CBD

UNEP

Convention on Biological Diversity

Distr.
GENERAL

CBD/SBSTTA/22/INF/27
21 June 2018

ENGLISH ONLY

SUBSIDIARY BODY ON SCIENTIFIC, TECHNICAL AND TECHNOLOGICAL ADVICE
Twenty-second meeting
Montreal, Canada, 2-7 July 2018
Item 8 of the provisional agenda*

COMPILATION OF NATIONAL EXPERIENCES IN ACHIEVING AICHI BIODIVERSITY TARGET 11 IN MARINE AND COASTAL AREAS, INCLUDING AREA-BASED MANAGEMENT MEASURES USED IN MARINE FISHERIES AND OTHER OCEAN SECTORS

Note by the Executive Secretary

1. Pursuant to paragraph 7(b) of decision XIII/9, the Executive Secretary organized the Expert Workshop on Marine Protected Areas and Other Effective Area-based Conservation Measures for Achieving Aichi Biodiversity Target 11 in Marine and Coastal Areas in Montreal, Canada, from 6 to 9 February 2018. The workshop was hosted by the Government of Canada, and convened with financial support from the Governments of Canada and Norway. It was held in conjunction with the Technical Expert Workshop on Protected Areas and Other Effective Area-based Conservation Measures and their Role in for Achieving Aichi Biodiversity Target 11, with joint sessions on relevant topics. The outputs of these workshops will be considered by the Subsidiary Body on Scientific, Technical and Technological Advice at its twenty-second meeting.

2. In support of the workshop deliberations, the Secretariat commissioned three background studies on various issues related to marine protected areas and other effective area-based conservation measures. These background studies were provided as background information documents[1] to the expert workshop.

3. As requested by the participants of the above-mentioned workshop, these background studies have been further refined and compiled in the main body of the present document as information for participants at the twenty-second meeting of the Subsidiary Body on Scientific, Technical and Technological Advice. The present information document comprises the following three parts:

Part 1 (page 3): Cross-cutting issues and key messages related to the achievement of Aichi Biodiversity Target 11 through the use of marine protected areas and other effective area-based conservation measures;

Part 2 (page 61): Area-based conservation/management measures in non-fisheries marine sectors—delivering outcomes towards the achievement of Aichi Biodiversity Target 11;

Part 3 (page 83): Area-based management measures used in marine fisheries.

4. The document is being circulated in the form and language in which its component documents were received by the Secretariat.

---

* CBD/SBSTTA/22/1.

[1] Documents CBD/MCB/EM/2018/1/INF/1, CBD/MCB/EM/2018/1/INF/3, CBD/MCB/EM/2018/1/INF/4

PART I

Cross-cutting issues and key messages related to the achievement of Aichi Biodiversity Target 11 through the use of marine protected areas and other effective area-based conservation measures

Prepared by: Susanna Fuller as a background information document for the CBD Expert Workshop on Marine Protected Areas and Other Effective Area-based Conservation Measures for Achieving Aichi Biodiversity Target 11 in Marine and Coastal Areas (6 - 9 February 2018 - Montreal, Canada), as commissioned by the Secretariat of the Convention on Biological Diversity

Acknowledgements: The author wishes to thank Travis Aten for assistance in preparing this paper as well as framing provided by the two additional background papers for the workshop. Any errors, inaccuracies or omissions are the author's. Feedback on the paper is welcomed by e-mail at susannadfuller@gmail.com.

Table of Contents

Executive Summary
Marine protected areas (MPAs) are accepted as one tool to protect biodiversity, mitigate human impacts, restore species diversity and ecosystem function and provide an insurance policy against broad scale climate impacts. The Convention on Biological Diversity (CBD) Aichi Target 11 commits Parties to protect 10% of their marine and coastal environment by 2020. Progress is being made towards this target, with more than a doubling of MPA coverage since the adoption of Target 11 in 2010. Efforts to achieve Aichi Target 11 also assist with meeting other Aichi Targets, including 6 (Sustainable fisheries), 10 (Coral reef protection), 12 (Prevent extinction), 14 (Ecosystem Services) and 18 (Traditional Knowledge and Indigenous Rights), among others.

Target 11 can be met both by MPAs, as defined by the Convention on Biological Diversity and where the primary objective is conservation of biodiversity, and "other effective area-based conservation measures" (OEABCM), where biodiversity outcomes are achieved, but are not considered as protected areas for various reasons. OEABCMs can be considered as additional to marine protected areas (MPAs), but not a subset of them. International guidelines for OEABCMs have not yet been agreed, however draft guidelines have been produced by an IUCN Task Force.

OEABCMs can result from sector-based initiatives and can be simply, although not exclusively, categorized into non-fishery and fishery measures where the outcome of *in situ* conservation must be demonstrated. Some area-based fisheries measures may be considered as OEABCMs if they fulfill the intent of Target 11 regarding *in-situ* conservation objectives and the goals of the CBD. The onus on ensuring that the OEABCM is protecting biodiversity is a critical aspect of including any such areas towards meeting Target 11. Indigenous Community Conserved Areas (ICCAs) and Locally Managed Marine Areas (LMMAs), depending on elements of biodiversity protection within the designated area, can contribute to ecological and social benefits including protection of biodiversity and ecosystem services as well as access rights, food security and co-governance.

Concerns remain about the strength of protection in many of the areas being reported as protected and more work needs to be done to set clear standards and simplify reporting mechanisms through which effectiveness can be measured. Effective protection elements include design issues relating to both individual sites and protected area systems; adequacy and appropriateness of management systems and processes; and delivery of protected area objectives including conservation of values. All areas positioned as part of meeting the Target should be evaluated through the same effectiveness standard.

As MPAs and OEABCMs are being implemented, a broader understanding of elements to achieve biodiversity conservation is emerging. Often, large, long lasting and no-take MPAs deliver maximum benefits to ecological outcomes, while stakeholder inclusion, co-governance and clearly defined economic benefits or economic alternatives are key elements of achieving social outcomes. Conservation objectives are also more likely to be met if governance and management processes are agreed across all stakeholders.

