



Protecting Migratory Species in the Australian Marine Environment: A Cross-Jurisdictional Analysis of Policy and Management Plans

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Marine migratory species are difficult to manage because animal movements can span large areas and are unconstrained by jurisdictional boundaries. We reviewed policy and management plans associated with four case studies protected under the Australian *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999)* in order to identify the coherence of policy and management plans for managing marine migratory species in Australia. Environmental policies ($n = 23$) and management plans ($n = 115$) relevant to marine turtles, dugongs, humpback whales, and migratory shorebirds were reviewed. Few of the reviewed policies ($n = 7$) listed protected species and even fewer ($n = 4$) listed protected marine migratory species. Marine turtles were most represented in the reviewed policies ($n = 7$), while migratory shorebirds were most represented in management plans ($n = 59$). Policies and management plans were much more likely to identify relationships to other policies or plans within the same jurisdiction than to different jurisdictions. The *EPBC Act 1999* served as the central link between reviewed policies and plans, but the requirements of that Act were weakly integrated into the other documents. This weak integration and the biases toward specific migratory species in environmental policies and management plans are detrimental to the conservation of these Matters of National Environmental Significance in Australia. Any changes to the *EPBC Act 1999* will affect all environmental policy and management plans in Australia and highlights a need for cooperative, multi-level governance of migratory species. Our findings may have relevance to the conservation of marine migratory species in a broader international context.

Keywords: policy evaluation, policy coherence, marine migratory species, Matters of National Environmental Significance, marine governance

INTRODUCTION

Migratory species, both terrestrial and marine, are defined as species with life cycles characterized by cyclical movements between breeding and non-breeding areas (De Klemm, 1994; Gilmore et al., 2007; Robinson et al., 2009). These migrations are driven by biological (e.g., the need to mate) or ecological (e.g., low resources or optimal/suboptimal climate) factors (Gilmore et al., 2007; Robinson et al., 2009; Lascelles et al., 2014) and have important roles in habitat connectivity (Unsworth et al., 2015; Tol et al., 2017). For example, in the Coral Sea, off the northeast coast

of Australia, nesting green sea turtles (*Chelonia mydas*) tagged in Australia migrate to international feeding grounds in New Caledonia and back to their nesting grounds in Australia, crossing state, national, and international boundaries as they migrate (Read et al., 2014). Within Australia, some dugongs cross state jurisdictions when they make seasonal migrations between Queensland and New South Wales (Allen et al., 2004; Sheppard et al., 2006). The disconnect between governance levels complicates the management of migratory species, as state and national legislation and management can conflict (Ruckelshaus et al., 2008; Read et al., 2014) and fail to take account of the cumulative impacts on migrating animals.

Migratory species can be subjected to multiple anthropogenic threats and varying levels of protection as they move between protected and non-protected areas (Lascelles et al., 2014; Pendoley et al., 2014). Conservation policies, such as protected area legislation, are often constrained by political boundaries (De Klemm, 1994; Gärdenfors, 2001; Martin et al., 2007), whereas highly migratory species are unrestricted by jurisdictional boundaries (Boersma and Parrish, 1999; Hooker and Gerber, 2004). These differences often increase the governance difficulties in sustainably managing threats to migratory species, especially in the marine environment.

Governance in the marine environment is challenging because boundaries in the sea, while generally well-defined in a political sense, are not physically defined (Boersma and Parrish, 1999; Hooker and Gerber, 2004). In Australia, both the Commonwealth (federal) and state governments have jurisdiction over the marine environment, with state governments having jurisdiction up to 3 nautical miles from shore and federal jurisdiction extending from 3 nautical miles to the edge of the Economic Exclusion Zone (EEZ) (Geoscience Australia: Maritime Boundaries). In total, the Australian EEZ covers approximately 10 million square kilometers of ocean (Geoscience Australia: The Law of the Sea) (**Figure 1**). In the Great Barrier Reef World Heritage Area (348,000 km², GBRWHA) in Queensland (Qld), the federal Great Barrier Reef Marine Park (GBRMP) and the State GBRMP (Day, 2008, 2016) overlap. The boundary between the two jurisdictions is unclear because they define “low water mark” differently. The *Great Barrier Reef Marine Park Act 1975* granted the federal government authority over the entire Great Barrier Reef region but the boundary difference was resolved by complementary zoning of adjacent state and federal marine parks (Day, 2016), an example of policy coherence in a polycentric governance system (Dale et al., 2016; Morrison, 2017).

Polycentric governance systems are multi-government systems with independently operating centers (e.g., local, state, and national governments) that interact to some degree (Ostrom et al., 1961; Ostrom, 2012). Such systems have been identified as a means to address complex environmental problems (Biggs et al., 2012; Morrison, 2017), as independent government units may not be able to unilaterally resolve complex socio-ecological problems (Ostrom et al., 1961; Biggs et al., 2012). The success of polycentric governance systems in addressing environmental problems supports the need for policy coherence: complementary legislation that works between and within

legislative sectors to achieve mutually-decided policy outcomes (Nilsson et al., 2012). Policy coherence is necessary in the marine environment (Riskas et al., 2016; Fraser et al., 2017) and the need is intensified by the presence of threatened marine migratory species that may not face uniform threats across their range.

Much of the Australian federal government's authority over the environment is derived from Australia's obligations to conserve matters protected under international conventions (Hawke, 2009). Australia is a signatory party to the Convention on Biological Diversity and each party is required to develop and implement national environmental and biodiversity policies under Article 6 of that convention (Australian Government: UN Convention on Biological Diversity). Australia has fulfilled this obligation through the enactment of the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act 1999*, Australian Government, 1999; Farrier et al., 2007), which is designed to protect nationally important flora, fauna, and environments while protecting Australia's socioeconomic needs (*EPBC Act 1999*). The *EPBC Act* regulations include a list of threatened species, based on criteria broadly similar to those of the IUCN Red List, and of migratory species, based on species listed on both Appendix I & Appendix II of the Convention of Migratory Species (CMS), the Japan-Australia (JAMBA), China-Australia (CAMBA), and the Republic of Korea-Australia (ROKAMBA) Migratory Bird Agreements. The migratory species list of the *EPBC Act 1999* identifies 174 migratory species in Australia, including birds, mammals, marine reptiles, cetaceans, and sharks; 90 of the listed migratory species are found in the marine environment (Australian Government, 2016). Species that are listed as threatened or migratory are deemed to be Matters of National Environmental Significance (MNES), a categorization that influences the management tools used in their conservation.

Effective management of migratory species typically requires policy linkage and harmonization across the jurisdictional boundaries of the range states of these species. The current status of protection across the range of marine migratory species in Australia is unknown. In this paper, we explore the coherence between the policies and management plans used by Australian federal and state governments to manage federally-listed marine migratory species in Australia using a case study approach and document analysis. We reviewed national and state government environmental policies and management plans relating to six species of marine turtles, dugongs, humpback whales, and 27 species of migratory shorebirds, all of which are considered to be Matters of National Environmental Significance. As the resources available for conservation are limited (Farrier et al., 2007; Kim et al., 2016), it is important to identify key differences in conservation strategies for marine migratory species as a component of effective marine conservation.

METHODS

We employ a grounded theory approach through the use of a document analysis and comparative case studies. We conducted a document analysis of current (2018) Australian environmental

