Identifying key dynamics and ideal governance structures for successful ecological management

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ABSTRACT

Estuaries around the world are often degraded and subject to issues surrounding effective management and governance. Without substantial changes in the overall management of many catchments, there is a risk that estuarine health will further decline, causing serious social and economic impacts. The Peel region is one of Australia's fastest growing residential areas and the social and economic wellbeing of the local community is tied to the health of the Peel–Harvey estuary. This estuary is the largest in south Western Australia and has for decades incurred considerable anthropogenic impacts. This study uses the Peel–Harvey estuary as a case study for the assessment of governance structures and ecosystem dynamics using qualitative models. Each model highlights drivers that impact the most important assets, water quality and general environmental quality. Potential management strategies are identified to tackle ineffective monitoring and regulation of impacts, overlapping responsibilities between different public infrastructure providers, and a lack of accountability. Incorporating 'ideal' management strategies into 'future' models clarified paths of governance and provided better delivery of outcomes. Strong environmental and nutrient management were integral to effective environmental governance, as was the need for whole-of-government environmental decisions to be made in the context of predicted longer-term benefits for all sectors, including the general community. The assessment of social–ecological structures, issues and potential management strategies using qualitative models identified mechanisms to achieve effective management and resulted in predictions of increased environmental quality, as well as increased social and economic values.

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1. Introduction

Catchments worldwide are subject to multiple and interrelated impacts that typically require remedial management intervention, but are often managed by quite disconnected agencies. Ensuring appropriate governance structures for the facilitation of improvements in catchments and estuaries is critical and can be achieved by creating linkages for cooperation and mutual accountability at both local and higher levels. Furthermore, effective links between resource users and public infrastructure providers are critical to increase the

robustness of these social–ecological systems (Anderies et al., 2004). However, the initial alteration of governance structures may be a turbulent and arduous process (Mitchell and Hollick, 1993). Some successful examples include the management of Chesapeake Bay (Hennessey, 1994) and the Johnston River catchment in Queensland (Margerum, 1999), where steps towards integrated adaptive management, including alterations to governance, have been achieved. Similarly, because the majority of rivers in south-west Western Australia are in poor condition (Halse et al., 2002), these also require substantial long-term alterations to management if their health, as well as reliant social and economic systems, are to be improved. This study uses a qualitative modelling approach to identify key drivers of ongoing anthropogenic impacts and governance dynamics that, if modified, could shift these systems away from being dysfunctional and maladaptive to being functional and effective.

The Peel–Harvey estuarine system (Fig. 1) has been formally recognised as the most at-risk estuary (excluding freshwater environments) in Western Australia (Department of Fisheries, 2011). The surrounding area is one of the fastest growing regions in Australia (Department of Environment and Heritage, 2006). The rate of population growth and degradation for this estuary has similarities with many others globally (e.g., Lotze et al., 2006); we have therefore used it as a case study for the modelling and identification of mechanisms for improving governance. Residential land-use in the area is replacing agricultural and industrial land-use and recreational uses and the visual amenity of the estuary is highly valued for maintaining real estate values and tourism. In addition, wetlands of international importance, as recognised by the Ramsar Convention on Wetlands, are located within the Peel–Harvey region and international agreements include an obligation for their protection. For these reasons, the ecological health of the estuary is of high social and economic importance.

Estuarine health is an issue in the Peel–Harvey region as increased macroalgal volume and toxic algal growth (Department of Water, 2011) has lead to suggestions that the estuary may be shifting to a eutrophic state (Rogers et al., 2010). This is concerning given issues caused by eutrophication between 1960 and 1994; extreme levels of macroalgal growth, toxic algal blooms (*Nodularia* spp.) and large accumulations of algal wrack were observed around the estuary which stimulated public complaints to local councils (Atkins et al., 1993) and was partly responsible for a depression of real estate values (McComb and Davis, 1993). In response to these concerns, the state government constructed an artificial entrance, the Dawseville Cut (Fig. 1), to increase tidal flushing of the estuary in 1994 (Brearley, 2005).
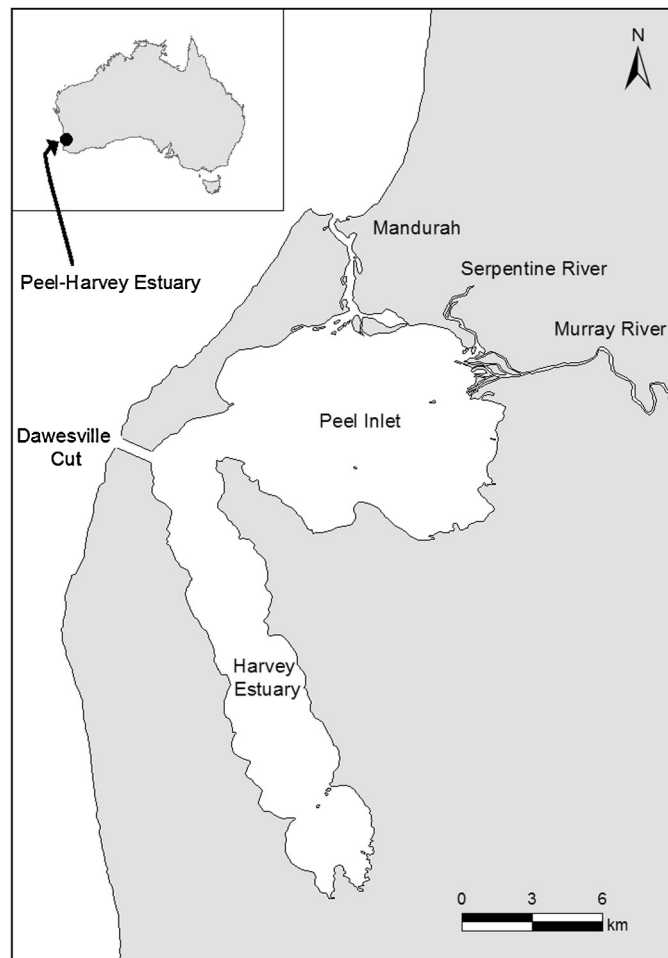

Fig. 1 – Peel–Harvey estuarine region, which includes Peel Inlet and the Harvey estuary.