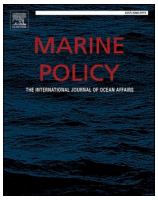
Marine Policy 152 (2023) 105524

Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol



Marine zoning for the Marine Plan Partnership (MaPP) in British Columbia, Canada

Charlie Short [a,*], Joanna L. Smith [b,1], John Bones [c], Steve Diggon [d], Aaron Heidt [e,2], Chris Mcdougall [f,2], Kylee A. Pawluk [g]

[a] Province of British Columbia. Ministry of Water, Land and Resource Stewardship, 4th Floor, 2975 Jutland Rd, Victoria, BC V8W 9C3, Canada
[b] Birdsmith Ecological Research, PO Box 535 Smithers, BC V0J 2N0, Canada
[c] Nanwakolas Council, 1441 16 Ave, Campbell River, BC V9W 2E4, Canada
[d] Coastal First Nations-Great Bear, Initiative. 409 Granville St Suite 1660, Vancouver, BC V6C 1T2, Canada
[e] Central Coast Indigenous Resource Alliance, 2790 Vargo Rd., Campbell River, BC V9W 4X1, Canada
[f] Haida Ocean Technical Team, Council of the Haida Nation, Box 98, Queen Charlotte, BC V0T1S0, Canada
[g] Marine Plan Partnership for the North Pacific Coast, 163 W Hastings St #400, Vancouver, BC V6B 1H5, Canada

ARTICLE INFO

Keywords:
Marine zoning
Marine spatial planning
Ecosystem-based management
British Columbia
Canada
First Nations

ABSTRACT

A zoning framework was developed for the Marine Plan Partnership for the North Pacific Coast (MaPP) in order to provide guidance for decisions regarding coastal and marine economic development, marine resource management, and marine protection or conservation across the MaPP region, the Northern Shelf Bioregion, British Columbia, Canada. The MaPP Zoning Framework was developed over an 18-month period at the beginning of the marine spatial planning (MSP) process with stakeholder consultation and incorporated lessons learned from other planning efforts in British Columbia and globally. The three main requirements for the Framework included that it was applicable and flexible for use across the MaPP regional boundary, which included four subregions that had diverse priorities and marine activities, that guiding principles for zoning would provide consistency for policy and other decisions within the MaPP regions, and that zone categories synergized with existing policy and legislation. A stakeholder advisory process was used to develop the Framework which resulted in three zone categories to achieve the goals of MaPP: Protection Management Zone (PMZ), Special Management Zone (SMZ), and General Management Zone (GMZ). Zone identification included numerous factors such as species and habitat diversity, cultural values, existing uses and activities, and priorities for sustainable economic development and conservation. The Framework was effectively used to zone 102,000 km^2 of the MaPP region during the MSP process for more than 15 different sectors that were within the scope of the MaPP partners' jurisdiction. Importantly, the Framework was successfully adapted across the four distinct MaPP subregions and consistently applied for an effective regional approach to decision making and management for both First Nations and provincial governments.

1. Introduction

Marine zoning is used to achieve numerous objectives for allocation of rights and responsibilities in marine and coastal areas [1] and is considered by some experts to be highly beneficial for effective ocean management [2–5]. Marine zoning is a process of identifying locations for specific objectives or activties such as for biodiversity conservation or economic uses, and delineating the areas with the use of coordinates [6]. Marine zoning is often cited as an important component of integrated ocean management as it can facilitate decisions for a range of existing and future uses and activities in the marine space; this, in turn, can improve overall jurisdictional integration between relevant authorities and provide clarity for a variety of user groups [7,8].

Marine zoning has had many global applications over the last 40 years including the development of marine protected area networks [9–12], the conservation of biodiversity or economic activities at

* Corresponding author.
E-mail address: charles.short@gov.bc.ca (C. Short).
[1] Nature United 366 Adelaide East, Suite 331, Toronto, ON, Canada, M5A 3×9
[2] Coastal First Nations-Great Bear Initiative. 409 Granville St Suite 1660, Vancouver, BC, Canada V6C 1T2

https://doi.org/10.1016/j.marpol.2023.105524
Received 9 August 2022; Received in revised form 5 January 2023; Accepted 29 January 2023
Available online 1 February 2023

particular locations [6,13–15], and the development of comprehensive marine spatial plans [2,16]. It is used as a common tool in the marine spatial planning (MSP) context to improve comprehensive spatial management, advance ecosystem-based management (EBM), and advance stakeholder and community engagement [4,7,17]. Zoning has also been used to reduce spatial conflicts between uses [18] and more recently to create opportunities for emerging economic development by establishing geographic boundaries and management plans for spatially distinct areas and specific uses [6].

In order to define zones and manage specific uses, marine management practitioners develop zoning frameworks and guides as well as utilize non-spatial tools and techniques [19,20]. These non-spatial components can include general management directions, provisions, and specific conditions and guidance for existing and potential future marine-based uses and/or activities that affect marine species, habitats, and ecosystems [19,20].

1.1. Zoning in British Columbia, Canada

In British Columbia, the practice of marine zoning has been in place for at least 30 years [21] and the general goals for zoning have been to: (a) recognize priority usage of the area, (b) alleviate competition and conflict among uses/users, (c) provide guidelines for use of public resources that abide by relevant policies and regulations, and (d) identify protected areas [21]. The approach in the marine realm has been consistent with strategic land use and coastal marine use planning that took place in the 1990 s to early 2000 s [see 16 for a description of these planning processes,21]. Zoning in Canada's Pacific Ocean has occurred for provincial and federally regulated activities and is thus familiar to mariners and marine users such as ballast water exchange areas for ships, marine traffic separation schemes, military exclusion zones, conservation zones, fisheries management zones, and ocean dumping zones [22,23]. There are multiple other zoning and planning initiatives in northern B.C., including the Pacific North Coast Integrated Management Area (PNCIMA) Plan which developed a high-level, strategic plan [24] and a focused conservation effort via the Marine Protected Area Network process [25]. These activities are tri-partite in nature involving the federal, provincial, and Indigenous governments as governing partners. Additionally, the provincial government is developing a Coastal Strategy.

In 2011, the Marine Plan Partnership for the North Pacific Coast (MaPP) MSP initiative was initiated by 18 Coastal First Nations and the Province of British Columbia [16]. The federal government, which has several management accountabilities in the marines space (e.g., fisheries management, transportation), chose not to participate in this process; the socio-political context of the MaPP planning process is described in [16]. The aim of the MaPP planning process was to provide spatially explicit recommendations to inform decision-making process in the MaPP study area consistent with an EBM approach [24,26,27]. The MaPP Partners, governance structure, EBM framework, and other key elements are detailed in [16], the overview paper for the MaPP special issue. The MaPP study area covers 102,000 km^2 of ocean space of the Northern Shelf Bioregion in northern British Columbia, Canada (Fig. 1) and was divided into four sub-regions (North Vancouver Island, Central Coast, North Coast, and Haida Gwaii) to facilitate effective MSP relevant to the MaPP Partners at appropriate scales (both sub-regional and the region as a whole). Four marine plans (one for each sub-region) [28–31] and a Regional Action Framework [32] were developed outlining marine zoning in the MaPP study area. Zoning was developed to provide policy direction for decision makers responsible for managing coastal and marine spaces and aligns with current policies and regulations or identifies gaps. Direction would consider multiple factors for decision makers and resource managers including tenuring (i.e., use of public space for a particular purpose under specified conditions), permits, and other marine resource allocations. Any zones identified though the planning process could be implemented through appropriate provincial or federal legislative frameworks during implementation, depending on the type of zone and particular values and issues. Furthermore, First Nations' traditional uses can continue in all zones in accordance with legal obligations and government policies, including practices for food, social, and ceremonial purposes. To achieve this, the Framework would need to provide consistent and scalable direction for the spatial delineation of existing and potential future marine-based uses and activities in the four sub-regions and address both spatial and non-spatial components of zoning.

The purpose of this paper is to describe the process of developing a zoning framework (the 'Framework') for the MaPP initiative [16]; detail the key components of the Framework; articulate the results of the frameworks' application in the study area; and offer some key lessons learned regarding this experience. In turn, this may serve as a useful case study and model for other coastal / maritime jurisdictions that may be embarking on marine spatial planning processes.

2. Developing the zoning framework

An iterative approach was used to develop the Framework over a period of 15–18 months from 2012 to 2014, during the first three years of the MaPP MSP process. Engagement with the MaPP stakeholder advisory committees and the public were important elements as stakeholder support and 'buy-in' was a desired outcome for the zoning process and are described in [33]. The Framework was developed collaboratively with technical planning teams, sub-regional and Regional Marine Advisory Committees, a Science Advisory Committee, and participatory workshops [33]. Select subject matter experts were engaged on several topics including International Union for the Conservation of Nature (IUCN) Marine Protected Area Categories and EBM, and multiple knowledge sources were consulted (e.g., published studies, Indigenous Knowledge, and local knowledge).

The planning teams reviewed published and unpublished zoning frameworks, MSP guidebooks, zone designations and categories, lessons learned, and associated planning tools or products developed in B.C. and elsewhere in the world (e.g., USA (Rhode Island), St. Kitts and Nevis, Australia, Belgium) [9,34,35]. Advice was sought from planners involved in completed and active MPA and MSP processes on several topics such as: the number of zone categories in a framework, pros and cons of activity-based (or use-based) versus objective-based zoning, and zoning in a policy versus regulatory (i.e., legal) context.