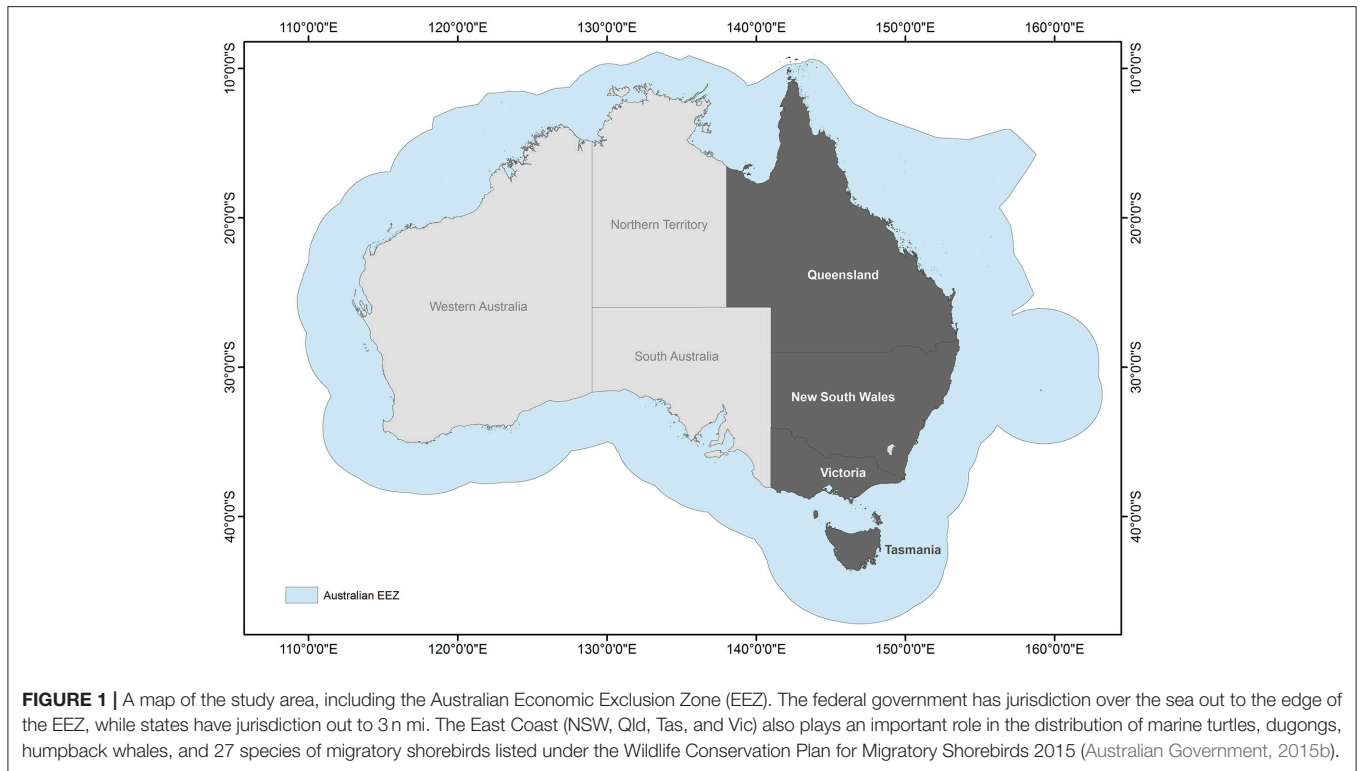


FIGURE 1 | A map of the study area, including the Australian Economic Exclusion Zone (EEZ). The federal government has jurisdiction over the sea out to the edge of the EEZ, while states have jurisdiction out to 3 n mi. The East Coast (NSW, Qld, Tas, and Vic) also plays an important role in the distribution of marine turtles, dugongs, humpback whales, and 27 species of migratory shorebirds listed under the Wildlife Conservation Plan for Migratory Shorebirds 2015 (Australian Government, 2015b).

policies and management plans at the national (federal) level, as well as in the eastern states of New South Wales (NSW), Queensland (Qld), Tasmania (Tas), and Victoria (Vic). We reviewed operational policies and management plans because this study focuses on current applications of management tools rather than the development or historical practice of environmental policy in Australia. For this study, we define a policy as statutory legislation or regulations that describe how the government will protect the environment. We define a management plan as a document that outlines how a policy or policies are implemented, while still protecting the environment.

We also used a comparative approach, using carefully selected case studies, as a means of illustrating the differences in managing different taxa, including the coherence of the instruments used to manage these species. Policy coherence emphasizes the interactions between policy commitments and outputs to reach mutual objectives (Nilsson et al., 2012; Benson and Lorenzoni, 2017) and has been shown to promote synergy between the policies of developed and developing nations in the realm of sustainable development and can be achieved by some environmental management regimes (OECD, 2013; Benson and Lorenzoni, 2017). We chose to include an analysis of policy coherence for this study because marine migratory species interact with several governance levels throughout their migrations that may not be coordinated.

Case Studies

The Australian federal government, and hence its *EPBC Act 1999*, are constrained by the Australian Constitution, as the Australian Constitution does not explicitly give the Commonwealth

Parliament the power to create legislation regarding the environment (Hawke, 2009). The federal government derives its power over the environment through Australia's requirement to enforce its international obligations. Marine turtles, dugongs, humpback whales, and migratory shorebirds are listed on the Appendices of the Convention on the Conservation of Migratory Species (CMS or Bonn Convention), which is the primary international convention for protecting migratory species. Listing on CMS allows for these species to be listed as migratory (and thus, MNES) under the *EPBC Act 1999*. Any actions that are likely to have a significant impact on an MNES requires approval from the federal Minister for the Environment (*EPBC Act 1999*). However, despite their listing on CMS and their status of MNES, these species do not face uniform threats throughout their range and there are many differences in the policy and management arrangements for these case studies (Table 1; see Table B1 in Appendix B for a more extensive list of national policy instruments for mitigating threats for each taxon).

We considered four case studies in this study: marine turtles (six species), dugongs (*Dugong dugon*), humpback whales (*Megaptera novaeangliae*) and migratory shorebirds (27 non-threatened species listed under the *Wildlife Conservation Plan for Migratory Shorebirds 2015* (Australian Government, 2015b); see Table C1 in Appendix C, for full list). Selection of case studies was purposive. These case studies were chosen because all six species of marine turtles found in Australia, plus dugongs, humpback whales, and the species of migratory shorebirds listed under the *Wildlife Conservation Plan (WCP) for Migratory Shorebirds 2015* are all

TABLE 1 | The EPBC listing of the four case studies in Australia chosen for this study, their respective national management plans, and the primary species-specific instrument (national) for mitigating threats for each case study.

Species or Group	EPBC listing	Recovery or conservation plan?	Primary policy instrument addressing species-specific threats
Marine Turtles	Marine, Migratory, Threatened (Listing varies by species)	Recovery Plan for 6 species (statutory)	<i>Recovery Plan for Marine Turtles 2017</i>
Dugong	Marine, Migratory	None currently	None currently
Humpback Whale	Migratory, Cetacean, Vulnerable	Conservation Advice (statutory)	<i>Conservation Advice Megaptera Novaeangliae</i>
Migratory Shorebirds	Marine (individual species), Migratory	Conservation Plan for 35 Species (statutory) ^a	<i>Wildlife Conservation Plan for Migratory Shorebirds 2015</i>

A more extensive list of policy instruments addressing these threats can be found in Table B1 of Supplementary Material (Appendix B).

^a There are 35 species listed under the *Wildlife Conservation Plan for Migratory Shorebirds 2015*; some species have since been listed as threatened, but the Plan has not yet been amended. This study considers 27 non-threatened species that are listed as marine and visit the east coast of Australia.

considered to be MNES, which influences how these species are protected.

Study Area

We chose the east coast states in Australia as study locations because they play important roles in the distribution of the four case studies used in this study. Australia is home to six species of marine turtles, with east coast subpopulations separated by genetic stocks (*Recovery Plan for Marine Turtles in Australia 2017*). Five of the six species of marine turtles in Australia nest on Queensland beaches (*Recovery Plan for Marine Turtles 2017*). Although the dugong's range in Australia extends from Shark Bay in Western Australia to Moreton Bay in southern Queensland (Marsh and Lefebvre, 1994; Marsh et al., 1999), the eastern Australian stocks are globally significant. Additionally, the east coast of Australia is a major migratory corridor for the east coast subpopulation of humpback whales migrating from Antarctic waters (Chittleborough, 1965; Noad et al., 2011) and is part of the East Asian-Australasian Flyway, used by a number of migratory shorebirds migrating from Russia and Asia (Milton, 2003) (**Figure 1**).

Collation of Environmental Policies and Management Plans

We collated national and state-level policies and management plans through an online search, supplemented by requests to the appropriate departments for missing documents. All potentially relevant (e.g., environmental policies from any of the locations used in this study) environmental policies and management plans (including terrestrial) from the study area were collated and reviewed using a key word search (**Table 2**). Policies and plans that did not protect any of the four case studies and/or their habitats were eliminated.

Review and Analysis of Environmental Policies and Management Plans

Environmental policies and management plans that were not eliminated after the key word search were determined to be potentially relevant to the protection of the migratory taxa used

TABLE 2 | Key words used to collate environmental policies and management plans in Australia related to four taxa of marine migratory species.

Category	Key words
Location	Australia, Qld, NSW, Vic, Tas
Case Studies	Migratory, marine turtles, sea turtles, turtles, dugongs, humpback whales, whales, migratory shorebirds, shorebirds, waders
Environments	Marine, coastal, intertidal, seagrass, beach, mangroves, wetlands, marshes

in this study. We then developed and applied a framework to conduct a thematic analysis of collated documents using predetermined search criteria in a manner similar to Pullin and Stewart (2006) (Appendix A, Figure A1). We reviewed these environmental policies and management plans using a system of inclusion and exclusion criteria (Pullin and Stewart, 2006; see Appendix A, Figure A1). We analyzed policies and plans based on what was explicitly stated in each document to reduce subjective assessment (Ortega-Argueta et al., 2011). The analysis framework served as a hierarchical filter and policies and plans were eliminated if they did not meet at least one of the essential criteria (see Appendix A, Figure A1). Policies and management plans that met one or more of the essential criteria were determined to be relevant and were further analyzed using additional criteria (See Appendix A, Figure A1).

