



The Marine Plan Partnership for the North Pacific Coast – MaPP: A collaborative and co-led marine planning process in British Columbia

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ABSTRACT

For more than a decade, marine spatial planning has been used around the world to advance objectives for conservation, economic development, and ecosystem-based management. Ecosystem-based management (EBM) in British Columbia began with the development of land use plans in the 1990s to address coastal and land use issues related to terrestrial land management. Managing marine resources is challenging on Canada's Pacific coast because of multiple, overlapping jurisdictions, unceded indigenous territories, and lack of coordination amongst governments in the region and their agencies. The Marine Plan Partnership for the North Pacific Coast (MaPP) was formed in 2011 and was a co-led partnership between 18 First Nations' and the Province of British Columbia governments. The purpose of the MaPP Initiative was to develop and implement marine plans for 102,000 square kilometers of coastal and offshore water in northern British Columbia. A co-led governance framework included the member First Nations and the Provincial government structured into multiple levels of decisions making, conflict resolution, and technical support. Integral to the planning process was broad and continual stakeholder engagement through multiple advisory committees as well as public engagement. The planning process made use of multiple information sources including traditional, scientific, and local knowledge and was completed in 3.5 years. The result was the development and signing into policy of four sub-regional marine plans (one for each of the four MaPP sub-regions: Haida Gwaii, North Coast, Central Coast, and North Vancouver Island) and a Regional Action Framework. The sub-regional plans delineate protection, special, and general management zones for multiple objectives and will inform future policy decisions for marine protected areas, tenures, resource management and coastal development through an EBM approach. The plans will inform permits for marine tenures including aquaculture, offshore renewable energy siting, contribute to Canada's marine protected areas network, and improve coastal infrastructure. The Regional Action Framework highlights activities to occur across the entire region through five main activity areas (Regional Governance, Ecological Integrity and Human Well-being, Compliance and Enforcement, Cumulative Effects Assessment, and Zoning Recommendations). Funding for planning was through a public-private model that also supported the development of the plans and decision support tools (e.g. planning and mapping portal). Discussions regarding implementation began during the planning phase to ensure long-term commitment from the Partners and continuity to improve decision making and management within the MaPP area. The process design and methodology created by MaPP can be a model for planning in areas that involve multiple authorities, complex geographies and jurisdictional arrangements that can be scaled up for regional, cross border, and transboundary marine spatial planning.

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1. Introduction

The world's oceans contribute \$1.5 trillion annually to the overall global economy and billions of people rely on healthy marine ecosystems [1]. Globally, pressures on the oceans are having measurable and increasingly negative impacts on ecological integrity and human well-being [2–4]. Currently, there are wide ranging activities in the Canadian north Pacific having greater ecological and community impacts that originally anticipated. Ban et al. [5] mapped and analyzed potential cumulative effects using regional human use data for the north Pacific waters of British Columbia, Canada and found that the entire continental shelf is affected to some degree by multiple human activities. Existing and potential anthropogenic threats to marine environmental quality in the north Pacific include: significant increases in commercial and recreational boat traffic, expanding port facilities, commercial and recreational fishing, and aquaculture [5,6]. There are also mounting social pressures in the region, as rural coastal communities struggle with declines in population, investment, transportation connections, and a lack of infrastructure [7]. As the demands for ocean space and resources grow, so too does the need for inclusive, coordinated and comprehensive management regimes. Federal, provincial, local, and First Nations governments share responsibility for ensuring the marine environment has the capacity to support social and economic benefits, and while there is some coordination, each government has their own policies, programs and priorities. Integrated marine planning is recognized as an effective approach for balancing multiple objectives, managing development and conflicting uses, planning for future activities, and providing for the long-term sustainable use of marine resources [8–12].

The Marine Plan Partnership for the North Pacific Coast (MaPP) initiative is governments' response to the need for integrated marine planning. Between November 2011 and April 2016, the British Columbia Provincial Government (hereafter called the Province) and 18 First Nations governments (together termed The Partners), co-led the MaPP initiative. MaPP developed four marine plans (one for each of Haida Gwaii, North Coast, Central Coast and North Vancouver Island sub-regions) and one Regional Action Framework (RAF) covering the 102,000 square kilometres of coastal and offshore waters in British Columbia's Northern Shelf Bioregion (Fig. 1). A primary focus of the MaPP plans was to provide recommendations for marine conservation and a variety of marine uses and activities regulated by the Province, such as aquaculture siting, seafood processing and marketing, tourism and recreation, marine-based forestry operations, renewable energy and research and monitoring [13–16].

1.1. Description of the planning area

The MaPP region is located in the transition zone between the Gulf of Alaska and California Current, and shares its planning boundary with the Northern Shelf Bioregion (see 2.3 Boundaries) and is adjacent to the Great Bear Rainforest. Together, the Great Bear Rainforest and the MaPP region is the largest contiguous land-sea area to be planned and managed under an Ecosystem Based Management approach. The region experiences high freshwater inputs, strong tidal mixing, and has varied bottom topography [17]. Seasonal, coastal upwelling creates ideal conditions for high species diversity and abundant marine life in the region [18]. High primary productivity supports spawning and rearing for several species of ecological, economic and cultural importance including salmon (*Oncorhynchus* spp), eulachon (*Thaleichthys pacificus*) and herring (*Clupea pallasii*) [17] as well as keystone predators such as Orca (*Orcinus orca*) [19]. The region contains a globally significant population of glass sponges (hexactinellid species), a rare taxonomic group that forms vertically complex reefs and supports hundreds of other species [20,21].

There are 64 communities adjacent to the Northern Shelf Bioregion, including 32 First Nation communities [22]. Indigenous peoples have occupied this region for many thousands of years; recent research has

dated archaeological sites on the B.C. coast to as far back as 14,000 years before present [23–25]. The health and wellbeing of coastal First Nations has always been tightly linked to the health and productivity of the marine environment [26]. Access to abundant and reliable food sources such as seaweed, salmon and shellfish species supported seasonal villages and also enabled the establishment of permanent villages and rich, complex cultures and societies [25,27–29]. Historic and ongoing relationships with the ocean and marine resources are critical foundations of First Nations' food, social, cultural and economic laws, custom, practices and traditions, including governance and management [22]. Today, First Nations continue to use and depend on resources within their territories to feed, teach and heal their communities [27,30].

The economy of the MaPP region is rooted in the harvest, processing, and transport of natural resources and goods [31]. Important economic sectors include commercial and recreational fishing, aquaculture, marine transportation, coastal forestry, marine research, tourism, public recreation, and government services [31]. The Port of Prince Rupert links Canada's businesses to important markets in the United States, Asia, and Europe. Smaller ports and harbours provide supplies, services and safe harbours, however the overall infrastructure is ageing and under stress; key services like boat haul-outs, wharves, loading docks, and ice plants are not as available or dependable within the region as they once were [32].