After the review of materials from other plans, the development of the Framework took place in several steps. First, an outline for the Framework and a zone schematic were created. Second, the Framework was drafted, submitted for review and discussion with stakeholders, and revised. Third, the Framework was finalized and approved by the MaPP Working Group for application in the MaPP study area. Once approved, planning and decision-support tools were created or used with the Framework to identify new zones throughout the MaPP region [36,37] and 'Recommended Uses and Activities' (RUA) tables were developed to outline acceptable activities in a zone.

2.1. From outline to zoning framework

An outline for the Framework was prepared by the technical planning team in December 2012 and included: Introduction, Context, Guiding Principles, Objectives, Zone Categories, and Appendices. Multiple approaches to zoning and zone nomenclature were discussed including whether to use unique geographic names for each zone or a gradational scheme. After several months, a complex zoning scheme was replaced by a simple schematic representing three, non-overlapping zones with three different objectives. The outline document received approval from the MaPP Marine Working Group and a working draft of the Framework was developed and presented to stakeholders for discussion and review in the sub-regional and regional committees in July 2013. In the first iteration of consultations, strong areas of agreement

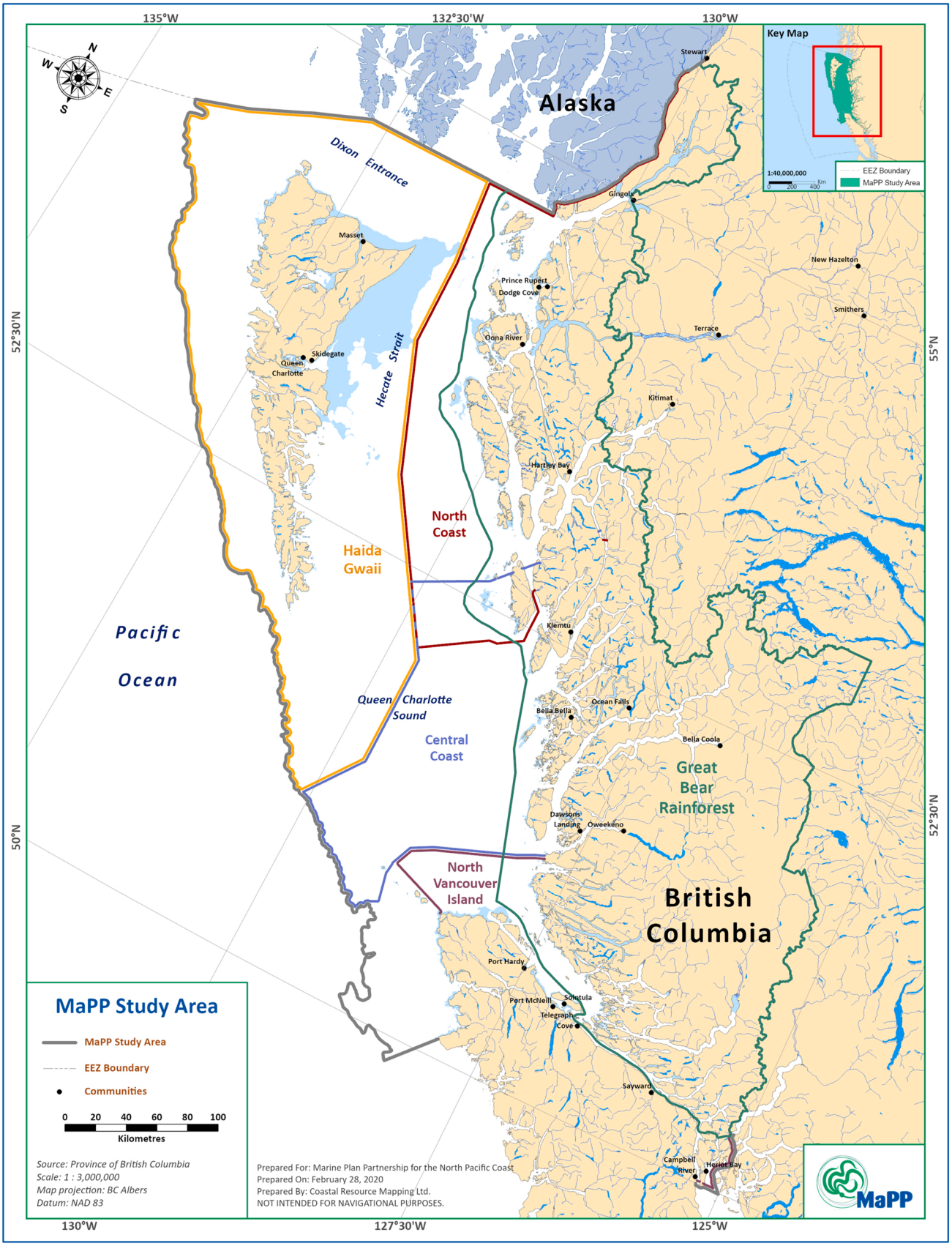


Fig. 1. Map of the MaPP study area showing the four sub-regions: Haida Gwaii, North Coast, Central Coast, and North Vancouver Island and the Great Bear Rainforest Initiative boundary.

included that vertical or three-dimensional zoning would not take place, a General Management Zone (GMZ) category would allocate space for uses and activities consistent with EBM principles, a Special Management Zone (SMZ) would define specific uses and activities for economic development purposes or cultural uses, and zones would not contain sub-zones with conflicting values, interests, or priorities. Vertical zoning was not included as there is general recommendation by the United Nations Educational, Scientific and Cultural organization (UNESCO) to not include this as it introduces further challenges such as delineating zones in a vertical plane as well as monitoring and enforcement of the resulting boundaries [20]. Further, IUCN protected area categories would inform management of the MPA zone but not be used for zone area names. In late 2013, the Marine Protected Area (MPA) Zone name was changed to Protection Management Zone (PMZ) to reflect the intention of the zone for broad marine protection values and acceptable uses, including ecosystem and cultural values identified in an area, avoid the implication that they would all be formalized marine protected areas, and create a name consistent with the other zone abbreviations (i.e., GMZ, SMZ, PMZ).

An important step in the development of the Framework was to build support from the governance partners and user groups for identifying zones. Prior to MaPP, comprehensive zoning for all uses and activities did not exist for the Northern Shelf Bioregion. Therefore, during stakeholder consultations, an iterative process involving drafting and redrafting with Partners and stakeholders was used to demonstrate the importance and utility of zoning and move from abstract concepts to practical application [see 33 for a full description of the MaPP engagement process]. At every opportunity, stakeholders were engaged through the use of spatial data and maps to illustrate how to organize and view the information in the context of the proposed Framework including use of online decision support platforms like SeaSketch[36], a web-based tool to view maps. These planning tools included spatial data catalogues, marine atlases (e.g., BC Marine Conservation Analysis [22], PNCIMA [38], BC MaP Hub [39]), and a compatibility matrix for acceptable uses [40,41]. Additionally, Marxan [42] and Marine InVEST [43] were used to identify priority conservation areas and ecosystem services, respectively, and SeaSketch was used to access spatial data and metadata, and undertake participatory mapping and spatial analyses [20]. This approach had a series of benefits for the local circumstance. It utilized best practice and blended experiences from a wide variety of cases, it was transparent and participatory, and it incorporated past work done in the planning area. Although spatial zoning was one of the desired outputs for the MaPP initiative, it was important to ensure the partners and user groups approached this with a set of defining principles and objectives to provide for a structured and locally specific approach.

3. Guiding principles and objectives for the zoning exercise

The MaPP Partners developed guiding principles and objectives for zoning in the MaPP study area. The guiding principles, or 'rules of the road', had two primary functions during the planning process: 1) to assist the development of zone designations; and, 2) to provide structured guidance on how to implement the Framework. Thirteen (13) guiding principles were developed in consultation with stakeholders in 2012 to apply zone designations consistently across four sub-regions and the MaPP study area:

1. Set clear zoning objectives as early as possible in the process and make this as participatory as possible.
2. Spatial planning tools should incorporate data and provide results at the appropriate geographic scale of the area to be zoned and be relevant to the overall objectives of the zoning process. Planning tools include compatibility matrix, vulnerability matrix, and Marxan analyses, as well as tradeoff analyses and scenario development [20].
3. Given both the unpredictable and highly variable nature of the marine environment as well as gaps in understanding, various approaches and knowledge or information types may be combined or used in the zoning process (e.g., best available scientific data, Indigenous knowledge, local knowledge, socio-political factors).
4. Knowledge, understanding and accurate information should be used for successful establishment and application of marine zones. Spend adequate time educating and informing people about the tools used to support the placement of the zones and wherever possible, provide tools that everyone can use. To the extent possible, make sure people understand why things are where they are to increase user buy-in and compliance.
5. Assumptions behind the designation of zones should be clearly stated and uncertainties highlighted.
6. Obtain social, cultural, economic, and ecological information and the determination of values (that often form the basis for zone placement) from a diversity of knowledge bases such as scientific, traditional or local.
7. Decisions for zoning designations need to come from, or be informed by, a variety of backgrounds to reflect the range of values present in the MaPP study area or sub-regions. Decisions will be influenced by the values held by the decision makers, and their interpretation of ecological, social, cultural and economic information.
8. Weigh simplicity against effectiveness.
9. Build on past and existing zoning efforts that are consistent with an ecosystem-based management approach. For example, consider legally designated existing terrestrial zoning adjacent to marine zones for increased connectivity between land and marine environments.
10. Wherever possible, do not duplicate existing zoning efforts or create new conflicts with existing zones. For example, consider all existing marine zoning in the placement of any new zones (e.g., military zones, shipping lanes, marine protected areas) and consider areas in the process of becoming legally designated. This principle includes respect for existing marine laws and regulations that regulate marine activities (e.g., Fisheries Act, Shipping Act).
11. When feasible and where necessary, consider seasonal or temporal aspects for managing marine uses and activities through zoning. Dynamic zoning that considers solutions for specific times or seasons may need to be considered to avoid some conflicts between users, or when incompatible activities occur in the same place at different times.
12. The three-dimensional nature of the marine environment is recognized by designating a single horizontal zone that clearly stipulates what can, or cannot, occur in the benthic, pelagic and surface realms. The zoning framework is designed to apply across the entire water column (benthic, pelagic, surface realms), with non-overlapping zones designated based on surface coordinates and recommended marine uses and activities clearly identified for surface, pelagic and benthic areas, as appropriate.
13. Revisit zoning plans and adapt over time, where necessary.

