

**Reconstructing Ecological Baselines:
Toward Improved Management in
Aquatic Ecosystems**

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Abstract

Human disturbances that alter ecosystems are distinct from natural disturbances that drive variation, and are critical to separate in the study of ecological change. Patterns created by a combination of anthropogenic and natural drivers are often ambiguous so that existing patterns can be mistakenly considered a function of natural or anthropogenic processes. Consequently, a notable challenge in ecology and in natural resource management is not only to recognise ‘change’, but also its causes. This thesis explored shifts in ecological patterns, and human perception of them, in aquatic ecosystems across historical time scales of decades to hundreds of years. Particular emphasis was given to the activities of fishing and European colonisation, which are renowned drivers of alterations. Research methods encompassing ecology, fisheries science and history, were used to generate time series for select hypotheses of change. Fisheries production and catch data were combined with historical data from the Adelaide Fish Market to reconstruct several baselines for fisheries in South Australia from colonisation in 1836 through present. Using the conceptual models of fishing down and ‘neo-Europe’ to account for change, key shifts in fisheries were identified. These were the modern addition and expansion of fisheries at lower trophic levels and the historical predilection of European settlers toward exploiting inland species. Though there is strong evidence of critical changes in ecosystems due to resource extraction, the addition or introduction of new species to ecosystems can also be influential. The effect of contemporary concern of society toward a cryptogenic oyster species and its management was assessed from a historical perspective. Field experiments were used to evaluate the impact of this species as an epibiont on a native bivalve. These established that the species might bring positive benefits, which contrasted the negative societal perception of unwanted ‘invasion’. A factor contributing to this negative perspective was diminished general memory of the past presence of oyster reefs, which have been lost from that locality. A baseline of lost oyster reefs across the South Australian coastline was reconstructed through recovering fisheries catch and effort data and building a time line of change, including declines in perceived and actual abundance of this habitat due to overexploitation during the 1800s and early- to mid-1900s. The past distribution of oyster reefs was established, along with their eradication across more than 1,500 km of the

nearshore environment and loss of this knowledge through intergenerational amnesia. To account for such shifts scientists and managers can incorporate past baselines into their practice and to test this approach historical data were used to inform several aspects of planning for aquaculture. This thesis demonstrated that ecological baselines in temperate aquatic ecosystems have shifted and that more accurate representations of past states can be retrospectively reconstructed. Also, it illustrated the influence that change can have on societal and administrative perspectives and, accordingly, advocates for wider consideration of the shifting baseline syndrome. Without better representation of the past we risk misinterpreting change, negative and positive, which could perpetuate reduced expectations for the environment and its deterioration.

Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Heidi Katya Alleway

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