

The evolution of marine protected area planning in Aotearoa New Zealand: Reflections on participation and process

Kathryn Davies^{a,*}, Ani A. Murchie^a, Vince Kerr^b, Carolyn Lundquist^{a,c}

^a National Institute of Water and Atmospheric Research, PO Box 11115, Hillcrest, Hamilton 3251, New Zealand

^b Kerr and Associates, 176 Dip Rd, RD6, Whangarei 0176, New Zealand

^c University of Auckland, Private Bag 92019, Auckland 1142, New Zealand

ARTICLE INFO

Keywords:

Aotearoa
Marine protected areas
New Zealand
Participation
Process

ABSTRACT

Marine protected areas (MPAs) are a critical element of fisheries management and biodiversity conservation strategies. However, MPA planning is a complex undertaking that requires consideration of ecological and other knowledge, including indigenous knowledge, as well as balancing social, cultural, and economic interests. Engaging a range of stakeholders and indigenous partners in MPA planning, establishment, and management has consistently been identified as key to successful MPA implementation. This paper interrogates MPA planning in Aotearoa New Zealand, with a focus on the role of participation and collaboration in the development and implementation of MPAs. Previous and current MPA processes were evaluated using best practice principles drawn from international MPA and other participatory process literature. Several factors hypothesised to be associated with improvements and efficiencies in the involvement of participants in MPA decision making are assessed, including aspects of participation, best available information, social learning and capacity, fair and respective process, and efficiency of administration. Processes were compared before and after introduction of the New Zealand Marine Protected Areas Policy and Implementation Plan in 2005. Areas for improvement in future evolutions of MPA planning also emerged from this research; these centre primarily on the need for inclusive and balanced participation; inclusion of multiple values and information types in MPA decision-making; time to build trust and establish shared understanding; and resourcing. These recommendations represent a conceptualisation of MPAs operating within holistic social-ecological systems frameworks that encompass more than biodiversity conservation or extractive use, potentially redefining how MPAs are conceived of, developed, implemented and valued.

1. Introduction

Marine protected areas (MPAs) are now widely recognised as a critical element of local, national, and international approaches to fisheries management and biodiversity conservation [1,2]. MPA planning is highly complex, requiring careful consideration and analysis of data, as well as balancing often conflicting or overlapping interests. In many areas, MPA implementation will have some socio-economic impact (including cultural-ecological interactions) on local communities and fisheries, at least in the short term, because the strategy relies on regulation of fishing and other extractive practices [3]. MPAs are also non-indigenous management frameworks that may sever cultural-ecological interactions that have been accumulated and held across generations; cultural-ecological knowledge shapes local and tribal identity, wellbeing and environmental ethos [4,5]. Conversely, MPAs may

benefit local communities, providing heightened cultural, recreational and tourism opportunities [6,7]. Due to these complexities and conflicts, the engagement of a range of stakeholders and indigenous partners in MPA planning, establishment, and management has consistently been identified as key to successful MPA implementation [8]. Additionally, engaging representatives of these groups in MPA planning can bring a broader range of knowledge into MPA development and decision making [9].

The adoption of participatory approaches to MPA planning and implementation has been supported internationally by the Rio De Janeiro Conference (1992) and the Aarhus Convention (1998) [10]. A wide range of participatory processes and best practice protocols have emerged to meet this demand [e.g., 10–13]. However, these processes often take many years, extensive resourcing and considerable effort to achieve outcomes, and they are not always successful. There is evidence

* Corresponding author.

E-mail addresses: Kate.Davies@niwa.co.nz (K. Davies), Ani.Murchie@niwa.co.nz (A.A. Murchie), vince@kerrandassociates.co.nz (V. Kerr), Carolyn.Lundquist@niwa.co.nz (C. Lundquist).

<https://doi.org/10.1016/j.marpol.2018.03.025>

Received 31 July 2017; Received in revised form 4 March 2018; Accepted 23 March 2018
0308-597X/ © 2018 Elsevier Ltd. All rights reserved.

that social factors have a critical influence on the outcome of MPA planning processes [14–16], but these are not well understood due in part to the absence of cohesive social science in conservation and MPA planning [17]. Without a convincing explanation for the variations in MPA planning performance, applications may proceed in ignorance of the likelihood of their success or failure.

This paper interrogates MPA planning in Aotearoa New Zealand (Aotearoa NZ), with a focus on the role of participation in these processes. In this context, Māori or tangata whenua, the indigenous people of Aotearoa NZ, hold a unique position as partners with the Crown under the Treaty of Waitangi, widely recognised as the founding document of the country. To conduct this review, a range of previous and current MPA processes were evaluated using best practice principles drawn from international MPA and other participatory process literature. Our analysis examines whether MPA planning in Aotearoa NZ has evolved away from previous consultative models that were often time consuming and characterised by conflict, to become more time efficient and collaborative processes today. Efficiency is defined here in terms of implementing biodiversity protection mechanisms with minimum time allocated. Several factors hypothesised to improve or enhance broader participation in MPA decision making are assessed, including changes in government policy and associated practices. The introduction of the New Zealand Marine Protected Areas Policy and Implementation Plan (MPA Policy) in 2005 [18] and the associated implementation guidelines in 2008 [19] are a key feature of our assessment. More than a decade after the introduction of the MPA Policy, this paper explores how closely its implementation has aligned with international participatory best practices and principles, and points towards possible future evolutionary pathways for MPA planning. The lessons learned from this review provide internationally relevant insights into how collaborative MPA processes can improve implementation efficiencies in a developed country setting.

2. MPAs in Aotearoa New Zealand: background and context

2.1. Marine Reserves Act 1971

Aotearoa NZ's first no-take marine reserve was established in 1975 at a site adjacent to the University of Auckland's Leigh Marine Laboratory. The reserve was established under the Marine Reserves Act 1971 to preserve marine life for scientific study. To implement a marine reserve under this Act, applicants gather information about the proposed marine reserve from sources such as public documents and surveys, fisheries data, ecological surveys, tangata whenua consultation and public meetings. This information is interpreted by the applicant, developed into a marine reserve proposal, and made available for public critique through a process of 'public notification'. Members of the public may then make 'objections' to the application, though both submissions in support and opposition are typically received. Applicants may respond to the public submissions by making no revisions, minor revisions, or major revisions to the original proposal. The decision to establish a marine reserve under the Marine Reserves Act 1971 is made by the Minister of Conservation with concurrence from Ministers of Transport and Primary Industries. Historically, many of New Zealand's marine reserves resulted from single applications, with little consideration of alternative sites or management measures to provide for marine biodiversity protection or tangata whenua and/or community aspirations for marine protection.

2.2. Marine protected areas policy and implementation plan 2005

Although the Marine Reserves Act has remained largely unchanged since 1971, the purpose of marine reserves and other MPAs has evolved both socially and politically since that time. By the new millennium, the need to protect the range of marine habitats and ecosystems had been recognised in the New Zealand Biodiversity Strategy (NZBS) [20] and

the Convention on Biological Diversity (CBD) [21] as key to the protection of Aotearoa NZ's environmental taonga (treasures), including indigenous flora and fauna, and worldwide biodiversity.

The NZBS identifies the need to protect marine biodiversity through the implementation of an MPA network. The MPA Policy was developed to support this effort "by establishing a network...that is comprehensive and representative of New Zealand's marine habitats and ecosystems" [18,19]. The policy was specifically designed to contribute to NZBS objective 3.6 which aimed to protect 10% of New Zealand's marine environment by 2010 [18]. While significant progress towards establishing a representative MPA network has been made, gaps have been identified [22]. In response to international failures to meet the CBD targets [23], renewed targets (the Aichi Targets) were agreed to at the CBD in 2010.¹

The MPA Policy defines a protection standard (i.e., what uses are compatible with biodiversity protection) using three management categories: 1) no-take marine reserves (Type 1 MPAs); 2) other protected and managed areas that meet the protection standard (Type 2 MPAs); and 3) other forms of protection that do not achieve the standard (and so are not considered to be MPAs for the purposes of the Policy). For clarity of comparisons over time, the analysis in this paper includes only Type 1 MPAs, equivalent to the IUCN Ia category [24], which can provide protection from a wide range of activities including marine farming, fishing, other extraction, anchoring, point discharges, research, and bio-prospecting.

The MPA Policy provides a structure for implementation using Marine Protection Planning Forums (MPPFs) for each biogeographic region [18]. The implementation guidelines [19] set clear targets for the governance of MPPFs, stating that the following sectors should, where relevant, be represented on an MPPF:

- Tangata whenua
- Commercial fishers
- Recreational users including fishers, charter fishers and divers
- Conservation groups
- Tourism
- Aquaculture industry
- Marine science
- Minerals industry

While marine reserve proposals can still be advanced independently by an applicant that meets the criteria under the Marine Reserves Act 1971, the MPA Policy aims to bring these and other groups working on MPA proposals into regional MPA planning processes where possible.

2.3. Tangata whenua rights and responsibilities

A key feature of resource management in Aotearoa NZ is the position of tangata whenua as partners with the Crown under the Treaty of Waitangi and all subsequent resource management regulations. Accordingly, tangata whenua have the right to exercise kaitiakitanga (customary custodianship) through co-management and co-governance arrangements. In the context of MPA planning, these arrangements present opportunities for both mātauranga Māori (Māori knowledge system) and scientific knowledge to contribute to the evolution and enhancement of goals and practices related to fisheries management and biodiversity conservation. Tangata whenua resource management practices aim to provide for intergenerational sustainable use while protecting biodiversity. This is exemplified by practices and protocols such as 'taonga tuku iho' where a high priority is placed on inter-generational protection of valued taonga [25]. Where Type 1 MPAs have been implemented, tangata whenua proponents often consider this tool within a wider management context [26]. The rights of tangata

¹ <https://www.cbd.int/sp/targets/>.

Table 1
Summary of key research phases.

Research phase	Methodology	Case studies
Phase One: Preliminary review	Review of all Type 1 MPAs and processes implemented from 1975 to the present. General characteristics compiled from a range of information sources and data sets.	All 44 Type 1 MPAs established in Aotearoa NZ (as of May 2017), resulting from 31 planning processes (see Appendix A for details).
Phase Two: In-depth review	In-depth review of 13 Type 1 MPA case studies. Case studies chosen to represent a range of establishment dates, geographies, types of legislation and processes. Case study subset included two processes that initially foundered or failed and one that was recently re-started (i.e. Aotea Great Barrier and South East 1 and 2). Desktop exercise conducted to compile literature, legislation, and other data on participatory process elements.	Te Matuku Marine Reserve, Aotea Great Barrier, South East 1, Horoirangi Marine Reserve, Whangarei Harbour Marine Reserve*, Taputeranga Marine Reserve, Parininihi Marine Reserve, Fiordland*, Te Paepae o Aotea (Volkner Rocks) Marine Reserve, Subantarctic Islands*, West Coast*, Kaikōura/Hikurangi*, South East 2* *Case studies also included in phase three.
Phase Three: Structured interviews	Structured interviews to explore six case studies in more detail. Case studies chosen from phase two sample to maintain representation of establishment dates, geographies, types of legislation and processes, but also based on availability of participants in a position to 1) know the details needed to complete phase two of the research and 2) provide additional insights regarding those processes.	Whangarei Harbour Marine Reserve, Fiordland, Subantarctic Islands, West Coast, Kaikōura/Hikurangi, South East 2

whenua to manage their fisheries are recognised within a range of fisheries regulations and Acts [e.g., 27–29], but the associated management tools generally do not meet the MPA Policy protection standard and are not considered here. For further discussion of customary fisheries management see for example [30].

