5-2018

Marine Protected Areas in Areas Beyond National Jurisdiction: Defining "Success" for Conservation and Management

Emily Suzanne Nocito
University of Maine, emily.nocito@maine.edu

MARINE PROTECTED AREAS IN AREAS BEYOND NATIONAL JURISDICTION: DEFINING "SUCCESS" FOR CONSERVATION & MANAGEMENT

By

Emily Suzanne Nocito

B.S. Stony Brook University, 2016

A THESIS

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Science

(in Marine Policy)

The Graduate School

The University of Maine

May 2018

Advisory Committee:

Aaron Strong, Assistant Professor of Marine Policy, Advisor

Cassandra Brooks, Assistant Professor of Environmental Studies (UC-Boulder)

Yong Chen, Professor of Marine Science

Joshua Stoll, Assistant Research Professor of Marine Policy

MARINE PROTECTED AREAS IN AREAS BEYOND NATIONAL JURISDICTION: DEFINING "SUCCESS" FOR CONSERVATION & MANAGEMENT

By: Emily Suzanne Nocito

Thesis Advisor: Dr. Aaron Strong

An abstract of the Thesis Presented

In Partial Fulfillment of the Requirements for the

Degree of Master of Science

(in Marine Policy)

May 2018

With growing attention to and use of marine protected areas [MPAs], there are an increasing number of policy goals ascribed to these area-based management tools [ABMT]. One expectation is that an MPA can increase system "resilience", yet oftentimes resilience – including whether we are considering social, economic or ecological resilience – stays unspecified. In recent years, there has also been a specific focus on MPAs as tools to promote climate change resilient ocean systems. Through a meta-analysis of the scientific literature and an analysis of over one thousand three hundred voluntary commitments made at the United Nation Ocean Conference, this work presents a typology of how the concept of resilience is beyond deployed in MPA science and policy-making. Further analysis, supplemented by semi-structure interviews and surveys highlights the diversity of ways in which practitioners define MPA success. These analyses reveal that – in contemporary international ocean governance – different stakeholders are connecting MPAs to different forms of resilience. This work also

highlights a disconnect between expressed goals of MPAs, such as cultural effectiveness, and what is deemed important in practice (ecological factors).

Key Words: marine protected areas, area-based management tools, resilience, climate change,

ACKNOWLEDGEMENTS

The first of many thanks need to go to Dr. Aaron Strong for supporting my project and research, from the first conversation to this document. Thank-you to both Dr. Strong and the University of Maine for the funds to conduct this research. Thank-you to the rest of my committee for their invaluable feedback and support, Cassandra Brooks, Yong Chen and Joshua Stoll.

Thank you to the entire Strong Lab for listening to my numerous presentations, the feedback and the never-ending assistance as I bounced ideas off them. A special shout-out to Anama Solofa for being my guide to United Nation processes that otherwise would have taken me months to figure out. Thank you to Sue Thibodeau, Jodie Feero and Carrie Love for the administrative support and the constant stream of coffee and laughs. Andre Bucci, thank you for reading drafts and providing feedback, and for trying to teach me how to properly play pool. Juliet Woodruff & Sabina Muccigrosso, Zach McKeeby & Jannelle Patrick, from miles away you made me smile and laugh when I needed it most.

To my parents, thank you for listening to the late-night calls and smiling and nodding when I explained my research and trying to explain it to our extended family and friends. Doug Nocito and Amber Kay, the support you provided me got me where I am today. Thank you for reminding me that responsibility is punk rock. A high-five to the NY/NJ hardcore scene for providing the soundtrack to the last two years and welcoming me back home with open arms, and a hug to the Wilson Center for being my home away from home. TK, you were right- with a golden heart does come a rebel fist.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1: A HISTORY OF MPAs AND THE RISE OF "RESILIENCE"

Marine Protected Areas (MPAs) are an area-based management tool (ABMT) that have seen an increase in use over the last 30 years in both countries' exclusive economic zones (EEZs) and more recently, within the high seas, otherwise known as areas beyond national jurisdiction [ABNJs] (Lubchenco & Grorud-Colvert, 2015). ABMTs serve as a way to regulate human activity within a specified area, with the end goal of conservation or sustainable resource management (IUCN, n.d.). Historically, MPAs have existed without official recognition, being common in coastal indigenous communities throughout the world (Ocean Studies Board, 2001). In the United States, the first MPAs in terms of marine parks did not come about until the 1800s, and few existed with marine conservation in mind, but rather for the value of the ecosystem as it was. It was not until the end of World War II that these protected areas in the US and globally started to focus more on conservation (Ocean Studies Board, 2001; Wells et al., 2016). The 1990s saw MPAs created with fisheries restoration in mind (FAO, 2015). It was only in the last 20 years that MPAs became a focal point within international agreements and conferences, such as the first International Marine Protected Area Conference in 2005 (Alex Caveen, Tim Gray, Nick Polunin, 2015), and the adoption of the Convention on Biological Diversity (CBD) in 1992 (Ocean Studies Board, 2001). With the wave of established MPAs increasing, more and more sectors such as tourism, energy and transportation are considered stakeholders in the establishment process (Hoffmann E., Perez-Ruzafa, 2008) . This increase in stakeholders means that the stated reasons for establishing MPAs have become wide-spread, ranging from biological conservation and preservation to ensuring economic prosperity for future generations, and most recently, as an attempt to address climate change.

Defining MPAs

Given the diversity of policy goals and strategies for implementation and creation of MPAs, the question arises: what, exactly, should be considered as a marine protected area? While no one definition is applied to marine protected areas, it is the International Union for the Conservation of Nature (IUCN) definition for protected areas that is looked to when discussing MPAs in an international context. The IUCN defines a protected area as "a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Day et. al, 2012). It is important to note that this formal definition encompasses criteria beyond biophysical criteria. Through the addition of cultural values, it includes elements of local and community engagement and knowledge. Without social acceptability of the MPA, the likelihood of the biological objectives being reached decrease greatly (Voyer, Gollan, Barclay, & Gladstone, 2015).

IUCN Category	Definition
Ia	Category Ia are strictly protected areas set aside to protect biodiversity and also possibly geological/ geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring.

Ib	Category Ib protected areas are usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition
II	Category II protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.
III	Category III protected areas are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine caverns, geological feature such as a caves or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value.

IV	Category IV protected areas aim to protect particular species or habitats and management reflects this priority. Many category IV protected areas will need

Table 1 continued

Table 1 continued

	regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category.
V	Category V protected areas are where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values
VI	Category VI protected areas conserve ecosystems and habitats together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in natural condition, where a proportion is under sustainable natural resource management and where low-level non industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.

Table 1: Definitions of IUCN protected area categories, adapted from Day J., Dudley N., Hockings M., Holmes G., Laffoley D., 2012

A Comparison of Two Types of MPAs

MPA is not an all-encompassing term- beyond the IUCN definitions listed in Table 1, there are recognized MPA types. Among the many types of MPAs, a popular one is the multi-use MPA. This means that a number of activities can take place within the MPA, such as tourism diving, commercial fishing or cultural fishing. One commonly cited example of a multi-use MPA is the Great Barrier Reef Marine Park (GBRMP). The GBRMP is zoned into 9 different areas, ranging from general use to scientific research only to marine reserves.

On the other end of the spectrum are no-take zones, also called marine reserves. Unlike their multi-use MPA counterparts, the activities that can occur in marine reserves are strictly regulated, and fishing is not allowed. Globally, marine reserves make up the smallest portion of MPAs globally, with 94% of MPAs allowing fishing in some form (Costello & Ballantine, 2015).

Objectives of MU-MPA	Objectives of Marine Reserve
Ensure conservation of the MPA in perpetuity	Preserve ecosystems, species and geodiversity aspects with minimum disturbance by human activity
Provide protection for critical & representative habitats, ecosystems and ecological processes	Secure examples of natural environment for education, monitoring and scientific use
Separate conflicting human activities	Minimize disturbance through planning and implementation of research
Protect natural and/or cultural qualities of MPA while allowing human use	Conserve cultural and spiritual values
Reserve suitable areas for specified human use, while minimizing the effects of the uses	Conserve outstanding ecosystems, species and geodiversity features
Preserve some areas of the MPA in their natural state undisturbed by humans excluding scientific use	

Table 2: Differentiation of Objectives, adapted from Kelleher & Kenchington, 1992 and IUCN, 2017

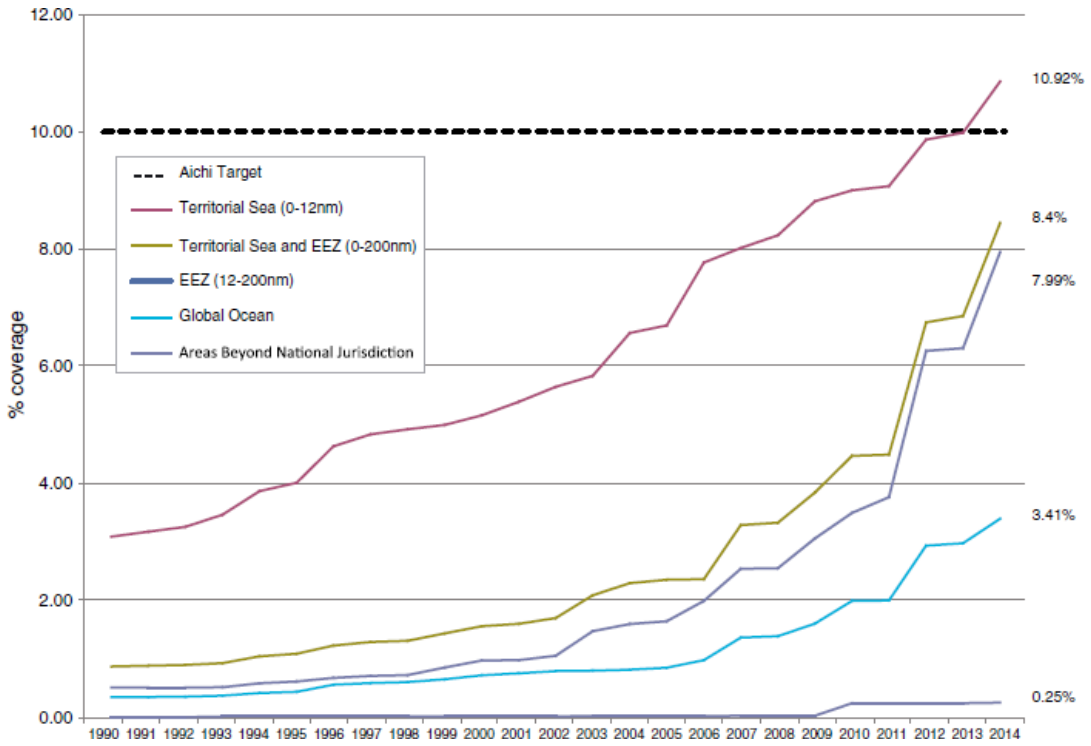

Figure 1: Trends in global MPA coverage over time (Thomas et al., 2014)

. More recently, there has been a shift in both the location and use of MPAs. In terms of the use, there has been a surge in the creation of MPA networks in attempts to thwart or minimize the effects of anthropogenic driven climate change and natural climate change. In location, there has been an increase in both the creation and dialogue concerning MPAs in ABNJs (Fig 1) (Thomas et al., 2014). MPAs in EEZs are already difficult to create and sustain; adding additional elements such as climate resilience, or moving the MPA into international waters, increases the uncertainty in an already complicated situation.

Marine Protected Areas in Areas Beyond National Jurisdiction

MPAs within ABNJ can create significant institutional interaction and legal issues when creating a framework for their management (Rochette et al., 2014), but are immensely important due to the majority of ocean space being within ABNJs. As of 2017, there are 12 of these High

Seas Marine Protected Areas (HS-MPAs). Two are located in the Southern Ocean, and the remaining ten are within the Northeast Atlantic region. Those in the Southern Ocean were the first HS-MPAs, under the Commission for the Conservation of Antarctic Marine Living Resources [CCAMLR], while the Northeast HS-MPAs were established under the Oslo-Paris (OSPAR) convention (Smith & Jabour, 2018). The consideration of cultural dimensions of MPAs becomes more challenging when discussing MPAs in areas beyond national jurisdiction [ABNJ]. In cases of ABNJ, stakeholder engagement does not occur in public meetings, on beaches or in town halls- the engagement occurs at high level political forums, conferences and meetings. Stakeholders are represented by their country's delegations, non-governmental organizations [NGOs], intergovernmental organizations [IGOs] and an array of other groups. A gap analysis of marine biodiversity use within ABNJs found widespread regulatory, governance and participation gaps (Gjerde, Kristina M., Dotinga, H.; Molenaar, E., Rayfuse, R., Warner, R., 2008).Some benefits of HS-MPAs allow for filling in the gaps within MPA networks, allow governments to meet requirements made under UN commitments and allow for the protection of marine biodiversity (Corrigan & Kershaw, 2008).