Gaps exist in reporting on effective protection, accepted indicators for equity of protected area measures, connectivity, climate change mitigation as well as indicators to assess how MPAs and OEABCMs can be assessed as integrating into the broader seascape. For existing and new MPAs and OEABCMs, qualitative and quantitative measures of effectiveness must be a focus going forward, with a commitment to strengthening protection and meeting global standards, in order to stem the tide of marine and coastal biodiversity loss. Considerations for financial mechanisms and capacity for States to be able to ensure effective protection, through meeting MPA objectives and measuring outcomes should be made to ensure both equity and ability for all States to achieve meaningful conservation of biological diversity, and maximize ecological and social outcomes.

1. Introduction

In response to a growing number of threats to the marine environment to improve biodiversity protections via international agreements and national laws and policies, parties to the Convention on Biological Diversity (CBD) agreed to a suite of Targets at the 2010 Conference of Parties (COP)[2], including a target of focused on area-based conservation of 10% of coastal and marine environments by 2020.[3] Spatial protections can achieve a variety of objectives, from species and habitat protection to biomass increases as well as foster equitable governance frameworks that can enable and support monitoring and enforcement. In addition, spatial protections are identified as a key component to achieving Target 5 of the Sustainable Development Goal 14 to "conserve and sustainable use the oceans, seas and marine resources."[4]

This document provides and overview of existing frameworks for marine spatial protections, including other effective conservation measures, as input to an expert workshop[5]. Marine protected areas and other effective area-based conservation measures are addressed in more detail in additional background documents prepared for the meeting.[6,7,8] This background document compiles existing information progress towards achieving Aichi Target 11, effectiveness of protected areas, governance, science basis and needs to achieve biodiversity and ecosystem functioning outcomes of spatial protections in coastal and marine environments. Finally, gaps in current knowledge and frameworks as well as reporting systems are discussed as a means to engage expertise in addressing these gaps.

2. Commitments to Biodiversity Protection: Aichi Target 11

The recognition that coastal and marine environments are increasingly under threat from human activity, and in some cases unlikely to recover losses of biodiversity and ecosystem function as a result of cumulative impacts has resulted in global commitments to protect 10% of the marine and coastal environment by 2020. This agreement is a key aspect of the CBD Aichi Targets agreed in 2010. Initial calls for a representative global network of marine protected areas by 2012 were made at the the World Summit on Sustainable Development (WSSD) in 2002, and reiterated at the IUCN World Parks Conference in 2004. Following a lack of progress towards the WSSD goal of 2020, the CBD COP 10 extended the initial deadline to 2020.

The Convention on Biological Diversity[9] is the main international legal instrument addressing protected areas and has catalyzed State level legal frameworks that enable protection of terrestrial and marine environments. Article 2 of the Convention defined protected areas as "a geographically defined area, which is designated or regulated and managed to achieve specific conservation objectives"[10] and Article 8 of the Convention contains specific references to protected areas by encouraging Parties to:

- Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity;
- Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity;
- Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use;

---

[2] CBD COP 10 https://www.cbd.int/cop10/
[3] Aichi Target 11 http://www.un.org/sustainabledevelopment/oceans/
[4] Sustainable Development Goal 14 https://sustainabledevelopment.un.org/sdg14
[5] https://www.cbd.int/meetings/MCB-EM-2018-01
[6] CBD/MCB/EM/2018/1/INF/2
[7] CBD/MCB/EM/2018/1/INF/3
[8] Rees, S.E., Foster N.L.,Langmead, O.,Pittman,S.,,Johnson, D.E., (2016). Defining the qualitative elements of Aichi Biodiversity Target 11 with regard to the marine and coastal environment. A report to the Convention on Biological Diversity expert meeting complied by the Marine Institute at Plymouth University, UK. p. 54
[9] CBD Convention https://www.cbd.int/convention/
[10] Article 2 of the Convention https://www.cbd.int/convention/articles/default.shtml?a=cbd-02

- Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas;
- Cooperate in providing financial and other support for in-situ conservation, particularly to developing countries.[11]

As part of implementing the protected areas aspects of the Convention, the 2010 Aichi Targets included clear objectives for achieving specific percentages of area-based protection in the terrestrial and marine environment, through Target 11 which commits signatories to the Convention to:

> *By 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape.*[12]

The recognition that progress is needed and implementation slow, has resulted in an increasing number of commitments linked to ocean protection including meeting the Aichi Target 11 as well as voluntary commitments relating to Target 5 as part of the UN Oceans Conference on SDG 14 (393 commitments by State and non-state actors as of January 2018).[13]

2.1 Progress Towards Commitments

Progress as measured by the United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC) assessment of areas reported to the World Database on Protected Areas (WDPA) shows 6.97% of the world coastal and marine areas protected with 15,609 areas registered. As of January 2018, 16.03% of coastal and marine areas within national jurisdiction have been protected, with 1.18% on the high seas. Recent contributions towards meeting the Aichi Target have been made by the establishment of large marine protected areas greater than 100,000 km^2.[14]

States have made commitments to further protection, and if all national commitments are met by 2020, areas considered protected according to the CBD definition of protected areas, there would be a 4.0% increase in the global ocean. Marine protected area coverage for areas under national jurisdiction would reach 23.7%; global ocean coverage would reach 10.3%. More robust consideration of the contributions of other effective area-based conservation measures may help fill current gaps in the more than 11 million km^2 gap remaining to reach the minimum 10% coverage target for the whole ocean.[15]

For areas identified as Key Biodiversity Areas (KBAs)[16], as of April 2016 19.3% of all KBAs were protected by MPAs as reported in the WDPA and as of October 2017, out of 232 marine ecological regions, 94 (or 41%) have reached 10% coverage by designated marine protected areas reported in WDPA. The ~ 8 million km^2 increase in MPA coverage between April 2016 and August 2017 will have increased the protection of many marine ecoregions and marine KBAs. Recognition and and appropriate accounting of OECMS may further improve the coverage of marine ecological regions and KBAs.

