
**Spatial and Temporal Variation of Benthic Macrofaunal
Communities in the Intermittently Closed Estuaries of the
Solitary Islands Marine Park, Australia**

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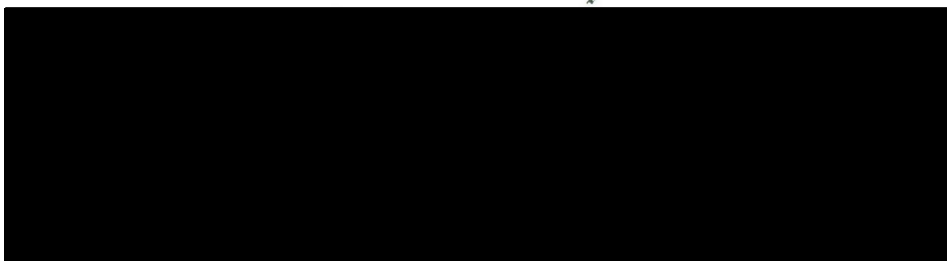


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University of New England - September 2006*

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis and all sources used have been acknowledged in this thesis.

Beth F. Hastie



ABSTRACT

Intermittently closed estuaries comprise up to 92 % of the estuaries along the New South Wales (NSW) coast. Despite being the most abundant estuary type in southeast Australia, intermittently closed estuaries are, ecologically, very poorly understood. This is a result of past estuarine research in Australia primarily having focussed on permanently open systems. Consequently, there is little scientific information on which to base management guidelines concerning intermittently closed estuaries, with the prevailing management approach giving little attention to their natural differences to other estuarine systems or their elevated sensitivity to anthropogenic influences.

The overall objective of this work, therefore, was to develop a greater understanding of the ecology of intermittently closed estuaries by examining community variation within them, and comparing this with nearby permanently open estuaries. Conducted within the Solitary Islands Marine Park, the major proportion of the study comprised seasonal sampling of benthic macrofauna in six intermittently closed and three permanently open estuaries. This continued over a two-year period, with the aims of: 1) determining the degree of spatial variation within and between the two estuary types; 2) examining how the relationship between the two estuary types changed over time; and 3) investigating temporal variation within each estuary.

Distinct community differences were observed between the intermittently closed and permanently open estuary types and these differences persisted through out the study. This was despite a high degree of variation between the individual estuaries nested within each type. Further, whilst always significantly different, the two estuary types were most similar when all of the intermittently closed estuaries were open. These community patterns within and between estuary types appear to be driven by catchment size, which influences the likelihood of entrance closure and, hence, the resultant changes in environmental conditions.

Temporal changes were most notable at the lower sites of the intermittently closed estuaries, where the effects of entrance closure resulted in assemblages becoming either depauperate or dominated by species that were otherwise most commonly associated with sites further

upstream. These particular trends were usually most strongly correlated with variation in either salinity or sediment parameters, especially organic content.

The project also investigated the application of a number of surrogate measures for the rapid assessment of biodiversity in estuarine benthic communities. The development of methods to rapidly assess biodiversity in a range of coastal environments is crucial in aiding better management and conservation of biodiversity. The specific biodiversity surrogates examined were the diversity of indicator groups (e.g. molluscs, polychaetes, crustaceans) and the diversity of higher taxa (e.g. genus, family, order). The family-level higher taxon was considered to be the most effective biodiversity surrogate as it: i) accurately predicted species richness, ii) reflected the ecological patterns of the species-level assemblage and iii) is cost-effective, resulting in savings in time and taxonomic expertise. Further assessment of the application and potential value of this higher taxon approach is essential in providing reliable tools for biodiversity monitoring and assessment, which will contribute to the adequate protection of estuarine habitats and benthic fauna conservation.

The results of this research confirm an ecological differentiation between the intermittently closed and permanently open estuary types. In addition to unique communities between estuary types, they also highlight the high degree of individuality between the estuaries within each type. As the first long-term benthic study in the region involving a number of estuaries this, essentially baseline, information makes a long-overdue contribution to the current knowledge of estuaries in southeastern Australia and has important implications for estuarine management in this region.

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Note that credit is given throughout the thesis for photographs taken by someone other than myself.

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