Examples of relevant environmental management plans included recovery plans, threat abatement plans, and industry plans, among others (see Table B2 in Appendix B for descriptions). Most plans were publicly available online; others were solicited from the appropriate organization. We reviewed protected area management plans from each state until data saturation was reached; that is, no new themes emerged while reviewing and coding the plans (Fusch and Ness, 2015).

Relevant policies and management plans were numerically coded. NVivo (QSR International - Version 11.4.0) was used to organize and iteratively code qualitative portions of the framework for recurrent themes and to supplement the

quantitatively coded portion of the framework (see Table B3 in Appendix B for themes and codes). IBM SPSS Statistics (Version 24) was used to calculate frequencies of the quantitative data. We determined policy coherence by the identification of an explicit relationship between policies or management plans and were displayed using network graphs created in NetDraw (Borgatti, 2002). We triangulated data based on previous studies and previous reviews of Australian environmental policies and management plans (e.g., Hawke, 2009; Ortega-Argueta et al., 2011).

Limitations

Our study focused on explicit statements in Australian environmental policies and management plans and did not make any inferences. This approach may have eliminated some conservation tools used for protecting the case studies or their habitats, but were not clearly identifiable in the policy or management plan. Additionally, some plans were not available despite extensive efforts to obtain them, a situation that may have excluded some plans that are used in protecting marine migratory species in Australia. While the use of network graphs to visualize relationships between policy instruments (rather than actors) is a novel approach in exploring environmental governance, our study identified the presence of relationships between policy instruments based solely on available data collected from the document analysis. Thus, data were unavailable to analyze relationship strength, but these data may become available through interviews conducted during the next stage of this research.

RESULTS

In total, 23 environmental policies and 115 management plans (total documents = 138; see Tables C2, C3 in Appendix C for full list) were deemed to be relevant: federal ($n = 4$ policies; $n = 25$ plans), Bilateral (Joint) ($n = 3$; $n = 2$), New South Wales ($n = 6$; $n = 16$), Queensland ($n = 4$; $n = 34$), Tasmania ($n = 4$; $n = 20$), and Victoria ($n = 2$; $n = 18$).

Relevance of Environmental Policies and Management Plans in Australia

Protected species were not a focal point of the reviewed environmental policies. Less than one-third ($n = 7$) of the 23 reviewed policies specifically identified individually protected species; at least one policy in each state included a protected species list. Only one policy, the *EPBC Act 1999*, included a list of migratory species. Ten policies and 51 plans aligned with key threatening processes as defined by either the *EPBC Act 1999* or state legislation (see Table C4 in Appendix C for full list). Thirteen policies protected marine species and four of these protected marine migratory species.

Protection of Marine Migratory Species in Australia

Our thematic analysis identified eight policies that protected one or more of the four case study taxa. Marine turtles were protected most frequently ($n = 7$), followed by dugongs ($n = 5$), humpback

whales ($n = 3$), and migratory shorebirds (27 species as listed under the *Wildlife Conservation Plan for Migratory Shorebirds 2015*, Australian Government, 2015b; $n = 1$). Totals exceed eight because some policies were relevant to more than one case study.

Management plans were the instrument most often used to protect migratory species in Australia. Of the 115 plans reviewed, 101 were relevant to one or more of the taxa. Management strategies for shorebird species listed under the *Wildlife Conservation Plan for Migratory Shorebirds 2015* (Australian Government, 2015b) were most frequent ($n = 59$), followed by marine turtles ($n = 34$), dugongs ($n = 20$), and humpback whales ($n = 18$). Totals exceed 101 because some plans were relevant to more than one case study.

Each case study was associated with a specific type of management plan. Marine turtles and dugongs were most commonly protected by industry-generated environmental management plans ($n = 14$, $n = 10$ respectively), while shorebirds were protected most commonly by protected area management plans ($n = 44$). Humpback whales were most commonly protected by protected area management plans ($n = 4$) and industry-generated environmental management plans ($n = 3$) (Figure 2).

Coherence of Conservation Tools Used to Protect Marine Migratory Species in Australia

Overall, the coherence and complementarity of conservation tools used to protect marine migratory species in Australia was variable. While policies and management plans tended to display greater coherence with other policies and plans within the same jurisdiction, relationships between state and federal government documents, and between domestic policies and international conventions were rarely explicit, as explained below.

Coherence With International Instruments

Relationships between domestic policies and international conventions were found to be underdeveloped. Of the 23 environmental policies reviewed, six refer to one or more international agreements to which Australia is a signatory party. These include three federal environmental policies, two bilateral agreements between the federal government and Queensland, and one policy from Queensland. IUCN Listings were the most cited ($n = 3$), followed by listings on Appendices from the Convention on the International Trade of Endangered Species (CITES) ($n = 2$), the Torres Strait Treaty ($n = 2$), and the London Protocol ($n = 2$), the protocol designed to combat marine pollution.

Relationships with international conventions and agreements were more developed in the management plans than in the policies. Over half ($n = 60$) of the reviewed plans identified relationships to one or more international agreements. The Japan-Australia (JAMBA) and China-Australia (CAMBA) Migratory Bird Agreements were the most frequently cited agreements ($n=45$ for both), followed by the Republic of Korea-Australia (ROKAMBA) Migratory bird agreement ($n = 20$), and IUCN Listings ($n = 20$). Of the 20 IUCN References, only the

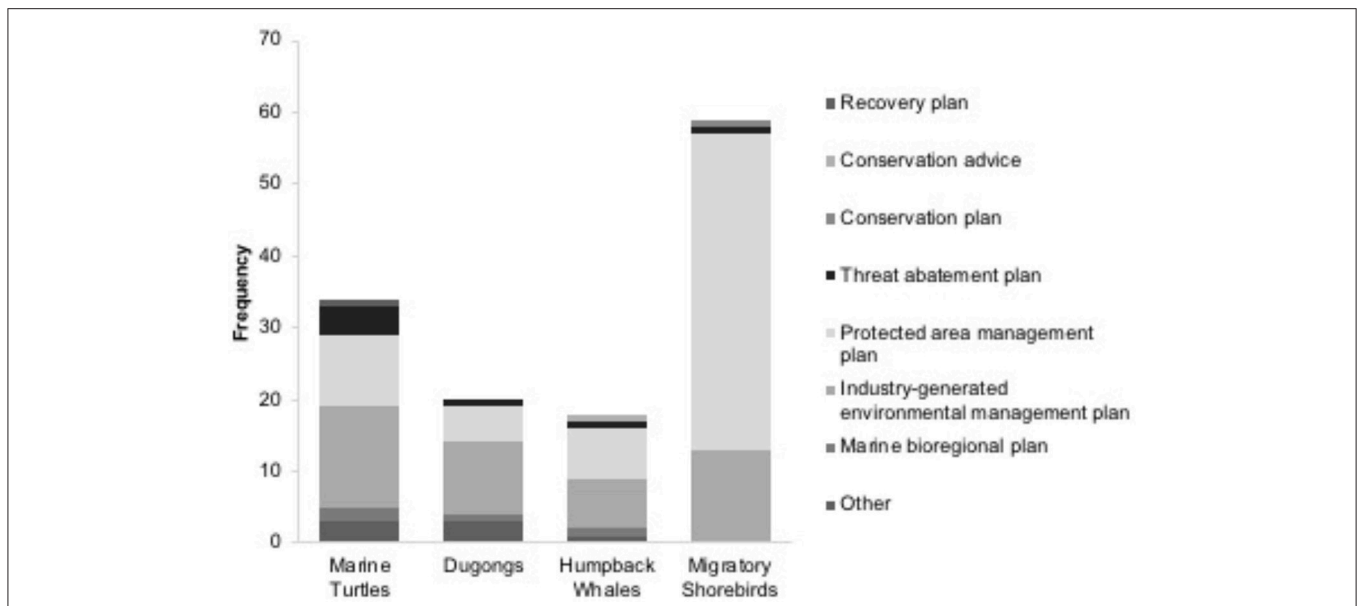


FIGURE 2 | The breakdown of relevant management plan types protecting marine turtles, dugongs, humpback whales, and 27 species of migratory shorebirds in Australia. Legend order reflects the color order (from top to bottom) of the stacked bar graph.