The quality of protection is not reported to the WDPA, however the development of the IUCN Green List Standard for Protected Areas,[17] which includes criteria for good governance, sound design and planning

---

[11] Article 8 of Convention https://www.cbd.int/convention/articles/default.shtml?a=cbd-08
[12] TARGET 11 - Technical Rationale extended (provided in document COP/10/INF/12/Rev.1) https://www.cbd.int/sp/targets/rationale/target-11/
[13] Registry of Voluntary Commitments for UN Oceans Conference: https://oceanconference.un.org/commitments/
[14] UNEP-WCMC (2016) Protected Planet Report https://www.protectedplanet.net/marine (online portal with updated information accessed January 29 2018).
[15] Information provided by the CBD Secretariat.
[16] IUCN (2016). A Global Standard for Identification of Key Biodiversity Areas. Gland, Switzerland. 27p.
[17] IUCN and WCPA (2016) OUCN Green List of Protected and Conserved Areas. Standard Version 1.1. Gland. Switzerland.

and effective management, can provide a mechanism to standardize protection criteria and incentivize continuous improvement of the strength protection of existing areas. Assessing effectiveness of areas reported to the WDPA database is also needed in order to ensure that spatial measures are achieving their stated objectives.

2.2 Relationship of Target 11 to Other Aichi Targets

Spatial protection in coastal and marine environments can achieve a myriad of biodiversity conservation objectives from habitat conservation, reduction of human impacts and direct threats to biodiversity and protection of important life history stages for depleted species. Generally marine protected areas have a variety of objectives, that can be met by reducing a single threat or reducing and managing multiple threats. Additionally, the mechanism and governance structures through which protected areas are established and implemented, can help meet Aichi Targets related to restoring ecosystem services, incorporating traditional knowledge and protecting social and cultural values.

Progress towards Target 11 can achieve outcomes in other Targets and related Strategic Goals. For marine protection, these explicitly include:

Under Strategic Goal B – to reduce the direct pressures on biodiversity and promote sustainable use:

> ***Target 6****: By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem-based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.*
>
> ***Target 10****: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.*

Clarifying where Target 11 measures can achieve Target 6 objectives and vice versa is a key aspect of providing guidance to States on what should count as effective *in situ* conservation. For example, a single species spatial measure may only restrict one activity, and may be effective in restoring a population, however it is unlikely that such measures will also meet standards required for biodiversity protection as a whole with effective management of all activities. Protected areas in coral reefs may assist in meeting Target 10, but only if these protected areas are effective at reducing multiple anthropogenic impacts.

Under Strategic Goal C - To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity:

> ***Target 12****: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and* sustained.

Under Strategic Goal D - Enhance the benefits to all from biodiversity and ecosystem services:

> ***Target 14****: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.*

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building:

> ***Target 18****: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.*

State focus has been largely on designating areas that can be counted towards the 2020 10% Target (See Appendix 1 for a summary of State responses to CBD Notification 2017-084), establishing criteria and evaluating effectiveness for Target 11 areas as the specific quantitative Target is in theory, more measureable than the others. Other related Targets are more complex in terms of State and sub-State level legal and policy frameworks and may rely on metrics and outcomes developed by a variety of government departments as well as local and indigenous communities through customary or Indigenous Law and governance structures.

2.3 Further Integration of Area-Based Conservation with Other Relevant International Commitments and Agreements

As noted above, Target 5 of Sustainable Development Goal (SDG) 14 includes implementing coastal and marine protected areas.

The 1995 United Nations Fish Stocks Agreement (UNFSA)[18] provides for an ecosystem approach to fisheries management, including protecting protection of biodiversity in the marine environment and conservation and management measures to restore depleted species – which can include spatial protections for the management of fisheries and habitats. The benefits to fisheries from marine protected areas are well established from a variety of ecosystems.[19][20]

While there is evidence that spatial protections can contribute to climate change mitigation[21] and increased resilience of ecosystems to climate change impacts,[22] specific links between marine protected areas as part of implementing the United Nations Framework Convention on Climate Change (UNFCCC)[23] or "Paris Agreement" have yet to be made on any significant level.

Governance frameworks for protected or conserved areas that allow for effective co-management with indigenous peoples, or full governance by indigenous peoples, including access to food security and sustainable livelihoods can assist with implementation of the United Nations Declaration of Rights of Indigenous Peoples (UNDRIP).[24]

To date, comprehensive reporting on how marine protected areas or other effective area-based conservation measures fulfill the obligations of other agreements or commitments does not exist. However, efforts to evaluate management effectiveness may begin to address other agreements particularly where there is an alignment of objectives.

3. Range of Area-Based Management Tools in Coastal and Marine Areas

The primary focus of States has been on incorporating protected areas under relevant national legislation as well as finding mechanisms through which to include areas where there may be biodiversity outcomes without the primary goal being conservation of biodiversity (See Appendix 2).

---

[18] United Nations Fish Stocks Agreement, Article 5 http://www.un.org/depts/los/convention_agreements/texts/fish_stocks_agreement/CONF164_37.htm

[19] Roberts, C., 2012. Marine ecology: reserves do have a key role in fisheries. *Current Biology*, *22*(11), pp.R444-R446.

[20] Sciberras, M., Jenkins, S.R., Mant, R., Kaiser, M.J., Hawkins, S.J. and Pullin, A.S., 2015. Evaluating the relative conservation value of fully and partially protected marine areas. *Fish and Fisheries*, *16*(1), pp.58-77.

