Feeding biology of the Crown-of-Thorns Starfish, *Acanthaster planci* (Linnaeus)

Thesis submitted by

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ABSTRACT

Field and laboratory studies were undertaken to examine aspects of the feeding biology of Acanthaster planci (Linnaeus) in the central region of the Great Barrier Reef. Day and night surveys were carried out to examine feeding periodicity, and measurements of feeding and movement rates were made by monitoring tagged animals. Diet and feeding preferences were assessed in the field and laboratory studies were undertaken to assess the importance of nutritional quality of food in governing feeding preferences.

Small starfish feed nocturnally and remain cryptic during the day. Large starfish are primarily diurnal feeders and are rarely cryptic. Starfish are most mobile around dawn and dusk. It is proposed that the observed behaviour patterns have evolved as a predator avoidance strategy with large starfish achieving a refuge in size. These size dependent behavioural patterns, together with changes in population size structure, have important implications for assessing the numbers of starfish remaining undetected in A. planci survey and control programs.

Rates of movement in A. planci are dependent on food availability. These are about 1 $m.day^{-1}$ in areas of high coral cover and about 4 $m.day^{-1}$ in patches of low coral cover. Starfish in extensive areas of depleted coral cover move at rates of about 10 $m.day^{-1}$.

Feeding rates in A. planci are dependent on starfish size and season, being greatest prior to the summer spawning season. Starfish at Davies Reef in summer averaged 1.5 feeds per day, killing about 300 cm^2 of coral cover or 15 g DW (dry weight) of soft coral tissues per day. Biomass utilization is about 4 g DW or 90 kJ per day. Feeding rates in winter are about half those of summer.

Feeding rate measurements were applied to ecological and physiological considerations in A. planci. The magnitude of changes to coral communities in terms of area and biomass of coral killed during A. planci outbreaks is substantial. Outbreaking populations (ca. 100000 starfish per reef) will kill thousands of square metres of coral; equivalent to hundreds of kilograms dry weight of soft tissues per day. Feeding rate measurements were used to predict a threshold population level of about 1000 starfish per km^2 which would cause minimal damage to coral communities on the Great Barrier Reef. It is evident that large scale fluctuations in A. planci populations can occur without causing extensive coral mortality. Comparison of physiological requirements with feeding rates confirms that, despite increased feeding rates in large adults, growth is determinant and senility of large A. planci can be expected. As suggested in previous studies, this occurs because as the starfish grows its capacity to feed cannot meet the demands of metabolising tissue.

The diet of A. planci is almost exclusively scleractinian corals (90 - 95 %). Non-coral prey are taken in increasing abundance in areas of low coral availability. A. planci exhibits strong feeding preferences in both the field and the laboratory. The scleractinian families Acroporidae and Pocilloporidae are most favoured. Non-preferred prey are taken in increasing abundance in areas depleted of favoured species. The nutritional value of different species of coral prey was assessed and related to the observed feeding preferences. Several attributes may affect a coral species suitability as food; these are surface area complexity, biomass, nutritional value and abundance. Prey preference was more closely related to a general assessment of food suitability than to the absolute predictions of optimal diet theory. It is proposed that the ability to feed more efficiently on certain prey types is the most important factor giving rise to observed and published patterns of prey selection.

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DECLARATION

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

J K Keesing
7 March 1990