserted into the soft bottom as fence. Casuarina poles were also used. The pen was partitioned into four experimental plots A, B, C and D each of size 5 m x 5 m. Within the pen, partitioned cages were placed for continuous monitoring. Macro-benthos (biomass and density) in the pen and the Bay at 10, 20, 30 and 40 m from the pen were assessed before stocking and periodically after clam stocking. *D. cuneatus* (1000 nos.), *M. casta* (1000 nos.) and *P. malabarica* (1000 nos.) collected from Hare Island and Vellapatti beach near Tuticorin were stocked in the pen. *P. malabarica* (800 nos.) collected from Ashtamudi Lake in Kerala were also stocked. Macro-benthos (biomass and density) in the pen and the bay were assessed before stocking.

Within each experimental plot, three trays with iron frame and netlon webbing of size 50 cm^2 were placed and stocked with 50 nos. of each species to monitor the mortality directly. The mortality due to transplantation/transportation was assessed through counting the number of dead shells in the experimental trays. Observations were made on days D-2, D-5, D-10, D-15, D-30. The survival was estimated from the number of surviving clams on each observation day. After one month, these trays were removed and further sampling was directly from each plot. Apart from this, about 2000 to 3000 different size group clams (*Meretrix* spp., *Donax* spp. and *Paphia* spp.) were just stocked in the open bay area randomly. Further observations were made on alternate months and assessments made in each plot.

Control sites were selected at distances 10 m, 20 m, 30 m to 40 m away from the experimental sites in all directions and the values were averaged to represent the macro-benthic molluscan population of the bay.

Survival of *Meretrix* spp. and *Donax* spp. was above 90%. Complete mortality was observed in the case of *P. malabarica* transported from Kollam and stocked in the experimental plots.. Survival of *Paphia* spp. from Vellapatti was 84%.

In January 2010 *i.e.*, 14 months after transplantation, the average density in the experimental plots were 29 nos m^{-2} with a biomass of 8.09 g m^{-2}. In addition to the stocked clams, cockles at a density of 6 no m^{-2} and gastropods like *Cerithidium* (218 nos m^{-2}) and *Umbonium* (278 nos m^{-2}) were also observed in the experimental site indicating natural settlement. By March 2011, the clam population in the bay was found to be completely revived.

At the control sites, natural settlement of other clam species like *M. meretrix, M. opima* and *P. malabarica* were observed thereby establishing a heterogeneous population of clams (Fig.1) with an average density and biomass of 74 nos. m^{-2} and 115 g m^{-2} respectively. Clam fishing by nearby villagers (Fig. 2 and 3) started from March 2010 onwards at 15 days per month with a production of 2.5 t and the shells were marketed to the lime shell industry @ ₹ 25/ kg which earned them an estimated total value of ₹ 62,500/-. Thus by transplantation and through natural settlement of larvae, the clam population of Tuticorin Bay was revived and the fishery was re-established.

Fig. 1. Heterogeneous population of clams from restored area of Tuticorin Bay

Fig. 2. Clam fishing in Tuticorin Bay

Fig. 3. Clam fishermen with catch, at Tuticorin