Today, there is a growing tourism sector dependent on a healthy marine ecosystem and abundant marine life. Cultural tourism is emerging as a niche market, drawing tourists to the region and creating employment in First Nations' and local communities [33].

1.2. Socio-political context

Jurisdiction over the marine environment in Canada, in particular the coastal and shelf waters, is complex. First Nations, provincial, and federal governments all have jurisdiction, responsibilities, and interests in the management of the ocean within the MaPP planning boundary. Most of B.C. is unceded land, traditionally under the jurisdiction of distinct Indigenous communities to which they exercise rights and title. Aboriginal rights and title are recognized and affirmed under Section 35 (1) of the *Constitution Act, 1982* [34], but are not defined in this Act. A series of court cases have helped define rights and title under Canadian law and have clarified requirements that the Crown (federal and provincial governments) must uphold when making management decisions about resources on First Nations' territorial lands and/or waters [35–41].

The federal-provincial distribution of legislative powers in Canada is defined in the *Constitution Act* (1867) [42]. The division of powers gives provincial governments jurisdiction over dry land, coastal straits, and submerged lands, as well as all flora and fauna attached to these lands and all subsurface resources. The federal government has jurisdiction over fisheries, shipping, marine pollution, and navigation of all parts of the ocean within Canada's economic exclusion zone as well as portions of the territorial seas outside provincial boundaries. The federal government was not a participant in the Marine Plan Partnership due to complex political and operational issues.

1.3. The partners

The Partners refers to 18 First Nations and the Province that were signatories of the MaPP plans. The 18 First Nations governments were represented by four aggregate organizations, each of which worked within one of the four sub-regions (Table 1); an aggregate is a grouping of First Nations governments who have decided to collaborate on common topics. Not all First Nations located within the MaPP boundary chose to participate in the planning process but they were part of the broader engagement and consultation process. The Province was represented by staff of the Ministry of Forests, Lands, Natural Resource Operations (FLNRO; as of May 15, 2019 it is now termed the Ministry of

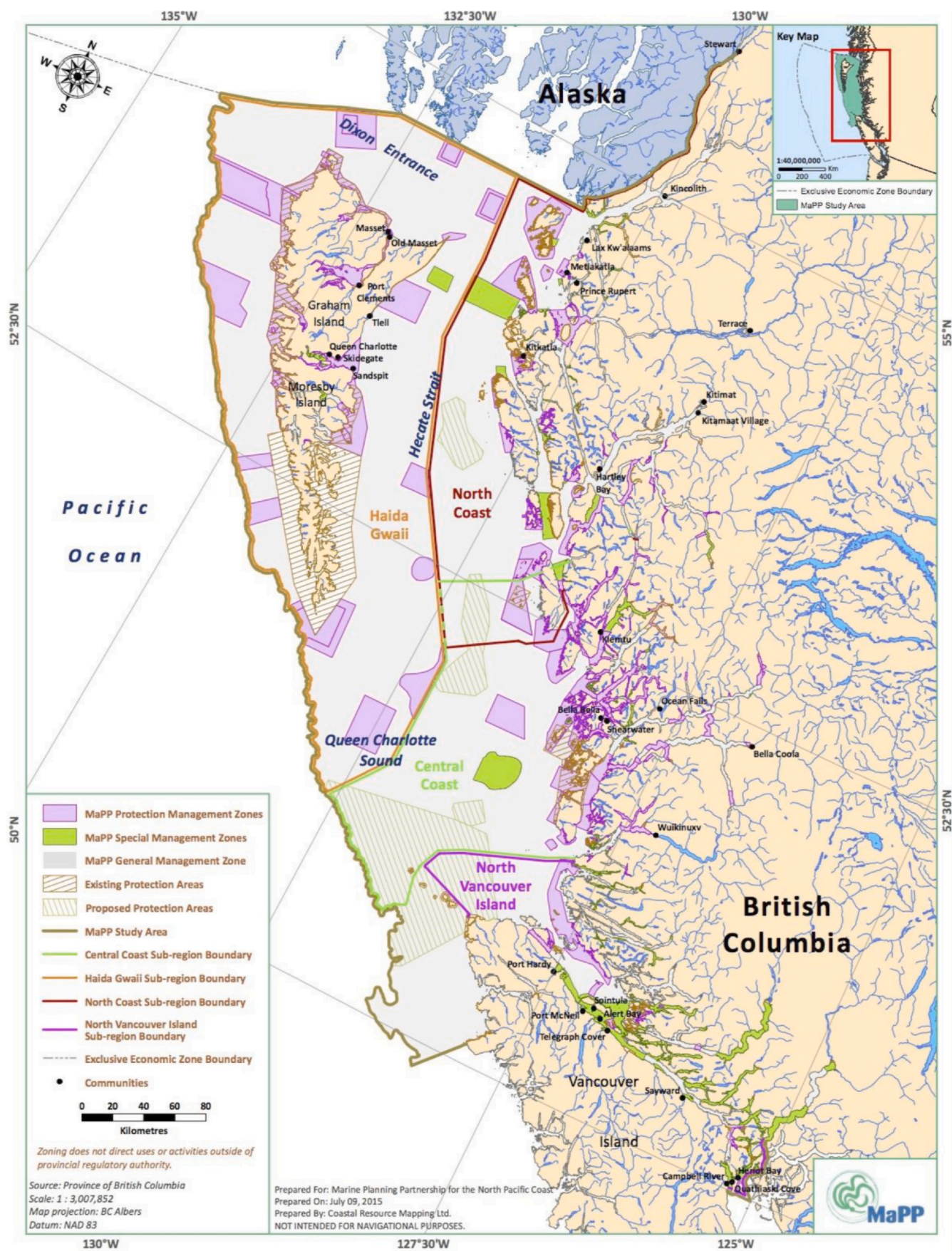


Fig. 1. Map of the planning boundary for the Marine Plan Partnership for the North Pacific Coast, British Columbia, Canada highlighting the three zoning framework management zone types.

Table 1

First Nations aggregate organizations and signatories of the MaPP plans.

Sub-Region	Representative Aggregate(s)	Nations
Haida Gwaii Central Coast	Council of the Haida Nation Central Coast Indigenous Resource Alliance	Haida Heiltsuk Kitasoo/Xai'Xais Nuxalk Wuikinuxv Gitga'at Metlakatla Haisla Kitselas Kitsumkalum Gitxaala
North Coast	North Coast-Skeena First Nations Stewardship Society	Mamalilikulla-Qwe'Qwa'Sot'Em Tlowitsis Da'naxda'xw Awaetlala Gwa'sala-Nakwaxda'xw Wei Wai Kum Kwiakah K'ómoks
North Vancouver Island	Nanwakolas Council	

Forests, Lands, Natural Resource Operations & Rural Development, FLNRO-RD).