In conjunction with the defined principles, it was also important to articulate specific zoning objectives to help frame and scope the exercise. Zoning objectives were intended to articulate the desired outcomes from zone designation, thereby providing users with a reference point to measure performance and monitor effectiveness during plan implementation and review cycles. Zoning objectives also supported the EBM approach of MaPP.

1. Identify and address present and potential future conflicts among marine uses and activities, and between uses and ecological

integrity, to find an optimal solution that results in maximum spatial and temporal compatibility;
2. Provide certainty for marine sectors and users, including those who rely on the marine environment for their food, and for economic development opportunities;
3. Recommend spatial locations for marine protection that include either or both ecological and cultural values including locations that will contribute to a Marine Protected Areas Network for the Northern Shelf Bioregion;
4. Guide and/or direct overall conservation and resource management and decision-making by provincial, First Nations, federal and local governments; and
5. Build efficiencies in permitting for marine uses and activities notwithstanding the necessary adherence to federal, provincial, local and First Nation government policy, regulations, checks, and due process.

The iterative process of developing a Framework outline, socializing the implications and use of marine zoning to both the MaPP planning partners and user groups, and defining principles and objectives was an important step towards the spatial zoning component of the process. This, in turn, created for a more informed and efficient zone designation and application process.

4. Zone designation development

During the development of the Framework, a global analysis revealed a high degree of variability in the number of zone types and level complexity across frameworks [e.g., 9,13]. In early 2012, the MaPP planning team reached out to Australia's Great Barrier Reef Marine Park Authority (GBRMPA) for advice and any lessons learned to guide the development of a zoning framework for the MaPP process. The GBRMPA zoning framework includes eight different zones to meet the objective(s) for conserving the habitats across 344,440 km^2 in Eastern Australia [9, 44]. The information shared from the GBRMPA to MaPP was to keep the framework simple and have between 3 and 5 zone categories. An additional recommendation was to use an objective-based approach, with clear links in the Framework to what can be implemented with existing regulations. For MaPP, the process of defining the scale and scope of the initiative was an important step in the design of the Framework; the Framework needed to address multiple marine based uses and activities (Table 1) that reflected the partners' authorities and overall vision, apply across a variety of spatial scales, and be flexible enough to account for localized environmental, social, and cultural variability. This was an important part of the discussion on how to both initiate zoning design discussions amongst the MaPP Partners and arrive at a three-zone approach for the MaPP study area.

Three zone types were defined in the Framework for designation: General Management Zone (GMZ), Special Management Zone (SMZ), and Protection Management Zone (PMZ) (Table 2). Briefly, a General Management Zone was intended for new and existing uses and activities that reflect an EBM approach. A Special Management Zone was for uses and activities that were of particular interest for specified cultural and sustainable economic development purposes now and in the future. A Protection Management Zone was primarily to promote conservation or protection of identified ecological or cultural values.

Flexibility within the Framework, general management directions and/or conditional statements were all used to capture specific needs and the variation between four sub-regions given societal and cultural preferences. For example, a conditional statement in a GMZ regarding finfish aquaculture in the Central Coast Marine Plan makes special note of current moratoria regarding net-pen finfish aquaculture and denotes the need to address First Nations interests in whose territory the activity is proposed. In other instances where PMZs or SMZs are designated, more specific conditions were also developed, such as a requirement for adherence to local government by-laws and avoidance of specific

Table 1
Descriptions of marine uses and activities in the MaPP study area, December 2013.

Category	Marine Use or Activity	Description
Aquaculture	Bottom Aquaculture – Marine Plants, Shellfish, Other Invertebrates	Cultivation and harvesting of marine plants, shellfish and other invertebrates for commercial purposes. Culture activity takes place on the sea floor and/or between the high water mark and the low water mark in a natural or manufactured environment. Includes associated physical structures such as rock walls, fencing and anti-predator netting.
	Off Bottom Aquaculture – Marine Plants, Shellfish, Other invertebrates	Cultivation and harvesting of marine plants, shellfish and other invertebrates for commercial purposes. Culture activity takes place on the surface or within the water column using grow-out structures such as bags, nets, strings, trays or tubes suspended from longlines or rafts anchored to the seabed. Includes associated physical structures such as anchor blocks, feed barges and sheds, float homes for accommodation, navigational markers, net storage, and mooring lines.
	Off Bottom Aquaculture – Finfish	Cultivation and harvesting of finfish for commercial purposes. Culture activity takes place on the surface or within the water column using net cages anchored to the seabed or closed pens. Includes associated physical structures such as anchor blocks, feed barges and sheds, float homes for accommodation, navigational markers, net storage, and mooring lines.
Energy	Renewable Energy Generation	Energy generation from wave, wind, tidal and/or other renewable marine sources. Includes generation structures fixed or anchored to the seabed or foreshore, and industrial facilities such as maintenance buildings. Does not include transmission or distribution lines on land or in the sea.
Industry	Forestry Operations – Log sort and/or log dump	Marine operations associated with deposition, sorting, and processing of harvested timber. Includes related facilities and infrastructure, log dumps, log sorts, heli-log drop sites, as well as physical structures such as anchor devices, fill, pilings, permanent ways or ramps and floating camps for accommodation. May involve modifications of intertidal area to support related activities.
	Forestry Operations - Helicopter drop sites	Marine operations associated with helicopter log drop sites.
	Mining Operations	Marine operations associated with extracting of minerals, including sand and gravel mined from foreshore, nearshore and offshore areas, and including related sorting, storage and processing facilities as well as related structures. Does not include wharves or docks used for loading and transport of mined products from upland mining operations.

(*continued on next page*)

Table 1 (*continued*)

Category	Marine Use or Activity	Description
Infrastructure	Commercial and Recreational Anchorages	A natural sheltered area or harbour used for temporary and untenured public, recreational or commercial boat anchorage. May include commercial tow boat reserves and other marine areas reserved under provincial legislation for safety-oriented purposes.
	Float Homes	Structures built on a flotation system, which are used for permanent or seasonal residential habitation and are not intended for navigation or as a navigational craft. Does not include floating structures used for commercial purposes (e.g. forestry float camps, or marine aquaculture).
	Floating Lodges	Floating structures and facilities used for accommodation associated with commercial tourism purposes, including floating lodges or "mother ships" moored on the seabed. May include access to camps on adjacent upland. This does not include pocket cruisers or private commercial tourism vessels
	Level 1 Docks, Wharves & Facilities	Facilities designed to accommodate commercial, community, public or private marine use by small vessels. Facilities generally do not include a concentration of marine services. Includes private and public moorage facilities, commercial and community boat ramps, docks associated with upland lodges and base camps, boat haul-outs, and associated structures such as boat lifts and anchor lines. Permanently affixed to foreshore or seabed.
	Level 2 Docks, Wharves & Facilities	Facilities designed to attract and accommodate large commercial vessels or ships, or multiple small vessels for commercial, community, institutional, or private marine uses. Includes docks, wharves, piers, ramps, breakwaters, and related structures in harbours, marinas and ferry terminals, and associated marine services (e.g., ways, repairs, food services, pump-out sites, fuel). Structures may be affixed to foreshore and seabed through pilings or floats, or involve foreshore fill. Includes commercial ports.
Recreation & Tourism	Commercial Recreation and Tourism	Non-extractive commercial recreation involving a paid service component such as crewed boats, guiding and interpretation, cultural tourism to interpret cultural heritage, nature-based adventure and ecotourism.
	Public Recreation and Tourism	Non-extractive uses and activities include birding, boating, jet skiing, kayak staging and landing areas, motor boating, sailing, scuba diving, snorkelling, stand up paddle boarding, surfing, swimming, temporary anchorage, water skiing, whale watching, wildlife viewing, and windsurfing. Public recreation does not involve a paid service component.
Research	Research	Activities designed to establish or expand knowledge of the marine environment and undertaken by educational institutions, research institutions, surveyors, research companies or consultants. Also includes citizen science, non-profit activities, and locally based research and monitoring activities.
Utilities	Linear Utilities	Underwater lines and structures for flow, transit, distribution or broadcast of water, electricity, and telecommunication services for public and/or private purposes. Generally on or under the seabed or anchored to the seabed, but may also be suspended in the water column. Includes associated rights of way. Includes associated infrastructure and rights of way.
	Point Source Utilities	Outfalls and discharge points for sewage wastewater for public, private, commercial and/or industrial purposes.

Table 2
Overview of the purpose, objective, and example of the three zone types.

Zoning Type	Purpose	Objective	Examples
General Management Zone (GMZ)	Allocates space for marine uses and activities managed under an EBM framework	To manage for present and potential future marine uses	GMZ will not be categorized to reflect different values, interests, or priorities, that is, there will not be sub-zones or categories for different uses, activities, or objectives
Special Management Zone (SMZ)	Allocates space for high priority and/or high potential marine uses and activities	To manage for one or more identified high priority and/or high potential marine uses or activities.	Shellfish aquaculture, marine renewable energy, marine community or culture, marine tourism
Protection Management Zone (PMZ)	Allocates space for conservation purposes or objectives	To protect the full range of values that marine environments provide with a primary emphasis on maintaining marine biodiversity	Sponge reefs, seamounts, canyons, foraging habitats for seabirds

cultural sites.

4.1. General management zone (GMZ)

A General Management Zone (GMZ) was intended for uses and activities through an overarching EBM approach, which is the key consideration that distinguishes the GMZ from the status quo. Management prescriptions in regulations or policy would be identified as well as the general management direction provided in sub-regional marine plans including prohibitions and exceptions for activities that occur on the seabed, pelagic, or surface areas.

In a GMZ, acceptable public, commercial, and industrial uses and activities would exist for the foreseeable future and managed (in accordance with an EBM approach) using current tenuring policies, standards, and best practices. Acceptable activities in a GMZ included, but were not limited to: community services and maritime

infrastructure, tourism, and energy or power developments, as reflected in the RUA tables. GMZs also included recreational and commercial fishing, vessel transportation, and other activities in accordance with federal government management.

4.2. Special management zone (SMZ)

A Special Management Zone (SMZ) provided direction unique to encouraging, strengthening, and/or maintaining a high priority and/or high potential marine use or activity such as shellfish and marine plant aquaculture, cultural heritage, commercial and public recreation and tourism, and marine renewable energy. SMZ areas were sometimes named for the type of activity that occurred, for example, Special Management Zone – Aquaculture - but this was not always required. Existing and future economic development opportunities were also considered, as well as cultural uses and activities that require specific environmental conditions or locations in order to be viable and consistent with an EBM approach. In the RUA tables, public, commercial, and industrial uses and activities were denoted according to compatibility and suitability with the high priority and/or potential use that occurred in this area, as well as the vulnerability of ecosystem types to the stressors that an activity creates [45]. For example, community plans for economic development within the MaPP study area were reviewed in the context of the list of industrial uses and activities (see Table 2) to determine compatibility.

4.3. Protection management zone (PMZ)

A Protection Management Zone (PMZ) allocated space primarily for maintaining or promoting conservation and protection of ecological and cultural values or features ranging from local (e.g. a kelp bed) to regional scales (e.g., spawning or aggregation areas for specific species). The objective of the PMZ zoning type was to protect the full range or specified values that marine environments provide with a primary emphasis on maintaining marine biodiversity, ecological representation and resilience, and special features in the MaPP study area (e.g., sponge reefs, seamounts, canyons, or seabird foraging habitats). Furthermore, areas were identified and proposed for consideration in the context of a robust legislated network of marine protected areas under the applicable provincial or federal legislation (e.g., implementation of the Canada-British Columbia MPA Network Strategy).

PMZs were intended to capture the range of acceptable and desired tenured uses that were compatible with protection. As previously mentioned, the use of the term “Protection” (rather than protected) was chosen in 2013 specifically to distinguish between legally defined Marine Protected Areas (MPAs) [40] and additional forms of protection that may or may not be legally binding. The IUCN Guidelines for Marine Protected Areas [40] were used as a reference in the discussion for acceptable uses and activities in each PMZ. The IUCN categories were not applied to each PMZ area in part because MaPP was going to be adopted as policy, not a legally enforceable plan. This meant that the PMZ areas would not be legally established through MaPP and therefore not reflected in the World Database on Protected Areas for publication.

Concluding the definition and scope of the specific marine uses and activities, the scope and objectives of the zone types (including nomenclature), and the framing of this in conjunction with the guiding principles and overall objectives, was important to enable the spatial application of the Framework.

5. Applying the zoning framework to identify zones

Proposing and finalizing zone boundaries and the associated recommended uses and activities involved integrated different knowledge sets, planning tools, stakeholder engagement, and policy and legal mechanisms. The knowledge and information component included Indigenous knowledge, local knowledge, sector knowledge, western science, and spatial data layers for species, habitats, and marine uses. The technical component included biophysical and spatial annealing, Marxan [42] was used to identify high value conservation areas and Geographic Information Systems (GIS) were used for spatial analyses. The policy and legal components included marine resource management instruments such as agreements, laws (e.g., BC Land Act), regulations, standards, policies (e.g., BC Lands policies on aquaculture, docks, wharves, telecommunications), and guidelines from provincial, First Nations’, and federal governments. Decisions were informed and supported by all relevant existing coastal plans and decisions in BC (e.g., Central Coast Land and Resource Management Plan, Johnstone Bute Coastal Marine Plan, Coast Land Use Decision - Ecosystem-based Management Working Group) [46–48].

To support each zoning proposal and the efficient compilation of information for stakeholder review of areas, a rationale was prepared for each zone with detailed information on purpose, species, habitats, marine uses, existing zones and possible future uses. A ’Recommended Uses and Activities’ (RUA) table template was drafted by the Partners, based on known uses and activities that require authorization in the marine zone, for each zone designation, polygon, or category in all sub-regions (Fig. 2). The purpose of the RUA table was to describe the acceptable uses and activities now and into the foreseeable future (up to 20 years). In the RUA template, activities legend included acceptable (either A or ✓), conditional (either C or ○), not acceptable (X), or not applicable (N/A) for where an activity does not occur and is not reasonably expected to occur in the foreseeable future (i.e., 5–20 yrs.). For example, sub-surface mining is prohibited in all marine waters in British Columbia under a current policy moratorium and thus received a N/A. If a change in this policy (or any other relevant policy) occurs, then the RUA table would need to be reviewed and updated during a plan amendment process. For each zone proposal, stakeholder advisory committees were engaged on the rationale and associated RUA tables, contributing to the iterative approach where feedback was taken back to the MaPP Partners for review and incorporation where appropriate, before a final zone designation was prepared.

Temporal scales were also incorporated into zone designations with conditions, where feasible, such as if a particular activity only occurred at certain times of the year and thus spatial overlap may or may not be relevant for the RUA table. An example of this is the use of marine space for temporary log storage in remote areas via helicopter drop zones and the use of these same spaces for coastal tourism (e.g, sea kayaking) - two uses incompatible at the same time. However, if temporally separated, the two activities can occur through specific conditional statements for the zone.

5.1. Sub-regional application and flexibility

Incorporating a large degree of flexibility allowed the MaPP Partners to represent the diversity of biophysical, social, economic, and cultural values across the entire study area which fostered sufficient detail and broad stakeholder and public support. Flexibility in the design and application of the Framework was essential because the MaPP study area includes more than 20 coastal communities with similar and different values, needs, and marine uses that occur at a variety of spatial scales. For example, forestry log handling sites, docks, wharves, and marinas occur throughout the study area while linear infrastructure and certain marine activities like finfish aquaculture are permited in only parts of the coast. The resulting zones and associated recommendations and conditions met provincial and Indigenous governmental requirements including with respect to the review of permit and tenure applications in the coastal zone.

During zone development, each sub-regional planning group developed RUA tables for each zone proposal that reflected the current and potential future uses and activities in the area. The RUA tables received multiple rounds of inputs from stakeholder groups and would be customized for specific situations within a sub-region. For example,

Category	Marine Uses and Activities	General Management Zone	Diigun Sda Aduu – Cloak Bay	Kehdaa Gwaayee - NW Graham - Small Islands	Gwaay's Kún Gagadiis – West Langara Nearshore	Táas Dámdagaas Gagadiis – Jalun River Beach	T'aalan Sil'ang Gagadee - Lepas Bay Inside	K'wayandáas Sda - NW Graham - Cape Knox	Gwaay's Kún K'adgwii – West Langara Offshore	K'iis Gwaay Aduu - Langara	Jaalan Gagadiis – Jalun to Naden
Site Name / Zone Type		GMZ	PMZ*			PMZ*		PMZ*		PMZ*	PMZ*
Aquaculture	Bottom Culture Aquaculture Siting – Plants, Shellfish, Other Invertebrates	✓	X	X	X	X	X	X	n/a	✓	✓
	Off Bottom Aquaculture Siting – Plants, Shellfish, Other Invertebrates	✓	X	X	X	X	X	X	n/a	✓	✓
	Off-Bottom Aquaculture Siting – Finfish	X	X	X	X	X	X	X	X	X	X
Energy	Renewable Energy Generation	✓	X	X	X	X	X	X	X	✓	✓
Industry	Forestry Operations	✓	X	X	X	X	X	X	n/a	✓	✓
	Mining Operations	X	X	X	X	X	X	X	X	X	X
Infrastructure	Commercial and Recreational Anchorages	✓	O[2,4]	O[2,4]	O[2,4]	O[2,4]	O[2,4]	O[2,4]	O[2,4]	✓	✓
	Float Homes	✓	X	X	X	X	X	X	n/a	O[2,4]	O[2,4]
	Floating Lodges	✓	X	X	X	X	X	X	n/a	O[2,4]	O[2,4]
	Level 1 Docks, Wharves & Facilities	✓	O[2,3,4]	X	O[3]	O[2,3,4]	O[2,3,4]	O[2,3,4]	n/a	✓	✓
	Level 2 Docks, Wharves & Facilities	✓	X	X	X	X	X	X	n/a	O[5]	O[5]
Recreation/ Tourism	Commercial Recreation and Tourism	✓	O[2,4]	O[2]	O[2,4]	O[2,4]	O[2,4]	✓	✓	✓	✓
	Public Recreation and Tourism	✓	O[2,4]	O[2]	O[2,4]	O[2,4]	O[2,4]	✓	✓	✓	✓
Research	Research	✓	O[1]	O[1]	O[1]	O[1,4]	O[1,4]	✓	✓	✓	✓
Utilities	Linear Utilities	✓	X	X	X	X	X	X	n/a	✓	✓
	Point Source Utilities	✓	X	X	X	X	X	X	n/a	O[2,4]	O[2,4]

* Haida designation is Kagin Diiyagan (Massett Haida) or Kuuyada (Skidegate Haida)

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. 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 in such circumstances. Zoning does not direct uses or activities outside of provincial regulatory authority.

Key:	
Haida traditional uses, including practices for food, social, ceremonial and stewardship purposes, continue in accordance with legal obligations.	
Acceptable: Uses and activities are considered to be 'acceptable' subject to applicable laws, policy and relevant agreements between the Parties. Acceptability of any use/activity does not guarantee that a use/activity will be approved.	✓
Conditionally Acceptable: Uses and activities are considered to be 'conditionally acceptable' subject to applicable laws, policy and relevant agreements between the Parties, and provided they are consistent with (adhere to) the plan conditions. Conditional acceptability of any use/activity does not guarantee that a use/activity will be approved.	O
Not Acceptable: Uses and activities are considered to be 'not acceptable' and should not be approved.	X
Not Applicable: The use or activity could not or would not occur in this zone due to the physical environment or other limitations (e.g. forestry operations in offshore PMZs).	n/a
Note: This table does not alter the Council of Haida Nation and Province of BC referral obligations under existing agreements.	

List of Conditional Statements

O[1]: Only research activities that are non-extractive and will not disturb sensitive or critical features and habitat are acceptable.
O[2]: Should avoid disturbance of sensitive or critical features and habitat; further site conditions may be identified in an approved Protection Management Plan.
O[3]: Infrastructure enabling Haida access to adjacent reserve lands permitted.
O[4]: Activity should be compatible with Haida cultural use of the area, including consideration of Haida activities and/or stewardship knowledge; further site conditions may be identified in an approved Protection Management Plan.
O[5]: Infrastructure and associated activities should be compatible with vision and conservation objectives of PMZ or SMZ; further site conditions may be identified in an approved Protection Management Plan.

Fig. 2. Example of a Recommended Uses and Activities (RUA) table from the Haida Gwaii Marine Plan (Table 8.15 Recommended Uses and Activities for Dixon Entrance – NW Graham marine zones).

finfish aquaculture occurred and was conditionally recommended in the NVI sub-region but was not recommended in the NC sub-region due to an existing moratorium since 2008 [49] and the Framework could accommodate these differences in policy and legislation.

Flexibility was also important for governance differences such as the shared First Nations territories in the North Coast and Central Coast sub-regions. A final example of this flexibility is highlighted by the different zoning schemes for Haida Gwaii and North Vancouver Island; in Haida Gwaii, there are 87 Protection Management Zones throughout the sub-region but only one large one in the North Vancouver Island sub-region. Overall, flexibility and scalability of the Framwork was a critical factor for the application of the Framework and is seen as a key lessoned learned that MaPP is able to make to MSP globally.

5.2. Zone establishment & implementation

The Framework is currently being implemented as policy by the Provincial and Indigenous governments, not signed into law. In practice, the policy helps guide the Provincial delegated decision makers' and First Nations' assessments of the suitability of a particular use or activity taking place in a specific spatial location. This policy-based approach can allow for sub-regional customization accounting for localized values and pressures, adaptability to change and refinement, and administrative efficiency when applicants apply for uses and activities that are consistent with the zoning recommendations. However, the reverse may also be true as proponents can still apply for uses and activities that are not consistent with the Framework and which may cause issues between the Partners if policy is not followed by Provincial and First Nations decision makers. In this instance, and if this were to be proven problematic over time, legally defined zones would need to be implemented to be enforceable. Additionally, the PMZs were anticipated to contribute to the process of designing of a network of Marine Protected Areas in the same planning boundary currently underway [50]. The purpose of the MPA network process is to implement the Canada – British Columbia MPA Network Strategy [51] and to assist with achieving Canada's commitment to the Convention on Biological Diversity and UN Susutainable Development Goals (UN SDGs).

As per the MaPP goals, the Framework did not lead to legally designated zones during the MaPP process in part because of the scope of the plan and that other jurisdictions within the waters did not participate in the MaPP planning process (i.e., federal government). The purpose of MaPP was to contribute to integrated ocean management in the North Pacific Coast (and Northern Shelf Bioregion) with the policy directives aimed at uses and activities within the stakeholder-supported Framework and RUA tables. Marine spatial planning is a specific case of integrated ocean management to assist with marine decision-making [52] and marine policy is one of several important governance options. Buy-in, effectiveness and compliance can be high if a policy is developed and well written with stakeholders using a bottom-up approach versus top-down legislation [53].

One potential drawback of the Framework is the fact that a statutory decision maker (i.e., a person who has the legal authority to carry out decisions regarding access to public resources) is not legally bound to make decisions consistent with the RUA table recommendations, as per the inherent standard for policy-based management. Another potential drawback is that the referring Indigenous government is not compelled to support or deny a particular use or activity that is consistent with the RUA table recommendations. Thirdly, a particular marine user cannot be penalized if they do not follow the RUA recommendations because they are not legally binding. Essentially, this a voluntary plan with a 'should follow' vs. a 'must follow' scenario for implementation. However, both a statutory decision maker and Indigenous government need to consider all relevant information when making a decision and in the case of the MaPP plans, the Framework and associated RUA table recommendations have considerable weight in that process. This is further reinforced through the official signing of implementation agreements for each of the four sub-regional plans by respective political authorities in 2017 [16].

Administratively, the Framework has been seen by the MaPP Partners as effectively facilitating compliance in terms of response to provincial tenure applications. To assess the efficacy of a policy-based approach for marine zoning and compliance with MaPP's recommendations, a review of tenure decisions made over three years of implementation was conducted. The analysis (unpublished) found that over 80% of the tenuring decisions made within the MaPP planning area were consistent with the recommendations in the Framework. Furthermore, user groups and stakeholders continue to positively engage and participate in established advisory committees [54] indicating a degree of broader support which is a critical component to successful plan implementation [55–57]. If, in the future, the Partners see value in legislating the MaPP zones, it would be necessary to conduct a specific analysis to determine whether or not this would increase the benefits already derived from the current approach.

6. Zoning outcomes

A final version of the Framework was approved for the MaPP study area in August 2014 that included:

- Outputs associated with Zoning at sub-regional and regional scales
- Principles for Establishing Zones: to provide clear guidance for applying the zoning framework consistently across the MaPP study area at both regional and sub-regional scales
- Geographic Scale
- Zoning Objectives: to identify the key management results that would support the developed EBM framework after applying zoning to the MaPP study area.
- Zone Designations: zone name, description, objective, management approach
- Glossary and Abbreviations
- Appendices: EBM Principles, IUCN Descriptions for Marine Protected Areas, Guidelines for applying the framework, sample designation map, Planning Tools: Compatibility Matrix, Recommended Uses and Activities table, and Vulnerability Matrix

In total, the MaPP Partners developed and are currently implementing 295 zones within 101,524 km^2 of the MaPP Region (Table 3, Fig. 3).

7. Zoning in a multi-jurisdictional space

One of the hallmarks of the MaPP process was the utilization of an EBM approach and, when combined with the adjacent Great Bear Rainforest management approach, it is one of the largest contiguous land-sea EBM management regimes globally (~166,000 km^2). However, given the legal and jurisdictional realities governing how Canada manages marine resources and activities, all levels of government must work together to achieve true marine EBM. In the case of the MaPP initiative, only the provincial government and Indigenous governments were partners, and this resulted in several limitations. Of most notable

Table 3
Zoning summary statistics for the Marine Plan Partnership for the North Pacific Coast, 2014–2017.

Zone Type	Total Area (km^2)	Percent of the MaPP Region	Shoreline* Length (km)	Percent of MaPP Region Shoreline	# Zones
Protection Management Zone (PMZ)	16,278	16%	10,850	37%	241
Special Management Zone (SMZ)	3786	4%	4004	14%	53
General Management Zone (GMZ)	63,292	62%	8271	28%	1
Existing and proposed protected areas not within PMZs	14,050	14%	5573	19%	-
MaPP Region without MaPP zoning	4118	4%	753	2%	-
Total	101,524	100%	29,451	100%	295

* Shoreline is the linear extent of the MaPP region measured at the mean high water mark, including the perimeter of islands.