Marine Protected Areas as a Tool and as a Controversy

When discussing protected areas in the marine environment, MPAs are sometimes considered to be a fishery management tool- such as by the Food and Agricultural Organization (FAO)- when they can function more as an ABMT that operationalizes policies, allowing its implementation a wide range of uses. MPAs as an ABMT have been shown to be capable of increasing biological richness, restoring degraded areas, and increasing fisheries stocks (Agardy, 2000; Gell & Roberts, 2003) and protecting cultural and historical areas of importance (Kelleher,

Graeme; Kenchington, 1992). Despite, or, perhaps, because of this multitude of policy goals, implementing MPAs can be controversial.

Controversy can span every aspect of the MPA. There has been controversy over the role of stakeholder participation, such as how much participation is too much, or whether protected areas are actually beneficial to stakeholders (Hogg, Noguera-Méndez, Semitiel-García, Gray, & Young, 2017; West, Igoe, & Brockington, 2006). There is debate about the size of MPA, such as too big to be enforceable or too small to be useful in conservation (Clements & Hay, 2017; Halpern, 2003; Leenhardt, Cazalet, Salvat, Claudet, & Feral, 2013). The controversy is not just limited to academia- in early 2018 an Op-Ed piece was written about MPAs and the "just add water" approach to reach the goals laid out in some international documents (Rocha, 2018).

Spatially, MPA placement is often determined by gathering information from marine biology, oceanography, ecology and other 'biophysical sciences' fields, along with data and input from policy, economics, business, and international relations. The last- and some may argue, most important- aspect of MPA management is local and stakeholder participation (Gopnik et al., 2012; R. Pomeroy & Douvere, 2008; Sayce et al., 2013). An example of a commonly cited 'successful' MPA is the Palau Protected Areas Network (PAN), which was established under Palauan national law in 2003. PAN is made up of a mix of MPA types, ranging from no-take to subsistence fishing (Friedlander et al., 2017). Palau has a rich cultural history that includes traditional moratoria on fishing. PAN is set up as a network of MPAs, and has been found to be economically beneficial, through both tourism and fisheries spillover. PAN is a prime example of how a multi-disciplinary approach is key to establishing MPAs.

Assessing Success of MPAs

Given the wide diversity of both MPAs and policy-goals of MPAs and their increasing importance in ABNJ, understanding how we can define "success" for implemented MPAs is a key question for policy researchers, There has been work done for assessing the effectiveness or success of marine protected areas, although there is still no set consensus about *how effective* they are – and of course it depends on the metrics used to assess effectiveness. I have categorized these metrics to fall into three categories: biophysical, governance and socio-economic.

Sampling of Goals	**Source**
Food security enhanced or maintained Environmental awareness and knowledge enhanced Marine resources sustained or protected Degraded areas restored	(R. S. Pomeroy, Watson, Parks, & Cid, 2005)
Food web integrity Quality of human health Stakeholder knowledge of natural history Enforcement coverage	(Tupper, Asif, Garces, & Pido, 2015)
Focal species abundance Local marine resource use patterns Local understanding of MPA rules and regulations	(Garces, Pido, Tupper, & Silvestre, 2013)

Clearly defined enforcement procedures	
Area under no or reduced human impact Level of stakeholder participation and satisfaction in management process and activities Type, level and return of fishing effort Protection of critical habitats such as coral reefs, mangroves, sea grass	(Gallacher et al., 2016)

Table 3: Sampling of example indicators of an effective MPA from the literature

Metrics and indices for tracking success across multiple ocean issues and its' wellbeing are not new- one of the most thorough is the Ocean Health Index [OHI]. OHI is the first assessment tool for the oceans that encompasses a multi-dimensional approach, i.e. physical, economic, biological and social elements. Their data is collected from multiple global databases and pre-existing databases (Ocean Health Index, 2018). The overall goal of OHI is to evaluate how the ocean provides 10 pre-selected benefits to people, and how it is projected to continue to do so into the future.

One indicator of how well the benefits are being provided is through resilience. The OHI, though, recognizes the multiple definitions of resilience, and recognizes three kinds of resilience: ecological, social and institutional (Katona, 2015). While resilience is seen as a way to provide support to the 10 benefits, there has been a boom in resilience itself to be a benefit, especially related to climate change. Along with the expansion of MPA usage as a policy tool, there has been a concomitant expansion in the consideration of MPAs as a tool for expanding resilience.

One emerging sub-category within this metric relates climate change to resilience, or

'climate resilient'. A number of organizations, such as NOAA and IUCN have produced pamphlets and guidebooks on climate-resilient MPAs (Simard, Laffoley, & Baxter, 2013; Wenzel & Wahle, 2013). While there are few MPAs currently in existence with climate-resilience in effect, it is an important consideration (Hopkins, Bailey, & Potts, 2016) . Within the literature, there is debate on whether to conserve vulnerable marine ecosystems in hopes of restoration, or to conserve those areas that are less vulnerable to continue preservation (Maina et al., 2015). It has also been posited that the benefits of climate-resilient MPAs will span biophysical and socio-economic goals, allowing for potentially a more successful MPA (Green et al., 2014; McLeod, Salm, Green, & Almany, 2009).

The Role of Resilience in Marine Protected Areas

Resilience can be considered a family term in the realm of cluster concepts- all the definitions resemble each other, yet are uniquely different (Parsons, 1973). One noted difficulty of family resemblance clusters is that one may "blunder when [they] try to explain the similarity between two individuals in terms of what they have in common in virtue of which the term is true of them" (Parsons, 1973). In simpler terms, yourself and a colleague could be speaking about resilience in any sense- broad, such as with the overall environment, or more specific, such as with an MPA. While both persons are discussing the same concept, their interpretation of the concept during the conversation may be vastly different. This can lead to misunderstanding, which may have dire consequences in the future. Here I present a typology of forms of resilience applied to MPAs, derived from a meta-analysis as well as voluntary commitments made during the UN Ocean Conference. I have including how they are defined in my codebook and deployed in my analysis. Given the use of varying indicators of success, as well as the different definitions of resilience as they are applied to MPAs, understanding *how* actors, including

governments, NGOs, academic scientists, and others are deploying the concept of resilience related to MPAs in policy practice is a key research question. Understanding and describing the multiple ways in which resilience is used will help advance our understanding of ocean governance and also inform the development of metrics related to MPA assessment for future high-seas ABMTs. To aid in this, here I present an analysis of the treatment of resilience as it relates to MPAs within voluntary commitments made at 2017 UN Ocean Conference and a meta-analysis of the MPA-resilience literature. These two analyses were supplemented by semi-structured key informant interviews and results from a high-level survey of international ocean governance professionals.

Social-Ecological Systems Resilience

In terms of social-ecological systems (SES), there are a number of definitions of resilience within that concept. Brand and Jax, 2007 separated SES resilience into two sub-categories: social-ecological and resilience approach. They define social-ecological via Adger, Brown & Tompkins, 2005 "the capacity of a social-ecological systems to absorb recurrent disturbances (…) so as to retain essential structures, processes and feedbacks". For the resilience approach, Brand and Jax refer to Folke's definition: "a perspective or approach to analyze social-ecological systems". For the purposes of this analysis, the definition given by Walker et al., 2004 was used as a master definition for both the meta-analysis that was conducted and the voluntary commitments because it seemed to encompass the two SES sub-categories. This definition is as follows: "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks" (Walker, Holling, Carpenter, & Kinzig, 2004).

Human Community Resilience

There was a lot of variability in the definition of community resilience within the meta-analysis. Some focused heavily on the community's response to climate change impacts, while others were broader. Due to the lack of commonality, a source not from the papers of the meta-analysis or the voluntary commitments that covered all the different definitions was found. I settled on the definition being "the existence, development, and engagement of community resources by community members to thrive in an environment characterized by change, uncertainty, unpredictability, and surprise" (Magis, 2010). For those definitions from the meta-analysis that reference climate change, the Magis definition covers it in the latter half of the definition. For those definitions that are more local-centric, the former half of the definition is suitable.

Ecological Resilience

It would be remiss to leave out what may be the most seminal paper on resilience in the realm of conservation science. In an analysis of scholarly networks related to resilience, C.S. Holling had the most citations, more than double the next author (Janssen, Schoon, Ke, & Börner, 2006). In what is called the original-ecological by a paper by Brand and Jax, 2007, Holling's 1973 paper defines resilience as the "measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables". Due to the proliferation of Holling's definitions within the meta-analysis, his 1973 definition was used to identify ecological resilience.

Coral Resilience

The vast majority of papers within the meta-analysis came to the conclusion that coral resilience had two key components. The first is that the corals should be able to resist shifts to an alternate state (Abelson et al., 2016; Cheal, Wilson, Emslie, Dolman, & Sweatman, 2008; Davies et al., 2016). The second aspect is that they should be able to recover from disturbances, if disturbances do occur (Cheal et al., 2008; Graham, Chong-Seng, Huchery, Januchowski-Hartley, & Nash, 2014; Kittinger, Duin, & Wilcox, 2010).

Coastal Resilience

None of the papers in the meta-analysis defined coastal resilience, although papers mentioned coastal resilience. I eventually turned to the National Oceanic and Atmospheric Association [NOAA]. NOAA's National Ocean Service defines coastal resilience as the "ability of a community to 'bounce back' after hazardous events such as hurricanes, coastal storms, and flooding" (NOAA, 2017).

Cultural Resilience

None of the voluntary commitments dealt with cultural resilience, and no explicit definition was given in the meta-analysis. After consulting a number of papers on the importance of culture in the establishment of marine protected areas, and a common theme was that the marine protected area needed to keep cultural values and concerns safe (Kikiloi et al., 2017). I defined cultural resilience as the ability of a community's culture and cultural practices to withstand physical disturbances, such as disturbances due to climate change impacts.

Economic Resilience

Only two papers in the meta-analysis dealt with economic resilience, and of two, only one defined it. This definition, however, is sound with the context of the two papers within the meta-analysis. In the meta-analysis, economic resilience was defined as "a business' ability to adapt and respond to an economic impact," (Moore, Lamond, & Appleby, 2016).

General Resilience

The term "general resilience" was applied when resilience was mentioned in a very nonspecific capacity in the meta-analysis and voluntary commitments. The most applicable definition given by the meta-analysis came from Glaser et al., 2015. They write that "In an equally generic manner, resilience has been defined as "the capacity of a system to continually change and adapt and yet remain within critical thresholds" (Glaser et al., 2015). When a paper was vague in the type of resilience they were discussing, then the code of general was applied.

Other Resilience

There were no papers in the meta-analysis that fell into this "other" category, but this category emerged from the voluntary commitments registry created for the UN Ocean Conference. An example of this is the commitment made by Raisa Mar, a conservation artist who pledged to create underwater art instillations to "provide opportunities for studies on corals, their evolution, resilience and species interaction"

Reef Resilience

This refers to the combination of coral, fish and the ecosystem, as opposed to strictly coral. After consulting the numerous definitions of reef resilience, I came up with a master definition that encompasses the key points. Reef resilience is the ability of a reef to keep key

processes while resisting or absorbing anthropogenic and non-anthropogenic disturbances, without changing into an alternative state.

Climate Resilience

Climate resilience had a number of varying definitions, so for the purposes of this code book, I took it upon myself to create a definition of climate resilience that serves as an amalgamation of definitions. Climate resilience is the ability of an area to either (a) adapt, (b) resist and/or (c) recover from the effects of climate change or climate variability.

Chapter 2: VOLUNTARY COMMITMENTS AND THE UN OCEAN CONFERENCE

A History of MDGs, SDGs and SDG 14

A few years ago, in 2015, the United Nation's Millennium Development Goals (MDGs), first established in 2000 and agreed upon in 2001, ended. The MDGs were focused on combatting extreme poverty and were followed up with the induction of the Sustainable Development Goals (SDGs), which instead were focused on sustainable development and livelihood (Sachs, 2015). One notable difference between the MDGs and SDGs is the shift onto a more sustainability framework. Of the eight MDGs, only one broadly dealt with the environment, MDG #7 *Ensure environmental sustainability* (United Nations, 2015). Of the 17 SDGs, they can be broadly divided into four categories: SDGs 1-7 are an extension of the previous MDGs, SDGs 8-10 deal with inclusivity, and the last set of SDGs 11-15 deal with urbanization and sustainability (Kumar, Kumar, & Vivekadhish, 2016), and the last two of the SDGs surround peace and partnership. Rather than just one focused on broadly environmental sustainability, there are five that deal with some aspect of the environment. Another key difference between MDGs and SDGs is the difference in targets to ensure fulfillment- the MDGs had 21 targets to achieve, with the SDGs have 169 targets. This highlights the specificity and wide-range of achievability of the SDGs. The goal for Life under Water- SDG 14- actually got its start before 2015. It was called for in 2010 under the Convention on Biological Diversity's Aichi targets, which are aimed at improving global biodiversity conservation (Rochette et al., 2014). Their target 11 calls for the same target under SDG 14.5:

> By 2020, at least…10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape.