1.4. Planning history

The MaPP initiative was the first of its kind in Canada; a co-led partnership between a provincial government and multiple First Nations governments to plan for marine uses and activities at different geographic scales. Although MaPP is unique for these reasons, the Partners had extensive relevant planning history that provided in-depth scientific, local, and Indigenous knowledge, insight and experience with process design, and working within a co-led governance structure.

1.4.1. Marine planning in Canada prior to the formation of MaPP

The signing of Canada's *Oceans Act* [43] provided legislation for integrated ocean management and authorized the Canadian federal government to develop a national oceans management strategy guided by the principles of sustainable development, the precautionary approach, and integrated management. Canada's *Ocean Strategy*, released in 2002 [44], defined the vision, principles, and policy objectives for the future management of Canada's estuarine, coastal, and marine ecosystems. These two milestones set the stage for marine planning in Canada.

During this time, the Partners individually began to develop their own plans. The Province developed a number of coastal plans for areas of Vancouver Island to provide direction for the authorization of uses of Crown Land [45–47]. These plans were developed using a consultative approach with First Nations and stakeholders, and were focused on enhancing sustainable economic development opportunities for coastal communities and maintaining environmental values. The First Nations-led planning began in 2004 in the Central Coast, North Coast, and Haida Gwaii communities. First Nation Community Plans included components such as a community vision for marine territories, cultural values, goals, and strategies for managing ocean resources including economic development opportunities and protection for specific areas. First Nations' pre-planning involved gathering of internal interests, values, Indigenous knowledge, and policy perspectives, and was foundational to the development of MaPP products [48].

In 2008 the federal and First Nations' governments signed a Memorandum of Understanding to begin the Pacific North Coast Integrated Management Area (PNCIMA) process; the Province officially joined in November of 2010 [49]. PNCIMA pre-planning occurred from 2006 to 2010 and included the identification of valued ecosystem and socio-economic components, which describe the elements of social-ecological systems that humans view as significant or valuable

[22]. The original PNCIMA objectives were to create an integrated ocean management plan based on an ecosystem-based management framework for commercial fisheries, marine protection, transportation, and climate change [50]. Stakeholders were engaged through the Integrated Oceans Advisory Committee (IOAC), which included broad sectoral participation. However, in September 2011, the federal government withdrew from the public-private funding partnership established with First Nations' and provincial governments, thereby unilaterally altering the PNCIMA process from a spatially based, comprehensive, multi-scale planning initiative to a high level, non-spatial, strategic plan [51]. MaPP was born out of this decision as the participating First Nations and the Province pursued their interests in providing spatial direction to address the issues and opportunities that had been originally scoped through PNCIMA. The PNCIMA plan was completed in 2017.

1.4.2. Terrestrial planning in British Columbia

Prior to the signing of the *Oceans Act*, terrestrial planning was underway in B.C., providing the Partners with important experience working together at planning tables to solve resource management issues. The terrestrial-based strategic plans formally began in 1996 [52]. In order to implement the results of the planning tables, the Province recognized the need to negotiate land-use agreements with the First Nations. The subsequent agreement, which became known as the Great Bear Rainforest Agreement, was a commitment to manage the globally significant ecosystem covering 6.4 million hectares along the B.C. coast using an ecosystem-based management approach [53]. The importance of First Nations engagement in planning resulted in a new planning policy by the Province that required all future plans to be co-led by First Nations and stakeholder tables to be advisory to the government planning co-leads.

Key outcomes of the Great Bear Rainforest Agreement were legislated "land-use orders" created to prescribe management practices for forestry activities and resource use zoning, and new protected areas that accommodated Aboriginal title and rights and increased First Nation authority to govern and manage their territories [54]. These outcomes contributed to the context for marine use planning, particularly the governance framework for decision making and implementation agreements.

2. Planning methodology

In general, a marine spatial planning process is undertaken in a number of iterative steps with outputs for each of these steps ultimately leading to the development of a marine spatial plan [55]. The iterative steps are similar to those used in land-use planning or environmental

impact assessments [8] including identifying authority to plan, securing funding and capacity, determining the planning boundary, and developing planning objectives [55]. The scope of MaPP planning was agreed upon between 2011 and 2012 based on an analysis of the Partners' authorities, mandates, priorities and capacity. Priority lists were developed by sub-region and common topics or issues were selected. The MaPP plans were informed by an ecosystem-based management framework, developed during the PNCIMA planning process. Partners in each MaPP sub-region coordinated area-based planning processes that included the identification of local community participants and priorities, but broader, regional-scale administrative coordination helped to support and align sub-regional planning, deliverables and timelines. The plans are sub-regional but where there is overlap the RAF provides direction for action at the regional scale.

2.1. Jurisdiction and scope

Though the planning area is under the traditional jurisdiction of the First Nations Partners, provincial governments do not have the jurisdiction needed to pursue the full suite of objectives and strategies required for comprehensive marine use planning. Thus, the scope of the marine plans was based on the Partners' collective authorities, mandates, priorities, and capacity, and was agreed upon early in the planning phase. The roles and responsibilities of the governing partners were established prior to the commencement of the planning process and formalized in a Letter of Intent. These steps ensured that mandates were clear and allowed the Partners to focus on shared priorities that could be achieved within the planning timelines.

For example, shipping and transportation, deep sea mining, oil and gas exploration and development, and the conservation and management of fishery resources were out of scope for MaPP. Topics related to fisheries economy - including cultural, commercial and recreational fisheries values, seafood processing, marketing, and infrastructure were included, as the Province has some responsibilities once finfish and shellfish are landed.

2.2. EBM framework

Ecosystem-based management (EBM) is defined as an "adaptive approach to managing human activities that seeks to ensure the coexistence of healthy, fully functioning ecosystems and human communities. The intent is to maintain those spatial and temporal characteristics of ecosystems such that component species and ecological processes can be sustained, and human wellbeing supported and improved" [3]. The EBM framework used by MaPP was developed and endorsed by First Nations, provincial, and federal governments, and marine stakeholders who participated in the PNCIMA initiative. The framework was developed to be broadly applicable as governments, along with stakeholders, move towards a more holistic and integrated approach to ocean use in the planning area [22]. There were four overarching goals the EBM framework sought to achieve: 1) integrity of marine ecosystems, 2) human well-being, 3) collaborative governance and management, and 4) improved understanding of complex marine ecosystems (Fig. 2).

2.3. Boundaries

The MaPP regional boundary was decided upon in November 2011 to align with the PNCIMA boundary and the Northern Shelf Bioregion boundary [56]. Spatial units for the Pacific Ocean off British Columbia were identified in 2009, through a scientific review primarily based on oceanographic and bathymetric similarities and advisory processes [56]. The area includes 102,000 square kilometres of coastal and pelagic habitats from Quadra Island-Bute Inlet in the south, to the Canada-Alaska border in the North (Fig. 1). West to east, the boundary extends from the base of the continental slope to the coastal watersheds.