3. Case studies and analytical framework

Only no-take marine reserves (Type 1 MPAs) and management areas that contain Type 1 MPAs were assessed for this study. Although today these measures increasingly sit within management frameworks that enable both protection and sustainable use, tracing the evolution of equivalent processes over time (i.e., marine reserves and Type 1 MPAs exclusive of any other type of management tool) increased the transparency of the analysis. The research has proceeded in three phases summarised in [Table 1](#). The first phase was a preliminary review of all Type 1 MPAs and processes implemented from 1975 to the present. General characteristics (e.g., date of implementation, legislation used to implement, size and location of reserve area) were compiled from a range of information sources and datasets [see [31] and also [Appendix A](#)].

In the second phase, a subset of 13 MPA case studies was chosen for further review, including two processes that initially foundered or failed and one that was recently re-started (i.e., Aotea Great Barrier and South-East 1 and 2). A desktop exercise was conducted to compile literature, legislation, and other data on participatory process elements such as the number and type of sectors involved in the application process, the decision-making process, and the number of submissions associated with each MPA application. This exercise revealed that while some process information was accessible, it was usually incomplete. To address this concern, a third research phase was initiated, in which structured interviews were utilised to collect a more in-depth dataset for a further subset of six MPA processes. These interviews highlight timely reflections regarding future efforts to establish MPAs in Aotearoa NZ [for interview questions see [Appendix B](#)]. Research procedures were performed in compliance with relevant human research ethics laws and institutional guidelines, including obtaining informed consent from all participants prior to conducting interviews, and protecting participants’ privacy rights.

Based on information compiled for Phase One, a subset of all MPA processes to date (including failed processes) was identified for which sufficient information was available (Phase Two) and/or persons were identified and willing to participate who had relevant knowledge about particular processes (Phase Three). Case studies for assessment in Phases Two and Three were selected to maximise process diversity across a range of dates (i.e., formal establishment of MPAs in approximately the last 15 years including case studies established both

pre- and post MPA Policy), geographies, types of legislation and process. Phase Three case studies were chosen to maintain the representation of establishment dates, geographies, types of legislation and processes in Phase Two, though selections were constrained based on availability of participants with detailed knowledge of each Phase Three case study. Structured interviews were conducted with six individuals (five government employees and one consultant/community member) familiar with at least one Phase Two case study ([Table 1](#)). Attempts to find a participant who could discuss processes that did not result in the formation of an MPA were unsuccessful. No Māori managers or tangata whenua for these marine spaces were targeted for interviews, so only high-level statements can be made about some aspects of the participatory processes that unfolded. This is a significant gap in understanding of participatory and collaborative marine management processes which should be addressed in future work.

Interviews were coded using the NVivo 11 software, according to the analytic framework themes in [[Table 2](#)]. This thematic coding provided a general understanding of the MPA establishment processes but is by no means an exhaustive treatment. Each case study has unique details and context associated with submissions, development, and implementation that are not within the scope of this paper to discuss. Instead, this paper clarifies high-level drivers, broad characteristics, and patterns of MPA development and implementation in Aotearoa NZ.

To evaluate the Phase Two and Three case studies, international

Table 2
Evaluation framework for participatory MPA planning [adapted from [8,32–35]].

Characteristics	Elements evaluated
Diverse and representative participation	<ul style="list-style-type: none"> ● Tangata whenua ● Stakeholders (e.g. commercial fishers, recreational users including fishers, charter fishers and divers, conservation groups, tourism, aquaculture industry, marine science, minerals industry, etc.) ● Public
Best available information	<ul style="list-style-type: none"> ● Ecological/Biodiversity ● Cultural (e.g. mātauranga Māori) ● Social ● Economic
Social learning and co-productive capacity	<ul style="list-style-type: none"> ● Multi-directional learning ● Multiple knowledges combined ● Iterative/adaptive ● Trust
Fair and respectful process	<ul style="list-style-type: none"> ● Early engagement ● Independent facilitation ● Influence over decisions
Efficient administration	<ul style="list-style-type: none"> ● Transparency ● Funding ● Timeframes

best practice literature on participatory MPA planning and implementation was reviewed, and assessment criteria were developed. Much of the literature is derived from studies which evaluated participation in resource management processes in general and from different theoretical perspectives (i.e., democracy, social justice, fairness, competence, and social learning) [32]. More recent comparative MPA studies describe lessons learned from, and insights specific to, MPA participatory processes [e.g., 33]. Common process elements emerged and were grouped into five categories [Table 2]: 1) diverse and representative participation; 2) best available information; 3) social learning and capacity; 4) fair and respectful process; and 5) efficient administration.

This paper reviews participatory processes in two stages: the developmental and the implementation stages. The ‘developmental’ stage begins at the start of informal investigations (i.e., first evidence of interest in developing an MPA proposal) and proceeds until the submission of a formal MPA application. The ‘implementation’ stage begins after the submission of a formal application or proposal (or suite of proposals) to a decision maker and ends with either the formal establishment or failure to establish that MPA.

4. Results

4.1. Phase one: preliminary review

Type 1 MPAs cover 9.8% of New Zealand's Territorial Sea, but under the Marine Reserves Act 1971, marine reserves cannot be established in the Exclusive Economic Zone (EEZ) [Fig. 1]. A total of 44 Type 1 MPAs have been established in Aotearoa NZ (as of May 2017) resulting from 31 planning processes [for a complete list see Appendix A].

In May 2017, 11 of Aotearoa NZ's 14 biogeographic regions [Appendix C] contained at least one Type 1 marine reserve. The size and number of reserves varies extensively across the country, but the largest Type 1 MPAs are located far from densely populated areas (e.g., in the Kermadec or Subantarctic Islands). The Kermadec Islands Biogeographic Region is fully contained within a marine reserve that was established in 1990.

Over the last decade, forum-style and MPPF processes have increasingly characterised planning for Type 1 marine reserves and MPA networks [Fig. 2]. Since 2005, two forum-style marine planning processes have been completed and implemented outside of the MPA Policy, culminating in the Fiordland (Te Moana o Atawhenua) Marine Management Act 2005² [36] (including eight Type 1 MPAs), and the Kaikōura (Te Tai o Marokura) Marine Management Act 2014³ (including one Type 1 MPA) (<http://www.teamkorowai.org.nz/>). Additionally, MPPFs organised according to the MPA Policy standards have led to the establishment of MPA networks in the Subantarctic Islands Coastal Biogeographic region (including three Type 1 MPAs established under the Subantarctic Islands Marine Reserves Act 2014) and the West Coast South Island Coastal Biogeographic region (including five Type 1 MPAs established in 2014 under the Marine Reserves Act 1971). A MPPF planning process has also recently been initiated in part of the Southern Biogeographic Region (South-East Marine Protection Forum (<http://south-eastmarine.org.nz/>)).

The last decade has seen MPAs established in biogeographic regions that previously had few or no marine reserves (e.g., Subantarctic Islands, West Coast South Island, Southern). Recent MPAs are also more likely to be part of a network of MPAs rather than a one-off [Table 4]. However, MPAs and MPA networks established post 2005, when the MPA Policy was implemented, are not on average larger than previous efforts [Table 3].

4.2. Phase two: in-depth review

Key characteristics of the MPA case studies included in Phases Two and Three of the research have been compiled into [Table 4] below. The type of applicant and/or primary proponent of an application has shifted away from being a single entity in the years before the establishment of the Guardians of Fiordland's Fisheries and Marine Environment (1995), and towards a coalition or forum composed of tangata whenua and stakeholder representatives in the years after. The role of the Department of Conservation (DOC) has also shifted from being the developer to being the curator of an application developed by a forum. This evolution can also be seen in the growing number of sectors that contribute to applications, consisting of up to seven in recent years. All applications or proposals put forward since 1995 and assessed in this study included five or more of the MPPF sectors designated in the MPA Policy implementation guidelines. Recent non-forum processes often included many of the same sectors, with six sectoral groups (tangata whenua, commercial fishers, recreational users, conservation groups, tourism, and community representatives) involved in the Te Paepae o Aotea (Volkner Rocks) Marine Reserve and three groups (recreational users, conservation groups, community representatives) in the Taputeranga Marine Reserve in 2008.

A range of voting interest representatives are involved in MPA planning [Table 5], but some interests are missing from some processes (e.g., marine science). All of the forum-style and MPPF processes surveyed for Phase Two of this study relied on a facilitator or independent chairperson to assist with the smooth facilitation of MPA planning proceedings. This role was not formally designated for any non-forum processes.

The length of the total process of MPA planning and implementation, from the earliest stages of investigations and/or establishment of a group or forum, through to the establishment of a reserve or management area, has decreased over time. Non-forum processes assessed for this study took on average 15.1 years, with the longest taking 19 years and ending in a rejected proposal (Aotea Great Barrier), and the shortest taking eight years (Te Paepae o Aotea (Volkner Rocks) Marine Reserve). Forum-style processes assessed took 9.75 years on average, with the longest process taking 11 years (Subantarctic Islands) and the shortest taking nine years (both West Coast and Kaikōura/Hikurangi).

Forum-style processes assessed in Phase Two of this research resulted in more than one Type 1 marine reserve in all cases except for Kaikōura/Hikurangi, which led to the establishment of one marine reserve and a suite of other management areas. Non-forum processes resulted in either no marine reserves or a single marine reserve. Average MPA size was larger pre-2005, in part due to the Kermadecs Marine Reserve (1990, 7480 km²) and the Auckland Islands (Motu Maha) Marine Reserve (2003, 4980 km²) [Table 3, Appendix A]. However, median size, representative of the majority of inshore MPAs, was higher post-2006 [Table 3].

All forum-style and MPPF processes assessed in Phase Two received more submissions in support of the proposed marine reserves than in opposition, with percent opposition ranging from 43% of submissions (Kaikōura/Hikurangi [37]) to 2% and 3% opposition (Subantarctic Islands [38] and West Coast [39] respectively) [Fig. 3]. Non-forum processes experienced more opposition in general, with two processes out of four receiving a majority of submissions in opposition (75% in the case of Aotea Great Barrier 1 [40] and 85% regarding Te Paepae o Aotea (Volkner Rocks) [41]). Taputeranga received 47% of submissions in opposition [42], while Whangarei Harbour only received 15% in opposition [43].

The Phase Two case studies indicate that generally both the development and implementation stages of MPA applications took longer prior to the MPA Policy, but this is not based on an exhaustive dataset of MPA processes that have occurred in Aotearoa NZ in the last 30 years [Fig. 4]. Two of the failed processes assessed required some of the longest time commitments (Aotea Great Barrier 1 = 19 years, South-East

² <http://www.legislation.govt.nz/act/public/2005/0036/latest/DLM341226.html>.

³ <http://www.legislation.govt.nz/act/public/2014/0059/latest/DLM5851202.html>.