[21] Micheli, F., Saenz-Arroyo, A., Greenley, A., Vazquez, L., Montes, J.A.E., Rossetto, M. and De Leo, G.A., 2012. Evidence that marine reserves enhance resilience to climatic impacts. *PloS one*, *7*(7), p.e40832

[22] Green, A.L., Fernandes, L., Almany, G., Abesamis, R., McLeod, E., Aliño, P.M., White, A.T., Salm, R., Tanzer, J. and Pressey, R.L., 2014. Designing marine reserves for fisheries management, biodiversity conservation, and climate change adaptation. *Coastal Management*, *42*(2), pp.143-159.

[23] http://unfccc.int/paris_agreement/items/9485.php (Accessed January 23 2018)

[24] United Nations Declaration on the Rights of Indigenous Peoples *www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf* (Accessed January 21, 2018)

For areas where the primary purpose is biodiversity protection, the IUCN protected area categories and related guidance for the marine environment provide a baseline for categorizing the level of protection expected, based on a range of management measures or prohibitions on types of human activity. While the categories – ranging from no take areas to managed protected areas that allow multiple uses – provide a useful basis for assessing type of protection and identifying objectives, these categories are not currently being comprehensively applied nor reported upon as protected area are established. Secondly, criteria for "other effective conservation measures" that are not deemed protected and where biodiversity protection may not be the primary objective – but is an intended or unintended outcome have also yet to be agreed internationally. However, there is considerable literature and methods to assess qualitative elements of area-based management tools.[25] Reaching agreement on these key aspects will ensure that quantification of what counts as marine protection becomes more systematic and standardized.

3.1 Marine Protected Areas (MPAs)

The CBD defines coastal or marine protected areas as:

> *"an area within or adjacent to the marine environment, together with its overlying waters and associated flora, fauna, and historical and cultural features, which has been reserved by legislation or other effective means, including custom, with the effect that its marine and/or coastal biodiversity enjoys a higher level of protection than its surroundings."*[26]

In order to be included in the World Database on Protected Areas, areas must meet the definition of marine protected areas agreed by the IUCN and applies across marine and terrestrial environments:

> *"a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values."*

Categories of protected areas as well as guidance on assessing these categories have been developed by the IUCN (Box 1).[27,28] The 2012 IUCN Guidance provides further detail on specific examples and elements for consideration in assigning protected areas categories with particular considerations to the marine environment.[29] Efforts have also been made to further define qualitative elements of protected areas, which include representivity, replication, adequacy, viability, connectivity, management and level of protection[30] the majority of which can be applied to a single protected area as well as protected areas networks. Reporting on protected areas to the World Database on Protected Areas (WDPA) does not require details on the level of protection as outlined by the IUCN categories, but rather uses the IUCN and CBD definitions for protected areas.

Box 1. IUCN Protected Area Categories

I Strict protection [Ia) Strict nature reserve and Ib) Wilderness area]

II Ecosystem conservation and protection (i.e., National park)

III Conservation of natural features (i.e., Natural monument)

IV Conservation through active management (i.e., Habitat/species management area)

V Landscape/seascape conservation and recreation (i.e., Protected landscape/seascape)

VI Sustainable use of natural resources (i.e., Managed resource protected area)

[25] Rees, S.E., Foster N.L., Langmead, O., Pittman, S.,, Johnson, D.E., (2016). Defining the qualitative elements of Aichi Biodiversity Target 11 with regard to the marine and coastal environment. A report to the Convention on Biological Diversity expert meeting complied by the Marine Institute at Plymouth University, UK.

[26] CBD (2003). Marine and Coastal Biodiversity: Review, Further Elaboration and Refinement of the Programme of Work. Report of the Ad Hoc Technical Expert Group on Marine and Coastal Protected Areas (13 February 2003), UNEP Doc. UNEP/CBD/SBSTTA/6/INF/7, para. 30. https://www.cbd.int/kb/record/meetingDocument/4748?RecordType=meetingDocument&Event=SBSTTA-08. (Accessed January 20 2018)

[27] Dudley, N. (Editor) (2008). Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. x + 86 pp.

[28] Day J., Dudley N., Hockings M., Holmes G., Laffoley D., Stolton S. & S. Wells, (2012). Guidelines for applying the IUCN Protected Area Management Categories to Marine Protected Areas. Gland, Switzerland: IUCN. 36pp.

[29] Dudley, N. (Editor) (2008). Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. x + 86 pp. https://cmsdata.iucn.org/downloads/guidelines_for_applying_protected_area_management_categories.pdf

[30] Rees, S.E., Foster N.L., Langmead, O.,Pittman,S.,,Johnson, D.E., (2016). Defining the qualitative elements of Aichi Biodiversity Target 11 with regard to the marine and coastal environment. A report to the Convention on Biological Diversity expert meeting complied by the Marine Institute at Plymouth University, UK. p. 54

3.2 Areas Managed by Indigenous Peoples and Local Communities (ICCAs and LMMAs)

Indigenous stewardship and Indigenous Community Conserved Areas (ICCA) or Indigenous Protected Area (IPAs) are increasingly being documented and recognized as legitimate and effective mechanisms through which biodiversity conservation can be achieved. Locally Managed Marine Areas (LMMAs) which may in some cases be considered ICCAs, are also increasing in prevalence and depending governance structure and levels of biodiversity protection, could be included as part of protected area targets. With a growing awareness of the role that community-based initiatives can play, as well as the integration of these initiatives into Aichi Target 11 and in consideration of efforts to meet Target 14 and 18, efforts have been made better understand both effectiveness and viability of Indigenous and local governance structures.[31]

While ICCA's have been reported to a greater extent in terrestrial areas,[32] LMMA's occur exclusively in the coastal and marine environment. LMMA's tend to focus on benefits to local communities from improved governance and equity in marine areas, with food security and livelihoods supported by fisheries and other coastal industries seen as the primary benefit. ICCA's and LMMAs may be considered protected areas or OEABCMs if objectives and or outcomes benefit provide tangible biodiversity protection.[33] Incorporation of Indigenous and local community benefits into can increase willingness and engagement in biodiversity protection, however depending on the level and intensity of use as well as percentage of no-take areas within an ICCA or LMMA, biodiversity protection could be compromised rather than enhanced. Assessing these areas for clear objectives related to biodiversity is a critical aspect in determining whether or not they contribute to Target 11 or more prominently to other Aichi Targets and international commitments.