Recovery Plan for Marine Turtles 2017 referred to the IUCN Red List of Threatened Species; the other 19 plans reference the IUCN Protected Areas Categories System. The Bonn (CMS) Convention is cited 19 times, the Torres Strait Treaty is cited four times, and the CITES Appendices are cited three times.

Coherence Within Australia

The level of policy coherence within Australia varied. Fourteen policies identified relationships with other relevant Australian environmental policies. Two federal policies identified a relationship with other federal policies, two bilateral agreements connected to federal and state policies, five state policies identified a connection to federal policies, eight state policies identified a relationship to other environmental policies within that state, and one state policy, the *Nature Conservation Act 1992* (Qld), connected to a bilateral agreement. No policies connected to policies from another state. The *EPBC Act 1999*, Australia's main piece of environmental legislation, serves as a bridging link between NSW and Qld; without that bridge, there is no connectivity between the states. Tasmania displayed coherence within the state, but none of the reviewed policies directly connected to the *EPBC Act 1999*. Victoria displayed the lowest amount of connectivity, with no connections to other policies, including the other reviewed policies from Victoria (Figure 3).

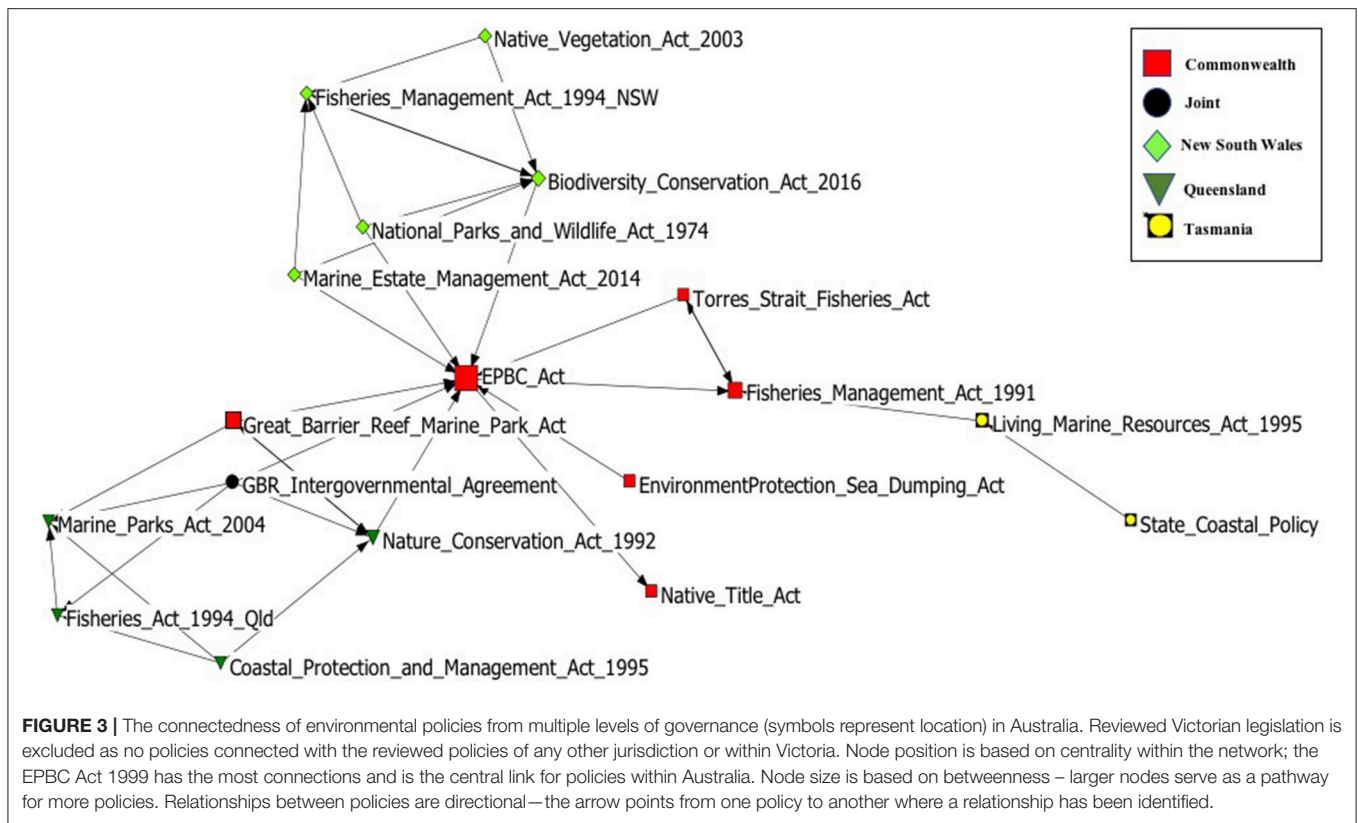
The relationships between policies and management plans was more developed than the relationships between policies, with 106 plans identifying a connection to one or more environmental policies. Twenty-three of the federal plans relate to federal policies, 56 state plans identify relationships to federal policies, and 71 state plans refer to policies within that same state. Only two plans, the Australia Pacific LNG Upstream Project: Pipeline Threatened Fauna Management Plan (industry-generated environmental management plan) and the *Recovery*

Plan for Marine Turtles in Australia 2017, operated under multi-state legislation. Despite being jointly made by the relevant federal, Qld, and NSW ministers, the *Recovery Plan for Marine Turtles in Australia 2017* demonstrated little connection to legislation from Qld and NSW (Figure 4a).

Relationships between management plans were less established than any other relationship type. Eight federal plans identified relationships with other federal plans. Nine state plans identified relationships with other plans from the same state. No state plans identified relationships to federal management plans or to plans from other states. Indirect connections to plans within the same state (or other states) were created by environmental policies at the state or federal levels (Figure 4B).

DISCUSSION

Our study used a grounded theory approach to provide a thematic analysis of Australian policy and management plans related to six species of marine turtles, dugongs, humpback whales, and 27 species of migratory shorebirds (non-threatened species listed under the *Wildlife Conservation Plan for Migratory Shorebirds 2015*, Australian Government, 2015b with habitat along the east coast). Our study identified biases toward certain species in Australian policies (statutory) and management plans (non-statutory, with the exception of recovery plans, threat abatement plans, and protected area management plans) and a disconnect between management tools operating at different governance levels. Additionally, these results emphasize the importance of the *EPBC Act 1999* in Australian natural resource governance and reinforces the argument for coherent policy and management in Australia to promote sustainable populations of marine migratory species.



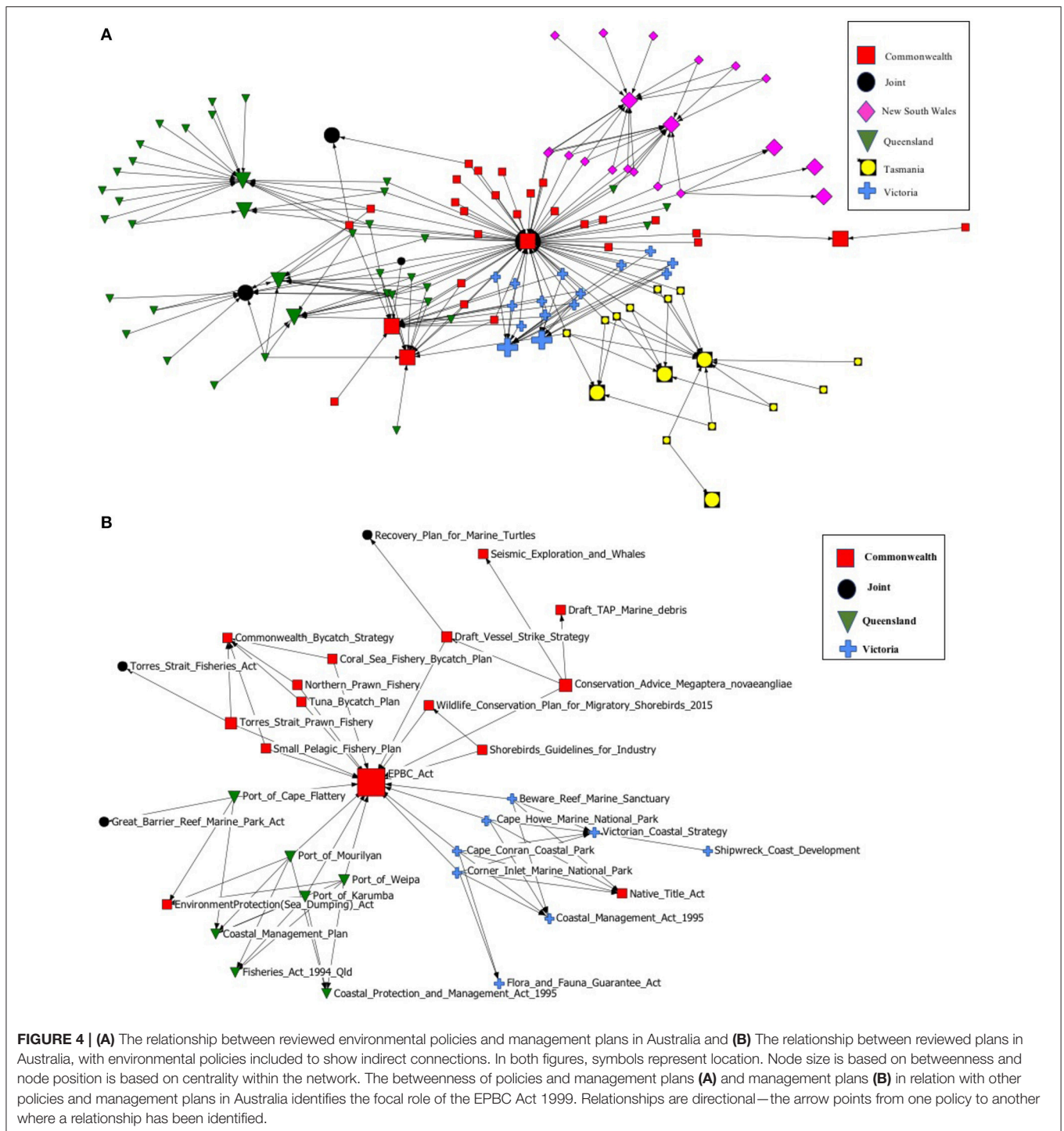
Protection of Marine Migratory Species in Australia