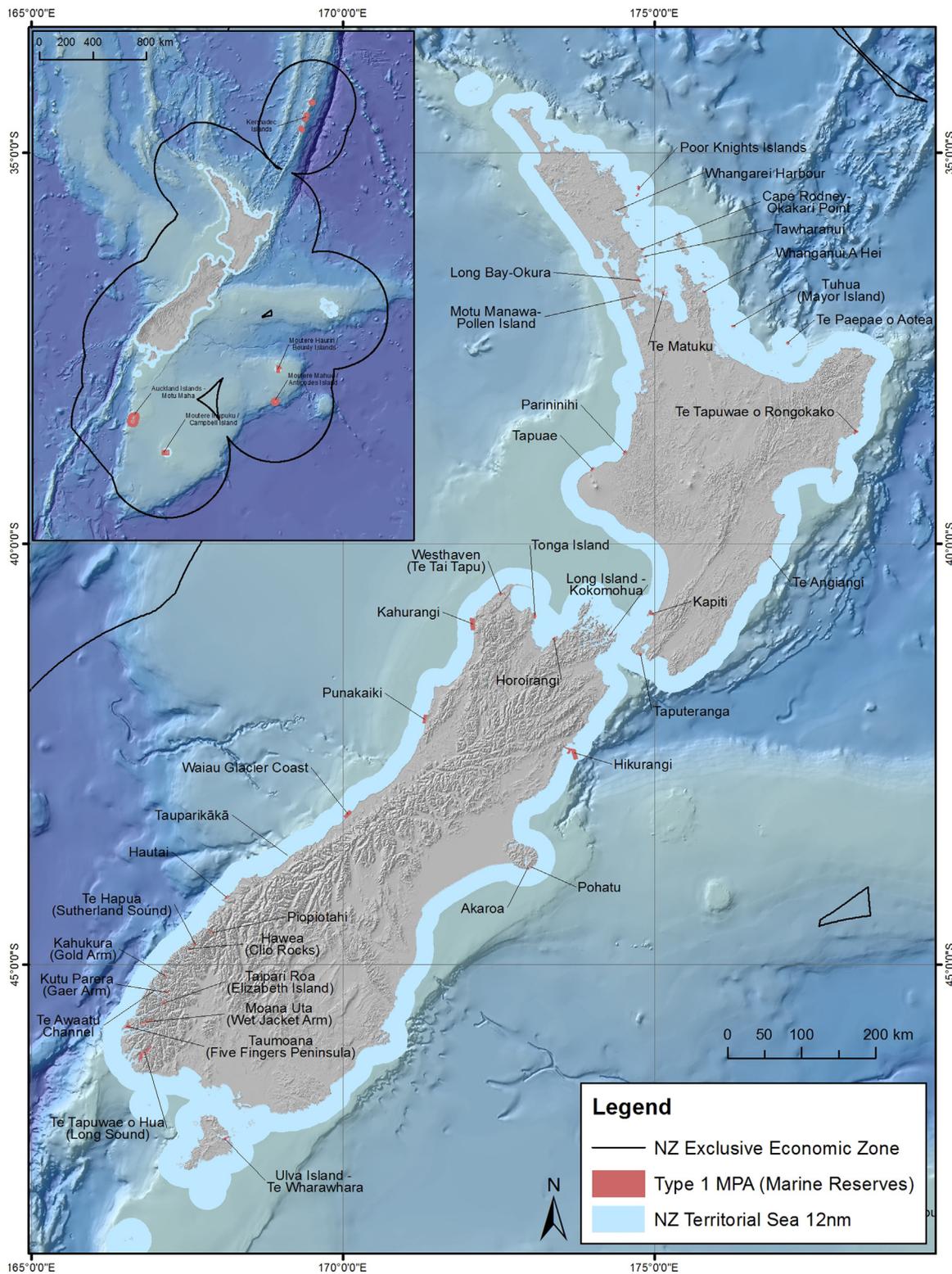


Fig. 1. Type 1 New Zealand Marine Reserves (as of May 2017). See Appendix A for further details.

1 = 16 years). The exception is Te Paepae o Aotea (Volkner Rocks), which progressed more quickly than any other proposed MPA assessed in Phase Two, taking only eight years from start to finish.

4.3. Phase three: structured interviews

Structured interviews provided additional detail regarding application development and decision-making processes, as well as how

logistical or structural details (e.g., facilitation, funding, timelines) affected project outcomes. Anonymised quotes from interviewees that exemplify or summarise key points regarding the evaluation criteria are presented in [Appendix D].

Interviewees generally agreed that scientific and local knowledge is regularly included in collaborative MPA planning, along with statutory information such as resource management and/or Treaty claims information, but cultural (e.g., mātauranga Māori), and socio-economic

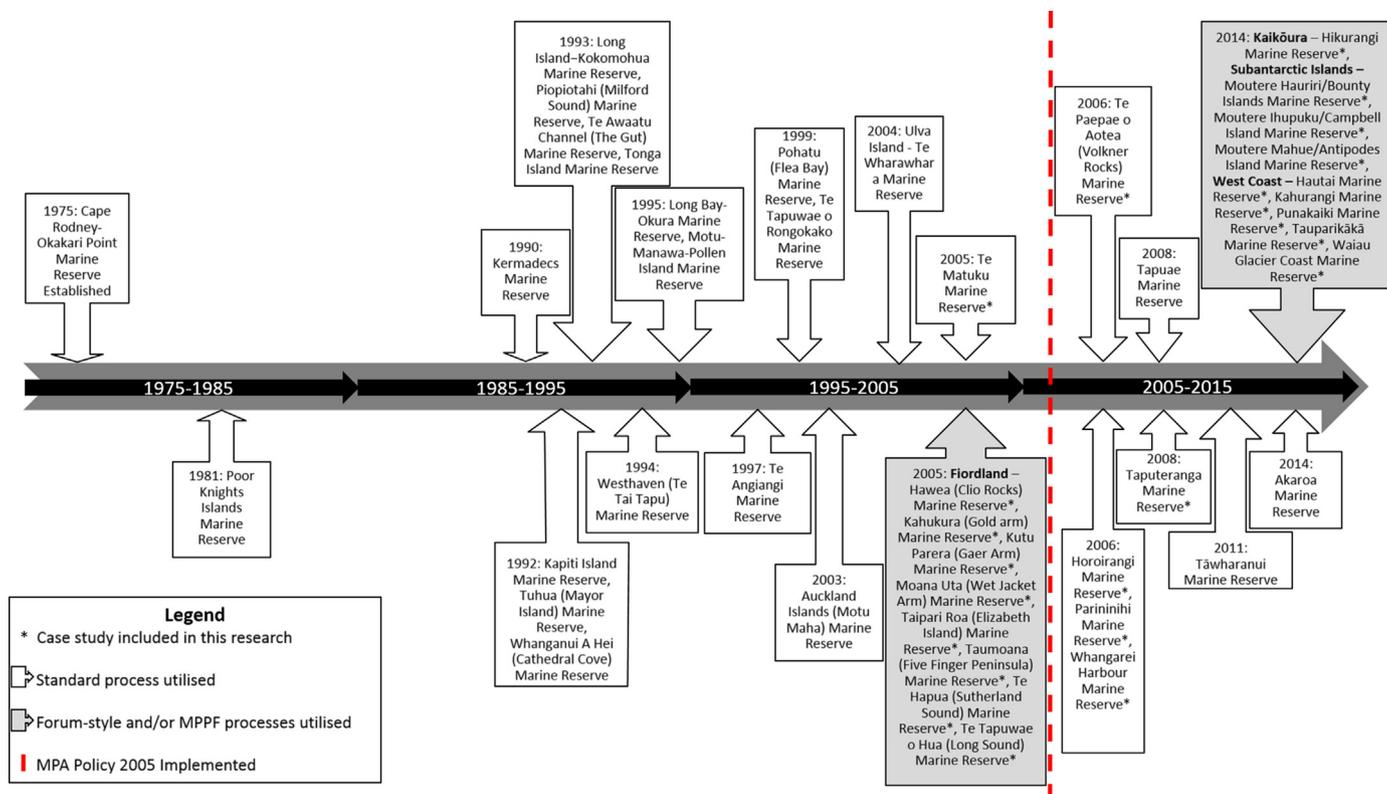


Fig. 2. MPA establishment timeline. Forum-style and MPPF processes have been increasingly utilised to establish Type 1 marine reserves and MPA networks over the last decade.

Table 3
Area allocated for protection under Type 1 MPAs in Aotearoa NZ.

	Total Area (km ²)	Number	Average (km ²)	Max	Min	Median
All Type 1 MPAs	17,431.29	44	396.17	7480.00	0.16	9.69
Type 1 MPAs 1975 through 2005:	12,726.29	27	471.34	7480.00	1.00	6.90
Type 1 MPAs from 2006 to present:	4,705.00	17	276.77	2173.00	0.16	14.04

information has not become much more visible in the development of proposals in the last decade or more [Table 6]. One interviewee pointed out that “Commercial fisheries might have had some information about important areas for trawling, long lining, and so forth, but they didn’t choose to share it.” Another challenge with information availability was that “There is often a mismatch in scales in terms of the data available and the questions being asked.” Several interviewees highlighted unequal representation or perspectives missing from forum membership which affected MPA decision making. One stated that “Based on numbers alone, environmental groups were not very well represented... Looking at the collective whole, there were strong commercial fishing interests represented.” Another pointed out that “The fact that scientists were not represented throughout the process may have impacted some of the decision making.”

Interviewees described many instances of social learning and the development of co-productive capacity among MPA planning participants and wider communities. For example, one interviewee explained that “Habitat classification – as defined by the MPA Policy – operates at the national level. Sometimes the national data doesn’t mesh with local knowledge, so we changed some of the areas to make them more

accurate with help from local input.” New tools have been developed to assist with the co-production and careful combination of knowledges. “[Decision support tools such as] SeaSketch⁴ can help people to rapidly visualise data – it allows them to interact with data, overlay maps, and see how things might play out.” A common vision was also described as an essential tool to bring multiple perspectives into alignment in an MPA planning process.

Under the MPA Policy, forum members are involved in all stages of proposal development except for the initial stages of proposing forum membership (usually conducted by DOC and Ministry for Primary Industries (MPI) staff), the choice by the decision maker/agency to pursue and implement the recommendations and the final decision making related to MPA boundaries. One interviewee agreed that having widespread involvement “from the beginning really set a good tone.” In contrast, most pre-forum (and pre-MPA Policy) processes had limited stakeholder input, primarily only during the submissions process, though with notable exceptions which undertook considerable consultation and engagement. One interviewee pointed out that MPA-related proceedings benefit from efforts conducted in advance of formal proposal development processes undertaken by tangata whenua, an agency, or another group, stating that this work helped to socialise the idea of an MPA in the region and began to develop trust among groups. Interviewees all felt that a time investment of up to two years and sometimes more may be required to get participants involved in MPPFs, establish a shared understanding of problems, and co-develop a vision and objectives for the MPA or network. Some interviewees suggested that discussions about rules and areas that might be protected are better left until later in the process so that participants can first gather information and develop trust within the group. Interviewees also explained that forum members were expected to engage with their constituents and the general public throughout the process, although this

⁴ <http://www.seasketch.org/>.

Table 4
 An overview of the case studies examined in Phase Two of the research. Forum-style and MPPF processes are demarcated with an asterisk (*). Cases are listed in chronological order from left to right by initiation of development stage; approximate dates are demarcated with a double asterisk (**).