The indicator for SDG 14.5 is through coverage of MPAs, while Aichi target 11 calls explicitly for MPAs within the text.

Table 4: Comparison of MDGs and SDGs

	Millennium Development Goal	**Sustainable Development Goal**
1	Eradicate extreme poverty and hunger	End poverty in all its forms everywhere
2	Achieve universal primary education	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3	Promote gender and equality and empower women	Ensure healthy lives and promote well-being for all at all ages
4	Reduce child mortality	Ensure inclusive and equitable quality education

		and promote lifelong learning opportunities for all
5	Improve maternal health	Achieve gender equality and empower all women and girls
6	Combat HIV/Aids, malaria and other diseases	Ensure availability and sustainable management of water and sanitation for all
7	Ensure environmental sustainability	Ensure access to affordable, reliable, sustainable and modern energy for all
8	Global partnerships for development	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9		Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10		Reduce inequality within and among countries

11		Makes cities and human settlements inclusive, safe, resilient and sustainable
12		Ensure sustainable consumption and production patterns
13		Take urgent action to combat climate change and its impacts
14		Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15		Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss
16		Promote peaceful and inclusive societies for sustainable development,

		provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17		Strengthen the means of implementation and revitalize the global partnerships for sustainable development

UN Ocean Conference 2017

SDG 14 is in its moment of prominence. During the first week of June 2017, a high-level United Nations conference met at the UN Headquarters in New York City to discuss the world's oceans. This conference was organized to advance implementation of the 14th Sustainable Development Goal, *to conserve and sustainably use the oceans, seas and marine resources for sustainable development* (United Nations, 2017), and was long-time coming. The General Assembly (GA) adopted resolution 70/226 in December of 2015 which specifically called for a high-level United Nations Conference on SDG 14. In 2016, under resolution 70/303, the GA confirmed its intentions to hold the conference and set out five goals for the meeting.

While many goals were laid out for this conference, one of the most prominent objectives was to build on existing partnerships and foster new collaborations. One way to achieve this target was through the creation of the voluntary commitment program. This "Call for Action" came from the heads of state and government, as well as high-level representatives. Under this "Call for Action", twenty-two actions were listed for stakeholders to partake in, including an

appeal to create voluntary commitments surrounding the oceans. As of September 2017, 1,395 commitments were registered through the voluntary commitment process, spanning across organizations and disciplines. Here, I analyze these commitments, specifically those related to the fifth objective of SDG 14. Objective 14.5 calls for the conservation of at least 10% of coastal and marine areas (United Nations, 2017), and the indicator of this fulfillment is through the creation of marine protected areas [MPAs]. Analyzing the distribution of voluntary commitments surrounding MPAs can give us a good predictor of whether the goal of 10% protection of the oceans will be achieved. It will also be useful to map where potential MPA sites will be in the future. Finally, assessing the deployment of different definitional types of "resilience" in the voluntary commitments will shed light about which actors in international ocean governance are defining resilience in what ways.

Methods

Voluntary Commitments

During the months preceding the 2017 United Nations Ocean Conference, as well as after, stakeholders were invited to make voluntary commitments under SDG 14. As of September 2017, 3 months after the conference ended, 1,395 commitments were made. These commitments were downloaded and sorted into those dealing with SDG 14.5, often referred to as the MPA subgoal[1]. These were then sorted into those that deal with resilience, for a total of 91 commitments that dealt with resilience and marine protected areas. These 91 commitments were coded using the same codebook as the meta-analysis (See Chapter 3), leading to a total of 133 codes.

[1] www. oceanconference.un.org/commitments/

Coding

Initial coding was done using the definitions of resilience defined in Chapter 1. Coding occurred using grounded theory (GT) methodology, starting with the question of "What constitutes a successful MPA within areas beyond national jurisdiction?". As the data was collected and coded, concepts and ideas were formed, which is how the topic of resilience rhetoric came to be. In the debate of Glaserian methodology versus Strauss and Corbin's approach, this study followed Strauss and Corbin's approach more closely (Heath & Cowley, 2004; Legewie, Schervier-legewie, & Strauss, 2004) in that literature and past experiences were used to inform a starting point (Strauss, 1987).

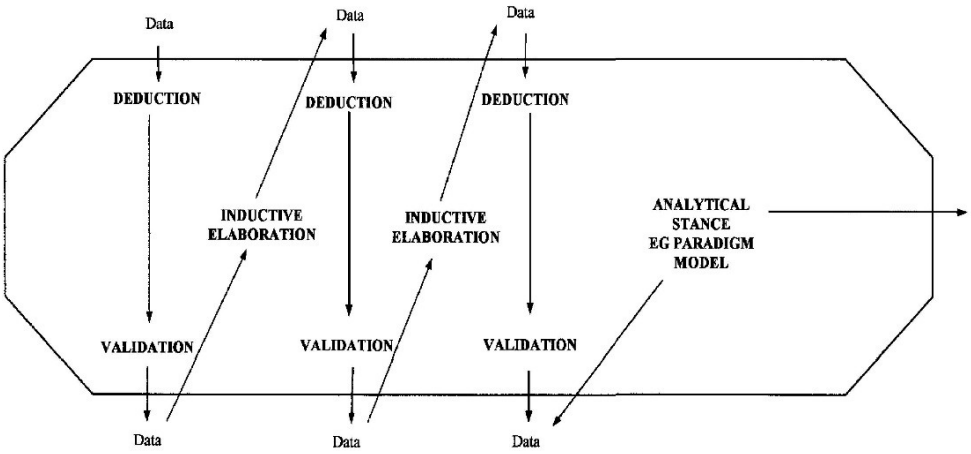

Figure 2. Strauss and Corbin's induction, deduction and validation in GT analysis (1998, taken from Heath & Cowley, 2004)

The analysis also followed Strauss and Corbin's three step process, in that the initial coding is meant for open coding, the intermediate phase is meant for axial coding and the final phase is meant for selective coding (Corbin & Strauss, 1990).

Table 5: Examples of codes from voluntary commitments made related to MPAs and resilience

Code	Voluntary Commitment Example
Biological	"Theme 2 Maximise the resilience of vulnerable species to the impacts of climate change and climate variability by reducing other pressures, including poor water quality"
Biological-Fish	"2. Promote measures to improve management and resiliency of fisheries / marine resources"
Climate	"California's evaluation of its MPA Network will include a focus on helping better understand how areas that reduce or remove fishing impacts may respond differently to, and potentially build resilience against, additional stressors like climate change and invasive species"
Coastal	"reduction of land-based marine littering, strengthening the resilience of coastal zones against the impacts of climate change"
Community	"Monaco commits financially support this integrated approach in favor of ocean acidification monitoring, strategies to strengthen the resilience of local communities, and concrete actions to adapt to and mitigate ocean acidification"
Coral	"This will protect coral reef biodiversity; build climate resilience of reefs as well as dependent industries and communities; and make coral reefs a part of sustainable development/a blue economy"
Cultural	N/A

Code	Voluntary Commitment Example
Economic	"Additionally, education and climate financing must also be made available to help developing countries build resilience. "
Ecosystem	"Pacific Island communities and ecosystems are resilient to the impacts of ocean acidification and a changing ocean, with practical adaption measures and alternate livelihoods in place."
General	"This initiative aims at conserving and sustainably use our marine environment and its resources for our current and future generations. It is also our contribution to the regional and global effort to maintain and restore the health, productivity and resilience of our Ocean"
Other	"Art Installations underwater provide opportunities for studies on corals, their evolution, resilience and species interaction."
Reef	N/A
SES	"1. Build socio-ecological resilience to coral reef degradation in the islands of the Western Indian Ocean"

Observations

To supplement the coding of voluntary commitments, observations of side events from the Ocean Conference in June 2017 at the United Nations Headquarters were also noted. This was done through the collaborative event ethnography (CEE) methodology, in which a synchronized group of researchers circulate a meeting to ensure maximum efficiency in data-collection (Campbell, Corson, Gray, MacDonald, & Brosius, 2014).

During this conference, a group of four researchers, including myself, spread ourselves throughout the conference in an attempt to cover as much of the 120+ side events as possible. Each of the other researchers were familiar with my research goals and objectives. They were also reminded to be on the lookout for rhetoric, conversations and speakers surrounding MPAs and resilience.

The researchers that I worked with were all from my laboratory group at University of Maine. They all had previous experience at large UN meetings. These two key skills were essential for getting proper notes that were focused on my area of research, and to ensure they were of the highest quality. This relationship with the other researchers also allowed me to ask clarifying questions, as well.

These researcher notes totaled 158 typed pages, with each person attending around 8 hours of content over the five-day conference. Notes focused on MPAs, ABNJs, climate change and resilience, among other items. The same codebook was used for the International Institute for Sustainable Development (IISD) daily recaps of the Ocean Conference, and these were coded by hand. The following is a copy of the codebook with an example of each code.

Code	Example from IISD Daily Briefings	Example from Collaborative Notes
MPA Negative Connotation	TONGA noted challenges in meeting its commitment of establishing 30% of its EEZ as MPA	EBSAs are not MPAs/fishing closure/jurisdictional matters
Coastal	GUYANA pointed to its programme on mangrove management to protect against coastal erosion	Protection of coastal ecosystems through reduction of pollution to marine environment to encourage innovation for investments to contribute to sustainable blue economy.
Collaboration/Partnership	BELGIUM highlighted collective action and inter-disciplinary, multi-stakeholder collaboration	Collaboration network for creative industries brands governments and environmentalists

Management of MPAs	SWEDEN outlined commitments…. [to] adopt an improved MPA governance framework by 2020.	Co Management agreement for creation of marine reserve, needed that shared	Table 6: Examples of codes from personal notes and IISD notes

		responsibility for marine resources
Resilience	Secretariat of the Pacific Regional Environment Programme (SPREP) to strengthen resilience to ocean acidification	Closing 16% of space in order to enhance economic diversity and resilience and protect oceans from vulnerabilities. "Economic diversity and resilience."
No-Take Zone	Belize promised to increase the number of its no-take zones by 2020	Science say that no take zones need to be increase and has support of fishers
Monitoring/Enforcement	PAPAU NEW GUINEA, with CAMBODIA, called for support to improve monitoring & surveillance	Need effective monitoring and enforcement, offer by Australia for more technology for monitoring fishing resources

Illegal, Unregulated, Unreported Fishing	President Tommy Remengesau, Palau… urged countries to ratify the Port State Measures Agreement to combat IUU fishing…	IUU Fishing is a criminal act akin to piracy and must be addressed with urgency.
MPA Neutral Connotation	TIMOR LESTE reported on co-managed MPAs based on communities' culture and science	For example, expand protected areas using tradition practices to preserve genetic diversity in our ecosystems
High seas/BBNJ/ABNJ	TONGA… called for launching the BBNJ intergovernmental negotiations in 2018.	At a global level we must work together to establish by 2020 an effectively managed MPA network within and beyond areas of national jurisdiction.

Climate Change	Henry Puna, Prime Minister of Cook Islands [committed] to the fight against climate change	Ocean is critical to energy, climate change, health, and poverty

International Documents	UN Messenger of Peace Leonardo DiCaprio… [called] for the conclusion of a “Paris Agreement for ocean”	International governance for the environment. Bringing together two international instruments: UNFCCC and UNCLOS
Possible MPA (inferred)	PORTUGAL emphasized their commitment to protect at least 14% of its coastal and marine areas	Already worked to implement MPAs with NGOs and universities
MPA Positive Connotation	Gabon, Palau and the Cook Islands kicked off the showcase of commitments with ambitious initiatives on marine protected areas	Committed to establishing 10% as “marine protected areas” will assist in efforts to improve health of oceans. MPAs → healthy

Coding took place over the course of three months, starting with the collaborative notes. The codes did not change much as the process went on- only one code was added [Possible MPA (inferred)]. It was added because in some cases I could not tell if it was truly a commitment to

creating an MPA or if it was just a passing comment. Not wanting to disregard that, I created a separate code for such instances.