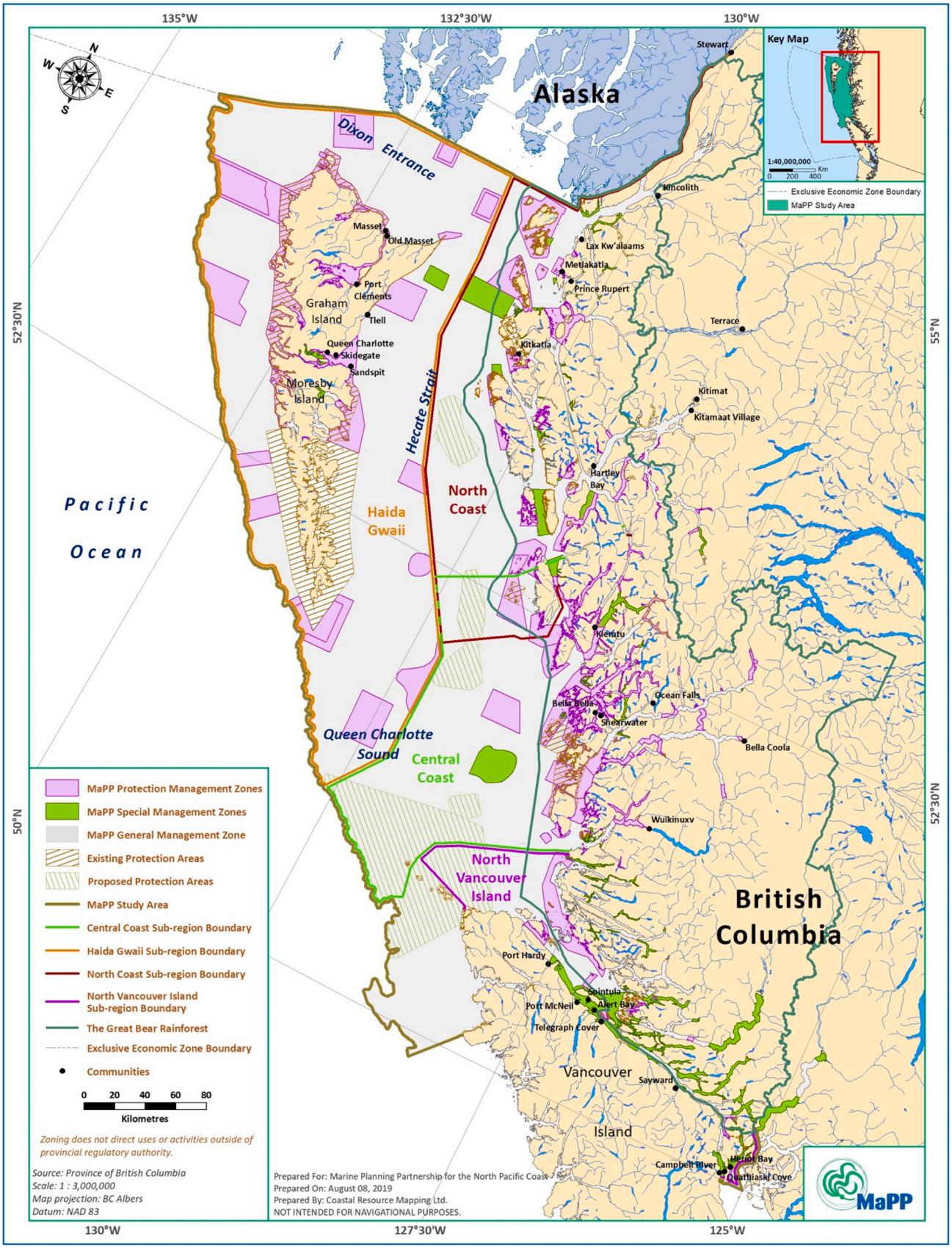


Fig. 3. Map of the MaPP study area showing the four sub-regions (Haida Gwaii, North Coast, Central Coast, and North Vancouver Island) and the zones developed using the Framework during the planning process.

significance is the lack of management direction for commercial and recreational fisheries, and marine transportation. Military uses within pre-existing marine protected areas were also excluded due to jurisdictional, legal, and process complexities associated with zoning in existing, legally designated areas. However, the scope of the Framework was first and foremost to guide Indigenous and provincial governments assessment of uses and activities, so matters of federal jurisdiction were determined to be beyond the scope of the zoning effort [16]. Consequently, the application of the EBM framework developed by the MaPP Partners falls short of being fully integrated and holistic. For example, while MaPP did not offer recommendations on uses and activities that fell outside the partners jurisdictional authorities, the Partners did use data from all available sources related to the MaPP goals including those that were not within jurisdictional scope, such as fishing and transportation, to inform management recommendations in association with zone types. Although this approach may receive some criticism, it allowed the Partners to fully implement the Framework while accounting for all uses and activities, regardless of jurisdictional limitations. In time, the application of the Framework may inform activities such commercial and recreation fishing and marine transportation if the relevant authorities choose to participate.

7.1. Benefits of zoning

For the MaPP Partners, the development and application of the Framework was done in an effort to realize multiple benefits for the ocean space. Based on MSP in other jurisdictions with zoning, the anticipated outcomes of developing a zoning framework include: a reduction in user conflict in marine spaces, the conservation of important cultural and ecological values, administration efficiencies in terms of cost savings regarding the review and adjudication of permits and authorizations in the coastal zone, efficiencies in legislated Indigenous consultation processes, user certainty and a more secure and predictable investment climate for industry [2,7,34].

The anticipated benefits of zoning were discussed by the MaPP Partners and presented during engagement with user groups, local government, and communities to improve 'buy-in'. It was a challenge to connect the anticipated benefits of zoning during an active MSP process given a multitude of ecological and social factors. For example, while the MaPP plans established specific zones for economic development purposes, this does not guarantee they will be used or developed. Broader economic conditions, whether locally or globally, can have a profound effect on investment opportunity and be a limiting factor regardless of a zoning designation. Similarly, zones established for conservation purposes can also be impacted by broad scale processes or administrative challenges (e.g., changing climatic conditions or lack of funding for monitoring) that may hamper their effectiveness. A robust and rigorous assessment during implementation is crucial to demonstrate the effectiveness of zoning in the marine environment and for MaPP, this will take time to demonstrate given the stages of implementation and scale at which zoning was applied.

8. Lessons learned

During the process of developing the Framework, the MaPP Partners overcame several challenges and obstacles. Upon reflection, there are five overarching lessons learned which could be applied to other MSP processes globally that are contemplating marine zoning.

1. **Keep marine zoning straightforward and simple.** Early in the process, there was interest to create zones for every major marine activity, sometimes termed activity-based or use-based zoning (e.g., energy zone, aquaculture zone, tourism zone, Indigenous uses zone). This path resulted in highly variable zoning terminology across four sub-regions. Upon reflection, the Partners realized this approach would require an overly complicated framework and put the planning Partners in a position of favoritism over neutrality in order to decide the names of the zone categories. In addition, it would have been complex from a user's perspective and may have affected overall compliance during implementation. These experiences led the Partners to use an objective-based framework, with three zone categories, that would be flexible, adaptable, and clearly differentiate between three distinct objectives. This approach allowed for more time to be spent on the process to locate and propose zones versus deciding between zone categories. The Protection Management Zones were further assessed using international guidelines (i.e., IUCN categories for Marine Protected Areas) and to specify special management in SMZs, as necessary.
2. **Develop zoning principles, objectives, and designations with input from user groups early in the process**. For the MaPP Partners, this would have likely shortened the overall timelines to develop the Framework and may have allowed for more robust analyses of the potential impacts of zone designations during consultations. The approach taken was to prepare a draft Framework, receive approval from senior governance members, and then present to stakeholders for discussion and their inputs. In retrospect, it may have been beneficial to develop the Framework earlier with stakeholders from the very beginning, receive input and buy-in, and then move through MaPP collaborative governance structures for approvals. During MSP, spatial designations are often the most contentious and controversial components of the process as it can have the most direct and tangible implications to use of ocean space [19].
3. **Match zoning with the implementation mechanism.** If the desired use of a zoning framework is clear, and there is a robust governance structure in place, (i.e., political support and broad community buy-in), policy-based zoning may be sufficient with regards to compliance from marine users. The purpose of MaPP was to preemptively plan for the future and improve and guide ocean management within the plan boundary. The primary use of the Framework was to provide policy-level recommendations to decision makers on the intended uses and activities in the plan area and, in the case of the MaPP Partners, the approach has been effective. If user compliance drops and/or decision makers fail to utilize the Framework for decision rationale, then legislative tools may be more effective and even necessary. It should be noted however, that the marine uses within the Plan area, under Provincial jurisdiction, are still governed by the appropriate legislation and regulations.
4. **Importance of zone naming conventions.** The naming conventions used for marine zoning may significantly impact stakeholder buy-in and reception by user groups. The MaPP planning process might have had fewer iterations for the Framework document if a neutral naming convention was used in the early drafts for purposes of discussion with stakeholders until final names were decided, such as Zone A, B, C. The use of specific names early on pulled focus from discussions about the overall Framework objectives. For example, the Partners initially suggested Marine Protected Area Zone and this was changed to Protection Management Zones after seven months of discussion and several rounds of review with stakeholders about the name. Ultimately, Protection Management Zone was chosen over Protected for three main reasons: 1) the former differentiated the latter from legislated Marine Protected Areas and/or avoided the interpretation that these sites will become legalized Marine Protected Areas; 2) the term "protection" resonated better with specific stakeholders that were concerned with future legal protections and restrictions; and 3) to avoid confusion with the IUCN Protected Area Guideline categories [40] where there are recommendations for uses depending on the MPA category. A fourth and minor consideration was that the three zones would then have similar acronyms: GMZ, SMZ, PMZ. Another example of naming was the use of the term Special Management Zones which was meant to target and emphasize specific sustainable economic opportunities or cultural uses in

the North Coast. The category name was viewed by some as too ambiguous, and the Partners weighed the length of time to change with the need to keep moving forward. The solution was to have specificity with each Special Management Zones, such as SMZ - Cultural Zone, SMZ - Renewable Energy Zone.

5. **Design an adaptable framework that can be applied within the planning boundary across multiple scales**. Flexibility across multiple scales for the four sub-regions allowed for application of the Framework in consideration of the local conditions. While in some cases this created some challenges in terms of interpretation for decision makers, for example, where zoning in some areas is not as spatially precise. Overall, the flexibility ultimately proved useful to allow for timely completion of the overall process.

