



Short Communication

A glaring omission in Australia's marine conservation planning

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ABSTRACT

The primary goal of Australia's National Representative System of Marine Protected Areas (NRSMPA) is to establish a comprehensive, adequate and representative system of MPAs. This study identifies a glaring contradiction to this policy. The provinces of Christmas and Cocos Islands are among the most unique and threatened marine bioregions in Australia, yet receive no protection from the NRSMPA. The lack of protection appears to be due to difficulties with multiple governance arrangements and other political priorities. These issues have already caused biodiversity loss in the terrestrial environment of these bioregions. The Australian Government must include the Christmas and Cocos provinces in the NRSMPA otherwise it risks irreversible loss of marine biodiversity in these unique bioregions.

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The recent paper by Barr and Possingham [1] demonstrates that Australia's National Representative System of Marine Protected Areas (NRSMPA) is clearly not representative. The authors propose reasons for why the Australian Government has decided on a non-representative and non-quantitative approach to management plans for conserving Australia's marine biodiversity. The authors identify that the Christmas Island Province and the Cocos (Keeling) Islands Province have the least (< 1%) protection of the 85 marine bioregions (Fig. 6, [1]), but do not discuss why these provinces have been neglected by the Australian Government.

The two provinces are located in the tropical eastern Indian Ocean and collectively this area is referred to as the Sunda Province [2,3]. The reason why the Christmas and Cocos provinces have the least protection is because they have been omitted from the NRSMPA planning process (compare Figs. 1 and 2 in [1]). This begs the question as to why these two provinces are not part of the Australian Government's management plans for conserving marine biodiversity.

The marine bioregions and provinces identified in the NRSMPA planning process were determined from data on species richness and composition of shallow water fishes (0 to 200 m depth) [2,3]. The shallow water fish communities of Christmas and Cocos Islands are species rich compared to the rest of Australia (> 800 species in total, [4–6], Hobbs et al. unpublished data) and have a globally unique composition because they lie on the Indo-Pacific biogeographic border [7]. This includes the greatest number of

hybrid reef fishes in the world [8] and more than 50 fish species not found anywhere else in Australian waters [5,6]. These islands have numerous endemic fishes [5,9], with Christmas Island ranked seventh in the world for the number of endemic coral reef fishes per area of habitat [10]. The Cocos Islands has some of the world's highest densities of vulnerable fishes [11,12], while Christmas Island is one of only two Australian locations that have known whale shark aggregations [13]. Therefore, based on the metric (fishes) used to define marine bioregions, the Christmas and Cocos provinces should have been among the first protected by the NRSMPA.

Although the marine environment of the Christmas and Cocos provinces has received little research, it is still evident that its unique and rich marine biodiversity is not limited to fishes. For example, limited surveys have identified more than 600 mollusc species and over 200 crustacean species from shallow waters (< 20 m) at the Cocos Islands [14,15]. Christmas Island has an extraordinarily unique community of crabs, with a high proportion of endemic species that are continually being discovered [16]. Furthermore, the island has the greatest diversity of land crabs in the world and these crabs are the keystone species of the terrestrial ecosystem [16]. This system is entirely reliant on the survival of land crab offspring during the marine larval phase. The anchialine fauna of Christmas Island is also of international significance [17]. Both Christmas and Cocos are internationally renowned as some of the most important seabird rookeries in the Indian Ocean, including several endemic species. The unusual characteristics and formation of the abyssal plain and seamounts in the deep waters (> 4000 m) surrounding the islands are not present in other bioregions, and are likely to support unique and

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diverse biological communities [18]. The Cocos Islands are considered Australia's only true coral atoll [19] and no other Australian island has the karst network of underwater caves that are present at Christmas Island. By any metric, the Cocos and Christmas provinces would be among the most unique marine bioregions in Australia and throughout the Indo-Pacific and their protection should be a NRSMPA priority.