The purpose of the marine EBM framework is to achieve:

1. Integrity of the marine ecosystems, primarily with respect to their structure, function and resilience
2. Human well-being supported through societal, economic, spiritual and cultural connections to marine ecosystems
3. Collaborative, effective, transparent, integrated governance and management and public engagement
4. Improved understanding of complex marine ecosystems and changing marine environments.

Fig. 2. The overarching purpose of the EBM framework used during the development of the MaPP plans [22].

The geographic extent is defined from the high-water mark to the shelf break.

The four sub-regional planning boundaries were determined using several criteria, including: First Nation territories, Regional District boundaries, ecological considerations, and commonality of marine planning issues and opportunities. The four sub-regions (Haida Gwaii, North Coast, Central Coast, and North Vancouver Island) were defined in June 2012 and included two with overlapping boundaries, the North Coast and Central Coast. A small section of the MaPP regional boundary (Fig. 1) was outside the sub-regional boundaries.

2.4. Governance

A Letter of Intent signed in 2011 [57] committed the Partners to a co-led governance structure with each having equal decision-making authority on all aspects of the initiative, including allocation of resources and funding, process design, plan content, and the approach to stakeholder and public engagement. A co-led approach allowed for the identification of a shared vision for management of coastal and marine values, and is one means of ensuring Aboriginal title and rights, including rights to manage and harvest resources on territorial lands and waters, are respected and protected [58].

The governance structure (Fig. 3) included committees at different levels from strategic direction to decision making and planning. Each committee or team was co-led by representatives from both the Province and the appropriate partner First Nation(s') aggregate. The roles of each committee were described in terms of reference, along with the process for arriving at decisions and resolving disputes. Formal agreements solidifying the co-governance structures ensured the proper approval structures were in place when the plans were completed.

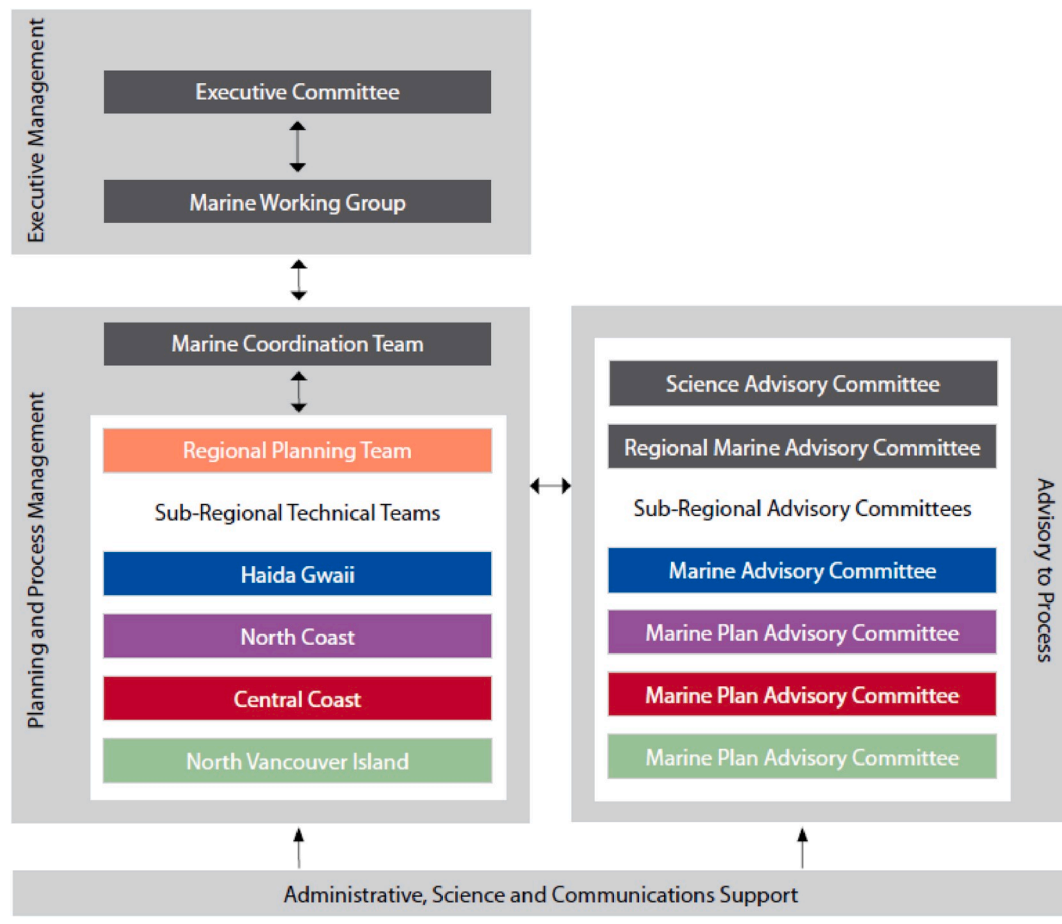


Fig. 3. Governance framework developed by the Marine Plan Partnership for sub-regional and regional planning.

An Executive Committee, with representation from Ministers, Deputy Ministers, Assistant Deputy Ministers, and First Nations Leaders provided strategic direction and made decisions and resolutions for key issues or conflicts during planning. This committee met on an “as needed” basis. The Marine Working Group met bimonthly and provided overarching direction and oversight to the Regional Planning Team and Sub-Regional Technical Teams. Representation included membership from the Province and partner First Nation(s’) aggregate organizations (Table 1).

The Marine Coordination Team, a senior-level technical group comprised of two representatives from the province and two from First Nations, managed the overall planning process and provided an efficient mechanism to communicate and implement decisions from the Executive Committee and Marine Working Group. The Marine Coordination Team also provided support to both the Regional Planning Team and Sub-Regional Technical Teams, promoting consistency between the four Sub-Regional Technical Teams and led development of the Regional Action Framework.

Each of the four Sub-Regional Technical Teams included representatives from both Partners. The Sub-Regional Technical Teams were responsible for developing their sub-regional marine plan and contributing to the development of key regional-scale deliverables, including the zoning framework and the Regional Action Framework.

A team of more than 15 full-time independent contractors provided administrative, financial, scientific, technical, communications, and facilitation support. Reporting to the Marine Coordination Team and Sub-Regional Technical Teams, the contractors increased capacity to nearly 40 people who were dedicated to MaPP (Fig. 3). Additionally, more than 40 expert consultants were hired to develop specific

deliverables, provide expert reviews and analyses, conduct spatial analysis, and provide copy edit and publishing services.

A Science Coordinator played a crucial role in providing leadership, advice, and guidance on the science and technical requirements for the MaPP initiative. Information and deliverable review were supported by the Science Coordinator and a Science Advisory Committee (SAC). This Advisory Committee, established early in the planning process, consisted of scientists and practitioners tasked with providing scientific analysis and advice to the Sub-Regional Technical Team, and ensuring planning products and outcomes were informed by the best available science. The Committee advised on a range of topics including: cumulative effects, climate change, habitat vulnerability, and development of a compatibility matrix for marine uses, activities, and values.

