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Further efforts to protect biodiversity in coastal waters of South Australia

Hugh Kirkman*, Scoresby A. Shepherd

Scientific Working Group for Marine Protected Areas, 5a Garden Grove, Seaholme, Victoria 3018, South Australia, Australia

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ABSTRACT

Marine sanctuary zones (MSZs) in South Australia were established under a regime of opposition from commercial and recreational fishers with some assistance from fisheries scientists. Fish exploitation was not the only threat discussed by the Scientific Working Group for Marine Protected Areas (MPAs) but it was considered as a major threat. There was some argument over the interpretation of the "Precautionary Principle" but one of the reasons for establishing a marine sanctuary zone is to conserve marine biological diversity not to manage fisheries. The genetic effects of overfishing fish and invertebrates can have a lasting effect on populations and the food web around them. Monitoring, evaluation and reporting are considered essential to management of MSZs' long-term strategy in terms of evaluating the efficacy of zoning arrangements and conservation outcomes. It is not certain that South Australia's system of MSZs will deliver their required outcome due to the compromises to science that had to be made.

1. Introduction

The process by which the South Australian Representative System of Marine Protected Areas (SARSMPA) and Marine Sanctuary Zones (MSZs) came into being was explained by Kirkman (2013). From the passing of the Marine Parks Act in 2007 a representative system of MSZs has been decided on by the Minister for the Environment and now, they are being implemented.

The objectives of the South Australian Marine Parks Act 2007 (S.A., 2007) are to build a robust network of marine protected areas (MPAs) representative of the eight bioregions in South Australia and reflect world's best practice in marine parks design. The Marine Parks Act also partly fulfils Australia's obligations as a signatory to the Convention on Biological Diversity (CBD) (United Nations Environment Programme, 1994) and the major components of the Q2 Jakarta Mandate developed under that Convention. Australia committed to the target in the World Summit on Sustainable Development Plan of Implementation laid out in the CBD's Programme of Work on protected areas as follows: *The establishment and maintenance ..... by 2012 for marine areas of comprehensive effectively managed and ecologically representative national and regional systems of protected areas that collectively, inter alia through a global network, contribute to achieving the three objectives of the Convention and the 2012 target to significantly reduce the current rate of biodiversity loss at the global, regional, national and sub-national levels and contribute to poverty reduction and the pursuit of sustainable development* (Wells et al., 2008). The 19th IUCN assembly and the fourth World Parks Congress all proposed to centralise the establishment of protected areas. The World Summit on Sustainable Development in 2002 called for the establishment of marine protected areas consistent with international laws and based on scientific information, including representative networks by 2012 (Wells et al., 2008). The Evian agreement, signed by G8 Nations in 2003, agreed to these terms (Wells et al., 2008) https://archive.org/stream/nationalregional08well#page/12/mode/2up. The Durban Action Plan, developed in 2003, called for regional action and targets to establish a network of protected areas by 2010 within the jurisdiction of regional environmental protocols. It recommended establishing protected areas for 20–30% of the world's oceans by the goal date of 2012. The UN later also endorsed another decision, Decision VII/15, in 2006: Effective conservation of 10% of each of the world's ecological regions by 2010.

The Commonwealth of Australia developed the National Representative System of Marine Protected Areas (NRSMPA) to comply with its obligations. The Australian states must comply with any convention agreement made by the Commonwealth. An explanation of the process of selecting MPAs and how it was implemented in South Australia is given in Kirkman (2013).

It should be pointed out that, in this paper, MPAs are areas set aside by the Government of South Australia as marine and coastal

* Corresponding author.
E-mail address: hughkirkman@ozemail.com.au (H. Kirkman).

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areas that are restricted to some regulations. MPAs are General Managed Use Zones (GMUZs) in South Australia and are defined under the Act (S.A., 2007) of the South Australian parliament to "*protect and conserve biological diversity and marine habitats by declaring and providing for the management of a comprehensive, adequate and representative system of marine parks*". Objectives are also to assist in the maintenance of ecological process, adaptation to the impacts of climate change, protecting and conserving features of natural or cultural heritage significance, allowing ecological sustainable development and use of marine environments and providing opportunities for public appreciation, education, understanding and enjoyment of marine environments.

Kearney et al. (2012) correctly point out that 13.2% by area of the global total of MPAs were under Australian administration by 2005, they fail to mention, however, that most of this is the Great Barrier Reef Marine Park. The Great Barrier Reef Marine Park has a network of marine sanctuaries with 34% of the region protected, the rest of Australia's waters have very little protection in place. Currently, less than 5% of Australia's states' waters protect Australia's marine life from extractive threats, including fishing and mining. Source: 2008 Collaborative Australian Protected Area Database data (http://www.environment.gov.au/science/soe/2011-report/6-marine/4-effectiveness/4-2-protected-areas). The states' part in creating MSZs is totally inadequate.