	Te Matuku Marine Reserve	Aotea Great Barrier	South East	Horoirangi Marine Reserve	Whangarei Harbour Marine Reserve	Taputeranga Marine Reserve	Parimihi Marine Reserve	Fiordland*	Te Paepae o Aotea (Volkner Rocks) Marine Reserve	Subantarctic Islands*	West Coast	Kaikōura/Hikurangi*	South East 2*
Biogeographic Region	North Eastern	North Eastern	Southern	Southern	North Eastern	North Cook Straight	West Coast North Island	Fiordland	North Eastern	Subantarctic Islands	West Coast South Island	East Coast South Island	Southern
Applicant and/or Primary Proponent of Application	Royal Forest and Bird Protection Society	DOC	DOC	Royal Forest and Bird Protection Society	Kamo High School Year 13 Students	Royal Forest and Bird Protection Society/South Coast Marine Reserve Coalition	DOC	The Guardians of Fiordland's Fisheries and Marine Environment	DOC/Whakaari Marine Protection Steering Committee	DOC/ Subantarctic MPPF	DOC – Director General of Conservation/ West Coast MPPF	DOC/Te Korowai o Te Tai-o-Marokura (the Kaikōura Coastal Marine Guardians)	Will likely be DOC/ SE MPPF when finalised
Number of representative categories included in application development	1	1	1	1	1	3	1	7	6	5	6	6	7
Earliest investigations and/or establishment of group	1989	1989	1990**	1990	1990	1991	1993	1995	1998	2003	2005	2005	2013
Application submitted	1999	2004	1992** 2006**	1999	2002	2000	1995	2003	2003	2010	2012	2012	Recommendations due 2017
Reserve/ Management Area established	2005	Proposal rejected	No reserve established	2006	2006	2008	2006	2005	2006	2014	2014	2014	In process
Total process Size of reserves/ management area	16 years 7 km ²	19 years 0	16 years** 0	16 years 9 km ²	16 years 2 km ²	17 years 9 km ²	13 years 18 km ²	10 years 96 km ²	8 years 13 km ²	11 years 4352 km ²	9 years 175.16 km ²	9 years 104 km ²	In process In process
Number of Type 1 reserves created	1	0	0	1	1	1	1	8	1	3	5	1	In process
Legislative framework	Marine Reserves Act 1971	Marine Reserves Act 1971	Marine Reserves Act 1971	Marine Reserves Act 1971	Marine Reserves Act 1971	Marine Reserves Act 1971	Marine Reserves Act 1971	Fiordland (Te Moana o Atawhenua) Marine Management Act 2005	Marine Reserves Act 1971	Subantarctic Islands Marine Reserves Act 2014	Marine Reserves Act 1971	Kaikōura (Te Tai o Marokura) Marine Management Act 2014	In process
Independent Facilitator or Chair	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Y	N/A	Y	Y	Y	Y

Table 5
Number of voting representatives included in forum-style and/or MPPF collaborative approaches to the development of MPAs assessed in Phase Two of this research.

MPA Policy representative categories	Fiordland	Subantarctics	West Coast	Kaikōura/Hikurangi	South East 2
Tangata whenua*	3	2	5	6	3
Commercial fishers including Māori commercial fishing interests	5	4	4	4	3
Recreational users including non-profit fisheries, fishers, charter fishers and divers, boating clubs, etc.	3	1	2	2	2
Conservation groups	0	3	3	2	2
Tourism	3	0	1	2	1
Marine science	1	2	0	0	1
Minerals industry	0	0	0	0	0
Aquaculture industry	0	0	0	0	0
Other categories included in some processes					
Community representatives	1	0	2	1	1
Plant science	1	0	0	0	0
Total number of representatives	17	12	17	17	13

* West Coast only included two representatives at a time but five representatives were involved over the life of the forum.

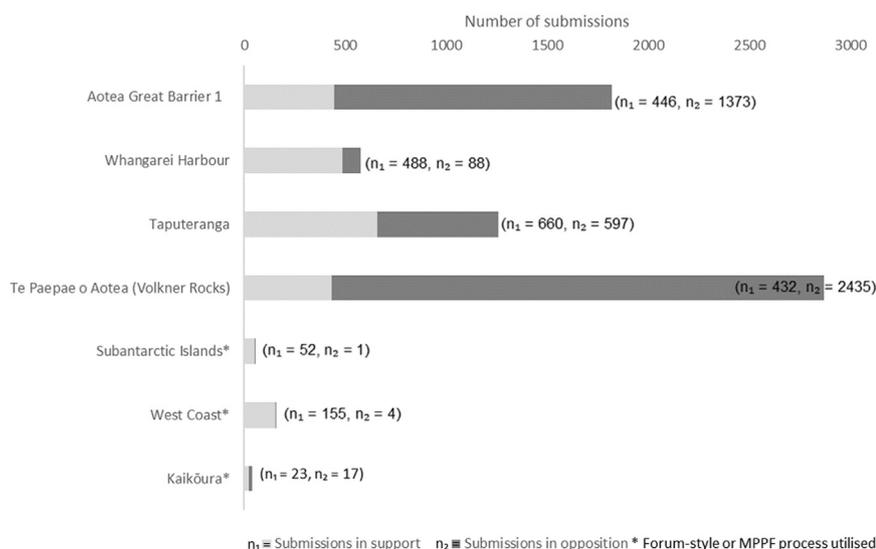


Fig. 3. Public submissions received for four individual MPAs and three MPA forum-style/MPPF processes. Several stages of submissions may be associated with MPA planning (e.g. West Coast Forum requested public submissions at three stages of proposal development); these results are for the statutory final stage associated with a formal MPA application proposal. Submissions in opposition and in support have been shown, while conditional, neutral, and other submissions have been omitted for the sake of clarity. Reliable and/or easily comparable data on submissions was not readily available for other MPAs described in this study.

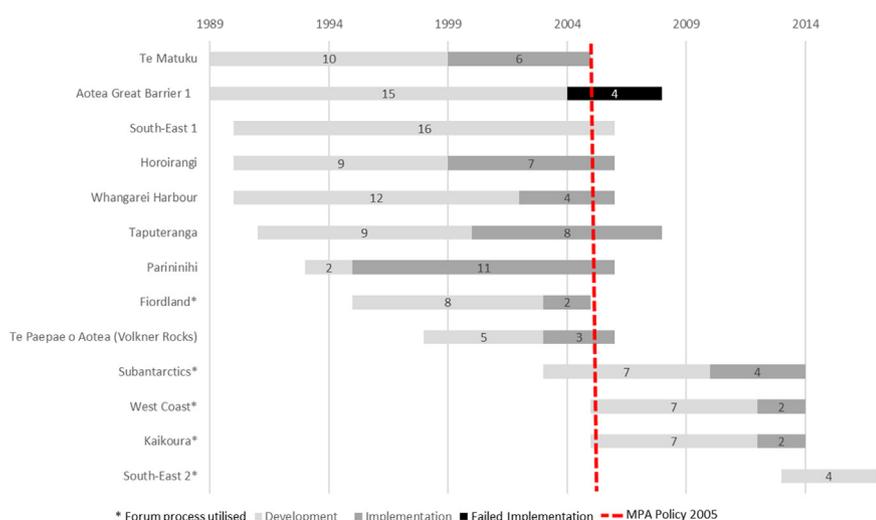


Fig. 4. Development and implementation timeframes for processes associated with Type 1 MPAs. Timeframe definitions are described in Section 3 of the paper. The Fiordland, Subantarctics, and West Coast processes resulted in the implementation of more than one Type 1 MPA [Table 4]. The West Coast Forum process technically only took five years (ending in 2010), followed by two further development years facilitated primarily by DOC prior to submission of a formal application in 2012.

occurred to varying degrees. Pre-MPA policy, iterative and adaptive development of MPA proposals was less common, whereas post-MPA Policy, iterative and adaptive reviews have become an essential part of proposal development.

Interviewees all felt that involving a facilitator or chair in forum processes is worth the investment, but one interviewee emphasised that the facilitator needed to remain neutral and another felt that facilitators

should encourage participants to have difficult conversations as part of the process. One interviewee indicated that the MPA planning process would not have been possible without the help of the facilitator.

Although forums generally seek consensus, several of the interviewees said that when groups reach an impasse they may vote on certain measures. In both the West Coast and the Subantarctic Islands, the forums could not reach consensus and instead developed a suite of

Table 6
Types of information included in forum-style and/or MPPF collaborative approaches to MPA proposal/Management plan development.

Type of information	Fiordland	Subantarctics	West Coast	Kaikoura/Hikurangi	South East 2
Natural sciences (e.g. marine ecology, conservation science)	Literature review of marine ecological values. Modelling and mapping of inner and outer waters of Fiordland (physical variables such as exposure, salinity, temperature). Verified with some surveys. Baseline monitoring of some ecological areas.	Habitat mapping according to MPA classification system. Literature review on biodiversity values. General biodiversity info – e.g. seabird colonies, fishes, invertebrates.	Values, uses, features described from a regional perspective and also specific to 14 local areas. Location of bird and seal colonies, other conservation/wildlife points of interest.	Literature review of marine ecological values. Habitat mapping (e.g. bathymetry, etc.). Some information on intertidal areas, not much on subtidal areas.	Habitat mapping using existing data and local knowledge. Other data layers include biogenic habitat, kelp beds, sponges, polechete beds, etc. Also data on bathymetry, multibeam – seafloor imagery, sea beds, mammals, distribution.
Local knowledge	Local knowledge from fishers and divers about special areas within Fiordland - led to the creation of the “china shops”. Process of identification involved workshops.	N/A - uninhabited islands.	Local knowledge of forum members was relied upon to fill gaps in knowledge about values and uses in the area.	Te Korowai forum members provided local knowledge e.g. user data (dive spots, etc.).	Biogenic habitat information was provided by local fishers. Also some local knowledge provided regarding species distributions, diversity of habitats.
Resource management and/or Treaty claims information	Statutory Acknowledgement for Te Mimi o Tu Te Rakiwhanoa (Fiordland Coastal Marine Area) in the Ngāi Tahu Claims Settlement Act 1998.	Distribution of fishing efforts, mining permits, tourism and research, degree of current protections (e.g. benthic crab fishery and mining identified).	Location of resource consents. Mapping of values and uses. Some cultural information (e.g. archaeological sites, mataitai reserves, etc.)	Ngāi Tahu values and uses of the Kaikoura Coast including Treaty claims and settlement details.	Existing resource management consents and Ngāi Tahu claims.
Socio-economic data	No structured/formal social, cultural or economic data collected.	Some discussion of fisheries but not very formal. Cultural and indigenous studies were not conducted. No social values studies conducted, but islands are designated world heritage sites, so there is some recognition of broader social value.	Sciences, planning and conservation focus, not much economic or other information.	No structured/formal social, cultural or economic data collected.	Not much economic or social data, although some data on access. Includes fisheries data (e.g. proportioned catch data, trawling, set net, long lining, etc.). Some surveys conducted on valuable recreational fishing areas, displacement of fisheries, economic assessment.
Cultural knowledge	No formal collection of cultural information.	No formal collection of cultural information. Iwi provided some site information.	Iwi representatives on the forum provided important cultural information such as location of taonga species, made suggestions about how to fill gaps, and appropriate/inappropriate locations for MPAs.	Iwi representatives on the forum provided important cultural information, some general work done on cultural and social values for Characterisation Report.	Iwi representatives on the forum provided important cultural information, made suggestions about how to fill gaps, and appropriate/inappropriate locations for MPAs.
Sources in addition to interviews	[36,44]	[45–47]	[48,49]	[50,51]	[52,53]

options for decision makers to choose from. Interviewees who described the West Coast and Kaikōura processes, which did not include voting marine science representatives, raised concerns about the possibility that biodiversity trade-offs had been made in favour of social benefits such as undisturbed access to recreational or commercial fishing grounds. Processes that have both bottom-up and top-down support are preferred by one interviewee:

“The fact that the process started out from the bottom up was helpful - the willingness and keenness to do something came from the locals, it was their drive that made it happen, it was their ideas, their knowledge, they had ownership over the issues. But having ministerial support at the top was also key – once the recommendations went to government, supportive ministers just pushed it through.”