Results

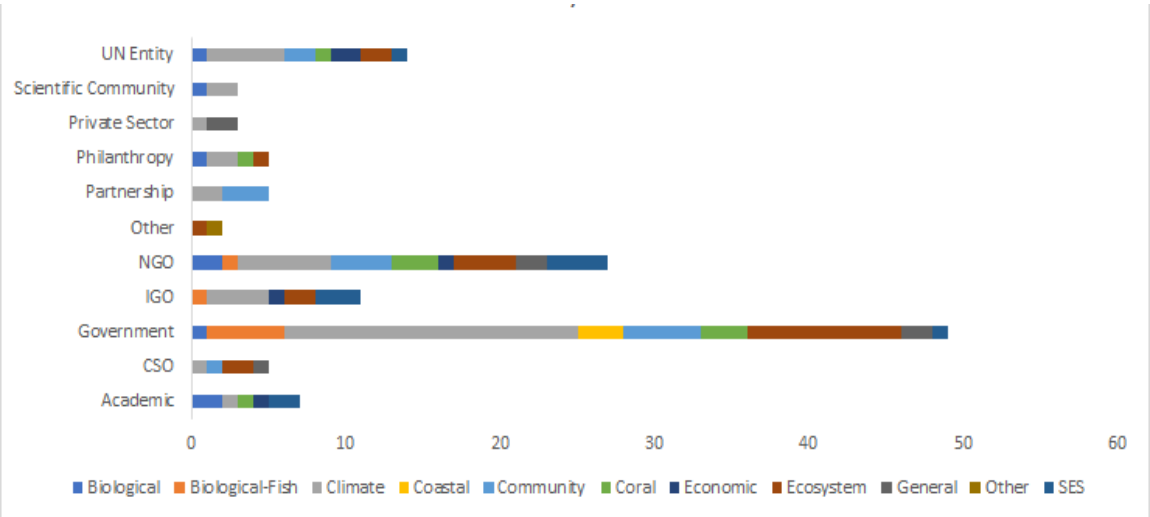

Figure 3: Voluntary commitments made related to MPAs and resilience at the Ocean Conference by June 2017. The entities listed were predetermined by the UN, while codes were created by the author.

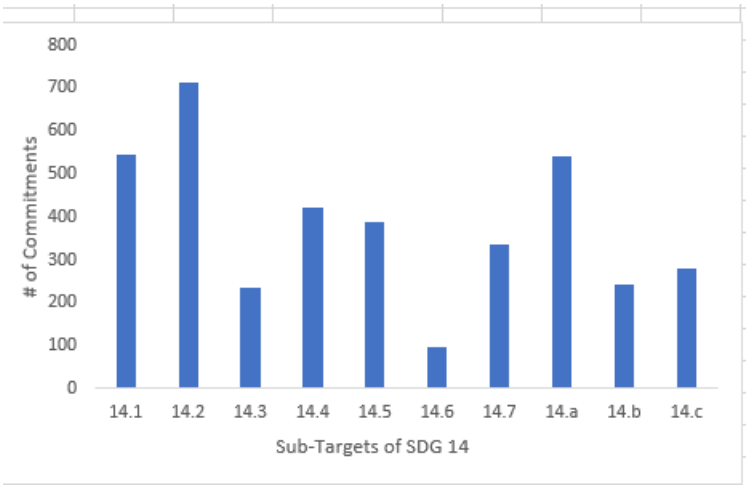

Figure 4: Total number of commitments under the sub-targets of SDG 14,

With N= 3797

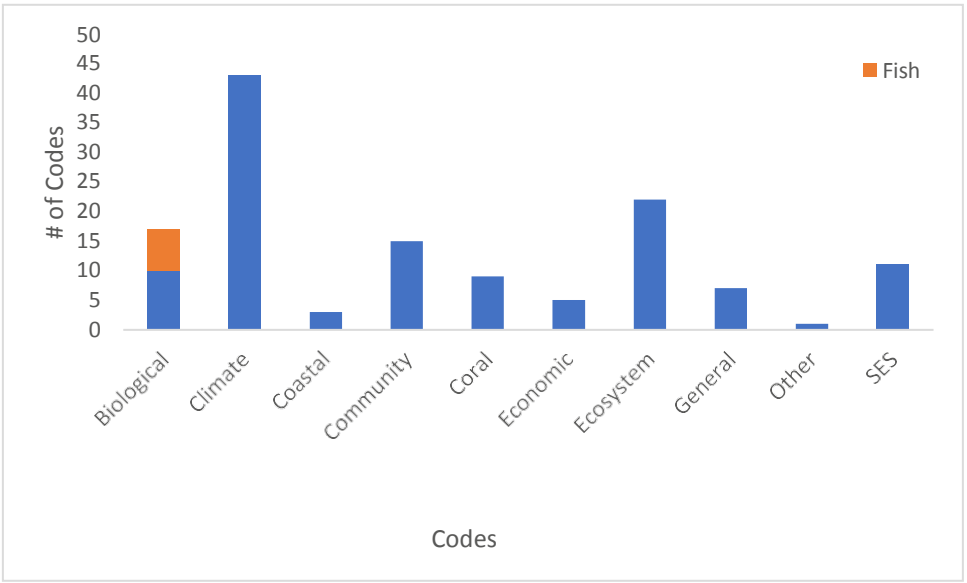

Figure 5: Code counts of resilience that came from voluntary commitments from Ocean Conference as of June 2017, with N=133. After running a X^2 test, it was shown that government was over-performing when dealing with climate resilience.

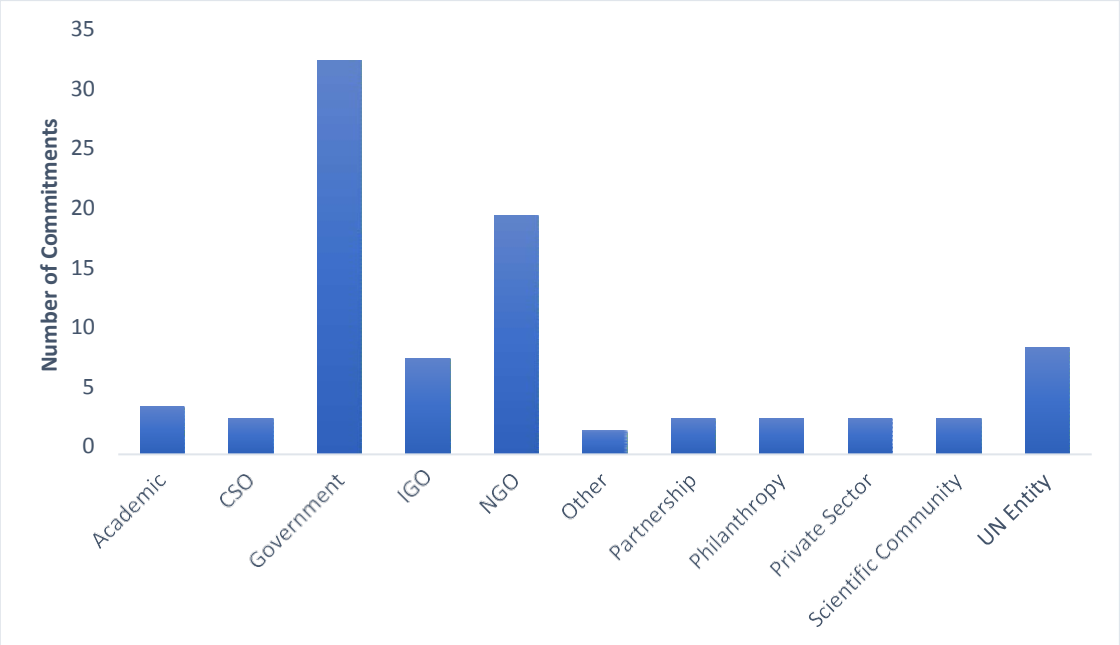

Figure 6: Counts of MPA & resilience commitments made at Ocean Conference as of June 2017 by pre-categorized entities, with N=91

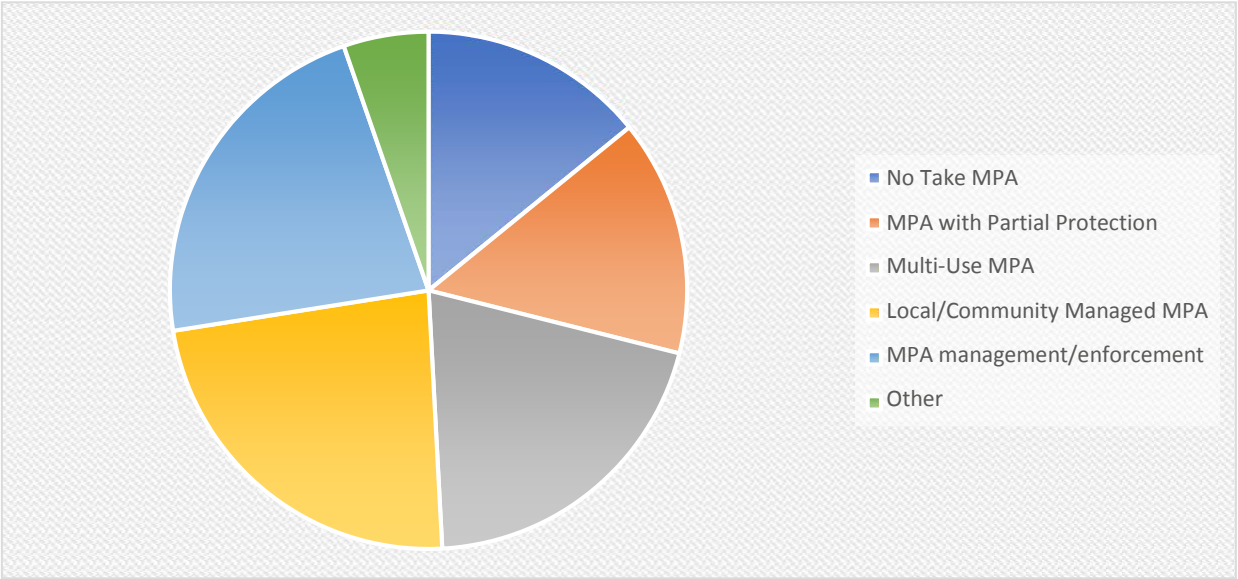

Figure 7: Types of MPAs voluntary commitment breakdown made at UN Ocean Conference as of June 2017, with N=771. The categories were established by the UN.

Table 7: Definitions of UN categories listed in the voluntary commitments under SDG 14.5

Category of MPA Commitments as Established by UN	**Definition**
Local Managed/Community MPA	An MPA that is largely or entirely managed at a local level by the associated community
Other	Any other process that does not fall into the provided categories.
MPA with Partial Protection	Partial Protection refers to aspects such as seasonal closures or catch limits
No Take MPA	No activity is permitted in MPA
Multi-Use MPA	Activities such as fishing, diving, boating may be allowed in specified areas
MPA management/enforcement	Commitments dealing with the management, governance or enforcement of MPAs

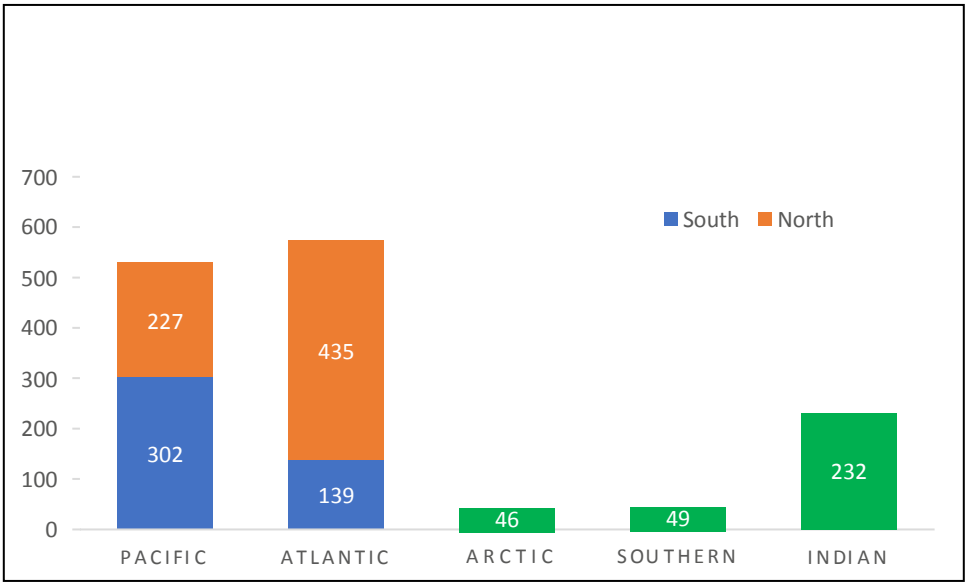

Figure 8: Number of MPA resilience commitments by ocean basin

Discussion

Clearly, within the UN Ocean Conference Voluntary Commitment system, governments are still leading the way, accounting for just under half of all voluntary commitments, with non-governmental organizations (NGOs) following. Over all the commitments made, just under 400 relate to SDG 14.5, which is oftentimes referred to as the MPAs goal (Fig. 4). The distribution of SDG 14 and of SDG 14.5 are very similar, except for Inter-Governmental Organizations [IGOs] being more active under 14.5.