Protection of marine migratory species in Australia is limited, represented by only four environmental policies. In Australia, the large, highly charismatic species (marine turtles, dugongs, and humpback whales) were protected under a greater number of statutory environmental policies than migratory shorebirds, despite the migratory shorebirds being the subject of specific international agreements. The bias toward protecting marine turtles, dugongs, and humpback whales may be due to the perceived charisma of these species to the general public and the listing of each species under the *EPBC Act 1999*.

Charismatic species are typically large vertebrates that appeal to humans for a specific aesthetic or symbolic trait (Small, 2012; Ducarme et al., 2013), and are often prioritized in conservation actions (McClenachan et al., 2012; Woinarski et al., 2017). Charismatic megafauna, such as marine turtles and dugongs, are regularly chosen as flagship and umbrella species for their environment and they are used to protect other species or gain conservation attention (Marsh et al., 1999; Home et al., 2009). Additionally, many species of charismatic megafauna chosen as flagships or umbrella species are endangered (Home et al., 2009), which influences national environmental policy.

Marine turtles and humpback whales are listed as threatened under the *EPBC Act 1999* and while less than one-third of the reviewed Australian policies listed protected species, threatened species listings often drive conservation actions and are used to

prioritize the resources used for protecting threatened species (Possingham et al., 2002; Parsons, 2016). The dugong is not a nationally-listed threatened species in Australia, but it is still recognized as a MNES and, along with marine turtles, holds high traditional value to Aboriginal and Torres Strait Islander People living in Northern Australia (Marsh et al., 2004). Australia is required to preserve traditional customs under international conventions, joint agreements (e.g., the Torres Strait Treaty), and under national legislation (e.g., the *Native Title Act 1993*) (Marsh et al., 2004), in addition to protecting the dugong under the *EPBC Act 1999*. Furthermore, the presence of iconic species like marine turtles and dugongs in the Great Barrier Reef Marine Park contributed to the “outstanding universal value” criterion for the original listing of the Great Barrier Reef as a World Heritage Area (GBRMPA, 2011). The 27 species of migratory shorebirds used as a case study and listed under the *Wildlife Conservation Plan for Migratory Shorebirds 2015* (Australian Government, 2015b) are included in international agreements (e.g., JAMBA/CAMBA/ROKAMBA), but are not listed as threatened in Australia and are not well-represented in Australian environmental policy. This lack of representation in Australian environmental policies does not extend to all management tools for shorebirds, as migratory shorebirds were protected by the greatest number of management plans. However, many of these management plans are not statutory, and the exclusion of migratory shorebirds from statutory environmental policy suggests that protection of migratory



shorebirds is not as effective as the protection of other marine migratory species.

Previous research has identified that there is considerable support for the protection of shorebirds (Glover et al., 2011), even though such support is not reflected in Australian statutory instruments. Migratory shorebirds are highly susceptible to habitat loss through coastal development (Buler and Moore,

2011) and protecting critical habitats used by migratory shorebirds, in the context of increasingly intensive coastal development, is essential (Dhanjal-Adams et al., 2016). Australia has followed global conservation trends and has developed a large number of statutory protected area management plans, primarily terrestrial, to protect areas as a means of conserving biodiversity (Bull et al., 2013; Dhanjal-Adams et al., 2016). Protected areas

do benefit marine migratory species (Palumbi, 2004; Dobbs et al., 2008), but many protected areas are static “paper parks” (Cullen-Unsworth and Unsworth, 2016) and often fail to address the habitat connectivity of migratory species (Dryden et al., 2008; Bull et al., 2013; Runge et al., 2015) that actively use non-protected areas during parts of their lifecycles (Szabo et al., 2016).

There appears to be a reliance on the implementation of protected areas as the main instrument for conserving biodiversity in Australia, as reflected by the large number of protected area management plans in New South Wales, Queensland, Tasmania, and Victoria. However, most of the reviewed protected area management plans were terrestrial. There is overlap in the different habitat types used by marine turtles, dugongs, humpback whales, and migratory shorebirds, and coastal ecosystems do not exist in isolation from neighboring habitats (Duarte et al., 2008). Terrestrial protected areas and their associated plans will only protect nesting sea turtles and roosting shorebirds that use the protected areas and provide no direct protection for the strictly aquatic humpback whales and dugongs.

Policy Coherence

The need for cross-jurisdictional, complementary legislation regarding marine migratory species is evident (McClenachan et al., 2012; Riskas et al., 2016) and is highlighted by the geographic range of marine turtles, dugongs, humpback whales, and migratory shorebirds. Australia is the world’s sixth largest country on the basis of land area (Geoscience Australia: Australia’s Size Compared), with states and territories larger than many countries, so animal movements even within state jurisdictions can span hundreds of kilometers. Additionally, for dugongs and marine turtles that inhabit the Torres Strait, international migrations between the waters of Australia and Papua New Guinea may happen daily. Thus, effectively managing marine migratory species requires a polycentric governance system and cooperative legislation. Non-uniform listing and protection between governance levels may affect species’ conservation and recovery (Welsh, 2004; McClenachan et al., 2012). Previous research has identified that much of the conservation of migratory species in Australia focuses on horizontal conservation (e.g., between nations) rather than vertical (e.g., between governance levels in the same nation) (Runge et al., 2017). We identified both horizontal and vertical gaps in marine governance in the conservation of marine migratory species in Australia.

International Coherence

Much of the effort to protect migratory species has concentrated on coordinating international agreements (De Klemm, 1994; Runge et al., 2017). In Australia, listings created by the International Union for Conservation of Nature (IUCN) were the most referenced international conservation tool in the reviewed policies and the third most referenced (tied with ROKAMBA) in management plans. However, most references were to the IUCN Protected Area Categories System, rather than the Red List of Threatened Species, which is interesting because many nations base their threatened species lists and statutory instruments

on the IUCN Red List (Gärdenfors, 2001; Farrier et al., 2007). However, even though the IUCN Red List of Threatened Species was included less often than the Protected Areas Category System in the reviewed Australian policies and management plans, it does not necessarily translate to less protection for marine migratory species in Australia. The IUCN Protected Area Categories System can be applied to both terrestrial and marine environments, indicating that species may be protected if they are using those protected areas.

International agreements pertaining to migratory shorebirds (e.g., JAMBA/CAMBA) that use the East Asian-Australasian Flyway were the most prevalent in management plans, a situation expected as migratory shorebirds were the most well-represented case study in the reviewed plans. However, ROKAMBA, another migratory bird agreement, was not included in as many management plans as JAMBA and CAMBA. JAMBA and CAMBA were signed in 1974 & 1986, respectively, whereas ROKAMBA dates from 2007 and some plans have not been revised since Australia signed ROKAMBA. Management plans should be updated to include ROKAMBA (and thus, reflect cooperation with the Republic of Korea), as international cooperation in protecting migratory shorebirds that make use of the East Asian-Australasian Flyway is necessary to support local conservation successes in the face of large population declines (Clemens et al., 2016; Szabo et al., 2016).