Coastal waters are a belt of water between the limits of the Australian States and of the Northern Territory and a line three nautical miles seaward of the territorial sea baseline. Title to the subjacent seabed is vested in the adjacent State or Territory as if that seabed was in waters that formed part of that State or Territory. www.ga.gov.au/scientific-topics/marine/jurisdiction/maritime-boundary-definitions#heading-3.

Coastal waters are extremely vulnerable to anthropogenic activity, and probably more vulnerable than deeper waters to climate change in the form of more intense and frequent storms and sea level rise. Commonwealth reserves are from the three nautical miles state waters to 200 nautical miles—the Exclusive Economic Zone.

The new Commonwealth marine reserves add more than 2.3 million km^2 to Australia's marine reserve estate, resulting in a total area of 3.1 million km^2 of ocean being managed primarily for biodiversity conservation, partly fulfilling the Australian Government's obligation to the CBD in the creation of the national system.

An important, unresolved question about MPAs is whether the many gaps in representation of species and ecosystems are random or systematic. Systematic gaps could, for example, be related to the ease with which MPAs can be established and be inversely related to the level of extractive uses of the ocean. This kind of systematic bias, if present, would mirror the widely observed bias in terrestrial reservation towards over-representation of ecosystems with the least value for extractive uses. Joppa and Pfaff (2009) showed a clear bias in protection towards certain biomes and ecoregions in terrestrial protected areas. These highly protected regions were generally those that received low levels of land degradation pressure, e.g. agriculture. One of the major disadvantages of this bias is that the species and ecosystems most associated with extractive uses and most in need of protection continue to decline without effective intervention (Pressey et al., 2000). The phenomenon of protected areas being "residual" to extractive uses (Margules and Pressey, 2000), although familiar in terrestrial regions, has been mentioned in the marine environment only briefly (Edgar et al., 2008; Guarderas et al., 2008; Edgar, 2011) and has not yet been formally explored (Devillers et al., 2014). These new MPAs in Australian federal waters, like the states' MPAs and MSZs, may be described as "residual" in that they are generally remote and unsuitable for commercial activities.

In their investigation into the conservation benefits of 87 MPAs worldwide Edgar et al. (2014) referred to MSZs as MPAs or "no-take" zones. They showed that for fishes the conservation value increased exponentially with the accumulation of five key features: and isolated by deep water or sand.

To assess which MSZs fulfilled their ecological potential, Edgar et al. (2014) used a wide geographic database to investigate how conservation value, characterized by ecological response of fish communities within MSZs, is affected by the cumulative effects of five key planning and management features (NEOLI):

(1) Degree of fishing permitted within MSZs;	No take	N
(2) Level of enforcement;	Enforced	E
(3) MSZ age (>10 years);	Old	O
(4) MSZ size (>100 km^2);	Large	L
(5) Presence of continuous habitat allowing unconstrained movement of fish across MSZ boundaries.	Isolated	I

Although this assessment relied on shallow reef fish densities and sizes along transects it was the only one that has assessed MSZs on a global basis. We are emphasising here that although fish were the data base for these MSZs, the effect of altering the fish levels of the food chain effects all biological diversity in each ecosystem.

Of the 87 MSZs investigated globally, only four possessed all five NEOLI features, whereas five MSZs possessed four features, and 39, 57 and 16 MSZs possessed three, two and one feature, respectively. The low proportion of MSZs possessing four or five NEOLI features (10%), and thus regarded here as effective, probably overstates the true proportion of effective MSZs worldwide. Their survey strategy deliberately targeted well known and well-regarded MSZs, with most large and long-established MSZs included in this study.

Using effective MSZs with the four or five key features as an unfished standard, comparisons of underwater survey data from effective MSZs with predictions based on survey data from fished coasts indicated that total fish biomass has declined about two-thirds from historical baselines as a result of fishing. Effective MSZs also had twice as many large (250 mm total length) fish species per transect, five times more large fish biomass, and fourteen times more shark biomass than fished areas (Edgar et al., 2014).

2. Zones

Kirkman (2013) explains marine park zoning plans for South Australia as featuring a combination of zones and special purpose areas to manage specific activities and uses. A zone is an area within a marine park that has boundaries defined by the management plan for the marine park and is identified by the management plan as a particular type of zone depending on the degree of protection required within the area. Two zones, Restricted Access Zone (RAZ) and Special Purpose Zone (SPZ), come under specific restrictions and are chosen on a case by case basis.

GMUZs are to provide protection for species and habitats within a marine park, whilst allowing ecologically sustainable use. GMUZs allow ongoing conduct of most activities, provided they are ecologically sustainable and consistent with the overall objectives of the SARSMPA. There is now unequivocal evidence that biodiversity loss reduces the efficiency by which ecological communities capture biologically essential resources, produce biomass, decompose and recycle biologically essential nutrients (Cardinale et al., 2012; Hooper et al., 2012).

Habitat Protection Zones (HPZs) are to provide protection for species and habitats within a marine park, whilst allowing activities and uses that do not harm habitats or the functioning of ecosystems. HPZs offer a level of protection and allow for a range of commercial and recreational activities that do not harm habitat or interfere with the services that habitats provide to populations that