ICCAs have specific criteria through which to determine if they can be considered as such. These include three elements: decisions and conservation objectives are often tied to food security and access to resources for Indigenous peoples, ccommunities and governments or non-state actors work collaboratively as equals in decision-making (effective co-governance) and the management authority has been ceded to local communities. The role of government or non-state organizations is largely restricted to providing advice and endorsing management decisions made by local communities, rather than having control over management and decision making.[34] ICCAs are diverse across a variety of factors including size, longevity, ecosystem and resources specific to geographic context, objectives, values and uses as well as degree of formal recognition and security of tenure of the Indigenous community. Common variables include that all ICCAs are tangible examples of local and legitimate community governance of specific territories.

LMMA's are defined by overarching objectives include objectives including but not entirely limited to (1) enhancing long-term sustainability of resource use; (2) increasing short-term harvesting efficiency; (3) restoring biodiversity and ecosystems; (4) maintaining or restoring breeding biomass offish or invertebrates; (5) enhancing the economy and livelihoods; (6) reinforcing customs; (7) asserting access and tenure rights; and (8) empowering communities.[35] Biodiversity conservation is not necessarily a primary objective but can be considered as one of a subset of broader objectives linked to resource access and livelihoods.[36]

---

[31] Borrini-Feyerabend, G., P. Bueno, T. Hay-Edie, B. Lang, A. Rastogi and T. Sandwith (2014). A primer on governance for protected and conserved areas, Stream on Enhancing Diversity and Quality of Governance, 2014 IUCN World Parks Congress. Gland, Switzerland: IUCN.

[32] ICCA Registry http://www.iccaregistry.org/

[33] Dudley, N. (Editor) (2008). Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. x + 86pp.https://cmsdata.iucn.org/downloads/guidelines_for_applying_protected_area_management_categories.pdf

[34] http://www.iccaforum.org/

[35] Jupiter, S.D., Cohen, P.J., Weeks, R., Tawake, A. and Govan, H., 2014. Locally-managed marine areas: multiple objectives and diverse strategies. *Pacific Conservation Biology*, *20*(2), pp.165-179.

[36] http://lmmanetwork.org/

3.3 Other Effective Area-Based Conservation Measures (OEABCMs)

OEABCMs have been defined as a suite of measures where biodiversity outcomes may be achieved because of specific resource management measures or areas where characteristics preclude a human activity – such as wreck sites, military dumping sites, undersea cable corridors, etc. where biodiversity is protected as an outcome.[37] The IUCN Draft Guidelines for Recognising and Reporting OEABCMs defines them as:

> *A geographically defined space, not recognised as a protected area, which is governed and managed over the long-term in ways that deliver the effective in-situ conservation of biodiversity, with associated ecosystem services and cultural and spiritual values.*[38]

Protection through OEABCMs can be achieved through conservation objectives considered primary conservation, or secondary, where conservation is not the explicit purpose of the area. There may also be cases where conservation occurs as a result of, but not because of the intent of the governance mechanism, which is termed ancillary conservation. Guidance on these OEABCMs is required so that States can adequately measure progress towards Aichi Target 11- and to meet, at least in part this need for further articulation of what constitutes an OEABCM an IUCN Task Force was created with the goal of developing draft guidance and to feed into deliberations for the 2018 CBD COP.[39]

The current draft IUCN Guidelines hold that OEABCMs should meet the qualitative elements of a protected area, but are not formally designated as such - either because of jurisdictional reasons or because the output is conservation rather than having specific conservation objectives. Through reviewing a series of case studies as well as expert advice[40], the current proposed criteria to identify OEABCMs includes four main elements: (1) ensure the area is not already considered a protected area, (2) essential conservation characteristics (location, governed, managed and long term, (3) effective in situ conservation is achieved and (4) ensure conservation outcome can be sustained – with the consideration that all 4 criteria should be met in order to be considered an OEABCM.

As States identify areas that may produce conservation outcomes consistent with a protected area, efforts are being made to develop criteria in the absence of internationally agreed advice. Canada has produced guidelines on OEABCM that focus only on fishery closures and has used these guidelines to screen 1000 potential fisheries management measures, effectively reducing the number that met the criteria to less than 50. The Canadian Council of Ecological Areas has also established guidelines for OEACBMs across terrestrial and marine environments. To date, other criteria have not been published – however sector-based closures and locally or indigenous managed and conserved areas already in existence may potentially be considered as OEABCMS.[41, 42]

3.3.1 Area-Based Fisheries Management

Fishing is the most globally prevalent human impact on the marine environment, taking place in coastal areas and in all ocean basins, with a long history and variety of levels of exploitation, intensity, frequency. Fisheries management has also long employed a variety of spatial management measures, with a range of objectives, however largely focused on reducing fishing pressure, protecting spawning areas and protecting habitat features or reducing impacts of fishing on non-target species. Such management measures could contribute to the protection of biodiversity, but not all fisheries management measures will meet expected qualitative aspects of protected areas nor will they produce biodiversity protection

---

[37] Spalding, M.D., Meliane, I., Milam, A., Fitzgerald, C. and Hale, L.Z., 2013. Protecting marine spaces: global targets and changing approaches. *Ocean Yearbook Online*, *27*(1), pp.213-248.
[38] https://www.cbd.int/doc/c/0165/9fc3/962fae6c8e6d0f8bc8ca361d/mcb-em-2018-01-inf-05-en.pdf
[39] IUCN WCPA, 2018. (Draft) Guidelines for Recognising and Reporting Other Effective 27 Area-based Conservation Measures. IUCN, Switzerland. Version 1.
[40] www.iucn.org/theme/protected-areas/wcpa/what-we-do/other-172 effective-area-based-conservation-measures-OEABCMs
[41] CBD/MCB/EM/2018/1/INF/2
[42] CBD/MCB/EM/2018/1/INF/3

outcomes. Fisheries management measures are most likely to contribute to Aichi Biodiversity Target 6, however there are cases where the measure could also be considered as contributing to Target 11.