The Torres Strait Treaty between Australia and Papua New Guinea, was underrepresented in the reviewed policies and management plans, despite its importance for managing marine turtles and dugongs. The Torres Strait Treaty maintains traditional hunting rights for Australian Aboriginal and Torres Strait Islanders inside the Torres Strait Protected Zone, as hunting turtles and dugongs is a key component of traditional customs for Australian Aboriginal and Torres Strait Islander Peoples (Kwan et al., 2006; Butler et al., 2012). The relationships are also undeveloped between the *Torres Strait Fisheries Act 1984* and other reviewed policies and management plans. The *Torres Strait Fisheries Act 1984* and the Torres Strait Treaty both address the traditional fishing rights of Australian Aboriginal and Torres Strait Islanders and weak integration of these rights into Australian environmental policy and management suggests that Australia is not effectively meeting its obligations to preserve both traditional customs and threatened species under international conventions.

Coherence Within Australia

National approaches to conservation can guide coordinated efforts to the conservation of marine migratory species (Runge et al., 2017). This approach is particularly critical in a federal system, where state legislation may not apply to the entire range of a threatened species (Welsh, 2004). Australia is striving toward a coordinated approach to conservation and for uniform threatened species listing across all levels of governance. This coordinated approach has been implemented as a common assessment method for national threatened species listing (Australian Government, 2015c), the terrestrial-focused Threatened Species Strategy (Australian Government, 2015a; Runge et al., 2017). Even if coordinated efforts were

implemented in marine management regimes that follow the approaches outlined in the (Australian Government, 2015a), marine migratory species that are not listed as threatened in Australia (e.g., dugongs and non-threatened migratory shorebirds protected under the *Wildlife Conservation Plan for Migratory Shorebirds 2015* Australian Government, 2015b) will not benefit from the proposed approach. Additionally, while some of the reviewed management plans addressed species-specific threats (e.g., *Marine Turtle Recovery Plan 2017*; Conservation Advice *Megaptera novaeangliae*), few policies and management plans addressed key threatening processes defined by either the *EPBC Act 1999* or relevant state legislation. These gaps in marine governance require coordination between states and between states and the federal government to ensure the effective management of marine migratory species in polycentric governance system.

We show that, despite some notable examples of progress, a coordinated approach to managing marine migratory species in Australia has not yet been achieved, as demonstrated by the low level of connectivity between different levels of governance. As the *EPBC Act 1999* serves as a bridging legislation for NSW and Qld, better integration of the *EPBC Act 1999* into Tasmanian and Victorian legislation might promote more effective environmental legislation over the marine environment and connectivity between states. Additionally, it is interesting that the reviewed policies from Victoria were not interconnected or connected to the policies of other jurisdictions; threatened species listing in Victoria is also the listing process most different from that used by other states or the federal government. Harmonization between national legislation, particularly the *EPBC Act 1999*, and state legislation is key to ensuring that environmental management outcomes are reached (Hawke, 2009).

The relationship between policies and management plans was more defined than the relationship between policies; most management plans connect to one or more of the reviewed environmental policies. Management plans are created under designating legislation, so a strong relationship is to be expected. However, reviewed plans directly connected only to federal or same-state policies. Further, the jointly-created *Marine Turtle Recovery Plan 2017*, while connected to federal and multi-state policies, did not identify a clear relationship between federal, NSW, and Qld legislation, perhaps due to last minute involvement of the states during plan development. The reviewed plans also only directly connected to plans within the same state. Weak integration of environmental policy and management plans is common in Australia (Ross and Dovers, 2008) and is problematic for marine migratory species, as it could indicate that groups implementing and working under legislative instruments and management plans designed to protect marine migratory species are operating independently of one another. A lack of coherence could also identify a communication gap (Smith et al., 1999) between governance levels and weakens the overall implementation of conservation tools for protecting marine migratory species in Australia (Runge et al., 2017), making it difficult to identify “ownership” of marine migratory species in a complex governance system.

The disconnect between policies and management plans can be problematic for managing species as many types of plans are not statutory. Management plans are often drafted as a form of threat mitigation rather than conservation, and non-statutory plans will have less of an impact on conservation than explicit environmental policy. Only recovery, protected area management, conservation advices, conservation plans, and threat abatement plans are statutory under the *EPBC Act 1999* (see Table B2 in Appendix B for descriptions). In addition, several recovery plans have expired under the *EPBC Act 1999* and are being replaced with conservation advices in order to address the backlog of recovery plans. The disadvantage of this is that conservation advices hold less weight than recovery plans when the Minister is making a decision regarding approving anthropogenic activities.

Future Research

The next stage of our research will involve interviews with key policy players and non-government stakeholders. These interviews will provide insight into the development and implementation of conservation policy instruments in Australia and may identify additionally relevant policies or management plans that were not identified in this study. These interviews are designed to provide information about the strength and nature of relationships between policy instruments to complement the analyses conducted in this study.

CONCLUSIONS

This study shows that not all species listed as Matters of National Environmental Significance are treated equally under Australian environmental policies and management plans, despite the international obligation to protect these species (Hawke, 2009). The larger charismatic megafauna, such as marine turtles, dugongs, and humpback whales, received more attention in statutory policy, whereas migratory shorebirds were more likely to feature in environmental management plans. The tendency to protect some species (e.g., migratory shorebirds) through management plans rather than statutory tools is a limitation in protecting marine migratory species, as many of these plans are non-binding. However, the major weakness identified through this study is a lack of connection between the federal and state governments, between states, and within the state of Victoria. The *EPBC Act 1999* is the central link between states, emphasizing both its role in environmental governance in Australia and the horizontal and vertical communication gaps between governance levels, particularly in and within the states. Any changes to the *EPBC Act 1999* will have a cascading effect on national and state legislation and management plans. Greater integration of the *EPBC Act 1999* into state and national legislation and management plans would help to improve coordination between state-government policy and planning. Increased cohesiveness between Australian environmental policy and the translation into management plans will improve protection for marine turtles, dugongs, humpback whales, and migratory shorebirds against anthropogenic threats throughout their ranges. One means to achieve this cohesiveness would be through the introduction of

a uniform treatment method for migratory species in Australia, similar to the common assessment method introduced for threatened species. Australia is larger than most other countries and a common method to protect and conserve migratory species would not only harmonize the management of these species but could also have a broader global application for protecting marine migratory species and promoting sustainable activities in the marine environment.

CLARIFICATIONS

1) In **Table 1**, the reason we have listed marine turtles as “threatened” and humpback whales as “vulnerable” is because the six species of marine turtles found in Australia do not all share the same threatened listing under the *Environment Protection and Biodiversity Conservation Act 1999* (e.g., loggerheads are listed as endangered and hawksbills are listed as vulnerable). Humpback whales are listed as vulnerable, which also means they are considered to be threatened in Australia under the *EPBC Act 1999*.

2) In Results: Relevance of Environmental Policies and Management Plans in Australia, we use the word “protected.”

REFERENCES

- Allen, S., Marsh, H., and Hodgson, A. (2004). “Occurrence and conservation of the dugong (*Sirenia: Dugongidae*) in New South Wales,” in *Proceedings of the Linnean Society*, Vol. 125, 211–216.
- Australian Government (2016). *SPRAT EPBC Migratory Lists in Species Profile and Threats Database*. Canberra, ACT: Department of the Environment and Energy, Commonwealth of Australia. Available online at: <http://www.environment.gov.au/sprat> (Accessed August 05, 2017).
- Australian Government (1999) *Environment Protection and Biodiversity Conservation Act*. Canberra, ACT: Department of the Environment and Energy, Commonwealth of Australia.
- Australian Government (2015a) *Threatened Species Strategy*. Canberra, ACT: Department of the Environment and Energy, Commonwealth of Australia. Available online at: <http://www.environment.gov.au/biodiversity/threatened/publications/strategy-home>. (Accessed June 14, 2016).
- Australian Government (2015b). *Wildlife Conservation Plan for Migratory Shorebirds*. Canberra, ACT: Department of the Environment and Energy, Commonwealth of Australia.
- Australian Government (2015c). *Common Assessment Method*. Canberra, ACT: Department of the Environment and Energy, Commonwealth of Australia. Available online at: <http://www.environment.gov.au/biodiversity/threatened/cam>. (Accessed August 21, 2017).
- Benson, D., and Lorenzoni, I. (2017). Climate change adaptation, flood risks, and policy coherence in integrated water resources management in England. *Reg Environ Change* 17, 1921–1932. doi: 10.1007/s10113-016-0959-6
- Biggs, R., Schlüter, M., Biggs, D., Bohensky, E. L., BurnSilver, S., Cundill, G., et al. (2012). Toward principles for enhancing the resilience of ecosystem services. *Annu. Rev. Environ. Resour.* 37, 421–428. doi: 10.1146/annurev-environ-051211-123836
- Boersma, P. D., and Parrish, J. K. (1999). Limiting abuse: marine protected areas, a limited solution. *Ecol. Econ.* 31, 287–304. doi: 10.1016/S0921-8009(99)00085-3
- Borgatti, S. P. (2002). *NetDraw Network Visualization*. Harvard, MA: Analytic Technologies.
- Buler, J. J., and Moore, F. M. (2011). Migrant-habitat relationships during stop over along an ecological barrier: extrinsic constraints and conservation implications. *J. Ornithol.* 152, S101–S112. doi: 10.1007/s10336-010-0640-7