I delve into what types of MPAs are being created under these voluntary commitments (Fig. 7). There are several types of MPAs, and they are not standardized. For example, the National Oceanic and Atmospheric Association [NOAA] lists five types of MPAs, while the International Union for Conservation of Nature [IUCN] lists seven. Many of the conversations throughout the conference were rooted in local and community practices. By supporting community-based MPAs, other SDGs are included, such as No Poverty [SDG 1], Gender

Equality [SDG 5] and more (Morgera & Ntona, 2017). Studies show that community support and local knowledge is key to successful MPAs, although what constitutes success is often debated within the international community. The lack of commitments pledging towards creating no-take zones, which are MPAs that prohibit the removal of marine life (Pichegru, Gremillet, Crawford, & Ryan, 2010) may indicate that the 10% conserved is not biologically or ecologically based. Globally, no-take zones are the least common of the various types of MPAs, with 1.23% of the total oceans being no-take zones (Day J., Dudley N., Hockings M., Holmes G., Laffoley D., 2012).

Overall, the spread (i.e. the number of basins covered) of the voluntary commitments matched the rhetoric we saw in New York at the conference in June. The Ocean Conference was heavily influenced by Pacific countries, specifically the Pacific Small Island Developing States [PSIDs]. About 25% of the side events on the official programme were co-hosted or hosted by PSID's governments, missions and organizations. This makes sense from the perspective of SDG 14.5, since the Pacific Islands are largely over-representative of oceanic protected areas, something that numerous Pacific countries called out during the conference.

Where these voluntary commitments will take us in terms of actual implementation of new MPAs is not known – SDG 14 is slated to expire in the year 2020, with an end goal of 10% conservation of the world's ocean and marine systems by that time. As we stand now, 6.4% of the oceans are protected in some capacity (Day J., Dudley N., Hockings M., Holmes G., Laffoley D., 2012) although how well protected is still not determined. As the voluntary commitments are implemented, the United Nations hopes to reach this highly attainable 10% goal. From the notes from the Ocean Conference and the voluntary commitments, it seems that countries are on track to reach this goal. Government is making the most commitments surrounding climate-resilience.

This could be because climate change is an ongoing concern outside of the environmental realm, such as on human health (McMichael, A.J. , Campbell-Lendrum, D.H., Corvalan, C.F., Ebi, K.L., Githeko, A.K., Scheraga, J.D., 2003). It could also be that concerns surrounding climate change relate to other international agreements, aside from the SDGs, such as the United Nations Framework Convention on Climate Change [UNFCCC], an international environmental treaty in which countries make commitments to combat climate change. Climate-resilient MPAs could have benefits outside those objectives set out by MPA planners, making them beneficial in multiple ways.

Chapter 3: DEFINING RESILIENCE IN THE SCIENCE-POLICY INTERFACE

Resilience

The etymology of resilience comes from the Latin resiliens, and originally meant "the act of rebounding". In the realm of academia, the resilience domain spans multiple disciplines. In this paper, I focused on the role of resilience in MPAs. Even in this highly specified field, the definitions of resilience varies greatly. This can pose problems during high level discussions. A group of people could be speaking of resilience in particular context, but their notions of what type of resilience could be very different. This can have ramifications in statements of goals and objectives, as well as policy coherence- one cannot operationalize resilience if it is not properly defined.

Coding

This chapter delves into 183 papers about marine protected areas and resilience, in an attempt to (i) identify different types of resilience in the MPA context & (ii) define these iterations of resilience, while collecting other data along the way. Well known resilience subtypes were identified, such as Holling's original ecological definition and Folke's 4-step extended ecological definition (Brand & Jax, 2007) but new, emerging types of resilience foreshadow the priorities of MPAs as we enter a new era of ocean sciences and conservation.

Resilience, as a term, is no longer strictly for the environment. Looking strictly at the field of sustainability and conservation science, this definition is still fluid and changing (Brand & Jax, 2007), and can be very narrow or very broad (Folke et al., 2010).

Table 8: Codes and examples from meta-analysis related to MPAs and resilience

Code	Meta-Analysis Example
Biological	"Resilience determines the persistence of relationships in an ecosystem. Therefore, the persistence of species and their relative proportion in the catch can also be used as a univariate measure of stability in a community and the effectiveness of protection from fishing"
Biological-Fish	"The payoff of reserves to fishers with ecological uncertainty arises from what we call

Code	Meta-Analysis Example
	a ‘resilience effect’. This is defined as the time that it takes for the population to return to close to its former level before a shock”
Climate	“One example is the thermal bleaching event that occurred in summer 2010 (Furby, Bouwmeester & Berumen, 2013, Pineda et al., 2013), which raised questions about the potential local impact of overfishing and coastal development on the inherent ability of reefs to recover from such major disturbances (resilience), particularly in the presence of climate change (Khalil, Cochran & Berumen, 2013).”
Coastal	N/A

Code	Meta-Analysis Example
Community	"Communities protected from exploitation and other human activities are thought to possess greater resilience to climate impacts the capacity to resist and recover from the effects of climate variability"
Coral	"These authors contend that coral assemblages of the Caribbean have lost their resilience—their capacity to recover following perturbation."
Cultural	No explicit definition
Economic	"It follows that economic resilience, or a business' ability to adapt and respond to an economic impact, is crucial to consider when measuring additionality, as this inherently will determine the residual economic impact – yet

Code	Meta-Analysis Example
	this appears to be neglected in the Econ IA literature.”
Ecosystem	“Ecological resilience is the capacity of ecosystems to absorb disturbances and respond to change while retaining essentially the same function, structure, and feedbacks”
General	“In an equally generic manner, resilience has been defined as “the capacity of a system to continually change and adapt and yet remain within critical thresholds”
Other	N/A
Reef	“Many of these impacts, such as cyclones and bleaching, are difficult to

Code	Meta-Analysis Example
	manage locally, but policies to mitigate local threats should give the reefs the best chance possible of being resilient and bouncing back”
SES	“‘Socio-ecological resilience’ describes the capacity of ecosystems to sustain societal development and progress with essential ecosystem services”

Methods

Meta-Analysis

The meta-analysis was pursued in an attempt to (i) identify different types of resilience in the MPA context & (ii) define these iterations of resilience, while collecting other data along the way. This project was started in late September 2017 using the database Web of Science, a database consisting of nearly 60 million records and multiple databases to allow cross-disciplinary research.

Papers were found over the course of two days, using a nested approach, with nest two being searched only within the first nest (Figure 9). The use of asterisks allowed words of different endings to be searched [i.e. resilien* resulted in resiliency, resilience, resilient]. A total of 769 results came back. To reach a manageable number, only papers- not books or book chapters- in English were used, and read to ensure they were relevant to the search. After sorting through papers, a final count of 183 papers was reached. Using Microsoft Excel, a spreadsheet of basic information was created, such as lead author, year of publication and abstract. Papers were read and coding related to resilience started broadly, with the main codes being ecological, biological and climate. During a second round of coding, the codes were expanded to include coral, (SES), economic, community, cultural, and general. The third round of coding saw the split of biological into biological and fish-focused biological, and the split of coral into strict coral focus and reef focus. Many papers had more than one focus on resiliency, so up to four codes were allowed. After the initial coding for types of resiliency, papers were looked at to see if they define resiliency, and if so, how. Papers were also coded for location vs. subject, whether they mentioned no-take zones, ecosystems services, whether they mentioned MPAs as a network, the location of the paper's study site and whether the focus was on a specific species. The coding took place over the course of a month in Microsoft Excel, with the information being gathered by November 2017. After the definitions of resilience were collected, they were sorted into their codes. The definitions were compared to find commonalities to create a 'master' definition. In cases where there were no definitions, or there was too much difference, outside sources were noted. The creation of a list of master definitions allowed for clearer discussion among the different forms of resilience. For a paper to explicitly define resilience, the definition had to either be directly in the text (e.g. "Communities protected from exploitation and other human

activities are thought to possess greater resilience to climate impacts- the capacity to resist and recover from the effects of climate variability") or via a well-known established definition (e.g. "a la Pimm") (Bates et al., 2014; Doyen, De Lara, Ferraris, & Pelletier, 2007).

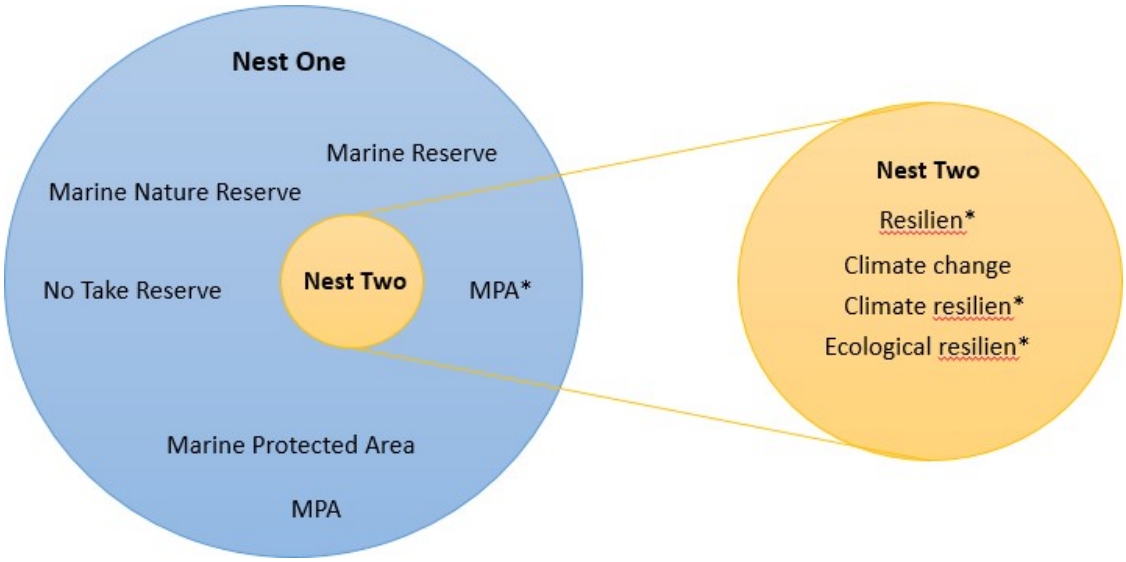

Figure 9: Nested terms in Web of Science search. The bottom tier is nest one, and the top is nest two, which was exclusively searched within the first nest.

Interview & Survey Population

Persons to interview were solicited from those attending high-level political forums [HLPFs], relevant conferences, and those actively involved in the oceans realm, on a number of governance levels. Interviews were kept anonymous for coding and security purposes, as per the IRB. Interviewees were solicited from attendance lists of High-Level Political Forums (HLPFs), and through word of mouth.

Surveys were handed out at HLPFs and through relevant listservs, such as IISD's Oceans digest and OCTO (formerly MPANews). Two separate surveys were created, though with the same questions. One was designated solely for listservs and word-of-mouth, and the other was released exclusively at HLPFs and conferences, such as the International Marine Protected Areas Conference in 2018. Surveys were anonymous for security purposes, and all questions were optional, as per the IRB.

Semi-Structured Interviews

In line with the semi-structured methodology, interviews were conducted with respondents once, with a core question guiding the associated questions (Jamshed, 2014). Interviews were conducted in a number of spaces, mainly dependent on what was easiest for the respondents. The majority took place at the United Nations, during meetings such as PrepCom and the Ocean Conference. In some cases. I traveled to the respondent to interview them, and some interviews occurred over the phone. I did not limit the amount of time the interview took place over- some were very short, at about 10 minutes, while others were hours long.

As interviews continued, questions were modified for clarity and additional questions were added as data was validated. For example, the first several interviews mentioned ecosystem services, so I prompted the rest of the interviewees as neutrally as possible. i.e. "Do you consider ecosystem services when discussing an MPA?".

The overall purpose of conducting the interviews was the elicit the attitudes, beliefs and motives behind persons involved in the MPA and oceans sciences realm. Interviewees were solicited through a number of means, but most came through snowball sampling, where a respondent suggests another person to speak to (Noy, 2008). I was also able to interview people that I knew through other connections, such as internships and classes.