Greater protection of the unique marine biodiversity of the Christmas and Cocos provinces is also warranted given the lack of existing protection (<1%) and the range of impacts that are threatening this biodiversity. Coral bleaching, disease and crown-of-thorns starfish have significantly affected corals reefs in the Christmas and Cocos provinces [20,21] and this habitat loss has resulted in the local extinction of at least one fish species [6]. At Christmas Island, more than 63 marine species are at risk and listed under the Environmental Protection and Biodiversity Conservation (EPBC) Act [22] because they require additional protective management. Despite numerous listed species, there is no protection from impacts such as the 2012 grounding of the MV *Tycoon*, where a poor management response (due to a lack of planning, action and resources) resulted in hundreds of tonnes of oil, diesel and phosphate being spilt onto coral reefs for months. Furthermore, continued phosphate-rich sedimentation from local mining operations goes unregulated. At the Cocos Islands, there are limited fishing regulations and no active compliance and thus overfishing has pushed several species (including those listed by the IUCN as "Vulnerable") to the brink of local extinction (e.g. coral trout and giant clam: [11]). In addition, a history of mass die-off events has resulted in mortality to millions of marine organisms [23,24]. Furthermore, the isolation of Christmas and Cocos Islands reduces resilience because populations with limited connectivity will be slower to recover from impacts, compared to mainland bioregions [25].

An increasing threat to the marine biodiversity of the Cocos and Christmas provinces is the illegal arrival of foreign boats. In the last 4 years more than 500 vessels carrying asylum seekers have entered Australian waters without permission with a large proportion arriving off Christmas Island and to a lesser extent the Cocos Islands. These vessels are brought in close to shore, are often tied up to moorings, and at least five have run aground on Christmas or Cocos. The unregulated entry of these decrepit vessels poses a high risk of introducing marine pests and diseases. Given that introduced species and diseases have devastated terrestrial biodiversity at Christmas Island, causing numerous extinctions [17], the lack of protection against these threats poses a significant risk to the region's unique marine biodiversity.

The multitude of governance arrangements in the Christmas and Cocos provinces may make it difficult to plan and implement marine reserve protection, however it increases the risk of biodiversity loss. Following an investigation into the extinction crisis occurring in the terrestrial environment at Christmas Island, a government-assigned expert working group identified that both the level and complexity of governance arrangements was a major hindrance to management actions aimed at conserving biodiversity [17]. The expert group made a high priority recommendation that environmental governance be changed to a single authority. The Australian Government rejected this recommendation. Successful management of a marine protected area across multiple governmental jurisdictions is necessary to avoid biodiversity loss, and is possible, as exemplified by the Great Barrier Reef [1].

If protecting the unique marine biodiversity of the Christmas and Cocos provinces is not a priority then biodiversity loss will occur due to conflicting priorities. For example, the arrival of asylum seekers and their confinement at the Christmas Island Immigration Detention Centre is a very contentious issue that has received much media attention and featured heavily in recent

federal elections. To build and operate the Detention Centre the Australian Government has circumvented the EPBC Act thereby avoiding its own legal environmental obligations that were established to protect biodiversity. This has had numerous negative impacts on the Island's biodiversity, including impacts to many vulnerable species that are protected under the EPBC Act [16,22]. Therefore, failing to include the Christmas and Cocos provinces in the NRSMPA places the region's unique biodiversity at risk from the government's other priorities.

The primary goal of the NRSMPA was to develop a "comprehensive, adequate and representative system of MPAs" that will protect Australia's marine biodiversity. However, the Christmas and Cocos provinces represent a glaring contradiction to this policy in that they are among the most unique and threatened marine bioregions in Australia, yet receive no protection from the NRSMPA. The lack of protection appears to be because of difficulties with existing governance arrangements and/or other political priorities. Both of these reasons have already caused population declines and extinctions in the terrestrial environment of this bioregion [17]. The exclusion of the Christmas and Cocos provinces from the NRSMPA represents a clear failure by the Australian Government to conserve marine biodiversity in this bioregion. The Australian Government must urgently reconsider the lack of protection within the Christmas and Cocos provinces otherwise marine biodiversity in this region may be irrevocably impacted. The evidence presented here concurs with Barr and Possingham [1] that the NRSMPA is not an example of a representative system, does not provide an adequate level of protection for the biodiversity in each marine bioregion, and will tarnish the Australian Government's international reputation as a world-leader in marine biodiversity protection.

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