2.5. Stakeholder and public engagement

Stakeholder engagement requires a substantial commitment of time and financial resources, yet it is critical for nurturing constituent support for planning processes and outcomes, and leads to better decisions that consider multiple perspectives and interests [55,59–62]. MaPP took advantage of a long history of past cooperation through PNCIMA and other initiatives to identify knowledgeable and committed sector or interest representatives to participate on regional and sub-regional advisory committees. Engagement was not consensus based but was an advisory process and is more fully explained in McGee et al. [62]. Stakeholders were invited to participate early in the MaPP planning process, and helped to define critical issues and opportunities, develop goals and objectives, and exchange and validate information [62]. Consistent with best practice, a broad spectrum of stakeholder groups

were encouraged to participate, and capacity funding to support consistent and meaningful participation was provided [63,64]. An evaluation of MaPP's approach to engagement was conducted by an independent consultant midway through planning, and the results were used to identify areas of success and areas for improvement. MaPP also hired professional communications specialists as well as professional facilitators to foster a collaborative spirit, facilitate dialogue, and help steer MaPP planners and advisory committee members through conflict or disagreement. Communities were invited to provide feedback on the draft spatial marine plan, and the MaPP initiative more generally, through a variety of tools including face-to-face meetings (e.g., discussions with Indigenous and local government representatives, public open houses, town halls), letters that described progress made and status of the planning initiative, on-line discussion forums, and feedback forms. Engagement opportunities were promoted by stakeholder advisory committee members and through advertisements in local papers and news releases.

2.6. Timeline

The planning phase started in 2011 and finished in 2016 with the official endorsement of the completed plans, although the majority of planning was completed between 2011 and 2014 (Fig. 4). The Partners spent approximately six months establishing planning objectives and seeking resources to develop the plans, eight months formalizing the governance structures, two and a half years developing planning tools, drafting the content of the marine plans, and engaging with stakeholders, and six months finalizing the four sub-regional marine plans. The Regional Action Framework [65] was approved one year after the sub-regional marine plans.

2.7. Funding model

Adequate financial resources are essential for effective marine spatial planning [55,66]. Securing sufficient funding for a multi-year planning

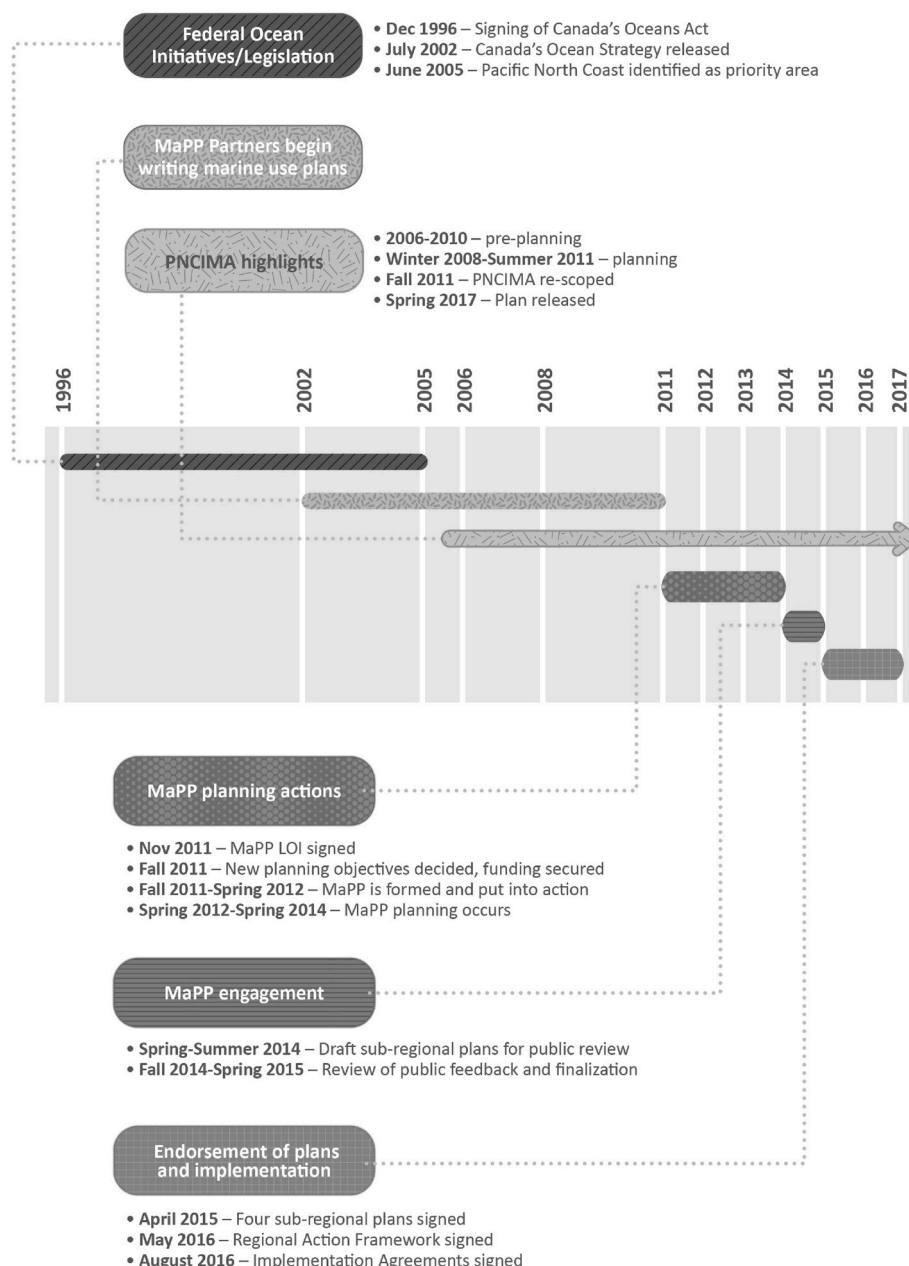


Fig. 4. A timeline for ocean protection and planning legislation in Canada and the North Pacific Coast in British Columbia, 1996–2017.

process is essential, yet extremely challenging. MaPP relied on a public-private funding model that included in-kind human resources from each of the MaPP Partners and grants from philanthropic foundations. The Partners reported to funders on progress in achieving grant outcomes but oversight on workplan implementation and financial decisions was provided by the Marine Working Group and Marine Coordination team.

2.8. Communications

MaPP developed a communications plan early in the planning process to ensure timely and comprehensive communication about major milestones and opportunities for public involvement. The communications plan for both stakeholders and the general public included recommendations for a website with general information, reports, advisory committee membership, a calendar, media articles, newsletters, stories, and videos. The calendar provided information about open houses for public reviews through to the official signing celebrations. Social media was not used during the planning process, however an online forum feature in the planning tools called SeaSketch (see 3.1 Decision Support Tools) was used to support sub-regional discussions with stakeholders. The Partners also presented at numerous international conferences to be reviewed by peers, share information about MaPP, and advance global best practices especially in relation to co-management models and planning with Indigenous peoples.