Interviewees felt that the MPA planning processes conducted in the last decade or so have been relatively well supported financially, although one interviewee pointed out that forums occasionally operate on tight budgets and rely on external grants to cover some costs. All interviewees felt that MPA planning processes could be further shortened, but not dramatically, due to the need to develop strong partnerships with tangata whenua and allow forums to build trust, develop a collective identity, and discuss forum plans with their wider stakeholder networks.

5. Discussion

Forum-style processes in Aotearoa NZ have improved the effectiveness of MPA planning and implementation to some extent across each of the following elements, reflecting principles for participatory processes derived from international best practice literature on MPA planning and implementation [Table 2].

5.1. Diverse and representative participation

Participation in MPA planning has evolved substantially in the last 30 years toward a more collaborative model, in line with the International Association for Public Participation (IAP2) participatory spectrum.⁵ Here, participation evolves from ‘informing’ and ‘consulting’ potentially only a narrow selection of pre-determined groups, into processes that ‘involve’ tangata whenua and stakeholder groups and require ‘collaborative’ processes where tangata whenua and stakeholders identify and consider alternative options and management approaches. The implementation of the MPA Policy further encouraged this progression by requiring collaborative MPPFs to develop MPA proposals. An increasing number and diversity of applicants/primary proponents of applications was observed over time [Table 4], although inconsistencies remain in the representation of relevant interests [Table 5]. MPA planning in Aotearoa NZ does not include ‘empower’ in the IAP2, as under current policies the Ministers for Conservation and Primary Industries jointly implement MPAs after recommendations by MPPFs.

Internationally, representative stakeholder involvement that incorporates affected indigenous peoples, diverse interest groups and the public is promoted for good planning, design, establishment, and management of marine protected areas [15,54–56]. This inclusive approach can offset opposition and reinforce the legitimacy of the reserve or network once established. For example, a lack of public participation in and acceptance of MPA proposals that were developed primarily using scientific input is frequently cited as a central reason for failed processes [57,58]. In Aotearoa NZ, an additional concern for tangata whenua is the potential erosion that MPA implementation may have on

customary and commercial assets and management options (e.g., kaimoana regulations, mātaaitai reserves) promised as a result of the Deed of Settlement and the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992 [59]. Similar concerns have consistently been raised elsewhere in the Pacific [60,61].

Data from this study supports claims that the inclusion of tangata whenua and a range of sector representatives in MPA planning produces less contentious proposals, as evidenced by fewer oppositional submissions when forum-style and MPPF processes are utilised [Fig. 3]. Numbers of submissions are not a perfect measure of support or objection to a proposal, but distinctions between the submissions made regarding non-forum versus forum-style and MPPF processes provides evidence of a large-scale pattern associated with the different approaches. Unfortunately, information was not available for submissions for most MPA processes; improved recording and accessibility of submissions would be useful in evaluating public support for future MPAs.

Forum membership can have a profound effect on the ways that MPAs are conceived of, developed, implemented, and valued. For example, the exclusion of marine science representatives from two of the forum processes (i.e., West Coast and Kaikōura) may have resulted in less-than ideal ecological outcomes regarding marine reserve placement, although this is difficult to definitively determine. Similarly, the inclusion of other relevant interests such as youth representatives [i.e., future generations, 62], a voice for the environment itself [i.e., Whanganui River, 63], representatives from land-based sectors [i.e., mountains to sea perspective, 64] and/or a broader conception of value that encompasses more than just extractive use [i.e., intangible and non-use values, 65] could lead to future MPA designations that prioritize more holistic agendas.

5.2. Best available information

There is widespread agreement that MPA design and implementation should be based on the ‘best available information’, which increasingly incorporates a range of information sources and knowledge systems [11,66,67]. This interpretation of ‘best available information’ has evolved in the context of collaborative or forum-style MPA planning processes where joint fact-finding, co-learning, and negotiated decision making are likely to occur. However, in more adversarial environmental planning processes, science and other kinds of information may be used to weaken the validity of competing interests [68], and scientific disagreements can then be misinterpreted to lack scientific rigor [69].

The experience of MPA planning in Aotearoa NZ provides a grounded example of the evolution from adversarial to collaborative approaches to MPA planning and associated interpretations of ‘best available information’. The Marine Reserves Act 1971 arranges information and interests in opposition to one another; the purpose of the Act is defined primarily in terms of scientific and natural values [s 1, 70], but objections are upheld based on non-scientific and non-ecological concerns such as the potential for undue interference with commercial fishing or rights of navigation [s 5 (6) (d), 70].

The purpose of the MPA Policy is similarly defined within the boundaries of conservation values, but it defines ‘best available information’ broadly as “the best information relating to ecological, environmental, social, cultural, and economic aspects of the marine environment that is available without unreasonable cost, effort, or time [18, p 19]”. This definition legitimises other kinds of information (beyond ecological or biophysical science) in the context of defining MPA components, thereby providing opportunities to illuminate other sets of values, highlight alternative areas for protection [66], or align previously mismatched scales in terms of data availability and questions being asked [e.g., Appendix D]. The inclusion of fisheries information [71], public preference data [72], and mātauranga Māori [64] may help forums to pinpoint mutually beneficial areas for protection, e.g., [73], but no single data set will be definitive.

⁵ http://c.yecd.com/sites/www.iap2.org/resource/resmgr/foundations_course/IAP2_P2_Spectrum_FINAL.pdf.

The creation of inter- and transdisciplinary processes and institutions such as collaborative forums that can accommodate multiple forms of information is a valuable step towards resolving potential conflicts [74]. Within these structures, the capacity to distinguish between disputes related to the content, meaning, and implications of information, and disputes that require the negotiation of interests and values, is likely to make conflict resolution more efficient [68]. For example, Type 1 MPAs could be perceived to be at odds with tangata whenua resource management practices and therefore may require a broader discussion about management goals and practices to gain support. Expanding the purpose of MPAs to include a more holistic conception of their role in supporting healthy marine social-ecological systems, and protection of social and cultural practices and values, would help to legitimise the incorporation of the ‘best available information’ from a variety of sources, and potentially alleviate conflicts and align goals.

5.3. Social learning and co-productive capacity

To sustain natural resources and maintain biodiversity, ecosystem dynamics must be considered in management; this requires the ability to observe, interpret, learn, and communicate about processes and variables [75,76]. Meanwhile, collective learning and actions are harnessed to understand and respond to environmental feedback and change at a variety of scales [77]; this is sometimes referred to as social learning [78] and co-productive capacity [79]. Co-productive capacity – the utilisation of scientific and other knowledges, governance capability, and institutional relationships that effect social transformation [79], is developed to some degree over the course of any MPA planning process. MPA applicants and forum members who invest time and effort to work across institutional, cultural, disciplinary, and other boundaries are developing their co-productive capacities.

Social learning and the development of co-productive capacity among participants and wider communities can occur under the Marine Reserves Act, but the MPA Policy provides more obvious support for these practices. For example, [Table 4] illustrates the emergence of more inclusive forum structures under the MPA Policy that incorporate a range of sectors into planning. Similarly, the MPA Policy seeks contributions from diverse knowledge sources, rather than solely biological and fisheries sciences, to define appropriate MPA boundaries [Table 6]. Interviewees described instances in which forum processes created opportunities for multi-directional learning to occur – for example when local knowledge was used to update gaps in national-scale data and redefine proposed MPA boundaries.

Results from this study indicate that trust building is an essential part of the MPA planning process and that it takes time for participants to develop trust. Trust has been identified as essential to management and governance approaches that address complex problems [80], primarily because trust enables collaboration [81], and trusted social networks are a conduit for information [82]. Additionally, the opportunity to improve the welfare of all parties involved is a critical element of trust [83]. Successful co-management therefore invariably involves long periods of relationship and trust building [80,84].

As forums co-produce MPA recommendations or proposals, these factors combine to enable collective learning and support capacity building so that groups can respond to changing circumstances [85,86]. The co-production process may also improve network connectivity [87] by creating feedback loops between forum members and their constituents. These encounters are not always formalised, however, and therefore occur to varying degrees across processes. Future work could utilise social network analysis to facilitate the spread of social learning and capacity building across a greater range of networks [88,89]. Additional challenges to overcome include the limited capacity and resources of many MPA planning participants [90], and the varying degrees of power, legitimacy and authority associated with certain types of knowledge, which must be carefully negotiated [91]. In recent years,

the former burden has been recognised in Aotearoa NZ, and participants are now often compensated for time and travel. The latter challenge can be addressed in part through the early identification of information needs, conflict resolution processes, and agreement on how sensitive information will be handled.

5.4. Fair and respectful process

Participatory process outcomes are sensitive to the way in which they are conducted [92]; fair and respectful processes allow all participants to contribute to the proceedings and develop trust and confidence in the outcomes. Formal participatory MPA processes have evolved to become more fair and respectful of participants by requiring early and ongoing collaboration with tangata whenua and relevant stakeholders, which both socialises MPAs and develops trust among groups [93,94].

A meaningful influence over decisions has been described as a crucial element of any fair and respectful MPA planning process [91]. MPA planning in Aotearoa NZ could improve here, as the impasses identified by some interviewees were perceived to reinforce existing power and representation imbalances within the group and lead to the under-valuing of some interests and disharmony overall [91]. For example, in some processes, participants representing commercial and recreational fishing interests outweigh other interests [44]. The exclusion of certain perspectives could lead to MPA boundaries not being respected, MPA areas not protecting enough representative habitat to provide conservation outcomes in alignment with CBD goals, or could infringe on the customary or commercial rights of tangata whenua. Missing or undervalued perspectives may also undermine long-term effectiveness, including the social legitimacy of an MPA [54]. Importantly, the rights of tangata whenua as indigenous people and Treaty partners, rather than as one of many interests, need to be accounted for in all aspects of MPA planning in Aotearoa NZ. The pivotal role of indigenous people in MPA planning has been recognised elsewhere [90] but is seldom realized.

Empowering forums to continue discussions until they reach consensus and avoid using voting processes to force decisions on challenging issues may help to avoid marginalising tangata whenua and stakeholders, but this approach is likely to impact process timeframes. Where MPA planning and implementation processes are supported by both bottom-up (i.e., locally driven) and top-down (i.e., legal mandate) proceedings, they may progress with some improved decision-making efficiencies. Facilitation that enables respectful and inclusive discourse can bring a diverse group of stakeholders toward shared objectives and the pursuit of mutual gain [95,96], which closely aligns with the establishment of meaningful participant influence over decisions.

Other improvements to participatory MPA planning could include systematic, multi-scale assessments of economic, social and cultural reliance on marine resources of the proposed management area [13]. Degraded environments and the erosion of customary practices can have negative effects on tangata whenua, especially on their role as kaitiaki and associated values such as kaitiakitanga and manaakitanga [5,64,97,98]. A formal assessment process that includes culturally appropriate indicators [99] could also inform decisions with respect to the equity of MPA boundaries and neighbouring customary management areas. This process could be particularly useful in highly contentious areas where MPA contributions to poverty alleviation and sustainable development are at odds [100].

Studies suggest that under certain conditions, MPAs can provide both biodiversity and social benefits [101,102], while under others, trade-offs are made between these [103]. Interviewees described these kinds of compromises as an integral part of forum negotiations, but no formal socio-economic or cultural assessments of indicators such as livelihoods or well-being were conducted. Without a convincing explanation for variations in social and biological performance, MPA policies can be developed in ignorance of who the beneficiaries and

benefactors will be [100,104]. This is a significant gap in our knowledge of MPA implementation that may have far-reaching implications for tangata whenua, as Treaty partners, in particular. In future efforts, MPA network planning could be designed with social performance goals, for example to improve wellbeing through poverty alleviation and support sustainable development through connecting no-take areas with other aligned marine resource uses or coastal development (e.g., tourism).

