Population Ecology of the Sydney Rock Oyster *Saccostrea Commercialis* and the Pacific Oyster *Crassostrea Gigas* in a New South Wales Estuary

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Declaration

I certify that this thesis has not already been submitted for any degree and is not being submitted as part of candidature for any other degree.

I also certify that this thesis has been written by me and that any help that I have received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

Frederick Rudolf Krassoi

Abstract

The Sydney rock oyster *Saccostrea commercialis* is a dominant sessile organism of intertidal rocky shore and mangrove communities of Port Stephens, New South Wales. This study describes patterns of distribution and abundance of *S. commercialis* in these habitats, as well as those of the recently introduced Pacific oyster *Crassostrea gigas*. Observations drawn from these mensurative studies were used to formulate and test hypotheses concerning the importance of some ecological processes in structuring intertidal oyster communities.

A preliminary survey in the spring of 1990 revealed for the first time the presence of *C. gigas* among *S. commercialis* rocky shore and mangrove communities in the inner port of Port Stephens. However, few *C. gigas* were present in the definitive surveys performed 1-2 years later, demonstrating a failure of the 1990 recruits to survive. For the purposes of characterising the intertidal oyster communities, rocky shore and mangrove communities were divided into low, mid and upper intertidal zones. In both communities, the density of *S. commercialis* increased with intertidal height to above the mid tide level, although a comparison of sites within Port Stephens demonstrated that oyster densities were significantly different within each intertidal zone. The maximum density in the low and mid zone rocky shore plots was approximately $600m^{-2}$. The size class structure of both communities was unimodal, with juvenile oysters poorly represented. This low density of juvenile oysters was despite an apparently abundant supply of *S. commercialis* larvae. Oysters were found to occur in abundance on mangrove pneumatophores, with the degree of aggregation and size of oyster clumps decreasing with intertidal height. Space was not limited, as most pneumatophores were unoccupied by oysters.

Recruitment onto experimental patches on a rocky shore and mangrove pneumatophore community was assessed over 1 year, and were examined biweekly during peak settlement times. Three to four episodes of recruitment were observed, with the first two suffering complete mortality over the summer period (December through March). Successful recruitment of *S. commercialis* occurred in autumn, although initial mortalities were high across all intertidal zones. The density of recruits decreased with increasing intertidal height in both communities. The presence of adult conspecifics or shells of conspecifics significantly enhanced the density of *S. commercialis* recruits onto model pneumatophores, but this was not always apparent on rocky shore plots. However, densities of recruits did not differ between treatments over time. The upper limit of intertidal distribution in

mangroves and on the rocky shore sites was similar. Recruitment of *C. gigas* was observed in July, but were few in number.

Thermal tolerances of larvae, 1 month-post settlement spat and adults of both *S. commercialis* and *C. gigas* were determined to assess the role of thermal stress in structuring oyster communities. The thermal tolerances of the larvae of the two species were similar. Oysters were more resistant to elevated temperatures with age, although *C. gigas* was less tolerant than *S. commercialis* over short exposures of elevated temperatures. The body temperatures of insolated model oysters were observed in some instances to exceed the thermal tolerances of spat, but not adults. Shading by mangroves reduced oyster body temperatures by up to 13.5^{o}C, to below that where mortality may be expected in spat. The lower relative thermal tolerance of spat may explain the failure of recruits to survive the summer, and the low density of oysters in the upper intertidal zone.

The effect of intra and inter-specific density on survival, size, and shape was tested at low, mid, and upper intertidal zones at 3 sites within Port Stephens. In the upper intertidal zone, high mortalities and reduced growth rates prevented any competitive interactions with both species. However in the low and mid intertidal zones, the presence of both high and low densities of *C. gigas* induced significant mortalities, reductions in size, and changes in shape in *S. commercialis*. This experiment demonstrated the potential competitive pressure faced by *S. commercialis* if density of *C. gigas* recruitment was to increase.

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