2.9. Independent process review

To determine the efficacy of the planning process, MaPP engaged with independent contractors to conduct both a mid-way review and an end of process review. These reports are internal documents, but the intent was to gain perspective from external consultants to evaluate the progress of the process in the mid-way review and summarize the strength, challenges, and lessons learned. The mid-way review outlined several recommendations for moving forward with planning and these were considered by the Partners. The end-process evaluation included a review of documents produced during the planning phase as well as interviews with various people involved in developing the plans. In total 41 people were interviewed including members from the various governance levels (e.g., the Marine Working Group members, the marine technical team, the science and administration team, etc), funders, contractors, and stakeholders.

3. Planning results

This section is not intended to be a comprehensive review of all of the products developed during the MaPP planning process, but rather a summary of the key items that led to the endorsement of the four sub-regional plans and the Regional Action Framework. Key MaPP products are summarized under the following categories: decision support tools, a marine zoning framework, sub-regional marine plans, a regional action framework, and implementation agreements. Various other tools and techniques were employed to support the development of the aforementioned MaPP outputs. Although not described in this paper, they included but are not limited to: regional and sub-regional indicators and targets for ecosystem-based management monitoring, a compliance, monitoring and enforcement framework, and a marine cumulative-effects monitoring and assessment framework.

3.1. Decision-support tools

Multiple decision support tools were developed at multiple scales to support the planning process. These tools are discussed in detail in Smith et al. [67]. In the first year a spatial data catalogue was compiled primarily from the data sets used to create the PNCIMA Atlas [68] and the British Columbia Marine Conservation Analysis atlas [69]; these

catalogues were maintained and updated throughout the entire planning process. A compatibility matrix was developed by examining Sustainable Grenadines [70] and Day et al. [71] and was used to discuss and identify uses or activities that might benefit from being spatially and/or temporally separated through zoning. This was done to either: a) increase compatibility or; b) reduce/eliminate potential conflict between activities or uses. An example compatibility matrix can be found in Day et al. [71]. A vulnerability matrix for ecosystem types was modeled after the analytical framework developed by Teck et al. [72], in an effort to provide a quantitative assessment of the vulnerability of ecosystem types to relevant stressors or marine uses in order to guide spatial planning. Marxan analysis [73] was used to inform discussions about priority conservation areas while minimizing their spatial extent, and was completed at regional and sub-regional scales. Finally, a specialised web-based planning tool called SeaSketch, developed by the McClintock Lab at the Marine Science Institute at the University of California Santa Barbara, was used to view more than 250 data layers including administrative boundaries, species, habitats, marine uses and model results. SeaSketch was also used to provide options for sub-regional advisory committees to discuss, revise, and propose changes to the zoning designs.

3.2. Zoning framework

A zoning framework was developed by the MaPP Technical Team with input from stakeholders and the Science Advisory Committee, to provide consistent direction for the sub-regional planning teams when they were developing spatial plans. The framework describes three zone categories to be applied across the MaPP region to plan for marine uses and activities consistent with an ecosystem-based management approach [3]. The Framework was informed by previous planning process in B.C. and worldwide, including lessons learned from the United States, St. Kitts and Nevis, and Australia's Great Barrier Reef (e.g. Refs. [74–76]). The International Union for Conservation of Nature (IUCN) guidelines for marine protected areas [71] were used to inform biodiversity protection and compatible uses zones. The completed Framework consisted of three zone categories: General Management Zones (GMZ), Special Management Zones (SMZ), and Protection Management Zones (PMZ) [77] (Fig. 1). The GMZs were designed to include a range of uses and activities managed using an ecosystem-based framework; the SMZs to encourage, support, or maintain high priority and high economic potential uses and activities; and the PMZs to provide marine conservation or protection.

3.3. Sub-regional marine plans

Each sub-region completed a sub-regional marine plan containing non-spatial and spatial components [13–16]. The objectives, strategies, and zoning in sub-regional plans reflected Indigenous knowledge, local knowledge provided by stakeholders and the general public, and biophysical and social science. As an example, protection and special management zones could have been defined on either quantitative data sets highlighting ecological value, Indigenous knowledge highlighting cultural value, or both. Where data sets were not available, Indigenous and local knowledge were used to fill gaps. These diverse sources of knowledge provided the Partners with multiple different sources for ecological, cultural, and human use information which resulted in broadly supported plan recommendations.

The marine plans provided recommendations for the future management of each sub-region including uses and activities within the mandates and authorities of the Partners. Recommendations included objectives and strategies for achieving healthier oceans and improving social and cultural outcomes. For example the Central Coast marine spatial plan includes an objective to “improve marine-based compliance monitoring through the establishment of collaborative relationship and enhanced coordination of enforcement activities” as a way to increase

Marine Use/Activity	Community Emphasis SMZ: 8, 12, 16, 37, 38	Cultural/Economic Emphasis SMZ: 1, 2, 4–7, 9, 11, 13, 15, 17, 21–31	Recreation/Tourism Emphasis SMZ: 3, 10, 14, 18–20, 32–36
Bottom Aquaculture (Sites) – Shellfish, Other Invertebrates, Marine Plants	C	A	A
Off-Bottom Aquaculture (Sites) – Shellfish, Other Invertebrates, Marine Plants	C	C	C
Off-Bottom Aquaculture Sites – Finfish	C	C	C
Renewable Energy Generation	C	C	C
Forestry Operations	C	C	C
Mining Operations	N	N	N
Commercial and Recreational Anchorage	C	C	A
Level 1 Docks, Wharves and Facilities	A	C	A
Level 2 Docks, Wharves and Facilities	C	N	C
Float Homes	C	N	N
Floating Lodges	C	C	A
Commercial Recreation and Tourism	C	C	C
Public Recreation and Tourism	A	C	A
Research	A	C	A
Linear and Point Source Utilities	A	C	A
A	Uses and activities are considered to be ‘acceptable’ subject to all applicable laws, policy and relevant agreements. Acceptability of any use/activities does not guarantee that a use/activity will be approved.		
C	Uses and activities are considered to be conditionally ‘acceptable’ subject to all applicable laws, policy and relevant agreements; and provided they are consistent with (adhere to) the plan conditions. Conditional acceptability of any use/activities does not guarantee that a use/activity will be approved.		
N	Uses and activities are considered to be ‘not acceptable’ and should not be approved.		
Where a use/activity is outside provincial regulatory authority, the approval of that use/activity is subject to the decision-making process (es) of the responsible authorities (including commercial and recreational fisheries, transportation and aquaculture licencing). Absence does not imply that the use/activity was not considered or evaluated or is of no interest. The reader should contact the appropriate management authority (ies) for direction on uses/activities that are not identified in the table. Zoning does not direct uses or activities outside of provincial regulatory authority.			

