

Impacts of *Acanthaster planci* (Crown-of-Thorns Starfish) population expansion on the Coral ecosystem of Pigeon Island Marine National Park, Sri Lanka

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Abstract

Pigeon Island Marine National Park in Sri Lanka is characterized by its pristine fringing coral reef with multitude array of its flora and fauna. Available literature highlights this finest coral reef ecosystem received minor damages from 1998 El-Niño and Tsunami 2004 events. In addition, this remote island is well known and popular as a holidaymaking, bathing, snorkelling and SCUBA diving site. However, during the past years the infestation of corallivorous Crown-of-Thorns Starfish (COT), (*Acanthaster planci*) has become a severe threat causing massive coral mortality throughout the Pigeon Island coral reef extent. The present survey was conducted in August 2013 at 10 locations around the main island to address the impacts of *A.plancion* the reef ecosystem. Manta-Tow, 15m Line Intercept Transect (LIT) and 15x2m belt transects were deployed in iso-depth contour to examine the bottom substrate composition, emphasizing on the dead coral percentage and the abundance of COT. Percentage cover of dead coral was about 23.32% and 15 COTs were rerecorded within 300m². There was a significant correlation between dead coral percentage and starfish abundance ($r= +0.963$, $p<0.05$) and significant correlation of determination ($R^2=0.927$, $p<0.05$). The estimated population density of COTs in Pigeon Island (5 individual m⁻²), is far higher than the optimum density (0.002-0.003 individual m⁻²) indicating a severe outbreak. The most probable reasons for their profusion might be the reduction of their predators due to high fishing pressure in the area and the changes in biotic/abiotic environment. However this appears as an underestimation mainly due to its cryptic behaviour resting under reef crevices. In order to control the adverse impacts caused by COT, regular removal, monitoring, research and the implementation of better management practices are proposed.

Keywords: Corallivorous, Crown-of-Thorns Starfish, COT, LIT, Manta-Tow

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Introduction

Acanthaster planci is a starfish lives associated with coral reefs and play a significant role in maintaining the coral diversity in reef ecosystems. They feed on coral polyps particularly on fast growing coral species such as *Acropora spp...*Hence, it unleashes

other coral and relating species to be colonized in the habitat. At present *A. planci* becomes as an imminent threat to coral reefs existence by exceeding their optimum densities resulting reef mortality. In the case of their feeding rate exceeds the recovery rate of coral growth, it indicates an Outbreak state (Lourey et al., 2000). Pigeon Island Marine National Park is one of the four marine protected areas in Sri Lanka and well-recognized for its pristine coral reef. The island is popular as a holidaymaking, bathing, snorkelling and SCUBA diving site. First scientific study was conducted at Pigeon Island in 1999 using Reef Check method (Christoffelsz et al., 2000) and they stated that in mid-nineteen seventies most of the reef was devastated by *A. planci*. Rajasuriya (2005) recorded 17 individuals per 2000m² and he further mentioned that profusion of the starfish population would be the reason for the slight increment of dead corals. Moreover, Green Tech Consultants (2009) also documented *A.planci* was abundant during the survey period. This study concerns the present status of *A. planci* population at Pigeon Island and the magnitude of its impact to the reef.

Materials and Methods

Fine scale reef survey (CRC Reef Research Centre, 2003) was adopted for the data collection in non-monsoon Period in August 2013. Prior to the site selection, Manta-tow survey method was carried out as a rapid survey method in order to select potential sites. Ten sites were selected around the island at iso-depth contours. At each site, 15m of Line Intercept Transects (LIT) were deployed parallel to the shoreline to determine the percentage coverage of dead corals and 15 x 2m belt transects were used to estimate the *A. planci* abundance (English, et al., 1997). The correlation between percentage dead corals and *A. planci* abundance was analyzed using SPSS (16.0) statistical package.

Results

The dead coral percentage of the study area was about 23.32%. 15 individuals of *A. planci* were encountered within 300m² of area. Snorkelling area and the area adjacent to the boat landing site were dominated with branching *Acropora* sp.

There is a significant positive correlation between dead coral percentage and starfish abundance ($r= +0.963$, $p<0.05$) and significant correlation of determination ($R^2=0.927$, $p<0.05$).

Discussion and Conclusion

The results reveal that the most probable reason for the dead coral is the high densities of *A. planci*. The abundant availability of their feeding preferences at southern flank of

the island could have been one of the triggers responsible for COT expansion. When compare with previous studies the percentage of dead corals has been exponentially increased from 6% (Green Tech Consultants, 2009) to 23.32%. 20-30 COTs individuals per 10,000 square meters are considered to be normal if the coral cover is about 40-50% (CRC Reef Research Center, 2003). But during this study 15 individuals were recorded in 300 m² areas indicating an active outbreak potential. The other reasons for the COT infestation most probably be the nutrient enrichment by agricultural runoff, sewage discharge and removal of predators (Brodie et al., 2004). GreenTech consultants (2009) listed starfish predators *Cheilinus undulates* and *Balistoides viridescens* during their survey. However, according to the findings in 2013, only *Balistoides viridescens* was recorded. Eradication and management of COTs must be conducted with great care preventing deliberate spawning during mechanical collection of adult females. Application of environmental friendly and low-cost Dry Acid (Sodium bisulphate) is considered possible options. However, periodical monitoring and surveillance is a must in order to evaluate the health of the reef.

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