Results

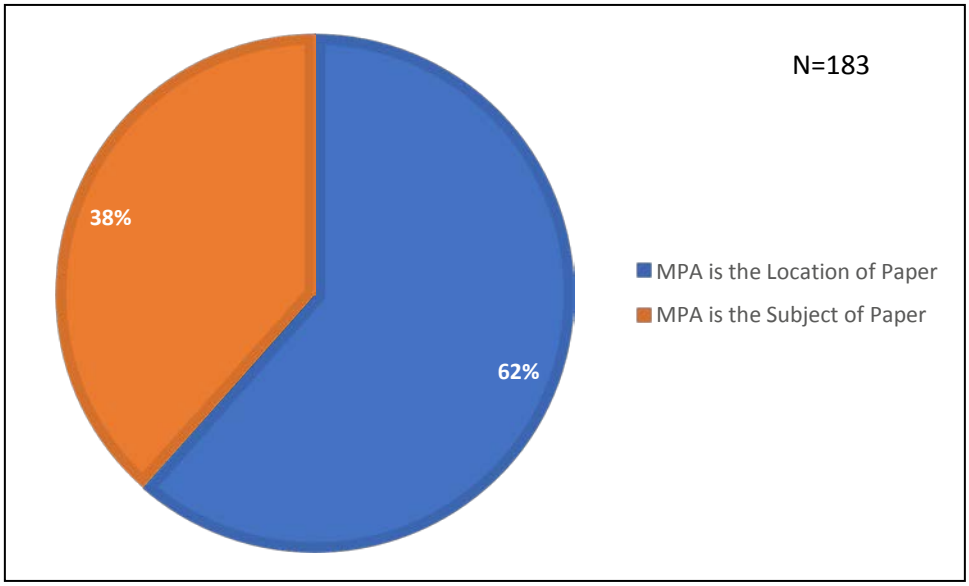

Figure 10: Determining whether the MPA served as the subject of the paper or the location/study site over 183 peer-reviewed journal articles. In more instances than not, the MPA itself was not being studied, but rather the content within the MPA

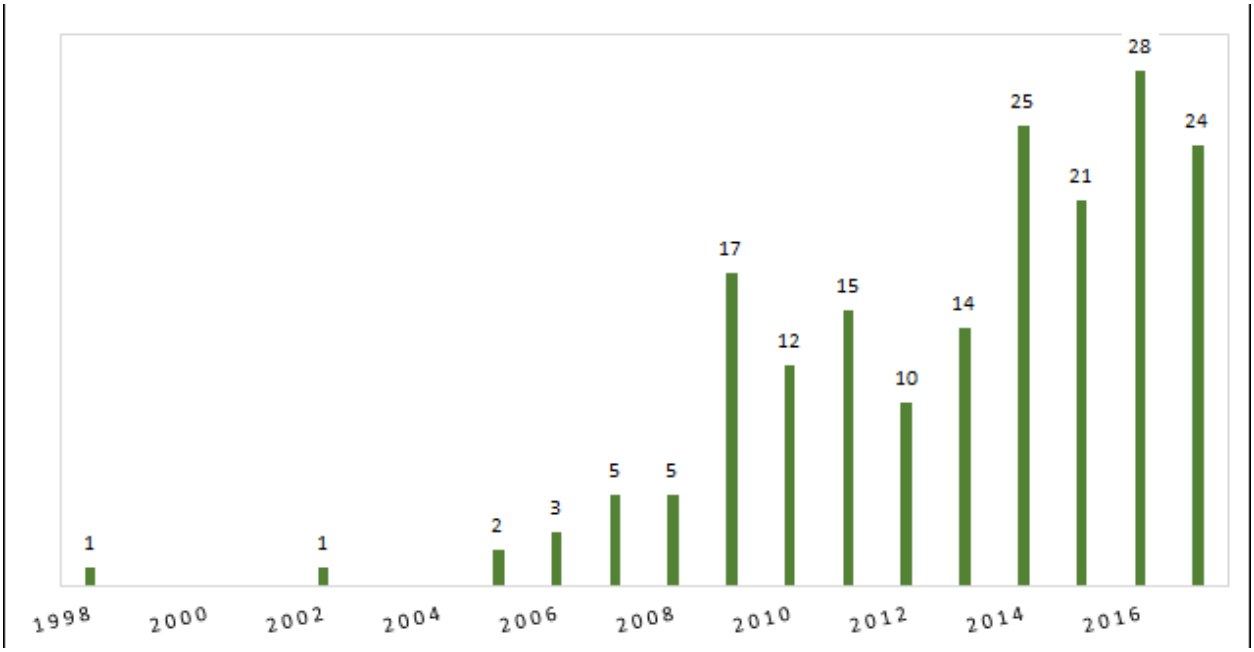

Figure 11: Number of papers throughout the years written on MPAs & resilience

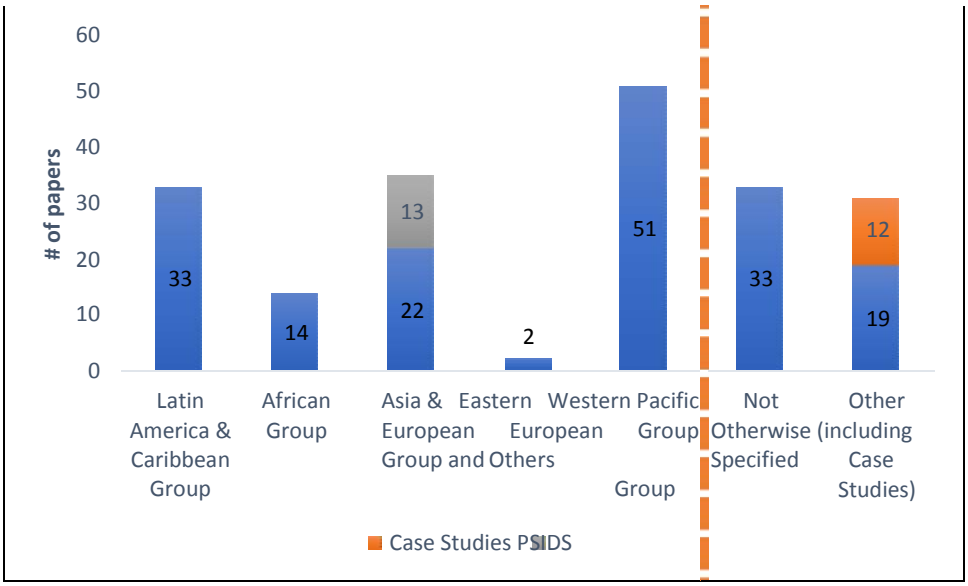

Figure 12: Locations of study sites of the papers. In some cases, the papers did not specify the location. In other cases, the study was conducted in international waters or multiple sites. Special attention was given to PSIDS

due to the rhetoric of the Ocean Conference in 2017. Note that the groups other than NOS and Other are official UN regional groups.

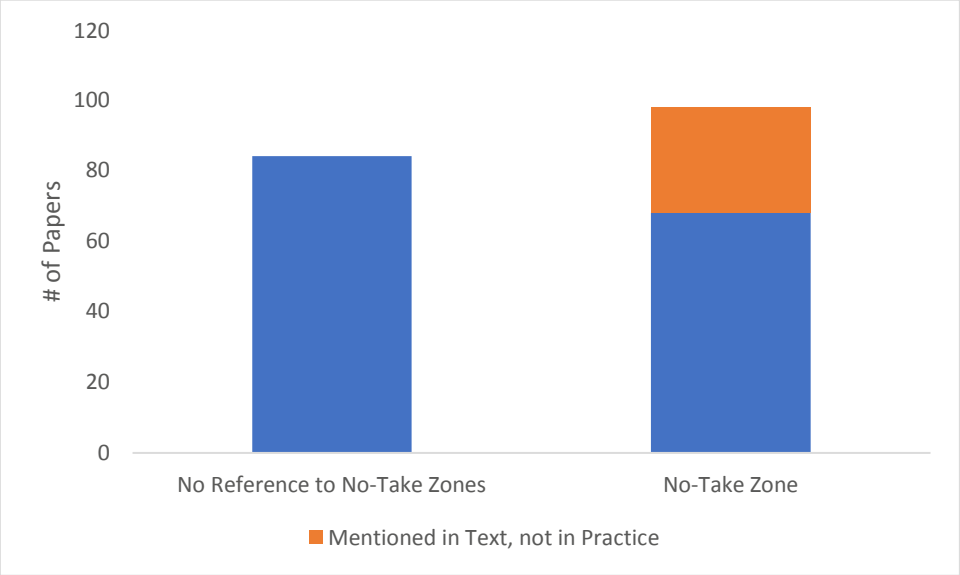

Figure 13: Papers that were in a no-take zone versus another type of MPA. In Some cases, the papers acknowledged no-take zones, but did not utilize in practice.

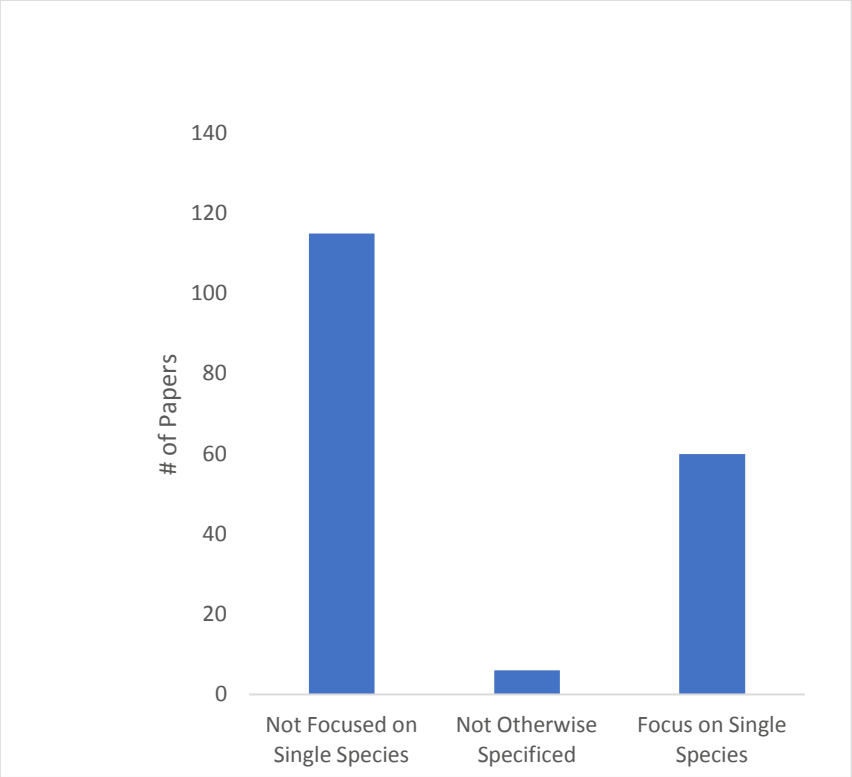

Figure 14: Papers in meta-analysis that were focused around a single species, with N=183.

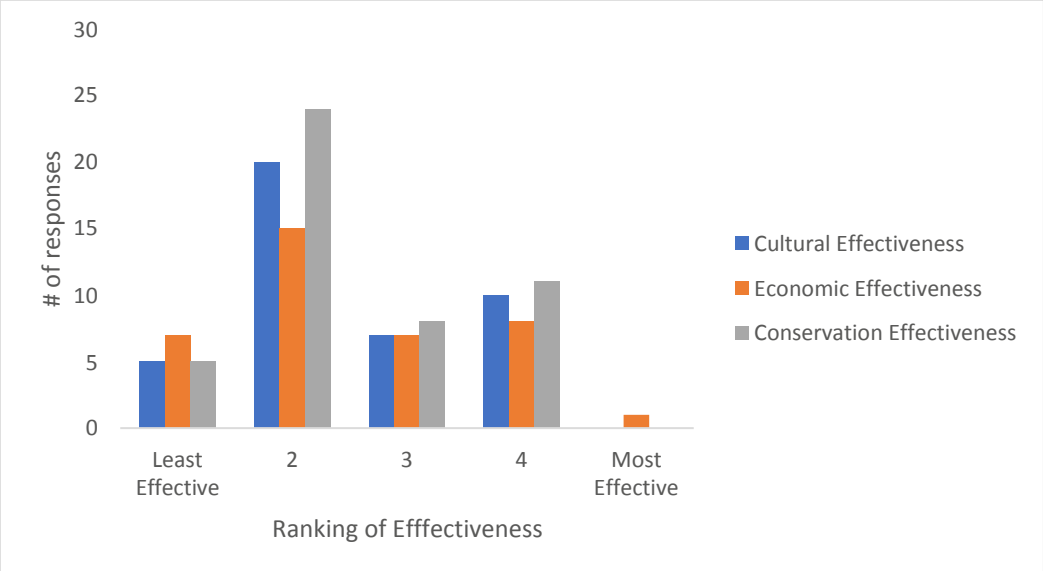

Figure 15: Respondant's ranking of three types of effectiveness. Majority received a 2, on a scale of least to most effective

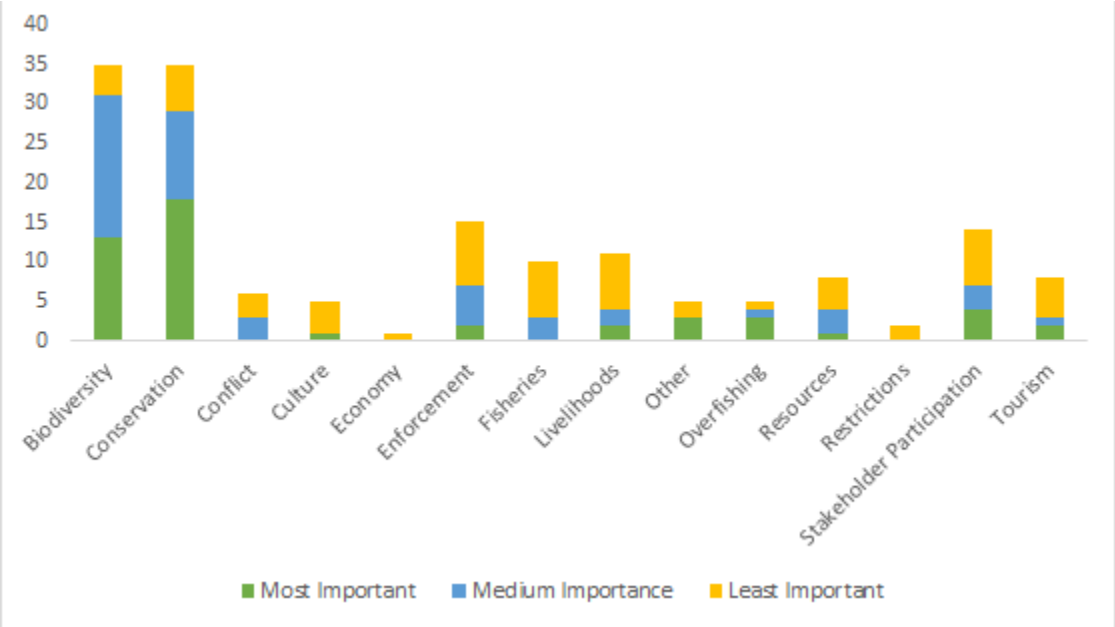

Figure 16: Responses to survey question "what three aspects make an MPA successful" and then asked to rank them. Note that the majority of those aspect ranked "most important" fall into the biophysical realm of options.