In a comprehensive overview of how fisheries management measures might be considered as OEABCMs, key elements of the particular management area should include an assessment of the ecological components of conservation concern in both the specific area and the larger region, and how the measure could contribute to their conservation, the size, duration, extent of restrictions and placement of the area; the ability of the management authority to implement the measure if adopted, and monitor and provide enforcement in area while the measure is in place; the structure of the fisheries that would be excluded by the measure, including how their likely responses to the measure could impact the effectiveness of the measure at providing biodiversity outcome and the potential contributions the measure could make to overall performance of the of the fishery.[43]

The context within which the fisheries management measure is established should be considered when evaluating a fisheries management measure as a potential OEABCM. Whether or not the measure is implemented within a broader ecosystem approach to fisheries management, the degree to which the measure was established based on best available science, the degree of protection offered to high priority biodiversity objectives and whether or not impacts in the adjacent area are also mitigated, and the governance process underlying the measure, including monitoring and enforcement all need to be considered in assessing the effectiveness and outcomes of a fisheries management measure that could be considered towards achieving Aichi Target 11.[44]

3.3.2 Non-Fishery Sector-Based Approaches

As a result of sector based impacts on the marine environment, management measures have been put in place to limit these impacts or in some cases, prohibit human activities because of reasons unrelated to biodiversity objectives, but resulting in biodiversity outcomes.[45] These include but are not limited to designated areas for subsea cables, where all potential activities that could disturb the infrastructure in question are prohibited, areas protected from shipping activity because of biodiversity concerns, wreck sites, cultural and historical sites that are protected from human activity. Critical to the success of these is the ability of States to monitor biodiversity outcomes.

4. Networks and Connectivity

Generally, a single marine protected area will not be enough to achieve overall biodiversity protection targets, particularly in the marine environment where there is considerable movement of species. Marine protected area networks can combine a suite of spatial conservation measures to achieve biodiversity objectives at larger scales, including maintaining ecosystem processes and function, synergistic interaction between sites to achieve overall protection.[46,47] Given that considerable efforts are still needed to develop and assess single protected areas and there currently are no network assessment tools *per se*, qualitative elements of individual protected areas could be applied to networks. From a jurisdictional perspective, networks will be most easily established within State waters, however assessment of transboundary effectiveness, between EEZs and across EEZs and areas beyond national jurisdiction requires coordination between States and sectoral governance bodies, particularly where OEABCMs are included in protected area networks. Network designs must also take into account overall biodiversity objectives and desired outcome for the ecosystem and species in question.[48]

---

[43] CBD/MCB/EM/2018/1/INF/3
[44] CBD/MCB/EM/2018/1/INF/3
[45] CBD/MCB/EM/2018/1/INF/2
[46] OSPAR Commission. Guidance on Developing an Ecologically Coherent Network of OSPAR Marine Protected Areas. 1-11 (2006).
[47] Government of Canada. 2011. *National Framework for Canada's Network of Marine Protected Areas*. Fisheries and Oceans Canada, Ottawa. 31 pp.
[48] Jessen, S., K. Chan, I. Côté, P. Dearden, E. De Santo, M.J. Fortin, F. Guichard, W. Haider,

As protected areas are to be integrated into the wider seascape, there is a need to ensure that marine spatial planning (MSP) initiatives incorporate protected areas within the planned areas. As well, in order to achieve biodiversity objectives and outcomes, MSP plans should take into account activities adjacent to proposed and established protected areas. Without the broader objective of MSP, there is a tendency to focus on the types of activities that can occur within a proposed protected area. MSP can help to ensure that stakeholders and governance agencies are involved in overall assessment of potential conflicts in the marine environment and how planning and zoning can avoid such conflicts. MSP has, to date, been most effective where there is a direct conflict (i.e. renewable energy and fishing activity) and hence a driver to create multi-sectoral plans. Assessment of MPA networks within the broader MSP context should also take into account the unintended impacts on biodiversity – either positive or negative as a result of creating areas where specific activities are permitted or prohibited.

5. Governance of Marine Protected Areas and OEABCMs

The IUCN distinguishes four broad governance types for protected and conserved areas according to the actors who take or took the fundamental decisions about them (e.g. the actors that "established" them and decided their main purpose and management). The four main governance types are:

- Type A. governance by government (at various levels and possibly combining various agencies)
- Type B. governance by various rights holders and stakeholders together (shared governance)
- Type C. governance by private individuals and organizations (usually the landholders), and
- Type D. governance by indigenous peoples and/or local communities.

Having these categories apply to both MPAs and OEABCMs could ease evaluation of management and governance effectiveness.

Good governance has also been recognized and supported by scientists as a foundational aspect of effective protection. A recent analysis of MPA governance undertaken through the United Nations Environment Programme (UNEP) suggests that the governance effectiveness depends largely on institutional diversity.[49] A comparison of 20 MPAs worldwide demonstrated the effectiveness of combining top-down, bottom-up, and economic-incentive approaches to governance yielded optimal outcomes for the protected areas in question. For example, local-community participation can provide detailed knowledge, but top-down structures are often essential for taking into account knowledge of ecological linkages across larger areas and more time.[50] While this work was focused on existing MPAs, it is anticipated that similar governance characteristics will also apply to OEABCMs and their relative effectiveness at delivering conservation outcomes.

Incentives are seen as a primary element of governance frameworks, with five categories of incentives identified as useful in improving MPA governance: (i) participation, (ii) legal, (iii) interpretative, (iv) knowledge, and (v) economic.