The five lessons above are just a small handful of learnings gained through the MaPP zoning development process and can likely be applied in any geography under a variety of socio-political systems including potential application in a transboundary context or in areas beyond national jurisdictional boundaries (i.e., high seas). Importantly, the Framework operates in conjunction with the MaPP aspatial ecosystem-based objectives and strategies (e.g., climate change mitigation techniques, governance processes, cumulative effects framework [58]) under a diverse set of thematic chapters in each of the four sub-regional plan and the regional action framework. Over time, the Partners may need to refine and adapt zone types and other processes may transform the policy-based designation to legalized designations.

9. Conclusion

The MaPP planning process developed a comprehensive Framework to guide the management of spatial areas of the North Pacific Coast. The Framework included a flexible suite of tools for the zoned areas such as RUA tables for the joint Provincial – Indigenous governments to use, and associated provisions and conditions for addressing tenure applications. The Framework also provided guidance for future ocean planning efforts such as the development of a Marine Protected Area Network. The Framework allowed for consistent application of principles and objectives for the entire MaPP area while accommodating sub-regional differences. The resultant zoned areas and recommended uses reflect important input from stakeholder advisory committees and a public engagement process.

Zoning and its associated application, commonplace in urban / terrestrial environments, is one tool for the marine environment that can provide both a strategic vision and operational guidance to an increasingly busy part of the world; our oceans and coastlines. As MSP gains in popularity and utility across the globe, the experience within the MaPP partnership has shown marine zoning can be effective at achieving a diverse set of goals and objectives [4]. While the chosen zoning approach during MaPP was not perfect and challenged the status quo amongst user groups, it was a practical and implementable method of identifying and enhancing compatibility between marine-based activities and adding to the safeguards for sensitive marine ecosystems. Over time, the Framework can be refined given that it was designed to be scalable, adaptable, and reflect social and cultural preferences across the whole planning area. The MaPP zones can help coastal and ocean managers within the provincial and Indigenous governments avoid or minimize conflicts amongst user groups as well as support decision-making that balances outcomes across social, cultural, economic, and ecological domains.

CRediT authorship contribution statement

Steve Diggon: Conceptualization, Investigation, Writing – original draft, Writing – review & editing, **John Bones:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing, **Charlie Short:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing, **Joanna Smith:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing, **Aaron Heidt:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing, **Chris McDougall:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing, **Kylee Pawluk:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing.

Data availability

No data was used for the research described in the article.

Acknowledgements

The MaPP Initiative was a project of Tides Canada Initiatives Society (now MakeWay), a Canadian Charity, which received a grant from the Gordon and Betty Moore Foundation for the purpose of supporting the MaPP Initiative planning process. The authors also thank all those who were involved in all aspects of the MaPP Initiative for their input and contributions.

References

[1] J. Day, The need and practice of monitoring, evaluating and adapting marine planning and management—lessons from the Great Barrier Reef, Mar. Policy 32 (2008) 823–831, https://doi.org/10.1016/j.marpol.2008.03.023.
[2] T. Agardy, Ocean Zoning: Making Marine Management More Effective, Earthscan,, 2010.
[3] C. Ehler, Conclusions: benefits, lessons learned, and future challenges of marine spatial planning, Mar. Pol. 32 (2008) 840–843, https://doi.org/10.1016/j.marpol.2008.03.014.
[4] C.N. Ehler, Two decades of progress in marine spatial planning, Mar. Policy 132 (2021), 104134, https://doi.org/10.1016/j.marpol.2020.104134.
[5] O.R. Young, G. Osherenko, J. Ekstrom, L.B. Crowder, J. Ogden, J.A. Wilson, J. C. Day, F. Douvere, C.N. Ehler, K.L. McLeod, B.S. Halpren, R. Peach, Solving the crisis in ocean governance: Place-based management of marine ecosystems, Environ.: Sci. Policy Sustain. Dev. 49 (2007) 20–32, https://doi.org/10.3200/ENVT.49.4.20-33.
[6] K.L. Yates, D.S. Schoeman, C.J. Klein, Ocean zoning for conservation, fisheries and marine renewable energy: assessing trade-offs and co-location opportunities, J. Environ. Manag. 152 (2015) 201–209, https://doi.org/10.1016/j.jenvman.2015.01.045.
[7] J.C. Day, R.A. Kenchington, J.M. Tanzer, D.S. Cameron, Marine zoning revisited: How decades of zoning the Great Barrier Reef has evolved as an effective spatial planning approach for marine ecosystem-based management, Aquat. Conserv. -Mar. Freshw. Ecosyst. 29 (2019) 9–32, https://doi.org/10.1002/aqc.3115.
[8] T. Agardy, G.N. di Sciara, P. Christie, Mind the gap: addressing the shortcomings of marine protected areas through large scale marine spatial planning, Mar. Policy 35 (2011) 226–232, https://doi.org/10.1016/j.marpol.2010.10.006.
[9] J.C. Day, Zoning—lessons from the Great Barrier Reef Marine Park, Ocean Coast. Manag. 45 (2002) 139–156, https://doi.org/10.1016/S0964-5691(02)00052-2.
[10] H.S. Grantham, V.N. Agostini, J. Wilson, S. Mangubhai, N. Hidayat, A. Muljadi, Muhajir, C. Rotinsulu, M. Mongdong, M.W. Beck, H.P. Possingham, A comparison of zoning analyses to inform the planning of a marine protected area network in Raja Ampat, Indonesia, Mar. Policy 38 (2013) 184–194, https://doi.org/10.1016/j.marpol.2012.05.035.
[11] M. Gleason, E. Fox, S. Ashcraft, J. Vasques, E. Whiteman, P. Serpa, E. Saarman, M. Caldwell, A. Frimodig, M. Miller-Henson, J. Kirlin, 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 (2013) 90–101, https://doi.org/10.1016/j.ocecoaman.2012.08.013.
[12] J.M. Burt, P. Akins, E. Latham, M. Beck, A.K. Salomon, N. Ban, Marine protected area network design features that support resilient human-ocean systems: Applications for British Columbia, Canada, Center for Open Science, 2014. ⟨https://ideas.repec.org/p/osf/marxiv/9tdhv.html⟩ (accessed June 1, 2022).
[13] V.N. Agostini, S.W. Margles, J.K. Knowles, S.R. Schill, R.J. Bovino, R.J. Blyther, Marine zoning in St. Kitts and Nevis: a design for sustainable management in the Caribbean, Ocean Coast. Manag. 104 (2015) 1–10, https://doi.org/10.1016/j.ocecoaman.2014.11.003.
[14] K.K. Arkema, S.C. Abramson, B.M. Dewsbury, Marine ecosystem-based management: from characterization to implementation, Front. Ecol. Environ. 4 (2006) 525–532, https://doi.org/10.1890/1540-9295(2006)4[525:MEMFCT]2.0.CO;2.
[15] W.-H. Lu, J. Liu, X.-Q. Xiang, W.-L. Song, A. McIlgorm, A comparison of marine spatial planning approaches in China: marine functional zoning and the marine ecological red line, Mar. Policy 62 (2015) 94–101, https://doi.org/10.1016/j.marpol.2015.09.004.
[16] S. Diggon, J. Bones, C.J. Short, J.L. Smith, M. Dickinson, K. Wozniak, K. Topelko, K. A. Pawluk, The Marine Plan Partnership for the North Pacific Coast – MaPP: A