5.5. Efficient administration

As participation in MPA planning has evolved, process administration has gained increasing importance. Transparency is a key factor, with participatory planning literature calling for stakeholders and indigenous peoples interested in MPA planning to have access to clear information about rules, decisions, performance, and accountability [90]. Adequate financial support and resources for MPA planning have also been highlighted as a factor in implementation and should be considered from the early stages of project development [31]. While some of this information is available piecemeal within project reports, minutes, websites and newsletters, processes do not yet have a clear format for sharing these details with the public. This gap was illustrated when we attempted to compile this information during Phase Two of this research. In particular, the cost of MPA planning is difficult to ascertain and should be more closely monitored in the future to help provide a full cost account of MPA planning processes and associated efficiencies and trade-offs.

Efficiency, in either time spent or size of area protected, does not necessarily equate to effective biodiversity protection. One example from Australia demonstrates how a quickly accepted MPA has provided little protection from resource use [105]; similar findings have been associated with the Benthic Protection Areas in Aotearoa NZ [106]. As one of many factors, however, efficiency can be useful to consider regarding the development and implementation stages of MPA planning. Our analysis shows that over time, some efficiencies related to the area allocated for protection have improved, but not significantly. This could be a factor to consider in terms of future indicators of MPA forum success rates.

Arguably, the utilisation of the biogeographic region approach implemented in the MPA Policy has encouraged systematic efforts to fill identified gaps in MPA representation (e.g., Subantarctic Islands, West Coast South Island, Southern, where there were previously few or no MPAs). Recent MPAs are also more likely to be part of a ‘network’ of MPAs [Table 4], but MPAs established after the MPA Policy was implemented are, on average, just over half the size of those implemented prior [Table 3]. The high variability in MPA sizes highlights the challenge of making simplistic comparisons based on summary data and renders these kinds of comparisons inadequate.

In terms of time efficiency, there is evidence to indicate that collaborative MPA processes in Aotearoa NZ may have resulted in less time being invested in both the development and implementation stages [Fig. 4], but this is not based on an exhaustive dataset. Additionally, many of the MPAs proposed prior to the MPA Policy were pioneering efforts and therefore key to socialising MPAs within local, regional, and national networks. The tendency towards shorter process and implementation timeframes [e.g., Fig. 4] can likely be attributed in part to this earlier work, but this element of the process is hard to quantify. It was generally agreed that while timeframes should be clearly established at the start of the planning process, they need to remain flexible [33].

6. Conclusions

This paper has interrogated MPA planning processes in Aotearoa NZ, with a focus on the role of participation and collaboration in the implementation of MPAs. Our analysis has shown that MPA planning in

Aotearoa NZ has evolved from previously adversarial processes into more collaborative ones that are accompanied by improvements in efficiency and broad support for MPA implementation. These benefits can largely be traced to the increasingly inclusive and holistic decision-making processes utilised by tangata whenua and stakeholder forums. The implementation of the MPA Policy in 2005 and the associated implementation guidelines in 2008 has been instrumental in supporting this evolution. Several areas for improvement in future evolutions of MPA planning have also emerged from this research. These centre primarily on the need to consider the role of MPAs within a holistic social-ecological systems framework, rather than just as a biodiversity protection tool. This approach would create more opportunities for tangata whenua and stakeholders to connect their values and knowledge to MPA planning processes and provide a shared mandate for implementation. Key improvements applicable to both national and international MPA processes are:

- The need for broader participation that is more inclusive and balanced than a set of pre-determined sectoral interests;
- Better understanding of drivers for tangata whenua participation, and incorporation of indigenous knowledge to inform MPA decision making;
- Inclusion of socio-economic and cultural information in MPA decision making that may reduce the adversarial nature of MPA processes through recognition of multiple values;
- The need to consider social learning elements such as time to build trust and establish shared understanding; and
- The need to resource processes to ensure representation, participation and independent facilitation.

Combined, these recommendations represent a broader conceptualisation of MPA values that encompass more than just biodiversity conservation or extractive use, and potentially redefine how MPAs are conceived of, developed, implemented and valued in the future.

Acknowledgements

Special thanks to D. Freeman, A. Baxter, K. Blakemore, G. Funnell, and D. Neale for reviewing this paper. Many thanks also to K. May, E. Williams and P. Blackett for feedback, to K. Montgomery and C. Muller for assistance with data collection and figures, and to B. Davies and R. Bulmer for statistical support. Funding for this project was provided by the Ministry of Business, Innovation and Employment strategic funding project COME1701.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.marpol.2018.03.025>.

References

- [1] B.S. Halpern, S. Walbridge, K.A. Selkoe, C.V. Kappel, F. Micheli, C. D'Agrosa, J.F. Bruno, K.S. Casey, C. Ebert, H.E. Fox, R. Fujita, D. Heinemann, H.S. Lenihan, E.M.P. Madin, M.P. Perry, E.R. Selig, M. Spalding, R. Steneck, R.T. Watson, A global map of human impact on marine ecosystems, *Science* 319 (5865) (2008) 948–952, <http://dx.doi.org/10.1126/science.1149345>.
- [2] H.E. Fox, M.B. Mascia, X. Basurto, A. Costa, L. Glew, D. Heinemann, L.B. Karrer, S.E. Lester, A. Lombana, R. Pomeroy, C.A. Recchia, C. Roberts, J.N. Sanchirico, L. P.-S. A. White, Reexamining the science of marine protected areas: linking knowledge to action, *Conserv. Lett.* 5 (2012) 1–10, <http://dx.doi.org/10.1111/j.1755-263X.2011.00207.x>.
- [3] M. Voyer, W. Gladstone, H. Goodall, Methods of social assessment in marine protected area planning: is public participation enough? *Mar. Policy* 36 (2) (2012) 432–439, <http://dx.doi.org/10.1016/j.marpol.2011.08.002>.
- [4] T.M. Tau, A. Goodall, D. Palmer, R. Tau, *Te Whakatau Kaupapa: ngāi Tahu Resource Management Strategy for the Canterbury Region*, Aoraki Press, Wellington, New Zealand, 1992.

