THE EARLY LARVAL DEVELOPMENTAL STAGES OF THE SPINY LOBSTER *Panulirus ornatus* (Fabricius, 1798) CULTURED UNDER LABORATORY CONDITIONS

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ABSTRACT

Phyllosomas of the ornate spiny rock lobster *Panulirus ornatus* (Fabricius, 1798) were hatched and reared under laboratory conditions. The phyllosomas moulted 9 times to reach the sixth developmental stage, with distinct morphological changes between each stage, though not always between each moult. *P. ornatus* were much smaller and less developed than temperate species, but the early developmental stages of this species were very similar to those of *P. homarus* (Linnaeus, 1758). Early phyllosomas of *P. ornatus* were compared to those of closely related species.

INTRODUCTION

Spiny (rock) lobsters (family Palinuridae) are an important marine resource for many countries, and Australia is the world’s largest producer and exporter of these animals (Phillips, 1985). The three most abundant species of Palinuridae across most of the Pacific islands are *Panulirus ornatus* (Fabricius, 1798), *P. penicillatus* (Olivier, 1791) and *P. versicolor* (Latreille, 1804) (cf. Adams & Dalzell, 1993).

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There are nine Australian species of rock lobster, with six tropical species of the genus *Panulirus* being found in northern areas of Australia (Phillips, 1985). *Panulirus ornatus* is the most abundant of these species in Torres Strait and the far northeastern coast of Queensland (Pitcher et al., 1997). Research on these animals has mainly focused on the adults, with little, or nothing, known on their early life history. This causes problems when trying to identify larval stages (phylllosomas) caught in plankton hauls. The successful culture of phylllosomas would fill the gap in knowledge of the early life history of these animals (Kittaka & Kimura, 1989). However, these stages are difficult to culture due to their delicate structure, long larval life, and our limited knowledge of their dietary requirements and digestive capabilities. Few observations have been made on the morphology and function of the feeding apparatus for phylllosomas (Kittaka, 1997), though it is known that the mouthpart morphology changes little during larval development, except in the density and complexity of setation and robustness (Johnston, 2001).

The phylllosomas of tropical rock lobsters are transparent, leaf-like in appearance, and are self-sustaining, with no obvious yolk from the egg to draw upon (Johnson, 1960; Booth & Phillips, 1994). Phylllosomas grow by a succession of molts terminating in a metamorphosis to a puerulus stage (Johnson, 1971). Larval development differs between species in terms of number and duration of stages and molts, as well as morphology. *Panulirus* species have been observed to go through 8-11 stages over 6-12 months (Kittaka & Ikegami, 1988; Kittaka & Kimura, 1989; Johnston, 2001), whilst *Jasus* species progress through 11 stages over 6-24 months (Kittaka, 1994; Johnston, 2001). Temperature and availability of food can affect the rate of larval development, and there may be a considerable range in size between phylllosomas of the same stage. The lengthy duration of development is a hindrance to successful culture.

A naupliosoma stage, which occurs before the phylllosoma stage, has sometimes been reported, but is of short duration and is still nourished by yolk received from the egg (Johnson, 1960). This stage was first named and described by Gilchrist (1916, cited in Silberbauer, 1971) and may be the result of a premature rupture of the egg (Robertson, 1969). This stage may not be obvious due to its short duration and can be missed because the eggs usually hatch at night. Jones et al. (1999) saw evidence of a naupliosoma stage for *P. ornatus* only once, when hatching occurred during the day, whilst Prasad & Tampi (1957) did not notice this stage, though it may have been overlooked because the first phyllosoma was seen early in the morning. Some earlier authors have observed this naupliosoma stage for different species, Sheard (1949) for the tropical species *Panulirus longipes* (A. Milne-Edwards, 1868) (cf. Prasad & Tampi, 1957); and Silberbauer (1971) for the temperate species *Jasus lalandii* (H. Milne Edwards, 1837).