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The Marine Planning Framework for South Australia: A new ecosystem-based zoning policy for marine management

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Abstract

The Marine Planning Framework for South Australia is a new large-scale, ecosystem-based zoning policy for management of development and use in the marine environment. Utilising the Geographic Information System (GIS), the model establishes four ecologically rated zones, derived from known ecological criteria. A series of goals, objectives and strategies represent the desired outcomes for each of the ecologically rated zones. A Performance Assessment System (PAS) will subsequently evaluate the success of the marine plans. Implementation will be supported by a collaborative whole-of-government approach. Marine plans will facilitate the delivery of long-term protection to the marine environment as a whole ecosystem, whilst enabling a broad range of activities to occur in a sustainable manner.
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1. Introduction

Rapid human population growth over the last few centuries has placed increasing pressure on the world's ecosystems [1–3]. The need for prudent management of this growth to ensure ecological sustainability has long been recognised for land-based systems. Cities and states commonly plan for development of commercial, residential, and agricultural activities through municipal zoning systems [4]. Only in recent years has the application of zoning models for the marine environment been recognised [5–7].

Efforts to manage the marine environment in the last few decades have traditionally relied on marine protected areas (MPAs) and fisheries management regulations. These approaches have explicit goals that are generally limited to specific species (e.g. fisheries regulations) or small areas recognised to have particular environmental values (e.g. MPAs) [6,8]. Although these approaches achieve their goals, they are limited in scope and insufficient in accommodating multiple uses and managing cumulative effects in the marine environment [9]. With the increasing pressure on marine ecosystems from human development and resource extraction, it has been recognised that large-scale, ecologically based zoning approach to marine management is imperative [5,7,10–13].

Large-scale ocean-zoning plans for the sustainable use of marine environments have recently been initiated by diverse jurisdictions around the world (national and state initiatives), motivated by different goals and outcomes. The United Kingdom has draft national legislation to authorise marine spatial planning in order to provide "an integrated, policy-based approach to the regulation, management, and protection of the marine environment" [14–16]. Belgium is using marine spatial planning to provide for a strategic and integrated framework for ecosystem-based, sea use management [17]. In Canada there have been efforts to implement Large Ocean Management Areas under the 1997 *Oceans Act* for all of Canada's marine regions in order to ensure the maintenance of the natural function of the ecosystems [18]. The Eastern Scotian Shelf Integrated Management Initiative is a result of this [19] and ocean zoning continues to be discussed further for the northwest Atlantic [20]. In the

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USA, many efforts have been made to initiate the concept of ocean zoning to the federal government to overhaul the ad hoc measures currently in place for marine activity management [7,10,12,21–24]. Joint planning initiatives are occurring between the United States and Canada for the large-scale ocean zoning of the Gulf of Maine [4,25]. New Zealand is working on an Ocean Policy to manage environmental effects of activities in the country's Exclusive Economic Zone from 12 to 200 nm from the coast [26], and China has legislation for marine function zoning plans in its territorial sea for the "purpose of strengthening the administration of the use of sea areas and promoting rational development and sustainable utilisation of sea areas" [27].

Smaller jurisdictions within nations (e.g. states) are also initiating large-scale marine planning concepts to manage development and use within the 3 nm jurisdictional limits (e.g. Massachusetts [28] and California [13] in the USA). Even though these jurisdictions contain the least amount of area, they are most important for the large-scale marine zoning programs as they experience the highest intensity of impacts from land-based influences. To date, there have been no attempts to develop a spatial zoning system for coastal waters.

In Australia, over 80% of the population lives on or near the coast [29]. Historically, the management of the coast and marine environment in Australia has been based on "sectoral" planning with agencies executing their roles and responsibilities without the full consideration of other existing or potential users and without any focus on functioning of the marine ecosystem. At least 27 separate pieces of legislation exist for the State of South Australia for governance of activities in the marine environment from aquaculture to ports to petroleum exploration. In 2004, the State Government of South Australia adopted the *Living Coast Strategy for South Australia* as the integrating framework for the ecologically sustainable use of its marine environment, an area that encompasses nearly 60,000 km^2 and is bounded by 4000 km of coastline [30]. One product of this initiative has been the *Marine Planning Framework for South Australia* released in 2006 [31].