Fig. 5. Recommended Uses and Activities Table for Special Management Zones outlined in the North Vancouver Island Plan [16].

the health of the ocean [15]. To improve social and cultural outcomes, the Haida Gwaii plan includes the objective to “increase community participation in fisheries processing and marketing” [13]. Spatial recommendations via zoning provided policy guidance intended to inform decision-making processes regarding uses and activities in the specific areas. Each zone includes a recommended use and activity table to guide licensing and tenuring decisions (Fig. 5).

Each of the MaPP plans contained initial commitments for plan implementation. Key priority actions and outcomes for near-term implementation were identified, which informed later development of

sub-regional implementation agreements. For example, the North Coast sub-region prioritized a number of key outcomes and priority actions to initiate within six months of finalizing the plan such as the establishing meaningful government to government partnership and supporting First Nations capacity for managing and responding to referrals, respectively [14]. The partners also committed to evaluating implementation progress through a set of performance indicators, monitoring of consistency of plan recommendations with land use decisions, and a review of plan content at 3 or 5 years to ensure ongoing relevancy as issues, opportunities, priorities, and conditions change.

3.4. Regional action framework

The Regional Action Framework [65] established actions that advanced common sub-regional interests at a regional scale and supported sub-regional marine plan recommendations. The themes in the Regional Action Framework were: governance, climate change, cumulative effects assessment, regional economy and infrastructure, marine pollution, ecosystem-based monitoring and indicators, compliance and enforcement, and zoning. Specific examples of some of the actions include: under governance developing collaborative governance arrangements for marine management, under climate change developing a regional risk assessment for ocean climate, and under ecosystem-based management monitoring and indicators developing and implementing training to increase First Nations involvement [65]. Information and guidance were drawn from a variety of sources including: First Nations strategic marine-use plans, provincial government reports and policies, past and present coastal and marine planning initiatives and processes, marine planning and ecosystem-based management, and sub-regional marine plan objectives, strategies, and implementation actions. Several internal regional reports were also prepared in relation to regional deliverables such as climate change adaptation, cumulative effects, and both human well-being and natural ecosystem-based management indicators.

3.5. Implementation agreements

The partners signed the Implementation Agreements in 2016. These agreements formalized the intention of the partners to jointly implement the sub-regional marine plans. They described the roles and responsibilities of the partners and the co-led governance framework to be used to collaboratively implement the marine plans, a process for resolving disagreement, and a commitment to joint pursuit of resourcing. Shortly after endorsement of the Implementation Agreements and confirmation of financing, workplans and budgets were developed translating priority objectives and strategies into actions under five outcomes: governance, marine zoning, stewardship, monitoring and enforcement, sustainable economic development and healthy communities, and climate change and adaptive management [78].

4. Discussion

Since the signing of the four sub-regional plans and the Regional Action Framework into policy, the Partners have had to opportunity to reflect on the process including the successes and the challenges. Here we outline key components to the planning process as a whole which lead to the successful signing of the four sub-regional plans. Topelko et al. [79] provides a more fulsome description of the lessons learned from the processes.

4.1. Leadership

Marine planning processes need strong leadership to bring diverse interest groups together [80,81]. The MaPP initiative resulted in unprecedented collaboration between partner First Nations' and the Province to provide leadership for a complex planning process involving a diversity of stakeholders. One of the hallmarks of an ecosystem-based management approach is to ensure adequate governance frameworks are in place to provide for decisions about ecological, social and economic objectives [3]. MaPP's governance framework provided a true co-led approach, with both partners having equal decision-making authority. All decisions about plan content, design and outputs, administration, technical planning, how funds were spent, external engagement, and communications were made by consensus between partner First Nations and provincial government representatives. Where conflicts occurred, partners engaged in a defined conflict resolution process at the appropriate governance level. In the rare event that the issue was

unresolved, partners could agree to disagree and revisit the issue at a later stage so not to delay the planning effort.

The co-led governance structure engrained First Nations' knowledge into the five planning outputs and brought together Indigenous knowledge with western or academic science throughout the planning process [48]. The integration of knowledge from many sources allowed the Partners to draw on scale-appropriate information and resulted in decisions that were credible, defensible, and ensured high levels of buy-in from Nations and stakeholders.

The governance structure also ensured broad consistency and flexibility in the approach to developing the sub-regional plans. For example, though each sub-region had a stakeholder advisory committee, different sectors or interests were represented depending on the local driving issues. This flexibility allowed each sub-region to develop management objectives that connected with their place-based challenges and opportunities as informed by similar community-based approaches to common property resource management proposed by Ostrom [82].

4.2. Alignment with complementary initiatives

Using an ecosystem-based management (EBM) approach to resource management can help to improve integration amongst resource agencies [83]. During the MaPP planning process effort was made to align with complementary and parallel planning initiatives (e.g. PNCIMA) to minimise redundancy and repetition, create synergies, and increase opportunities for successful implementation. The efforts to align planning initiatives and outputs resulted in significant benefits to the MaPP partners, leading to successful implementation [78]. Knowledge compiled and relationships built during the development of First Nations' led marine use plans, the PNCIMA initiative, and the Great Bear Rainforest agreement greatly assisted with advancing MaPP in several ways. First, First Nations' marine use plans provided a significant foundation to share Indigenous knowledge, community interests and priorities, and outline strategic direction regarding the management, use, and protection of their territories. Second, several key frameworks developed through the PNCIMA initiative, which included robust stakeholder participation and buy-in, were used in MaPP planning such as the Ecosystem-Based Management framework. Third, the collaborative decision-making governance structure and formal agreements established through the PNCIMA initiative were adopted and ensured equal say between the provincial and First Nations governments at both regional and sub-regional scales of planning. Fourth, baseline scientific data and spatial planning products developed through Indigenous Community Planning, PNCIMA, and the British Columbia Marine Conservation Analysis (BCMCA) were utilized in the development of MaPP planning outputs, significantly reducing the pre-planning that MaPP would otherwise have needed to undertake.

4.3. Scope, jurisdiction, and boundaries

Understanding and respecting jurisdiction is essential for the effective implementation of marine spatial plans [84]. During development of the four sub-regional plans, the Partners considered activities beyond the Province's jurisdiction in the marine environment, such as harvest of fish, marine transportation, and petroleum exploration. However, the Partners ultimately agreed to exclude marine plan recommendations for federally regulated activities and to address out-of-scope interests through other governance structures and initiatives.

One of the essential elements of marine spatial planning is a decision on the planning boundary [55]. The regional MaPP boundary generally aligned with Canada's Northern Shelf Bioregion, but the sub-regional boundaries were more difficult to delineate. When a precise line separating the North Coast and Central Coast sub-regions could not be defined, the Partners agreed to an overlap between the two sub-regions. Sub-regional Technical Teams kept each other apprised of planning progress in the overlap area and worked together to identify and refine

zoning boundaries and associated management recommendations. The Central Coast Marine Plan [15] and North Coast Marine Plan [14] incorporated both sub-region's zoning and direct the reader to the appropriate plan for additional zoning information. This approach may help inform other planning processes including transboundary and cross-border applications.