The use of this word is to refer to species listed as “protected” under federal and state legislation; some of these species are also considered to be threatened in that jurisdiction.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmars.2018.00229/full#supplementary-material>

- Bull, J. W., Suttle, K. B., Singh, N. J., and Milner-Gulland, E. J. (2013). Conservation when nothing stands still: moving targets and biodiversity offsets. *Front. Ecol. Environ.* 11, 203–210. doi: 10.1890/120020
- Butler, J. R. A., Tawake, A., Skewes, T., Tawake, L., and McGrath, V., (2012). Integrating traditional ecological knowledge and fisheries management in the Torres Strait, Australia: the catalytic role of turtles and dugongs as cultural keystone species. *Ecol. Soc.* 17:34 doi: 10.5751/ES-05165-170434
- Chittleborough, R. G. (1965). Dynamics of two populations of the humpback whale, *Megaptera novaeangliae* (Borowski). *Mar. Freshwater. Res.* 16, 33–128.
- Clemens, R. S., Rogers, D. I., Hansen, B. D., Gosbell, K., Minton, C. D. T., Straw, P., et al. (2016). Continental-scale decreases in shorebird populations in Australia. *Emu* 116, 119–135. doi: 10.1071/MU15056
- Cullen-Unsworth, L. C., and Unsworth, R. K. F. (2016). Strategies to enhance the resilience of the world’s seagrass meadows. *J. Appl. Ecol.* 53, 967–972. doi: 10.1111/1365-2664.12637
- Dale, A. P., Vella, K., Pressey, R. L., Brodie, J., Gooch, M., Potts, R., et al. (2016). Risk analysis of the governance system affecting outcomes in the Great Barrier Reef. *J. Environ. Manage.* 163, 712–721. doi: 10.1016/j.jenvman.2016.09.013
- Day, J. (2008). The need and practice of monitoring, evaluating and adapting marine planning and management – lessons from the Great Barrier Reef. *Mar. Policy* 32, 823–831. doi: 10.1016/j.marpol.2008.03.023
- Day, J. C. (2016). “Chapter 5: The Great Barrier Reef Marine Park – the grandfather of modern MPAs,” in *Big, Bold and Blue: Lessons from Australia’s Marine Protected Areas*, eds Fitzsimmons and Wescott (Clayton South, VIC: CSIRO Publishing), 65–97.
- De Klemm, C. (1994). “The problem of migratory species in international law,” in *Green Globe Yearbook of International Cooperation on Environment and Development 1994*, eds H. O. Bergesen and G. Parmann (Oxford: Oxford University Press), 67–77.
- Dhanjal-Adams, K. L., Hanson, J. O., Murray, N. J., Phinn, S. R., Wingate, V. R., Mustin, K., et al. (2016). The distribution and protection of intertidal habitats in Australia. *Emu* 116, 208–214. doi: 10.1071/MU15046
- Dobbs, K., Fernandes, L., Slegers, S., Jago, B., Thompson, L., Hall, J., et al. (2008). Incorporating dugong habitats into the marine protected area design for the Great Barrier Reef Marine Park, Queensland, Australia. *Ocean Coast. Manage.* 51, 368–375. doi: 10.1016/j.ocecoaman.2007.08.001
- Dryden, J., Grech, A., Moloney, J., and Hamann, M. (2008). Rezoning of the Great Barrier Reef World Heritage Area: does it afford greater protection for marine turtles? *Wildlife Res.* 35, 477–485. doi: 10.1071/WR07087