collaborative and co-led marine planning process in British Columbia, Mar. Policy 142 (2022), 104065, https://doi.org/10.1016/j.marpol.2020.104065.
[17] R.A. Kenchington, J.C. Day, Zoning, a fundamental cornerstone of effective Marine Spatial Planning: lessons learnt from the Great Barrier Reef, Australia, J. Coast Conserv 15 (2011) 271–278, https://doi.org/10.1007/s11852-011-0147-2.
[18] M.W. Beck, Z. Ferdana, J. Kachmar, K.K. Morrison, P. Taylor, Best practices for marine spatial planning, The Nature Conservancy,, Arlington, VA, 2009. ⟨https://marineplanning.org/wp-content/uploads/2015/07/msp_best_practices.pdf⟩. accessed May 30, 2019.
[19] A. Iglesias-Campos, J. Rubeck, D. Sanmiguel-Esteban, G. Schwarz, UNESCO-IOC, E. Commission. MSPglobal International Guide on Marine/Maritime Spatial Planning, UNESCO,, 2021, https://doi.org/10.25607/OBP-1666.
[20] C. Ehler, F. Douvere, Marine Spatial Planning: A Step-by-Step Approach toward Ecosystem-based Management. UNESCO, Intergovernmental Oceanographic Commission and Man and the Biosphere Programme,, Paris, 2009. ⟨https://www.researchgate.net/publication/268036864⟩. accessed May 31, 2019.
[21] M. of Forests, Coastal & Marine Plans - Province of British Columbia, (n.d.). ⟨https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/coastal-marine-plans⟩ (accessed June 1, 2022).
[22] British Columbia Marine Conservation Analysis, Marine Atlas of Pacific Canada: A product of the British Columbia Marine Conservation Analysis (BCMCA), BCMCA, Vancouver, BC, 2011. ⟨https://coastalfirstnations.ca/wp-content/uploads/2017/06/Marine-Atlas-of-Pacific-Canada.pdf⟩ (accessed May 28, 2019).
[23] Oceans Act (S.C. 1996, c31), 1996. ⟨https://laws-lois.justice.gc.ca/eng/acts/o-2.4/⟩.
[24] Pacific North Coast Integrated Management Area (PNCIMA) Initiative, Pacific North Coast Integrated Management Area Plan, 2017. ⟨http://www.pncima.org/media/documents/2016-plan/2316-dfo-pncima-report-v17-optimized.pdf⟩ (accessed May 30, 2019).
[25] mpanetwork – MPA Network, (n.d.). ⟨https://mpanetwork.ca/⟩ (accessed December 2, 2022).
[26] P.S. Levin, M.J. Fogarty, S.A. Murawski, D. Fluharty, Integrated ecosystem assessments: developing the scientific basis for ecosystem-based management of the ocean, PLoS. Biol. 7 (2009) 23–28, https://doi.org/10.1371/journal.pbio.1000014.
[27] M.M. Foley, B.S. Halpern, F. Micheli, M.H. Armsby, M.R. Caldwell, C.M. Crain, E. Prahler, N. Rohr, D. Sivas, M.W. Beck, M.H. Carr, L.B. Crowder, J.E. Duffy, S. D. Hacker, K.L. McLeod, S.R. Palumbi, C.H. Peterson, H.M. Regan, M. H. Ruckelshaus, P.A. Sandifer, R.S. Steneck, Guiding ecological principles for marine spatial planning, Mar. Pol. 34 (2010) 955–966, https://doi.org/10.1016/j.marpol.2010.02.001.
[28] Marine Planning Partnership Initiative, North Vancouver Island Marine Plan, 2015. ⟨http://mappocean.org/wp-content/uploads/2015/11/MarinePlan_NorthVancouverIsland_28072015_corrected.pdf⟩ (accessed May 31, 2019).
[29] Marine Planning Partnership Initiative, North Coast Marine Plan, 2015. ⟨http://mappocean.org/wp-content/uploads/2016/07/MarinePlan_NorthCoast_WebVer_20151207_corrected.pdf⟩ (accessed May 30, 2019).
[30] Marine Planning Partnership Initiative, Central Coast Marine Plan, 2015. ⟨http://mappocean.org/wp-content/uploads/2015/08/MarinePlan_CentralCoast_10082015.pdf⟩ (accessed May 30, 2019).
[31] Marine Planning Partnership Initiative, Haida Gwaii Marine Plan, 2015. ⟨http://mappocean.org/wp-content/uploads/2015/09/HGMP-WEB-2015–07-08.pdf⟩ (accessed May 31, 2019).
[32] Marine Plan Partnership Initiative, Regional Action Framework, 2016. ⟨http://mappocean.org/wp-content/uploads/2016/05/raf_mapp_v2.22_web.pdf⟩ (accessed May 31, 2019).
[33] G. McGee, J. Byington, J. Bones, S. Cargill, M. Dickinson, K. Wozniak, K.A. Pawluk, Marine Plan Partnership for the North Pacific Coast: Engagement and communication with stakeholders and the public, Mar. Policy (2021), 104613, https://doi.org/10.1016/j.marpol.2021.104613.
[34] J.S. Collie, W.L. Adamowicz, M.W. Beck, B. Craig, T.E. Essington, D. Fluharty, J. Rice, J.N. Sanchirico, Marine spatial planning in practice, Estuar. Coast. Shelf Sci. 117 (2013) 1–11, https://doi.org/10.1016/j.ecss.2012.11.010.
[35] S.B. Olsen, J.H. McCann, G. Fugate, The State of Rhode Island's pioneering marine spatial plan, Mar. Policy 45 (2014) 26–38, https://doi.org/10.1016/j.marpol.2013.11.003.
[36] Marine Plan Portal | MaPP, (n.d.). ⟨http://mappocean.org/resources/marine-planning-portal/⟩ (accessed December 27, 2022).
[37] N.C. Ban, C.R. Picard, A.C.J. Vincent, Comparing and integrating community-based and science-based approaches to prioritizing marine areas for protection, Conserv. Biol. 23 (2009) 899–910, https://doi.org/10.1111/j.1523-1739.2009.01185.x.
[38] Pacific North Coast Integrated Management Area Initiative, Atlas of the Pacific North Coast Integrated Management Area, Pacific North Coast Integrated Management Area Initiative, 2011. ⟨http://www.pncima.org/media/documents/atlas/pncima-atlas_print_online.pdf⟩ (accessed May 30, 2019).
[39] G.C. and P. Engagement, BC's Map Hub - Province of British Columbia, (n.d.). ⟨https://alpha.gov.bc.ca/gov/content/data/geographic-data-services/web-based-mapping/agol⟩ (accessed December 20, 2022).
[40] 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. ⟨https://www.iucn.org/sites/dev/files/import/downloads/uicn_categoriesamp_eng.pdf⟩ (accessed May 28, 2019).
[41] Sustainable Grenadines Inc, Developing a Framework for a Comprehensive Marine Multi-use Zoning Plan, Clifton, Union Island, St. Vincent and the Grenadines, 2012.
[42] I.R. Ball, H.P. Possingham, M. Watts, Marxan and relatives: Software for spatial conservation prioritisation. Chapter 14., in: A. Moilanen, K.A. Wilson, H. P. Possingham (Eds.), Spatial Conservation Prioritisation: Quantitative Methods and Computational Tools., Oxford University Press, Oxford, UK, 2009, pp. 185–195. ⟨https://www.researchgate.net/publication/43525654_Marxan_and_relatives_Software_for_spatial_conservation_prioritization/download⟩.
[43] InVEST | Marine Planning, (n.d.). ⟨https://marineplanning.org/decision-support/interactive-decision-support/invest-2/⟩ (accessed December 27, 2022).
[44] J.C. Day, K. Dobbs, Effective governance of a large and complex cross-jurisdictional marine protected area: Australia's Great Barrier Reef, Mar. Policy 41 (2013) 14–24, https://doi.org/10.1016/j.marpol.2012.12.020.
[45] S.J. Teck, B.S. Halpern, C.V. Kappel, F. Micheli, K.A. Selkoe, C.M. Crain, R. Martone, C. Shearer, J. Arvai, B. Fischhoff, G. Murray, R. Neslo, R. Cooke, Using expert judgment to estimate marine ecosystem vulnerability in the California Current, Ecol. Appl. 20 (2010) 1402–1416.
[46] M. of Forests, Central Coast Land & Resource Management Plan - Province of British Columbia, (n.d.). ⟨https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/west-coast/great-bear-rainforest/centralcoast-lrmp⟩ (accessed June 7, 2022).
[47] M. of Forests, Great Bear Rainforest - Coast Land Use Decision Update - Province of British Columbia, (n.d.). ⟨https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/west-coast/great-bear-rainforest⟩ (accessed June 7, 2022).
[48] Ministry of Sustainable Resource Management Coast and Marine Planning Branch, The Johnstone-Bute Coastal Plan, 2004. ⟨https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/coastal-marine/johnstone-bute-coastal-plan/johnstone_bute_coastal_plan.pdf⟩.
[49] M. of Forests, Land use - aquaculture - Province of British Columbia, (n.d.). ⟨https://www2.gov.bc.ca/gov/content/industry/crown-land-water/crown-land/crown-land-uses/aquaculture⟩ (accessed June 6, 2022).
[50] M.S. Watson, A.-M. Jackson, G. Lloyd-Smith, C.D. Hepburn, Comparing the marine protected area network planning process in British Columbia, Canada and New Zealand – planning for cooperative partnerships with indigenous communities, Mar. Policy 125 (2021), 104386, https://doi.org/10.1016/j.marpol.2020.104386.
[51] Canada-British Columbia Marine Protected Area Network Strategy, 2014. ⟨https://waves-vagues.dfo-mpo.gc.ca/Library/363827.pdf⟩ (accessed May 30, 2019).
[52] M. Zacharias, Marine Policy: An Introduction to Governance and International Law of the Oceans, Routledge, London, 2014. https://doi.org/10.4324/9780203095256.
[53] C.F. Gaymer, A.V. Stadel, N.C. Ban, P.F. Cárcamo, J. Ierna Jr., 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 (2014) 128–144, https://doi.org/10.1002/aqc.2508.
[54] MaPP | Marine Plan Partnership for the North Pacific Coast, (n.d.). ⟨http://mappocean.org/⟩ (accessed June 3, 2022).
[55] E. Fox, S. Hastings, M. Miller-Henson, D. Monie, J. Ugoretz, A. Frimodig, C. Shuman, B. Owens, R. Garwood, D. Connor, P. Serpa, M. Gleason, Addressing policy issues in a stakeholder-based and science-driven marine protected area network planning process, Ocean Coast. Manag. 74 (2013) 34–44, https://doi.org/10.1016/j.ocecoaman.2012.07.007.
[56] E. Olsen, D. Fluharty, A.H. Hoel, K. Hostens, F. Maes, E. Pecceu, Integration at the Round Table: marine spatial planning in multi-stakeholder settings, PLOS ONE 9 (2014), e109964, https://doi.org/10.1371/journal.pone.0109964.
[57] C. Frazão Santos, T. Agardy, F. Andrade, L.B. Crowder, C.N. Ehler, M.K. Orbach, Major challenges in developing marine spatial planning, Mar. Policy 132 (2021), 103248, https://doi.org/10.1016/j.marpol.2018.08.032.
[58] S.F. Wilson, A Framework for the Assessment and Management of Cumulative Effects on the North Pacific Coast, Marine Plan Partnership, 2020. ⟨http://mappocean.org/wp-content/uploads/2020/07/MaPP_CumulativeEffectsFrameworkNPC_2020_PRINT_compressed.pdf⟩.