- [5] R. Mules, Kā Uri ā Papatūānuku: an investigation of pre-contact resource management in Te Wāi Pounamu. (Bachelor of Arts), University of Otago, Dunedin, 2007 (Retrieved from), <<http://hdl.handle.net/10523/5161>>.
- [6] R.E. Johannes, The renaissance of community-based marine resource management in Oceania, *Ann. Rev. Ecol. Syst.* 33 (2002) 317–340, <http://dx.doi.org/10.1146/annurev.ecolsys.33.010802.150524>.
- [7] A.T. White, C.A. Courtney, A. Salamanca, Experience with marine protected area planning and management in the Philippines, *Coast. Manag.* 30 (2002) 1–26, <http://dx.doi.org/10.1080/08920750252692599>.
- [8] M. Sowman, S. Raemaekers, J.A. Sunde, A Short Guide to Integrating Human Dimensions into MPA Planning and Management, WWF-SA, Cape Town, 2014.
- [9] A. Scholz, K. Bonzon, R. Fujita, N. Benjamin, N. Woodling, P. Black, C. Steinback, L. Easterbrook, Participatory socioeconomic analysis: drawing on fishermen's knowledge for marine protected area planning in California, *Mar. Policy* 28 (4) (2004) 335–349, <http://dx.doi.org/10.1016/j.marpol.2003.09.003>.
- [10] RAC/SPA, IUCN-Med, Stakeholder Participation Toolkit for Identification, Designation and Management of Marine Protected Areas, Regional Activity Centre for Specially Protected Areas (RAC/SPA) & International Union for Conservation of Nature – Centre for Mediterranean Cooperation (IUCN-Med), Tunis, 2013 (Retrieved from), <http://www.rac-spa.org/sites/default/files/mpa_stakeholder_toolkit.pdf>.
- [11] C.M. Roberts, S. Andelman, G. Branch, R.H. Bustamante, J.C. Castilla, J. Dugan, B.S. Halpern, K.D. Lafferty, H. Leslie, J. Lubchenco, D. McArdle, H.P. Possingham, M. Ruckelshaus, R.R. Warner, Ecological criteria for evaluating candidate sites for marine reserves, *Ecol. Appl.* 13 (1) (2003) S199–S214 <<http://www.jstor.org/stable/3100008>>.
- [12] National Research Council, Marine Protected Areas: Tools for Sustaining Ocean Ecosystems, Committee on the Evaluation Design and Monitoring of Marine Reserves and Protected Areas in the United States, Ocean Studies Board, Washington DC, 2001 (Retrieved from), <<http://www.nap.edu/catalog/9994.html>>.
- [13] C.N. Ehler, F. Douvère, Marine spatial planning: a step-by-step approach towards ecosystem-based management, International Oceanographic Commission, Paris, 2009 (Retrieved from), <<http://unesdoc.unesco.org/images/0018/001865/186559e.pdf>>.
- [14] B.G. Blount, A. Pitchon, An anthropological research protocol for marine protected areas: creating a Niche in a Multidisciplinary Cultural Hierarchy, *Human. Organ.* 66 (2007) 103–111, <http://dx.doi.org/10.17730/humo.66.2.03380411153q50g6>.
- [15] M.B. Mascia, The human dimension of coral reef marine protected areas: recent social science research and its policy implications, *Conserv. Biol.* 17 (2003) 630–632, <http://dx.doi.org/10.1046/j.1523-1739.2003.01454.x>.
- [16] P. Suuronen, P. Jounela, V. Tschernij, Fishermen responses on marine protected areas in the Baltic cod fishery, *Mar. Policy* 34 (2010) 237–243, <http://dx.doi.org/10.1016/j.marpol.2009.07.001>.
- [17] D. Symes, E. Hoefnagel, Fisheries policy, research and the social sciences in Europe: challenges for the 21st century, *Mar. Policy* 34 (2010) 268–275, <http://dx.doi.org/10.1016/j.marpol.2009.07.006>.
- [18] Department of Conservation, Ministry of Fisheries, Marine Protected Areas: policy and Implementation Plan, Department of Conservation and Ministry of Fisheries, Wellington, New Zealand, 2005.
- [19] Ministry of Fisheries, Department of Conservation, Marine protected areas: classification, protection standard and implementation guidelines, Ministry of Fisheries and Department of Conservation, Wellington, New Zealand, 2008.
- [20] Department of Conservation, Ministry for the Environment, The New Zealand Biodiversity Strategy - our chance to turn the tide, Department of Conservation and Ministry for the Environment, Wellington, New Zealand, 2000.
- [21] Secretariat of the Convention on Biological Diversity, Technical advice on the establishment and management of a national system of marine and coastal protected areas. (CBD Technical Series no. 13), Secretariat of the Convention on Biological Diversity, 2004 (Retrieved from), <http://www.marinenz.org.nz/documents/cbd_tech_bulletin_no_13_2004.pdf>.
- [22] Department of Conservation, Ministry of Fisheries, Coastal marine habitats and marine protected areas in the New Zealand Territorial Sea: a broad scale gap analysis. Wellington, New Zealand, 2011.
- [23] D.P. Tittensor, M. Walpole, S.L.L. Hill, D.G. Boyce, G.L. Britten, N.D. Burgess, S.H.M. Butchart, P.W. Leadley, E.C. Regan, R. Alkemade, R. Baumung, C. Bellard, L. Bouwman, N.J. Bowles-Newark, A.M. Chenery, W.W.L. Cheung, V. Christensen, H.D. Cooper, A.R. Crowther, M.J.R. Dixon, A. Galli, V. Gaveau, R.D. Gregory, N.L. Gutierrez, T.L. Hirsch, R. Höft, S.R. Januchowski-Hartley, M. Karmann, C.B. Krug, F.J. Leverington, J. Loh, R.K. Lojenga, K. Malsch, A. Marques, D.H.W. Morgan, P.J. Mumby, T. Newbold, K. Noonan-Mooney, S.N. Pagad, B.C. Parks, H.M. Pereira, T. Robertson, C. Rondinini, L. Santini, J.P.W. Scharlemann, S. Schindler, U.R. Sumaila, L.S.L. Teh, J. van Kolck, P. Visconti, Y. Ye, A mid-term analysis of progress toward international biodiversity targets, *Science* 346 (6206) (2014) 241–244, <http://dx.doi.org/10.1126/science.1257484>.
- [24] J. Day, N. Dudley, M. Hockings, G. Holmes, D. Laffoley, S. Stolton, S. Wells, Guidelines for applying the IUCN Protected Area Management Categories to Marine Protected Areas, IUCN, Gland, Switzerland, 2012 (Retrieved from), <<https://www.iucn.org/content/guidelines-applying-iucn-protected-area-management-categories-marine-protected-areas-0>>.
- [25] S. Awatere, G. Harmsworth, Ngā Aroturukitanga tika mō ngā Kaitiaki: summary review of mātauranga Māori frameworks, approaches, and culturally appropriate monitoring tools for management of mahinga kai, Landcare Research, University of Waikato, 2014, p. 45.
- [26] C. Wilson, Māori Methods and Indicators for Marine Protection: summary of Research Findings, Ngati Kere, Ngati Konohi, Ministry for the Environment, Department of Conservation, Wellington, New Zealand, 2007.
- [27] Fisheries Act, 1996.
- [28] Fisheries (Kaimoana Customary Fishing) Regulations, 1998.
- [29] Fisheries (South Island Customary Fishing) Regulations, 1999.
- [30] A. Jackson, Ki Uta Ki Tai: He Taoka Tuku Iho. (Doctor of Philosophy), University of Otago, Dunedin, 2011.
- [31] C. Lundquist, K. Davies, L. McCartain, Best practice guidelines for marine protected area network design and evaluation, National Institute of Water & Atmospheric Research, New Zealand, 2015.
- [32] T.M. Dalton, Beyond biogeography: a framework for involving the Public in planning of US marine protected areas, *Conserv. Biol.* 19 (5) (2005) 1392–1401, <http://dx.doi.org/10.1111/j.1523-1739.2005.00116.x>.
- [33] M. Osmond, S. Airame, M.R. Caldwell, J.C. Day, Lessons for marine conservation planning: a comparison of three marine protected area planning processes, *Ocean Coast. Manag.* 53 (2010) 41–51, <http://dx.doi.org/10.1016/j.ocecoaman.2010.01.002>.
- [34] K. Davies, Many voices of the Manukau: participatory modelling, ecosystem services and decision making in New Zealand (Doctor of Philosophy), The University of Auckland, Auckland, New Zealand, 2015.
- [35] S.D. Brody, An evaluation of the establishment processes for Marine Protected Areas in the Gulf of Maine: understanding the Role of Community Involvement and Public Participation, Marine State Planning Office, Gulf of Maine Council on the Marine Environment, Augusta, Maine, 1998.
- [36] L. Teirney, Fiordland marine conservation strategy, Guardians of Fiordland, 2003.
- [37] Ministry for Primary Industries and Department of Conservation, Implementing key components of the Kaikōura Marine Strategy: Regulatory Impact Statement, 2013.
- [38] K. Mulcahy, R. Peart, A. Bull, Sub-Antarctic Marine Protection Planning Forum, Safeguarding our oceans: strengthening marine protection in New Zealand, Environmental Defence Society, Auckland, N.Z., 2012.
- [39] West Coast marine reserves approved, Radio New Zealand, 2013.
- [40] Director-General of Conservation, Aotea (Great Barrier) Marine Reserve Application: an application by the Director-General of Conservation, Department of Conservation, Auckland Conservancy, 2004.
- [41] Director-General of Conservation and the Whakaari Marine Protection Steering Committee, Answer to Objections to the Te Paepae Aotea (Volkner Rocks) Marine Reserve Application, 2003.
- [42] A. Manirakiza, Proposed Wellington South Coast Marine Reserve (Taputeranga Marine Reserve): towards Increasing Community Support. (Master of Development Studies), Victoria University of Wellington, Wellington, NZ, 2004.
- [43] Kamo High School Year 13 Geography Class, Applicants Report on Submissions to the Whangarei Harbor Marine Reserve Application, 2002.
- [44] K. Mulcahy, R. Peart, A. Bull, Fiordland Marine Guardians, Safeguarding our oceans: strengthening marine protection in New Zealand, Environmental Defence Society, Auckland, N.Z., 2012.
- [45] Subantarctic Marine Protection Planning Forum. Implementation of the marine protected areas policy in the territorial sea of the subantarctic biogeographic region of New Zealand: Consultation document.: Retrieved from <<http://www.marinenz.org.nz/documents/subantarctics-mpa-policy-consultation-document.pdf>>.
- [46] Department of Conservation and the Ministry of Fisheries, Regulatory Impact Statement: Subantarctic Islands Marine Protected Areas: Subantarctic Islands Marine Reserves Bill and accompanying Fisheries Act measures, 2009.
- [47] J.D. Booth, The marine ecosystem of New Zealand's subantarctic islands and their surrounding plateaus, National Institute of Water and Atmospheric Research, Wellington, New Zealand, 2004.
- [48] West Coast Marine Protection Forum, West Coast Marine Protection Forum Recommendation Report, 2010.
- [49] D. Neal, N.B. Pindur, M.C. Reedy, B. Watson, The West Coast Marine and Coastal Environment: an initial report for the West Coast Marine Protection Forum, West Coast Marine Protection, Hokitika, New Zealand, 2008 (Forum Retrieved from), <http://ref.coastalrestorationtrust.org.nz/site/assets/files/3205/neale_d_2007_wcmarineandcoastalenvironment.pdf>.
- [50] Te Korowai o Te Tai ō Marokura Kaikōura Coastal Marine Guardians, Kaikōura Marine Strategy: Sustaining Our Sea Kaikōura: Te Korowai o Te Tai ō Marokura Kaikōura Coastal Marine Guardians, 2012.
- [51] Te Korowai o Te Tai ō Marokura Kaikōura Coastal Marine Guardians, Kaikōura Coastal Marine Values and Uses: A Characterisation Report, Revised Second edition, Te Korowai o Te Tai ō Marokura Kaikōura Coastal Marine Guardians, Kaikōura, 2008.
- [52] South-East Marine Protection Forum Roopu Manaaki Ki Te Toka, For Consultation: proposed Marine Protected Areas for New Zealand's South Island South-East Coast, South-East Marine Protection Forum Roopu Manaaki Ki Te Toka, Dunedin, New Zealand, 2016 (Retrieved from), <<https://south-eastmarine.org.nz/yoursay/consultation/>>.
- [53] South-East Marine Protection Forum Roopu Manaaki Ki Te Toka, Proposed Marine Protected Areas for New Zealand's South Island South-East Coast: supporting Information for the Public Consultation Document, South-East Marine Protection Forum Roopu Manaaki Ki Te Toka, Dunedin, New Zealand, 2016 (Retrieved from), <<https://south-eastmarine.org.nz/yoursay/consultation/>>.
- [54] C.J. Lundquist, E.F. Granek, Strategies for successful marine conservation: integrating socioeconomic, political, and scientific factors, *Conserv. Biol.* 19 (6) (2005) 1771–1778, <http://dx.doi.org/10.1111/j.1523-1739.2005.00279.x>.
- [55] M.S. Reed, A. Graves, N. Dandy, H. Posthumus, K. Hubacek, J. Morris, C. Prell, C.H. Quinn, L.C. Stringer, Who's in and why? A typology of stakeholder analysis