- Duarte, C. M., Dennison, W. C., Orth, R. J. W., and Carruthers, T. J. B. (2008). The charisma of coastal ecosystems: addressing the imbalance. *Estuar. Coasts* 31, 233–238. doi: 10.1007/s12237-008-9038-7
- Ducarme, F., Luque, G. M., and Courchamp, F. (2013). What are “charismatic species” for conservation biologist? *Biosci. Master Rev.* 10, 1–8. Available online at: <http://biologie.ens-lyon.fr/ressources/bibliographies/pdf/m1-11-12-biosci-reviews-ducarme-f-2c-m.pdf?lang=fr>
- Farrier, D., Whelan, R., and Mooney, C. (2007). Threatened species listing as a trigger for conservation action. *Environ. Sci. Policy* 10, 219–229. doi: 10.1016/j.envsci.2006.12.001
- Fraser, K. A., Adams, V. M., Pressey, R. L., and Pandolfi, J. M. (2017). Purpose, policy, and practice: intent and reality for on-ground management and outcomes of the Great Barrier Reef Marine Park. *Mar. Policy* 81, 301–311. doi: 10.1016/j.marpol.2017.03.039
- Fusch, P. I., and Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. *Qualit. Rep.* 20, 1408–1416. Available online at: <https://nsuworks.nova.edu/tqr/vol20/iss9/3>
- Gärdenfors, U. (2001). Classifying threatened species at national versus global levels. *Trends Ecol. Evol.* 16, 511–516. doi: 10.1016/S0169-5347(01)02214-5
- GBRMPA (2011). *Criteria Values and Attributes*. Available online at: <http://www.gbrmpa.gov.au/about-the-reef/heritage/great-barrier-reef-world-heritage-area/criteria-values-and-attributes> (Accessed August 22, 2017).
- Gilmore, S., Mackey, B., and Berry, S. (2007). The extent of dispersive movement behaviour in Australian vertebrate animals, possible causes, and some implications for conservation. *Pacific Conserv. Biol.* 13, 93–103. doi: 10.1071/PC070093
- Glover, H. K., Weston, M. A., Maguire, G. S., Miller, K. K., and Christie, B. A. (2011). Towards ecologically meaningful and socially acceptable buffers: response distance of shorebirds in Victoria, Australia, to human disturbance. *Landsc. Urban Plan.* 103, 326–334. doi: 10.1016/j.landurbplan.2011.08.006
- Hawke, A. (2009). *The Australian Environment Act – Report of the Independent Review of the Environment Protection and Biodiversity Conservation Act 1999*. Available online at: www.environment.gov.au/epbc/review (Accessed September 28, 2017).
- Home, R., Keller, C., Nagel, P., Bauer, N., and Hunziker, M. (2009). Selection criteria for flagship species by conservation organizations. *Environ. Conserv.* 36, 139–148. doi: 10.1017/S0376892909990051
- Hooker, S. K., and Gerber, L. R. (2004). Marine reserves as a tool for ecosystem-based management: the potential importance of megafauna. *BioScience* 54, 27–39. doi: 10.1641/0006-3568(2004)054[0027:MRAATF]2.0.CO;2
- Kim, M. K., Evans, L., Scherl, L. M., and Marsh, H. (2016). The user, not the tool: perceptions of credibility and relevance affect the uptake of prioritisation. *Environ. Manage.* 57, 836–846. doi: 10.1007/s00267-015-0653-3
- Kwan, D., Marsh, H., and Delean, S. (2006). Factors influencing the sustainability of customary dugong hunting by a remote indigenous community. *Environ. Conserv.* 33, 164–171. doi: 10.1017/S0376892906002992
- Lascelles, B., Notarbartolo Di Sciarra, G., Agardy, T., Cuttelod, A., Eckert, S., Glowka, L., et al. (2014). Migratory marine species: their status, threats and conservation management needs. *Aquat. Conserv.* 24, 111–127. doi: 10.1002/aqc.2512
- Marsh, H., Eros, C., Corkeron, P., and Breen, B. (1999). A conservation strategy for dugongs: implications of Australian research. *Mar. Freshw. Res.* 50, 979–990. doi: 10.1071/MF99080
- Marsh, H., Lawler, I. R., Kwan, D., Delean, S., Pollock, K., and Alldredge, M. (2004). Aerial surveys and the potential biological removal technique indicate that the Torres Strait dugong fishery is unsustainable. *Anim. Conserv.* 7, 435–443. doi: 10.1017/S1367943004001635
- Marsh, H., and Lefebvre, L. W. (1994). Sirenian status and conservation efforts. *Aquat. Mamm.* 20, 155–170.
- Martin, T. G., Chades, I., Arcese, P., Marra, P. P., Possingham, H. P., and Norris, D. R. (2007). Optimal conservation of migratory species. *PLoS ONE* 8:e751. doi: 10.1371/journal.pone.0000751
- McClenachan, L., Cooper, A. B., Carpenter, K. E., and Dulvy, N. K. (2012). Extinction risk and bottlenecks in the conservation of charismatic marine species. *Conserv. Lett.* 5, 73–80. doi: 10.1111/j.1755-263X.2011.00206.x
- Milton, D. (2003). Threatened shorebird species of the East Asian-Australasian Flyway: significance for Australian wader study groups. *Wader. Study Group Bull.* 100, 105–110. Available online at: <https://sora.unm.edu/sites/default/files/journals/iwsgb/v100/p00105-p00110.pdf>
- Morrison, T. H. (2017). Evolving polycentric governance of the Great Barrier Reef. *Proc. Natl. Acad. Sci. U.S.A.* 114, E3013–E3021. doi: 10.1073/pnas.1620830114
- Nilsson, M., Zamparutti, T., Petersen, J. E., Nykvist, B., Rudberg, P., and McGuinn. (2012). Understanding policy coherence: analytical framework and examples of sector-environment policy interactions in the EU. *Environ. Policy Govern.* 22, 395–423. doi: 10.1002/eet.1589
- Noad, M. J., Paton, D., and Cato, D. H. (2011). Absolute and relative abundance estimates of Australia east coast humpback whales (*Megaptera novaeangliae*). *J. Cetacean Res. Manage.* 3, 243–252. Available online at: https://www.researchgate.net/profile/David_Paton2/publication/37629829_Absolute_and_relative_abundance_estimates_of_Australian_east_cost_humpback_whales_Megaptera_novaeangliae/links/00b7d5331d3389e26a000000.pdf
- OECD (2013). *Policy Coherence for Inclusive and Sustainable Development*. OECD Post 2015: Element 8, Paper 1. Available online at: <https://www.oecd.org/development/pcd/POST-2015%20PCD.pdf> (Accessed May 14, 2018).
- Ortega-Argueta, A., Baxter, G., and Hockings, M. (2011). Compliance of Australian threatened species recovery plans with legislative requirements. *J. Environ. Manage.* 92, 2054–2060. doi: 10.1016/j.jenvman.2011.03.032
- Ostrom, E. (2012). Nested externalities and polycentric institutions: must we wait for global solutions to climate change before taking actions at other scales? *Econ. Theory* 49, 353–369. doi: 10.1007/s00199-010-0558-6
- Ostrom, V., Tiebout, C. M., and Warren, R. (1961). The organization of government in metropolitan areas: a theoretical inquiry. *Am. Polit. Sci. Assoc.* 55, 831–842.
- Palumbi, S. R. (2004). Marine reserves and ocean neighborhoods: the spatial scale of marine populations and their management. *Annu. Rev. Environ. Resour.* 29, 31–68. doi: 10.1146/annurev.energy.29.062403.102254
- Parsons, E. C. M. (2016). Why IUCN should replace “Data Deficient” conservation status with a precautionary “Assume Threatened” status – A cetacean case study. *Front. Mar. Sci.* 3:193. doi: 10.3389/fmars.2016.00193
- Pendoley, K. L., Schofield, G., Whittock, P. A., Ierodiaconou, D., and Hays, G. C. (2014). Protected species use of a coastal marine migratory corridor connecting marine protected areas. *Mar. Biol.* 161, 1455–1466. doi: 10.1007/s00227-014-2433-7
- Possingham, H. P., Anelman, S. J., Burgman, M. A., Medellin, R. A., Master, L. L., and Keith, D. A. (2002). Limits to the use of threatened species lists. *Trends Ecol. Evol.* 17, 503–507. doi: 10.1016/S0169-5347(02)02614-9
- Pullin, A. S., and Stewart, G. B. (2006). Guidelines for systematic review in conservation and environmental management. *Conserv. Biol.* 20, 1647–1656. doi: 10.1111/j.1523-1739.2006.00485.x
- Read, T. C., Wantiez, L., Werry, J. M., Farman, R., Petro, G., and Limpus, C. J. (2014). Migrations of green turtles (*Chelonia mydas*) between nesting and foraging grounds across the Coral Sea. *PLoS ONE* 9:e100083. doi: 10.1371/journal.pone.0100083
- Riskas, K. A., Fuentes, M. M. P. B., and Hamann, M. (2016). Justifying the need for collaborative management of fisheries bycatch: a lesson from marine turtles in Australia. *Biol. Conserv.* 196, 40–47. doi: 10.1016/j.biocon.2016.02.001
- Robinson, R. A., Crick, H. Q. P., Learmonth, J. A., Maclean, I. M. D., Thomas, C. D., Bairlein, F., et al. (2009). Travelling through a warming world: climate change and migratory species. *Endanger. Species Res.* 7, 87–99. doi: 10.3354/esr00095
- Ross, A., and Dovers, S. (2008). Making the harder yards: environmental policy integration in Australia. *Aus. J. Public Administ.* 67, 245–260. doi: 10.1111/j.1467-8500.2008.00585.x
- Ruckelshaus, M., Klinger, T., Knowlton, N., and DeMaster, D. P. (2008). Marine ecosystem-based management in practice: scientific and governance challenges. *BioScience* 58, 53–63. doi: 10.1641/b580110
- Runge, C. A., Gallo-Cajiao, E., Carey, M. J., Garnett, S. T., Fuller, R. A., and McCormack, P. C. (2017). Coordinating domestic legislation and international agreements to conserve migratory species: a case study from Australia. *Conserv. Lett.* 10, 765–772. doi: 10.1111/conl.12345
- Runge, C. A., Watson, J. E. M., Butchart, S. H. M., Hanson, J. O., Possingham, H. P., and Fuller, R. A. (2015). Protected areas and global conservation of migratory birds. *Science* 350, 1255–1258. doi: 10.1126/science.aac9180

- Sheppard, J. K., Preen, A. R., Marsh, H., Lawler, I. R., Whiting, S. D., and Jones, R. E. (2006). Movement heterogeneity of dugongs, Dugong dugon (Müller) over large spatial scales. *J. Exp. Mar. Biol. Ecol.* 334, 64–83. doi: 10.1016/j.jembe.2006.01.011
- Small, E. (2012). The new Noah's Ark: beautiful and useful species only. Part 2. The chosen species. *Biodiversity* 13, 37–53. doi: 10.1080/14888386.2012.659443
- Smith, A. D. M., Sainsbury, K. J., and Stevens, R. A. (1999). Implementing effective fisheries-management systems – Management strategy evaluation and the Australian partnership approach. *ICES J. Mar. Sci.* 56, 967–979. doi: 10.1006/jmsc.1999.0540
- Szabo, J. K., Choi, C. Y., Clemens, R. S., and Hansen, B. (2016). Conservation without borders – solutions to declines of migratory shorebirds in the East Asian-Australasian Flyway. *Emu* 116, 215–221. doi: 10.1071/MU15133
- Tol, S. J., Jarvis, J. C., York, P. H., Grech, A., Congdon, B. C., and Coles, R. G. (2017). Long distance biotic dispersal of seagrass seeds by marine mega-herbivores. *Sci. Rep.* 7:4458. doi: 10.1038/s41598-017-04421-1
- Unsworth, R. K. F., Collier, C. J., Waycott, M., McKenzie, L. J., and Cullen-Unsworth, L. C. (2015). A framework for the resilience of seagrass ecosystems. *Mar. Pollut. Bull.* 100, 34–46. doi: 10.1016/j.marpolbul.2015.08.016
- Welsh, A. B. (2004). Factors influencing the effectiveness of local versus national protection of migratory species: a case study of lake sturgeon in the Great Lakes, North America. *Environ. Sci. Policy* 7, 315–328. doi: 10.1016/j.envsci.2004.03.003
- Woinarski, J. C. Z., Garnett, S. T., Legge, S. M., and Lindenmayer, D. B. (2017). The contribution of policy, law, management, research, and advocacy failings to the recent extinctions of three Australian vertebrate species. *Conserv. Biol.* 31, 13–23. doi: 10.1111/cobi.12852

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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