4.4. Engagement and communication

Stakeholders and the public generally provided a high level of support for MaPP's deliverables, including the four sub-regional plans and the Regional Action Framework. This was confirmed through letters of support written by stakeholder and included in plans (e.g., Ref. [16]) but also through the end-process evaluation which included interviews with stakeholders across the MaPP region. Success is attributed to the participatory and transparent advisory approach to stakeholder engagement that built upon lessons learned from previous coastal and land use planning initiatives in B.C [62]. Stakeholder advisory committee meetings were held every three months as scheduled in the agreed-upon terms of reference (see Ref. [13–16] for specific dates and meeting topics). This approach had the added benefit of keeping pressure on the technical teams to continue to generate draft planning products for discussion, and was a significant factor in the timely completion of planning products. A stakeholder engagement fund was created to provide financial support for stakeholders to participate in meetings and engage constituents within their sector or interest group, and an iterative cycle of input and discussion was maintained throughout the planning process.

Some of the challenges that MaPP successfully dealt with centered on managing the volume of information to share and review with stakeholders, the frequency of updates, and maintaining confidentiality of sensitive or proprietary information. MaPP developed newsletters, maintained a well-organized website, shared stories from local communities, held open houses in communities, and developed an email list serve to keep citizens informed of progress. Mechanisms were in place to acknowledge the contribution of stakeholders and citizens, and to ensure feedback was taken into consideration when decisions were made. Meeting summaries were posted on the website, and MaPP technical planners maintained detailed advice logs that included responses of the actions taken.

4.5. Timelines and funding

The four sub-regional marine plans and the Regional Action Framework were developed and approved in under four years, a relatively short timeframe. This is attributed to several factors, including the availability of pre-planning products (e.g., structures, agreements, baseline data, and assemblage of Indigenous knowledge) from other planning initiatives, an approach to stakeholder engagement that favoured collaboration over consensus, and adequate funding and capacity.

Marine spatial planning processes are expensive, and most governments do not have sufficient budgets to finance planning (and implementation) at large scales and/or in short time frames. MaPP funding originated from a public-private partnership negotiated to support the PNCIMA initiative. Due to political pressure, the federal government withdrew from the public-private partnership leaving the provincial and First Nations governments with an opportunity to establish the Marine Plan Partnership. The use of philanthropic funds from private donors has been controversial in other planning processes [66], and MaPP was no exception. However, public-private funding has contributed to several successful resource management initiatives in North America, including the Canadian Boreal Forest Agreement [85], the Massachusetts Oceans Partnership [86] and the California Marine Life Protection Act [66]. The MaPP public-private financing model enabled the Partners to implement the co-developed workplan and make decisions on all associated financial transactions.

4.6. Implementation

The integrated marine plans developed through MaPP have the potential to significantly alter how governments work together, and how coastal and marine values are managed in northern British Columbia. However, success requires a strong commitment to implementation. In 2013, MaPP partners initiated the development of a framework for implementation with completion of a financing strategy and business plan that identified the five previously discussed outcomes [78].

To support the first five years of implementation, in-kind resourcing from the partners was secured in 2015, along with a multi-million dollar commitment from philanthropic foundations that leveraged additional funds from private donors. That same year, the partners solidified the collaborative approach to implementation through the signing of four sub-regional implementation agreements, described earlier. In addition to securing personnel and selecting a mechanism for administering funds, efforts were made to identify clear priorities for short and long-term implementation and measures of plan performance [78].

The MaPP plans were borne from a shared desire of the Provincial and First Nations to move forward with integrated marine planning at a time when the federal government was choosing to scale back its involvement in related efforts. Since the signing of the MaPP plans, the federal government has renewed its political interest in ocean management, creating new opportunities for the MaPP team to further advance strategies involving areas of joint jurisdiction, such as marine protected area planning and marine incident planning and preparedness. It has also highlighted the challenges of involving new entities late in an ongoing process and the capacity demands of working on similar interest areas through multiple initiatives [78]. Most recently, there is a new commitment by the federal government for five new marine spatial plans using a similar framework or approach used by MaPP [87].

4.7. Lessons learned

While we more fully outline the lessons learned from the planning phase in Topelko et al. [79] we have distilled four key lessons to help guide other processes. First, though not unique, it is essential to scope a planning process carefully. MSP is intended to be an iterative process [55] and as such, we suggest not scoping a project too broadly as topics can be added during future plan review and plan amendment phases. Scoping a project too large may result in a lack of efficiency as implementation teams attempt to make progress on too many projects. Second, build in conflict resolution processes prior to starting planning. Having a clear process and structure to resolve conflicts between the Partners was key to ensuring the process moved forward during times when consensus was difficult to achieve. However, having a resolution process for stakeholder engagement would have also been helpful and is recommended for future processes. This would have been particularly useful for the MaPP process to assist with the advisory role (as opposed to consensus role) that stakeholders had and could have been incorporated into the advisory committee terms of reference. Third, ensure sufficient funding for stakeholder engagement. Though advisory, stakeholder engagement was still a key component to the process. As such, it was essential to have funding to ensure broad and consistent stakeholder engagement (for more info on this see Ref. [62]). Fourth, develop clear metrics to assess plan success during implementation. Some of the original MaPP objectives and strategies would benefit from refining to increase clarity thereby increasing efficacy in successfully implementing the plans. Some of these lessons are based on hindsight and due to challenges observed during our attempt to implement the plans.

5. Conclusions

The world's oceans continue to be placed under stress from human uses and climate change. In this context, the need for development and

implementation of marine spatial plans by coastal countries is becoming more urgent as a means of addressing the potential changes. The approach taken by the MaPP Initiative to develop these plans in a collaborative, co-led process by indigenous and provincial government partners, combining both indigenous and local knowledge with conventional western science and planning outcomes offers a powerful planning model for use in other coastal jurisdictions, including those sharing transboundary marine issues. Ultimately, the strength of the process was dependent on the collaboration between the Partners. MaPP was enhanced by preparatory planning efforts of the planning Partners, by development of planning tools using subject matter experts and stakeholders, and by previous or simultaneous planning processes within the planning boundary. With the signing of the sub-regional marine plans into policy in 2015 and the implementation plans endorsed in 2016, MaPP has created a legacy for marine planning not just within the planning boundary but for all of British Columbia and indeed for all of Canada.

Globally, the MaPP planning process can be a useful model for recognizing and embracing the benefits of jointly designed and planned marine space with Indigenous and non-indigenous governments, which include the creation of greater certainty and acceptance of ecosystem-based approaches to the management of shared ocean space.

Declaration of competing interest

All authors declare no competing interests.

CRediT authorship contribution statement

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