- methods for natural resource management, *J. Environ. Manag.* 90 (5) (2009) 1933–1949, <http://dx.doi.org/10.1016/j.jenvman.2009.01.001>.
- [56] ISRS, Marine protected areas (MPAs) in management of coral reefs (Briefing Paper 1), International Society for Reef Studies, 2004.
- [57] M. Gleason, E. Fox, S. Ashcraft, J. Vasques, E. Whiteman, P. Serpa, E. Saarman, M. Caldwell, A. Frimodig, M. Miller-Henson, J. Kirilin, B. Ota, E. Pope, M. Weber, K. Wiseman, Designing a network of marine protected areas in California: achievements, costs, lessons learned, and challenges ahead, *Ocean Coast. Manag.* 74 (0) (2013) 90–101, <http://dx.doi.org/10.1016/j.ocecoaman.2012.08.013>.
- [58] C.M. Weible, Caught in a maelstrom: implementing California marine protected areas, *Coast. Manag.* 36 (4) (2008) 350–373, <http://dx.doi.org/10.1080/08920750802266387>.
- [59] Treaty of Waitangi (Fisheries Claims) Settlement Act, 1992.
- [60] J.E. Cinner, S. Aswani, Integrating customary management into marine conservation, *Biol. Conserv.* 140 (3) (2007) 201–216, <http://dx.doi.org/10.1016/j.biocon.2007.08.008>.
- [61] S. Foale, B. Manele, Social and political barriers to the use of Marine Protected Areas for conservation and fishery management in Melanesia, *Asia Pac. Viewp.* 45 (3) (2004) 373–386, <http://dx.doi.org/10.1111/j.1467-8373.2004.00247.x>.
- [62] K.S. Ekele, Constitutional experiments: representing future generations through submajority rules, *J. Political Philos.* 17 (4) (2009) 440–461, <http://dx.doi.org/10.1111/j.1467-9760.2008.00328.x>.
- [63] Te Awa Tupua (Whanganui River Claims Settlement) Act, 2017.
- [64] G. Tipa, G. Harmsworth, E. Williams, J. Kitson, Integrating mātauranga Māori into freshwater management, planning and decision making (bookprinting.co.nz), in: P. Jellyman, T. Davie, C. Pearson, J. Harding (Eds.), *Advances in New Zealand Freshwater Science*, New Zealand Hydrological Society Inc., New Zealand Limnological Society Inc., 2016, pp. 613–632.
- [65] K.M.A. Chan, T. Satterfield, J. Goldstein, Rethinking ecosystem services to better address and navigate cultural values, *Ecol. Econ.* 74 (2012) 8–18, <http://dx.doi.org/10.1016/j.ecolecon.2011.11.011>.
- [66] S.C. Klain, K.M.A. Chan, Navigating coastal values: participatory mapping of ecosystem services for spatial planning, *Ecol. Econ.* 82 (2012) 104–113, <http://dx.doi.org/10.1016/j.ecolecon.2012.07.008>.
- [67] C.J. Klein, A. Chan, L. Kircher, A.J. Cundiff, N. Gardner, Y. Hrovat, A. Scholaz, B.E. Kendall, S. Airamé, Striking a balance between biodiversity conservation and socioeconomic viability in the design of marine protected areas, *Conserv. Biol.* 22 (3) (2008) 691–700, <http://dx.doi.org/10.1111/j.1523-1739.2008.00896.x>.
- [68] R.A. Clapp, C. Mortenson, Adversarial science: conflict resolution and scientific review in British Columbia's central coast, *Soc. Nat. Resour.* 24 (9) (2011) 902–916, <http://dx.doi.org/10.1080/08941921003801505>.
- [69] E. Saarman, M. Gleason, J. Ugoretz, S. Airamé, M. Carr, E. Fox, A. Frimodig, T. Mason, J. Vasques, The role of science in supporting marine protected area network planning and design in California, *Ocean Coast. Manag.* 74 (2013) 45–56, <http://dx.doi.org/10.1016/j.ocecoaman.2012.08.021>.
- [70] Marine Reserves Act, 1971.
- [71] R.E. Johannes, The case for data-less marine resource management: examples from tropical nearshore finfisheries, *Trends Ecol. Evol.* 13 (1998) 243–246, [http://dx.doi.org/10.1016/S0169-5347\(98\)01384-6](http://dx.doi.org/10.1016/S0169-5347(98)01384-6).
- [72] S. Chhun, V. Kahui, H. Moller, P. Thorsnes, Advancing marine policy toward ecosystem-based management by eliciting public preferences, *Mar. Resour. Econ.* 30 (3) (2015) 261–275, <http://dx.doi.org/10.1086/681052>.
- [73] J. Leathwick, A. Moilanen, M. Francis, J. Elith, P. Taylor, K. Julian, T. Hastie, C. Duffy, Novel methods for the design and evaluation of marine protected areas in offshore waters, *Conserv. Lett.* 1 (2008) 91–102, <http://dx.doi.org/10.1111/j.1755-263X.2008.00012.x>.
- [74] S. Dovers, Embedded Scales: interdisciplinary and Institutional Issues, in: V.A. Brown, J.A. Harris, J.Y. Russell (Eds.), *Tackling Wicked Problems: Through the Transdisciplinary Imagination*, Earthscan, London, 2010.
- [75] S.R. Carpenter, B.H. Walker, J.M. Anderies, N. Abel, From metaphor to measurement: resilience of What to What? *Ecosystems* 4 (2001) 765–781, <http://dx.doi.org/10.1007/s10021-001-0045-9>.
- [76] F. Berkes, C. Folke, J. Colding, Ecological practices and social mechanisms, in: F. Berkes, C. Folke, J. Colding (Eds.), *Linking Social and Ecological Systems: Management practices and social mechanisms for building resilience*, Cambridge University Press, Cambridge, 1998.
- [77] C. Folke, T. Hahn, P. Olsson, J. Norberg, Adaptive governance of social-ecological systems, *Annu. Rev. Environ. Resour.* 30 (2005) 441–473, <http://dx.doi.org/10.1146/annurev.energy.30.050504.144511>.
- [78] M.S. Reed, A.C. Evely, G. Cundill, I. Fazey, J. Glass, A. Laing, J. Newig, B. Parrish, C. Prell, C.M. Raymond, L.C. Stringer, What is social learning? *Ecol. Soc.* 15 (4) (2010) r1.
- [79] L.E. Van Kerkhoff, L. Lebel, Coproductive capacities: rethinking science-governance relations in a diverse world, *Ecol. Soc.* 20 (1) (2015) 14, <http://dx.doi.org/10.5751/ES-07188-200114>.
- [80] L. Lebel, J.M. Anderies, B. Campbell, C. Folke, S. Hatfield-Dodds, T.P. Hughes, J. Wilson, Governance and the Capacity to Manage Resilience in Regional Social-Ecological Systems, *Ecol. Soc.* 11 (1) (2006) 19 <<https://www.ecologyandsociety.org/vol11/iss1/art19/>>.
- [81] P. Olsson, C. Folke, F. Berkes, Adaptive comanagement for building resilience in social-ecological systems, *Environ. Manag.* 34 (1) (2004) 75–90, <http://dx.doi.org/10.1007/s00267-003-0101-7>.
- [82] M.S. Carolan, Social change and the adoption and adaptation of knowledge claims: whose truth do you trust in regard to sustainable agriculture? *Agric. Human. Values* 23 (2006) 325–339, <http://dx.doi.org/10.1007/s10460-006-9006-4>.
- [83] E. Ostrom, T.K. Ahn, The meaning of social capital and its link to collective action, in: G.T. Svendsen, G.L. Svendsen (Eds.), *Handbook of Social Capital: The Troika of Sociology, Political Science, and Economics*, Edward Elgar Publishing, Northampton, Massachusetts, 2009.
- [84] J. Pretty, H. Ward, Social Capital and the Environment, *World Dev.* 29 (2) (2001) 209–227, [http://dx.doi.org/10.1016/S0305-750X\(00\)00098-X](http://dx.doi.org/10.1016/S0305-750X(00)00098-X).
- [85] P. Beier, L.J. Hansen, L. Helbrecht, D. Behar, A how-to guide for coproduction of actionable, Sci., *Conserv. Lett.* 10 (3) (2016) 288–296, <http://dx.doi.org/10.1111/conl.12300>.
- [86] M.J. Colloff, S. Lavorel, L.E. van Kerkhoff, C. Wyborn, I. Fazey, R. Gordard, G.M. Mace, W.B. Foden, M. Dunlop, I.C. Prentice, J. Crowley, P. Leadley, P. Degeorges, Transforming conservation science and practice for a postnormal world, *Conserv. Biol. Early View* (2017), <http://dx.doi.org/10.1111/cobi.12912>.
- [87] A.H. Toomey, A.T. Knight, J. Barlow, Navigating the space between research and implementation in conservation, *Conserv. Lett. Early View* (2017), <http://dx.doi.org/10.1111/conl.12315>.
- [88] D.J. Watts, S.H. Strogatz, Collective dynamics of 'small-world' networks, *Nature* 393 (1998) 440–442, <http://dx.doi.org/10.1038/30918>.
- [89] M.S. Granovetter, The strength of weak ties, *Am. J. Sociol.* 78 (6) (1973) 1360–1380.
- [90] J.M. Burt, P. Akins, E. Latham, M. Beck, A.K. Salomon, N.C. Ban, Marine protected area network design features that support resilient human-ocean systems - Applications for British Columbia, Canada, Simon Fraser University, British Columbia, Canada, 2014.
- [91] J.V. López-Baao, G. Chapron, A. Treves, The Achilles heel of participatory conservation, *Biol. Conserv.* 212 (2017) 139–143, <http://dx.doi.org/10.1016/j.biocon.2017.06.007>.
- [92] M.S. Reed, Stakeholder participation for environmental management: a literature review, *Biol. Conserv.* 141 (2008) 2417–2431, <http://dx.doi.org/10.1016/j.biocon.2008.07.014>.
- [93] C.F. Gaymer, A.V. Stadel, N.C. Ban, P.F. Cárcamo, J. Ierna, L.M. Lieberknecht, Merging top-down and bottom-up approaches in marine protected areas planning: experiences from around the globe, *Aquat. Conserv.: Mar. Freshw. Ecosyst.* 24 (S2) (2014) 128–144, <http://dx.doi.org/10.1002/aqc.2508>.
- [94] IUCN World Commission on Protected Areas (IUCN-WCPA), Establishing marine protected area networks - making it happen. Washington, D.C, 2008.
- [95] K.A. Johnson, G. Dana, N.R. Jordan, K.J. Draeger, A. Kapuscinski, L.K. Schmitt Olabisi, P.B. Reich, Using participatory scenarios to stimulate Social learning for collaborative, *Sustain. Dev., Ecol. Soc.* 17 (2) (2012) 9 <<https://www.ecologyandsociety.org/vol17/iss2/art9/>>.
- [96] M. Gleason, S. McCreary, M. Miller-Henson, J. Ugoretz, E. Fox, M. Merrifield, W. McClintock, P. Serpa, K. Hoffman, Science-based and stakeholder-driven marine protected area network planning: a successful case study from north central California, *Ocean Coast. Manag.* 53 (2) (2010) 52–68, <http://dx.doi.org/10.1016/j.ocecoaman.2009.12.001>.
- [97] A. McCarthy, C. Hepburn, N. Scott, K. Schweikert, R. Turner, H. Moller, Local people see and care most? Severe depletion of inshore fisheries and its consequences for Māori communities in new Zealand, *Aquat. Conserv.: Mar. Freshw. Ecosyst.* 24 (3) (2014) 369–390, <http://dx.doi.org/10.1002/aqc.2378>.
- [98] J. Dick, J. Stephenson, R. Kirikiri, H. Moller, R. Turner, Listening to the Kaitiaki: consequences of the loss of abundance and biodiversity of coastal ecosystems in Aotearoa new Zealand, *MAI J.* 1 (2) (2012) 14.
- [99] G. Tipa, L. Teirney, A Cultural Health Index for Streams and Waterways: A tool for nationwide use Ministry for the Environment Retrieved from <<https://mfe.govt.nz/sites/default/files/cultural-health-index-for-streams-and-waterways-tech-report-apr06.pdf>>, 2006.
- [100] L. Glew, M.B. Mascia, F. Pakiding, Solving the mystery of MPA performance: monitoring social impacts, WWF, Washington DC, 2012.
- [101] C. Leisher, P. van Beukering, L.M. Scherl, Nature's investment bank: how marine protected areas contribute to poverty reduction, The Nature Conservancy, Arlington, Virginia, U.S.A, 2007.
- [102] G.R. Russ, A.C. Alcalá, A.P. Maypa, H.P. Calumpong, A.T. White, Marine reserve benefits local fisheries, *Ecol. Appl.* 14 (2) (2004) 597–606, <http://dx.doi.org/10.1890/03-5076>.
- [103] P. Christie, Marine Protected Areas as Biological Successes and Social Failures in Southeast Asia (Paper presented at the), American Fisheries Society Symposium, 2004.
- [104] A. Agrawal, K.H. Redford, Poverty, development and biodiversity conservation: shooting in the dark? (Working Paper No. 26), Wildlife Conservation Society, New York, 2006.
- [105] L.M. Barr, H.P. Possingham, Are outcomes matching policy commitments in Australian marine conservation planning? *Mar. Policy* 42 (2013) 39–48, <http://dx.doi.org/10.1016/j.marpol.2013.01.012>.
- [106] J. Helson, S. Leslie, G. Clement, R. Wells, R. Wood, Private rights, public benefits: industry-driven seabed protection, *Mar. Policy* 34 (3) (2010) 557–566, <http://dx.doi.org/10.1016/j.marpol.2009.11.002>.

Glossary

Term or Acronym (Definition)

CBD: Convention on Biological Diversity

DOC: Department of Conservation

EEZ: Exclusive Economic Zone

Kaitiakitanga: The intergenerational exercise of customary custodianship for a particular

area or resource.

Kaimoana: Seafood/marine fisheries.

Manaakitanga: The process of showing respect, generosity and care for others, caring for people, places and other living and non-living things.

Māori: Indigenous people of Aotearoa, literally original, normal, ordinary.

Mātaitai reserve and taiāpure: Customary fishing management tools/areas under the Treaty of Waitangi fisheries settlement.

Mātauranga Māori: A holistic perspective encompassing all aspects of knowledge and seeks to understand the relationships between all component parts and their inter-connections to gain an understanding of the whole system.

MPA: Marine Protected Area

MPI: Ministry for Primary Industries

MPPF: Bioregional Marine Protection Planning Forums

NZBS: New Zealand Biodiversity Strategy

Tangata whenua: Indigenous people of Aotearoa New Zealand, literally ‘people of the land’.

Taonga: Treasures of cultural and historical significance to Māori, e.g. can include species of indigenous flora and fauna.

Note: The te reo Māori definitions are not considered exhaustive and are included to provide some idea of the concepts embodied in the words. It is often difficult to translate terms in te reo Māori adequately using the English language.