Here we discuss the contents of the *Marine Planning Framework for South Australia* policy. We describe the principles of the Framework, the ecologically based zoning model, the Performance Assessment System (PAS) that will be used to assess the effectiveness of marine plans, and how the marine plans will be implemented.

2. Principles of the Marine Planning Framework

The *Marine Planning Framework for South Australia* (MPF) is underpinned by three key principles: ecologically sustainable development (ESD), ecosystem-based management and adaptive management. Ecologically sustainable development in this context is defined as using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be improved [32]. The ESD principle also incorporates the precautionary principle, in which, if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. The principle of ecosystem-based management is based on the importance of recognising ecosystem structures and functions and then responding to signals from the ecosystem in order to manage anthropogenic activities and uses. Adaptive management is described for use in this policy as a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. These principles will be applied through the development, implementation and review processes of the marine plans.

The MPF provides the structure and direction for the planning and management of activities in South Australia's marine environment. The resulting marine plans will establish an overarching strategic guide for State and Local Government planners and natural resource managers with the aim of ensuring a healthy, diverse and productive marine environment for both current and future generations.

3. The marine planning model

Assumptions were developed based on managing activities within the assimilative capability of the ecosystem in order to guide the development of the marine planning model. The key assumptions behind the model are that the data available should reasonably reflect the ecological parameters fundamental to the function of the ecosystem and its biological diversity and the spatial distribution of the ecological parameters of the ecosystem.

The aims of the model are to zone the planning area based on ecological criteria and identify and define the spatial boundaries of the zones.

3.1. Marine bioregions, biounits and marine plan boundaries

The marine plan boundaries are based on ecological bioregions. In South Australia, there are eight defined marine bioregions as part of a national system which were determined by distinctive patterns of biodiversity at a scale of 1000 km^2 [33]. These bioregions also contain smaller divisions called marine biounits, which are defined on the basis of coastal physiography, topography and major marine physical habitat or seascape features and habitat distributions at a scale of 100 km^2 (Fig. 1). For the purpose of marine planning, South Australian waters encompass all estuarine and marine waters from the highest astronomical tide (including stranded samphire swamps) to 3 nm out to sea including all bays and gulfs. The MPF provides for six marine plans across the eight bioregions covering all State waters. These areas include the Far West, West Coast, Lower Spencer Gulf, Spencer Gulf, Gulf St. Vincent/Kangaroo Island, and South East (Fig. 2).