Participative incentives ensure that a wide range of stakeholders collaborate in planning and ensure broader cooperation protected area management and monitoring. Depending on the level of collaboration and governance partnerships, the establishment of formal co-governance can be seen as offering a legal

---

G. Jamieson, D.L. Kramer, A. McCrea-Strub, M. Mulrennan, W.A. Montevecchi, J. Roff, A. Salomon, J. Gardner, L. Honka, R. Menafra and A. Woodley. 2011. Science-based Guidelines for MPAs and MPA Networks in Canada. Vancouver: Canadian Parks and Wilderness Society. 58 pp.

[49] McCay, B.J. and Jones, P.J., 2011. Marine protected areas and the governance of marine ecosystems and fisheries. *Conservation biology*, *25*(6), pp.1130-1133.

[50] Cudney-Bueno, R. and Basurto, X., 2009. Lack of cross-scale linkages reduces robustness of community-based fisheries management. *PloS one*, *4*(7), p.e6253.

incentive to ensure that the protected area is effective. Such collaboration or co-management has proved effective in coordinating both top-down and bottom-up governance of MPAs.[51]

Co-management refers to partnerships between local resource users and governments and is accepted as a viable approach to ocean governance, particularly for less migratory fisheries on which local coastal communities depend[52, 53] Co-management brings experience-based and traditional knowledge, the legitimacy of rules developed democratically, and the strength of local institutions together with the powers and resources of centralized governments.[54]

There is growing evidence that community-led MPAs and OEABCMS, including those that overlap or considered synergistic with ICCAs and LMMAs can be cost effective, resilient and often a more socially acceptable alternative to more traditional top-down methods of marine resource management. These types of governance systems are more prominent in developing countries and within tropical marine areas, and almost wholly based in coastal environments. Compliance is also improved where there is local governance, as there is a stronger sense of ownership over the protected area and its intended outcomes for local livelihoods.[55]

6.0 Effectiveness of Marine Protected Areas and OEABCMs

The effectiveness of marine spatial protections has long been seen as a vital aspect in determining their ability to achieve intended biodiversity conservation objectives.[56] While the WDPA is the most comprehensive database on both terrestrial and marine environments, there is currently no reported measure of effectiveness of these areas in achieving biodiversity outcomes or in identifying the types of protected areas. Reporting on management effectiveness is complex, given that States have a variety of mechanisms through which protected areas are managed and monitored and also that State capacity to do so will vary considerably.

The CBD COP Decision X/31 calls for *"...Parties to...expand and institutionalize management effectiveness assessments to work towards assessing 60 per cent of the total area of protected areas by 2015 using various national and regional tools, and report the results into the global database on management effectiveness"*. Considerable work is being undertaken at to further define criteria for effective and equitable management and how these elements can be measured. The Protected Areas Management Effectiveness (PAME) initiative of the WCPA has developed tools and frameworks through which States and entities can evaluate how well a particular protected area or network of areas is managed.

The term management effectiveness reflects three main 'themes' in protected area management, which include (i) design issues relating to both individual sites and protected area systems; (ii) adequacy and appropriateness of management systems and processes; and (iii) delivery of protected area objectives including conservation of values.[57] While criteria for effectiveness are important at the outset, in identifying and establishing marine protected areas, it is only over time that effectiveness and biodiversity

---

[51] Oyanedel R., et al., (2014). Establishing marine protected areas through bottom-up processes: insights from 2 contrasting initiatives in Chile. Aquatic Conserv. Mar. Freshw. Ecosyst. DOI: 10.1002/aqc.2546

[52] Defeo, O. and Castilla, J.C., 2005. More than one bag for the world fishery crisis and keys for co-management successes in selected artisanal Latin American shellfisheries. *Reviews in Fish Biology and Fisheries*, *15*(3), pp.265-283.

[53] Gutiérrez, N.L., Hilborn, R. and Defeo, O., 2011. Leadership, social capital and incentives promote successful fisheries. *Nature*, *470*(7334), p.386.

[54] McCay, B.J. and Jones, P.J., 2011. Marine protected areas and the governance of marine ecosystems and fisheries. *Conservation biology*, *25*(6), pp.1130-1133.

[55] Bennett, N.J. and Dearden, P., 2014. From measuring outcomes to providing inputs: Governance, management, and local development for more effective marine protected areas. *Marine Policy*, *50*, pp.96-110.

[56] Hockings, M., Stolton, S., Leverington, F., Dudley, N. and Courrau, J. (2006).Evaluating Effectiveness: Aframework for assessing management effectiveness of protected areas. 2ndedition. IUCN, Gland, Switzerland and Cambridge, UK. xiv + 105 pp.

[57] Requirement in the Programme of Work: Goal 4.2 - To evaluate and improve the effectiveness of protected areas management https://www.cbd.int/protected-old/PAME.shtml

conservation value can be assessed. Effectiveness can be measured in terms of qualitative and quantitative measures, with qualitative related largely to governance elements and qualitative related to conservation objectives and measurement of those objectives over time.

Ecological and social factors are known to foster effective MPAs, with primary factors including, but not limited to broad coverage of representative habitats, diverse size and spacing of protected areas (networks) and at the governance level - participatory decision-making, agreed upon resource use rights, active and accountable monitoring and enforcement systems as well as accessible conflict resolution mechanisms. A review of conservation benefits of 87 MPAs investigated globally found an exponential increase as a result of five key features: no take, well enforced, old (>10 years), large (>100 km^2), and isolated by deep water or sand.[58] Effectiveness is also expected to be improved where there MPAs are considered as part of larger scale marine planning, where activities surrounding the protected area are also well managed.[59] Effectiveness of community-led MPAs has been found to be dependent on six key factors, including a small population size in the adjacent area, protection has been implemented in response to a perceived crisis, alternative income streams are available, relatively high level of community participation in decision making and where there is ongoing advice from the implementing organization as well as appropriate engagement form the relevant government agency.[60] While ecological factors are key to enhancing the performance of MPAs, available capacity including resources and staff are fundamental for effective protected area management.[61] Standardization of effectiveness measures across MPAs and OEABCMs will be critical in ensuring that they are delivering on conservation outcomes.

For MPAs to realize their full potential as a tool for ocean governance, further advances in policy-relevant MPA science are required. These research frontiers include MPA impacts on non-target and wide-ranging species and habitats; impacts beyond MPA boundaries, on ecosystem services, and on resource-dependent human populations, as well as potential scale mismatches of ecosystem service flows. Explicitly treating MPAs as "policy experiments" and employing the tools of impact evaluation holds particular promise as a way for policy-relevant science to inform and advance science-based MPA policy.[62]

7.0. Equitable Management of Marine Protected Areas and OEABCMs

As implementation of protected areas progress and in addition to biodiversity outcomes there is a growing requirement for equity – either in compensation for lost income or livelihoods due to closed areas (i.e. fishers having to leave an area that is being used for another marine use, or being removed from harvesting), or to have governance be equitable. Ensuring that measures to achieve Aichi Target 11 are used to also meet Aichi Targets 14 and 18 can provide some assurance that equity is included in spatial protection measures.

A primary element of equity at the outset are processes from the initial identification of an area to be protected that are founded in comprehensive stakeholder inclusion. Stakeholder inclusion will depend on social structure and technology and equity will depend partly on the ability of affected groups to adapt to changed governance arrangement. Incorporating ICCAs and parts of LMMAs into protected area networks is a key aspect of building in equity to spatial protection. Research has demonstrated that post-

[58] Edgar, G.J., Stuart-Smith, R.D., Willis, T.J., Kininmonth, S., Baker, S.C., Banks, S., Barrett, N.S., Becerro, M.A., Bernard, A.T., Berkhout, J. and Buxton, C.D., 2014. Global conservation outcomes depend on marine protected areas with five key features. *Nature*, *506*(7487), pp.216-220.

[59] Agardy, T., Di Sciara, G.N. and Christie, P., 2011. Mind the gap: addressing the shortcomings of marine protected areas through large scale marine spatial planning. *Marine Policy*, *35*(2), pp.226-232.

[60] Jones, PJS, Qiu W, and De Santo EM (2011): Governing Marine Protected Areas - Getting the Balance Right. Technical Report. United Nations Environment Programme. http://www.mpag.info/governing-mpas-final-technical-report-web-res.pdf

[61] Gill, D.A., Mascia, M.B., Ahmadia, G.N., Glew, L., Lester, S.E., Barnes, M., Craigie, I., Darling, E.S., Free, C.M., Geldmann, J. and Holst, S., 2017. Capacity shortfalls hinder the performance of marine protected areas globally. *Nature*, *543*(7647), p.665.

[62] Fox, H.E., Mascia, M.B., Basurto, X., Costa, A., Glew, L., Heinemann, D., Karrer, L.B., Lester, S.E., Lombana, A.V., Pomeroy, R.S. and Recchia, C.A., 2012. Reexamining the science of marine protected areas: linking knowledge to action. *Conservation Letters*, *5*(1), pp.1-10.

MPA establishment, food security in adjacent communities generally remains stable or increased in older and smaller MPAs. With regards to local governance of MPAs, increased resource rights were positively correlated with MPA zoning and compliance with MPA regulations, however protection generally impacts at least a minority of the fishing activity – which can be expected given that areas are protected to reduce human impacts on biodiversity. [63]

Standardized criteria for equity in marine protection measures has not yet been established, and will likely need to be tailored to specific communities and governance structures. It can be guided by lessons learned from existing protected areas and elements of ICCAs and LMMAs. Case studies compiled by the International Collective in Support of Fishworkers (ICSF)[64] show mixed results in terms of effective and equitable MPAs. Inclusion of local communities and ensuring that conservation objectives and social objectives can be met through the protected area establishment is often more likely to lead to equitable outcomes, than top down approaches.

In addition to equitable management of individual area-based conservation measures, there are also equity factors to be considered in terms of capacity for States to effectively monitor these areas. Mechanisms to better use local and traditional knowledge as well as build science and community monitoring capacity should be an aspect of financing mechanism and knowledge and technology transfer between developed and developing States. This may become particularly important as area-based conservation measures are used to mitigate impacts of climate change.

8. Science and Information Considerations for Establishment, Monitoring and Effectiveness of MPAs and OEABCMs

Identification of areas that warrant protection, including biodiversity hotspots and representative areas, and post-establishment management and monitoring for effectiveness, rely on scientific information. This reliance is increasing as area-based conservation measures are established and then required to measure progress on achieving objectives. For both MPAs and OEABCMs, where biodiversity outcomes are expected, there is a need to clearly demonstrate conservation benefits.

As area-based conservation measures are established, there are opportunities to begin to measure progress against objectives. Efforts to bring together scientific consensus have been made in both the primary literature through various meta-analyses of marine protected areas.

Calls for improved scientific criteria for measuring the effectiveness of protected areas have come as States are reporting on area-based targets, with few additional quantitative metrics, and often claiming biodiversity outcomes when other metrics are indicating declines in species or habits.[65] While the 10% goal is one that was negotiated and deemed politically acceptable and achievable, there are debates about how much of our ocean needs to be protected to ensure continued ecosystem function, biodiversity protection, restoration of depleted fisheries or resilience to climate change.

Scientific information is required for identifying and designating area-based conservation measures, for setting clear objectives and to provide the basis for long term monitoring and assessment of effectiveness, as measured by biodiversity outcomes. While MPAs may require more scientific expertise at the outset, in order to ensure that OEABCMs are in fact producing biodiversity conservation outcomes, more attention is needed to ensure that there is capacity to track these outcomes. A counterpoint to achieving scientific proof of biodiversity protection, as increasingly the onus is on the protected area to "prove" that is worth

[63] Mascia, M.B., CLAUS, C. and Naidoo, R., 2010. Impacts of marine protected areas on fishing communities. *Conservation Biology*, *24*(5), pp.1424-1429.

[64] ICSF Case Studies on MPAs https://mpa.icsf.net/

[65] Watson, J.E., