

Thesis Abstract

## Can fishing abalone trigger changes towards habitat types unsuitable for commercial abalone fisheries?

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The Tasmanian blacklip abalone (*Haliotis rubra*) fishery supplies ~25% of the world market and, with a value of ~AUD\$120 M p.a., is the State's most valuable fishery. Fishing pressure is intense and management has been based on 'single-species' methods. However, with clear recognition that the fishery depends on the ecosystem that supports it, there is growing demand for a broader ecosystem based management approach (EBM). In this context we examined whether fishing of *H. rubra* has facilitated establishment of the invasive sea urchin (*Centrostephanus rodgersii*), and results in change in benthic community structure. We also assessed whether the establishment of *C. rodgersii* at high densities affects the *H. rubra* fishery.

Previous surveys demonstrated a negative relationship between densities of *C. rodgersii* and *H. rubra*. We used manipulative experiments to examine the effect of competition between these species on behaviour, movement, growth, and survival. Removals of *H. rubra* had no detectable effect on *C. rodgersii*, so there is no evidence that fishing of abalone contributed to the sea urchin invasion success. In contrast, introducing *C. rodgersii* to intact algal beds caused *H. rubra* to flee and seek shelter in cryptic microhabitats, and reduced their growth and survival rates, all of which would negatively impact on the abalone fishery. *H. rubra* only ventured into small *C. rodgersii* 'barrens' after sea urchins were removed and these areas revegetated. This suggests that lack food and/or loss of biogenic habitat structure explain the absence of abalone on barrens. The combined research suggests that management of *C. rodgersii* to optimise the *H. rubra* fishery requires complete removal of sea urchins and regrowth of barrens.

Surveys at a range of spatial scales, depths and locations demonstrated a positive relationship between cover of encrusting red algae (ERA) and densities of *H. rubra*, and a negative relationship between densities of abalone and cover of filamentous algae, sessile invertebrates and the sediment matrix. Removal of *H. rubra*, simulating heavy fishing, resulted in overgrowth of ERA by sessile invertebrates and a matrix of filamentous algae and sediment. Emergent *H. rubra* actively avoided areas overgrown by the matrix, which may negatively impact the fishery. Because *H. rubra* ostensibly prefer an 'open' bottom dominated by ERA, these changes create a positive feedback loop. Above some threshold, more fishing is likely to render a greater proportion of the benthos unsuitable for abalone. Since *H. rubra* depletion can cause a shift to habitats poorly conducive to abalone, EBM should consider the effects of fishing on benthic habitat structure.