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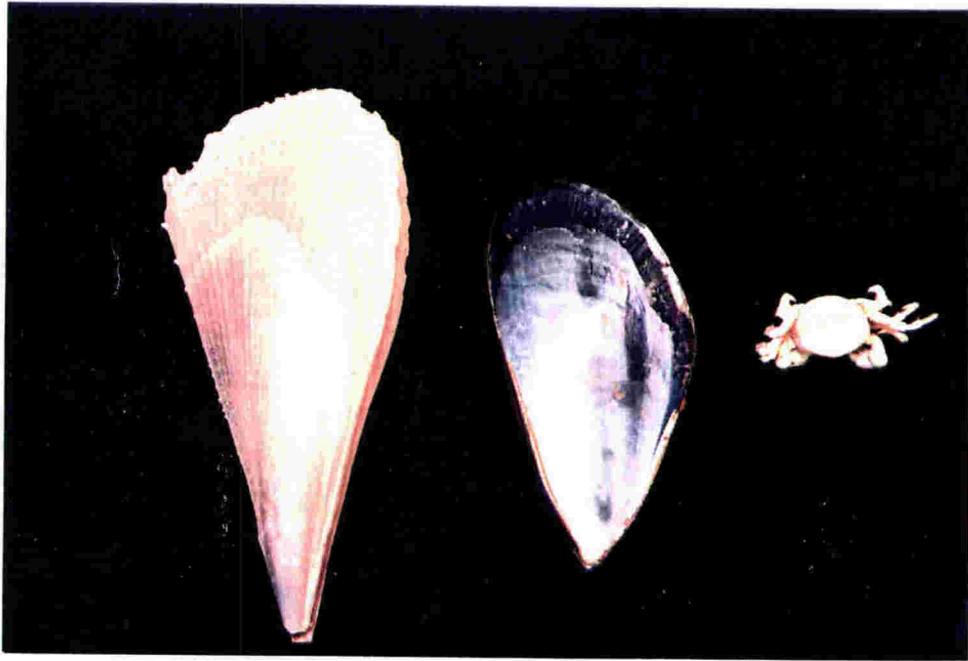
# Host Races and Cryptic Species in Marine Symbionts

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## Frontispiece



*Atrina zelandica* (left), *Perna canaliculus*, *Pinnotheres atrinicola* (right)

## Abstract

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The Pinnotheridae is a family of decapod crustaceans comprising more than 120 mostly microphagous and commensal species. As symbionts of a variety of aquatic invertebrates, pinnotherids typically live in an intimate association with their host depending on it for an almost lifelong source of nourishment and shelter, together with a site for mating. The New Zealand pinnotherid fauna was thought to comprise only one species, *Pinnotheres novaezelandiae* Filhol, associated with a multitude of hosts. Recently, however, a separate species, *P. atrinicola* Page, has been described which is regarded as being host specific to the horse mussel *Atrina zelandica* Gray. In this context, the relationship between pea crabs and their hosts is of special interest, and is the focus of this thesis.

An investigation into the population dynamics of the symbiotic relationship between *P. novaezelandiae* and its host, the green-lip mussel *Perna canaliculus*, at Westmere Reef, Auckland between May 1986 and July 1988 is reported. Ovigerous females and Stage I males and females were found throughout the sampling period, indicating that reproduction is continuous in this species. The developmental composition of the pea crab population reveals that soft-shelled males, usually regarded as an anomalous instar, formed a significant component of the pea crab population at all times. It is suggested that these individuals represent a distinct facies, analogous to the Stage II female instar. The presence of a pea crab was found to have a highly significant detrimental effect on mussel condition. Analysis of the distribution of pea crabs among the mussel population indicates mature crabs display a repulsed distribution favouring to live a solitary existence, whereas younger (pre-hard and Stage I) crabs showed a random distribution in broad agreement with a theoretical Poisson distribution.

The biological status of the two described taxa was investigated by a survey of electrophoretically detectable genetic variation of populations from throughout the North Island of New Zealand. Pea crabs from 18 host populations from nine geographically disparate localities were subjected to cellulose acetate and poly-acrylamide electrophoresis. Forty-one enzyme systems were screened for polymorphism. Clearly resolved enzyme phenotypes were obtained at 23 presumptive loci, of which 15 exhibited polymorphism. An analysis of electromorph frequency data revealed that both taxa are highly genetically structured and typified by high levels of polymorphism and heterozygosity; results atypical

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of brachyuran crabs. *P. atrinicola* was found to exhibit strong patterns of geographic differentiation and clinal variation in electromorph frequency. Of particular significance is the pattern of genetic differentiation observed among populations of *P. novaezelandiae*. Hierarchical F-statistics indicated that the preponderance of inter-population differentiation can be attributed to differences in electromorph frequency among host-associated populations of *P. novaezelandiae* within a sampling locality. Geographic differentiation was a comparatively insignificant factor in the structuring of the sampled *P. novaezelandiae* populations. Individuals belonging to two genetically very distinct units were found within a newly recorded host species, *Macra ovata ovata* Gray at Green and Wood Bays, Manukau Harbour. Hardy-Weinberg analyses indicate the host-associated populations of *P. novaezelandiae* exhibit such a pronounced pattern of homozygote excess and disturbance from genetic equilibrium in sympatry that it is unreasonable to consider them as a single panmictic population. It is concluded that significant biological discontinuities based on host origin exist within the currently recognised taxon. Such a conclusion is supported by data presented on qualitative differences in host recognition observed between different host-associated populations of *P. novaezelandiae*. Conservatively these discontinuities indicate host race development, although a viable alternate hypothesis would be the presence of cryptic, host-specific biological species within *P. novaezelandiae*.

Host race development as found here is a well recognised phenomenon in insect-host and parasitoid-host relationships, although little studied in marine symbiotic relationships. Such a phenomenon has important implications for ecological, behavioural and physiological studies on marine symbionts in general.

## Acknowledgements

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