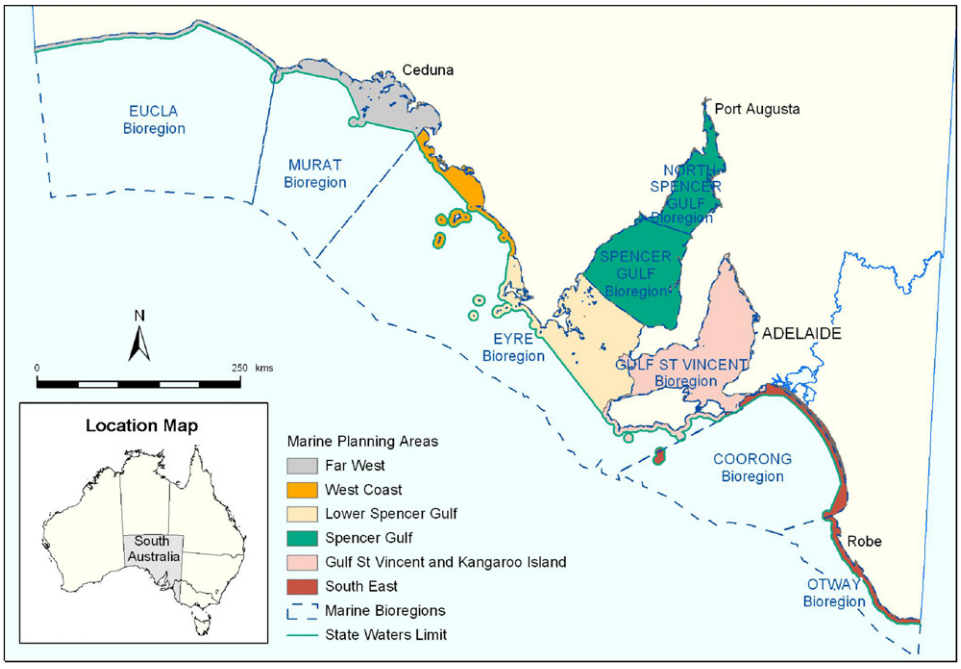

Fig. 1. Marine plan boundaries and bioregions for South Australia.

3.2. Methodology

The steps in the development of a marine plan are briefly described below and the detailed methodology and background information is in review [34].

3.2.1. Step 1: data collection

The first step in the development of a marine plan involves a process of data identification, collection, collation, and the creation of a series of maps depicting economic, social and cultural values of the planning area. Data were collected from a variety of sources such as published literature, information from community members and groups, private businesses, and other government agencies. The development of a model that is robust, transparent and repeatable requires the collation and analysis of existing information within a Geographic Information Systems (GIS) format. GIS are computer-based systems used for the manipulation and analysis of spatially distributed data and is the backbone to production of the marine plans.

3.2.2. Step 2: sorting spatial data

Once data were collected on environmental, economic, social and cultural heritage, it is compiled in GIS spatial layers. The environmental data were used for the development of the marine plan and social, economic, cultural and heritage data were used to support it.

3.2.3. Step 3: create GIS layers

The environmental layers in the marine plans contain information on habitats and uniqueness of the area.

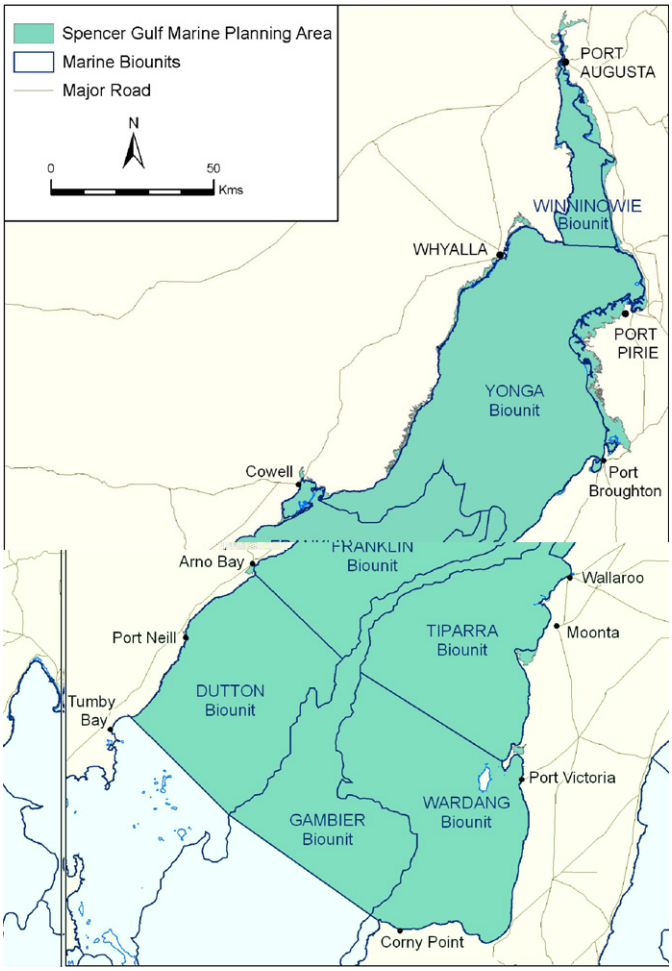

Fig. 2. Biounits for Spencer Gulf marine planning area.