Discussion

A question that arose from the academic literature was how MPAs were being utilized. It seemed that the majority of the literature focused on using the MPAs as what I am calling the "arena," or location for a research study. In these cases, the MPA itself is not the subject of the study, but simply the playing field. Similar to how people go to the arena not for the arena itself, but for the sports game occurring within the arena. In 62% of the papers, the MPA was just being used to study something within itself, whether it was a specific species or ecosystem (Fig. G).

The rest of the time, the MPA as a policy instrument was the actual subject of the study, usually about management, fishing or criteria surrounding MPAs. This shows that the academic value might not be in the MPA itself but in the benefits to research that come with the creation of an MPA – it might serve as an arena for scientific studies to occur.

The main goal of the meta-analysis was to determine what definitions were being used when discussing resilience in MPAs, but it soon became clear that the question of whether they were defining resilience had to be addressed first. More than two-thirds of the time, the paper did not define resilience at all (Figure H). Frequently authors are assuming the readers inherently know what iteration of resilience they are writing of. As we know from an old adage, assumptions rarely end well for reader and writer alike. This can also cause confusion in the planning and implementation of MPAs because the goal of resilience is far too broad to be effective. Stakeholders may want economic resilience, but managers and planners assume they want climate resilience.

It makes sense that Western Europe and Others Group (WEOG) would have the most papers because (i) that is where much of the funding for research comes from and (ii) Australia's Great Barrier Reef consists of many of the papers. While the low number of Pacific Small Island Developing States (PSIDS) may be surprising given the rhetoric of the conference, this could be due to the fact that some Pacific MPAs do not meet the categorization requirements of the IUCN (Day J., Dudley N., Hockings M., Holmes G., Laffoley D., 2012). The other group that I specified comprised of papers that looked at case studies or shared areas, such as the Coral Triangle or the Mediterranean Sea, and therefore were undistinguishable into UN groups.

There is a consensus among non-governmental organizations (NGOs) that no-take zones are considered the most effective version of MPAs for conservation and biodiversity. Due to this,

it was interesting to see how the academic literature dealt with no-take zones. In some cases, papers simply acknowledged that no-take zones existed (figure K), but fewer papers were focused on no-take zones. This is surprising because it can be expected most of the scientific studies are happening in more pristine, controlled environments. One factor that may explain this is the low numbers of no-take zones, which are few and far between.

Going along with Figure G, I wanted to investigate whether papers were focusing in on a single species, such as a specific fish or specific type of coral within an MPA. Largely, contrary to my initial assumption, the academic literature was not focused on a single species. This may coincide with often mentioned in surveys and interviews goal of biodiversity and conservation (Figure O). Another point that was oftentimes mentioned in interviews or in passing to me was the ecosystems services that were provided by an MPA- tourism, fishing etc. Yet in the literature, 70% of the papers did not mention ecosystem services (Figure M).

The vast majority of respondents to my survey ranked cultural effectiveness, economic effectiveness, and conservation effectiveness of the world's MPAs a 2 on a scale of least to most effective, showing the overall disappointment in the effectiveness of the MPAs worldwide (Figure N). When asked to choose the top three important aspects of an MPA from a pre-determined list, and to rank them, the most chosen options were biodiversity and conservation. This fits in with the goals of SDG 14, as well as other listed goals by NOAA and IUCN. Yet, much of the literature points to stakeholder participation being a key aspect, and this was largely unchosen, and when it was, ranked least important. This shows the disconnect between what can be called the "hard science" goals of an MPA and the "social science" goals of an MPA. There is still this malalignment within literature and practice within the MPA realm

CONCLUSION

There are numerous barriers towards creating a successful MPA. As additional objectives, such as resilience, are added and the goals – and thus the metrics of success– for MPAs multiply, stakeholder differences in perceptions of what constitutes an MPA will start to bifurcate. My results suggest that this is already happening – that the idea of a resilient MPA is defined in relation to the specific stakeholder group. This makes effective policy-making – which relies on agreed upon metrics for evaluation – challenging not just because there are differences but because everyone is using the same language and terms to mean different things. If practitioners are not clear on their intentions, such as being explicit in their definitions, there can be a multitude of issues. Some of these can include a misalignment of goals, misunderstanding of objectives and frustration at the lack of clarity. While rallying around "resilience" can have short-term benefits enabling progress in decision-making, as an indicator of success it needs greater clarity of objectives.

As climate-resilience is on the rise and is key for combatting climate change, I put forth a common resilience definition for clarity and coherence among MPAs. Climate resilience is the ability of an area to either (a) adapt, (b) resist and/or (c) recover from the effects of climate change or climate variability. This definition will allow stakeholders, academics, and all relevant practitioners to speak clearly and concisely on the subject of climate resilience, for both MPAs and for the environment at large. But first and foremost, practitioners must be clear when they are referring to "climate resilience" in distinction with other forms of resilience.

Another cause for concern is that there are not a sufficient number of studies being produced *about* MPAs. Rather than studying these ABMTs, academics are studying within the

area. For MPAs to be successful, they need to be properly studied, and not just for biophysical means. MPAs should be studied for governance, as well as socio-economic objectives.

There is also a disconnect between vocalized goals and goals in practice. Respondents to the survey agreed that the cultural effectiveness of MPAs was low but prioritized biophysical goals as most important. We cannot expect improvement when the deficiencies are not deemed important.

Supplemental: Personal Reflection

My intention was to figure out what makes an MPA successful, and really what I found was largely already known: to each their own. There is no general consensus on what makes an MPA good or successful or effective. And I think I've learned that that is okay. MPAs can often be seen as a end all be all solution, but the fact that there is still so much debate over the most basic of tenants- like objectives- shows we still have a long way to go, even though the sheer number are increasing, according to the voluntary commitments and comments made at Ocean Conference. The rhetoric was positive, making me think that we are gung ho with the fulfillment of Aichi Target 11/SDG 14.5, but are we just setting ourselves up for failure?

While I was writing this thesis, a preparatory committee established by the United Nations General Assembly [UNGA] was finishing up their meetings on the draft on the elements of a text of an internationally legally binding instrument [ILBI]. This ILBI would be under the UN Convention on the Law of the Sea [UNCLOS], and is focused specifically on the conservation and sustainable use of marine biodiversity of areas beyond national jurisdiction. After four sessions, over the course of two years, recommendations to the UNGA it was recommended that an intergovernmental conference [IGC] would be required to continue creating the text around the potential Open Ocean Treaty. The planned treaty is due by the year 2020, although the breadth of the treaty is still hazy.

One element of this future Open Ocean Treaty is the use of marine protected areas within the areas beyond national jurisdiction. While the text is incomplete now, MPAs are listed within the general elements of the Open Ocean Treaty. One of the key aspects of the section on MPAs is that the treaty would "set out objectives of…. marine protected areas, in areas beyond national jurisdiction for the conservation and sustainable use of marine biological diversity" (United

Nations General Assembly, 2017)This, coupled with the general principle listed of “building resilience to the effects of climate change” (United Nations General Assembly, 2017), may lead to the creation of these climate-resilient MPAs in the high seas.

Given all the data and the approach of the end of SDG 14, we can make a good assumption that the number of marine protected areas in the world are going to increase. However, the objectives and goals of these MPAs are likely to change, meaning that our definition of success should change too. Success is a moving target, malleable. The closer we can get to this target, however, the brighter our ocean’s future.

References

Abelson, A., Nelson, P. A., Edgar, G. J., Shashar, N., Reed, D. C., Belmaker, J., … Gaines, S. D. (2016). Expanding marine protected areas to include degraded coral reefs. *Conservation Biology*, *30*(6), 1182–1191. https://doi.org/10.1111/cobi.12722

Agardy, T. (2000). Effects of fisheries on marine ecosystems: A conservationist's perspective. *ICES Journal of Marine Science*, *57*(3), 761–765. https://doi.org/10.1006/jmsc.2000.0721

Alex Caveen, Tim Gray, Nick Polunin, S. M. S. (2015). *The Controversy over Marine Protected Areas Science meets Policy*.

Bates, A. E., Barrett, N. S., Stuart-Smith, R. D., Holbrook, N. J., Thompson, P. A., & Edgar, G. J. (2014). Resilience and signatures of tropicalization in protected reef fish communities. *Nature Climate Change*, *4*(1), 62–67. https://doi.org/10.1038/nclimate2062

Campbell, L., Corson, C., Gray, N., MacDonald, K., & Brosius, J. P. (2014). Studying Global Environmental Meetings to Understand Global Environmental Governance: Collaborative Event Ethnography at the Tenth Conference of the Parties to the Convention on Biological Diversity. *Global Environmental Politics*, *14*(3), 1–20. https://doi.org/10.1162/GLEP

Cheal, A. J., Wilson, S. K., Emslie, M. J., Dolman, A. M., & Sweatman, H. (2008). Responses of reef fish communities to coral declines on the Great Barrier Reef. *Marine Ecology Progress Series*, *372*, 211–223. https://doi.org/10.3354/meps07708

Clements, C. S., & Hay, M. E. (2017). Size matters: Predator outbreaks threaten foundation species in small Marine Protected Areas. *PLoS ONE*, *12*(2), 1–14. https://doi.org/10.1371/journal.pone.0171569

Corbin, J., & Strauss, A. (1990). Grounded Theory Research: Procedures, Canona and Evaluative Criteria. *Zeitschrift Fur Sociologie*, *19*(6), 418–427. https://doi.org/10.1007/BF00988593

Corrigan, C. M., & Kershaw, F. (2008). *Working Toward High Seas Marine Protected Areas*. *UNEP*.

Costello, M. J., & Ballantine, B. (2015). Biodiversity conservation should focus on no-take

Marine Reserves: 94% of Marine Protected Areas allow fishing. *Trends in Ecology and Evolution*, *30*(9), 507–509. https://doi.org/10.1016/j.tree.2015.06.011

Davies, H. N., Beckley, L. E., Kobryn, H. T., Lombard, A. T., Radford, B., & Heyward, A. (2016). Integrating climate change resilience features into the incremental refinement of an existing marine park. *PLoS ONE*, *11*(8), 1–21. https://doi.org/10.1371/journal.pone.0161094

Day J., Dudley N., Hockings M., Holmes G., Laffoley D., S. S. & W. S. (2012). *Developing capacity for a protected planet Guidelines for Applying the IUCN Protected Area Management Categories to Marine Protected Areas*. *Iucn*.

Doyen, L., De Lara, M., Ferraris, J., & Pelletier, D. (2007). Sustainability of exploited marine ecosystems through protected areas: A viability model and a coral reef case study. *Ecological Modelling*, *208*(2–4), 353–366. https://doi.org/10.1016/j.ecolmodel.2007.06.018

FAO. (2015). About MPAs, 1–2.

Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chappin, T., & Rockstr m, J. (2010). Resilience thinking: Integrating resiliencem adaptability and transformability. *Ecology and Society*, *15*(4), 20–28. https://doi.org/10.5751/ES-03610-150420

Friedlander, A. M., Golbuu, Y., Ballesteros, E., Caselle, J. E., Gouezo, M., Olsudong, D., & Sala, E. (2017). Size , age , and habitat determine effectiveness of Palau ' s Marine Protected Areas. *PLoS ONE*, 1–18. https://doi.org/10.5061/dryad.tp3j5.Funding

Gallacher, J., Simmonds, N., Fellowes, H., Brown, N., Gill, N., Clark, W., … Rodwell, L. D. (2016). Evaluating the success of a marine protected area: A systematic review approach. *Journal of Environmental Management*, *183*, 280–293. https://doi.org/10.1016/j.jenvman.2016.08.029

Garces, L. R., Pido, M. D., Tupper, M. H., & Silvestre, G. T. (2013). Evaluating the management effectiveness of three marine protected areas in the Calamianes Islands, Palawan Province, Philippines: Process, selected results and their implications for planning and management. *Ocean and Coastal Management*, *81*, 49–57. https://doi.org/10.1016/j.ocecoaman.2012.07.014

Gell, F. R., & Roberts, C. M. (2003). Benefits beyond boundaries: The fishery effects of marine reserves. *Trends in Ecology and Evolution*, *18*(9), 448–455. https://doi.org/10.1016/S0169-5347(03)00189-7

Gjerde, Kristina M., Dotinga, H.; Molenaar, E., Rayfuse, R., Warner, R. (2008). *Regulatory and Governance Gaps in the International Regime for the Conservation and Sustainable Use of Marine Biodiversity in Areas beyond National Jurisdiction*. *IUCN* (Vol. 1). Elsevier. https://doi.org/10.1038/535465a

Glaser, M., Breckwoldt, A., Deswandi, R., Radjawali, I., Baitoningsih, W., & Ferse, S. C. A. (2015). Of exploited reefs and fishers - A holistic view on participatory coastal and marine management in an Indonesian archipelago. *Ocean and Coastal Management*, *116*, 193–213. https://doi.org/10.1016/j.ocecoaman.2015.07.022

Gopnik, M., Fieseler, C., Cantral, L., McClellan, K., Pendleton, L., & Crowder, L. (2012). Coming to the table: Early stakeholder engagement in marine spatial planning. *Marine Policy*, *36*(5), 1139–1149. https://doi.org/10.1016/j.marpol.2012.02.012

Graham, N. A. J., Chong-Seng, K. M., Huchery, C., Januchowski-Hartley, F. A., & Nash, K. L. (2014). Coral reef community composition in the context of disturbance history on the Great Barrier Reef, Australia. *PLoS ONE*, *9*(7). https://doi.org/10.1371/journal.pone.0101204

Green, A. L., Fernandes, L., Almany, G., Abesamis, R., McLeod, E., Aliño, P. M., … Pressey, R. L. (2014). Designing Marine Reserves for Fisheries Management, Biodiversity Conservation, and Climate Change Adaptation. *Coastal Management*, *42*(2), 143–159. https://doi.org/10.1080/08920753.2014.877763

Halpern, B. S. (2003). the Impact of Marine Reserves: Do Reserves Work and Does Reserve Size Matter? *Ecological Applications*, *13*(1), 117–137.

Heath, H., & Cowley, S. (2004). Developing a grounded theory approach: A comparison of Glaser and Strauss. *International Journal of Nursing Studies*, *41*(2), 141–150. https://doi.org/10.1016/S0020-7489(03)00113-5

Hoffmann E.; Perez-Ruzafa, A. (2008). Marine Protected Areas as a tool for fishery management and ecosystem conservation: an Introduction. *ICES Journal of Marine Science*, *66*(1), 1–5. https://doi.org/10.1093/icesjms/fsn186

Hogg, K., Noguera-Méndez, P., Semitiel-García, M., Gray, T., & Young, S. (2017). Controversies over stakeholder participation in marine protected area (MPA) management: A case study of the Cabo de Palos-Islas Hormigas MPA. *Ocean and Coastal Management*, *144*, 120–128. https://doi.org/10.1016/j.ocecoaman.2017.05.002

Hopkins, C. R., Bailey, D. M., & Potts, T. (2016). Perceptions of practitioners: Managing marine protected areas for climate change resilience. *Ocean and Coastal Management*, *128*, 18–28. https://doi.org/10.1016/j.ocecoaman.2016.04.014

IUCN. (n.d.). *Measures such as area-based management tools, including marine protected areas*.

Janssen, M. A., Schoon, M. L., Ke, W., & Börner, K. (2006). Scholarly networks on resilience, vulnerability and adaptation within the human dimensions of global environmental change. *Global Environmental Change*, *16*(3), 240–252. https://doi.org/10.1016/j.gloenvcha.2006.04.001

Katona, S. (2015). Resilience: Music to our Ears.

Kelleher, Graeme; Kenchington, R. A. (1992). *Guidelines for establishing marine protected areas*.

Kikiloi, K., Friedlander, A. M., Wilhelm, A., Lewis, N., Quiocho, K., ʼĀila, W., & Kahoʻohalahala, S. (2017). Papahānaumokuākea: Integrating Culture in the Design and Management of one of the World's Largest Marine Protected Areas. *Coastal Management*, *45*(6), 436–451. https://doi.org/10.1080/08920753.2017.1373450

Kittinger, J. N., Duin, K. N., & Wilcox, B. A. (2010). Commercial fishing, conservation and compatibility in the Northwestern Hawaiian Islands. *Marine Policy*, *34*(2), 208–217. https://doi.org/10.1016/j.marpol.2009.06.007

Kumar, S., Kumar, N., & Vivekadhish, S. (2016). Millennium development goals (MDGS) to sustainable development goals (SDGS): Addressing unfinished agenda and strengthening sustainable development and partnership. *Indian Journal of Community Medicine*, *41*(1), 1. https://doi.org/10.4103/0970-0218.170955

Leenhardt, P., Cazalet, B., Salvat, B., Claudet, J., & Feral, F. (2013). The rise of large-scale marine protected areas: Conservation or geopolitics? *Ocean and Coastal Management*, *85*, 112–118. https://doi.org/10.1016/j.ocecoaman.2013.08.013

Legewie, H., Schervier-legewie, B., & Strauss, A. (2004). FORUM : QUALITATIVE SOCIAL RESEARCH " Research is Hard Work , it â€™ s Always a bit Suffering . Therefore , on the Other Side Research Should be Fun " Anselm Strauss in Conversation With. *Forum Qualitative Sozialforschung*, *5*(3), 2004–2006.

Lubchenco, J., & Grorud-Colvert, K. (2015). Making Waves: The science and politics of ocean protection. Mature science reveals opportunities for policy progress. *Science*, *350*(6259), 382–383. https://doi.org/10.1017/CBO9781107415324.004

Magis, K. (2010). Community resilience: An indicator of social sustainability. *Society and Natural Resources*, *23*(5), 401–416. https://doi.org/10.1080/08941920903305674

Maina, J. M., Jones, K. R., Hicks, C. C., McClanahan, T. R., Watson, J. E. M., Tuda, A. O., & Andréfouët, S. (2015). Designing climate-resilient marine protected area networks by combining remotely sensed coral reef habitat with coastal multi-use maps. *Remote Sensing*, *7*(12), 16571–16587. https://doi.org/10.3390/rs71215849

McLeod, E., Salm, R., Green, A., & Almany, J. (2009). Designing marine protected area networks to address the impacts of climate change. *Frontiers in Ecology and the Environment*, *7*(7), 362–370. https://doi.org/10.1890/070211

McMichael, A.J. , Campbell-Lendrum, D.H., Corvalan, C.F., Ebi, K.L., Githeko, A.K., Scheraga, J.D., W. (2003). *Climate change and human health. World Health Organization*.

Moore, F., Lamond, J., & Appleby, T. (2016). Assessing the significance of the economic impact of Marine Conservation Zones in the Irish Sea upon the fisheries sector and regional economy in Northern Ireland. *Marine Policy*, *74*(September), 136–142. https://doi.org/10.1016/j.marpol.2016.09.025

Morgera, E., & Ntona, M. (2017). Linking small-scale fisheries to international obligations on marine technology transfer. *University of Strathclyde*, (8).

NOAA. (2017). What is Resilience?

Ocean Studies Board. (2001). *Marine Protected Areas: Tools for Sustaining Ocean Ecosystem*. Washington, D.C.: National Academy Press.

Parsons, K. (1973). International Phenomenological Society Some Aspects of Whitehead â€™s Social Philosophy Author (s): A . H . Johnson Source : Philosophy and Phenomenological Research , Vol . 24 , No . 1 (Sep ., 1963), pp . 61-72 Published by : International Phenomenolo, *24*(1), 61–72.

Pichegru, L., Gremillet, D., Crawford, R. J. M., & Ryan, P. G. (2010). Marine no-take zone rapidly benefits endangered penguin. *Biology Letters*, *6*(4), 498–501. https://doi.org/10.1098/rsbl.2009.0913

Pomeroy, R., & Douvere, F. (2008). The engagement of stakeholders in the marine spatial planning process. *Marine Policy*, *32*(5), 816–822. https://doi.org/10.1016/j.marpol.2008.03.017

Pomeroy, R. S., Watson, L. M., Parks, J. E., & Cid, G. A. (2005). How is your MPA doing? A methodology for evaluating the management effectiveness of marine protected areas. *Ocean and Coastal Management*, *48*(7–8), 485–502. https://doi.org/10.1016/j.ocecoaman.2005.05.004

Rocha, L. (2018). Bigger Is Not Better for Ocean Conservation. *New York Times*. Retrieved from https://www.nytimes.com/2018/03/20/opinion/environment-ocean-conservation.html

Rochette, J., Gjerde, K., Druel, E., Ardron, J. A., Craw, A., Halpin, P., … Cleary, J. (2014). Delivering the Aichi target 11: Challenges and opportunities for marine areas beyond national jurisdiction. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *24*(S2), 31–43. https://doi.org/10.1002/aqc.2507

Sayce, K., Shuman, C., Connor, D., Reisewitz, A., Pope, E., Miller-Henson, M., … Owens, B. (2013). Beyond traditional stakeholder engagement: Public participation roles in California's statewide marine protected area planning process. *Ocean and Coastal Management*, *74*, 57–66. https://doi.org/10.1016/j.ocecoaman.2012.06.012

Simard, F., Laffoley, D., & Baxter, J. M. (2013). *Marine Protected Areas and climate change*.

Smith, D., & Jabour, J. (2018). MPAs in ABNJ: Lessons from two high seas regimes. *ICES Journal of Marine Science*, *75*(1), 417–425. https://doi.org/10.1093/icesjms/fsx189

Strauss, A. (1987). *Qualitative Analysis for Social Scientists*. Cambridge University.

Thomas, H. L., Macsharry, B., Morgan, L., Kingston, N., Moffitt, R., Stanwell-Smith, D., & Wood, L. (2014). Evaluating official marine protected area coverage for Aichi Target 11: Appraising the data and methods that define our progress. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *24*(S2), 8–23. https://doi.org/10.1002/aqc.2511

Tupper, M., Asif, F., Garces, L. R., & Pido, M. D. (2015). Evaluating the management effectiveness of marine protected areas at seven selected sites in the Philippines. *Marine Policy*, *56*, 33–42. https://doi.org/10.1016/j.marpol.2015.02.008

United Nations. (2015). *The Millennium Development Goals Report*. *United Nations*. https://doi.org/978-92-1-101320-7

United Nations. (2017). Communities of Ocean Action. Retrieved from https://oceanconference.un.org/

United Nations General Assembly. (2017). *Preparatory Committee established by General Assembly resolution 69/292: Development of an international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological dive*.

Voyer, M., Gollan, N., Barclay, K., & Gladstone, W. (2015). "It"s part of me'; understanding the values, images and principles of coastal users and their influence on the social acceptability of MPAs. *Marine Policy*, *52*, 93–102. https://doi.org/10.1016/j.marpol.2014.10.027

Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, Adaptability and Transformability in Social – ecological Systems. *Ecology and Society*, *9*(2), 5. https://doi.org/10.1103/PhysRevLett.95.258101

Wells, S., Ray, G. C., Gjerde, K. M., White, A. T., Muthiga, N., Bezaury Creel, J. E., … Reti, J. (2016). Building the future of MPAs – lessons from history. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *26*, 101–125. https://doi.org/10.1002/aqc.2680

Wenzel, L., & Wahle, C. (2013). *Marine Protected Areas: Building Resilience To Climate Change Impacts*.

West, P., Igoe, J., & Brockington, D. (2006). Parks and Peoples: The Social Impact of Protected Areas. *Annual Review of Anthropology*, *35*(1), 251–277. https://doi.org/10.1146/annurev.anthro.35.081705.123308

BIOGRAPHY OF THE AUTHOR

Emily Nocito was born and raised in New Jersey, moving away to attend Stony Brook University. It was here that she earned her BS in Coastal Environmental Studies, with a minor in Ecosystems and Human Impact. She is also the founder of 10 by 2020, a youth-led organization based on oceans education and awareness. While attending University of Maine in pursuit of her MS in Marine Policy, she also was acting program coordinator at the Wilson Center, as well as faculty advisor to the Spiritual Coexistence Student Group. Emily is a candidate for the Master of Science degree in Marine Policy from the University of Maine in May 2018.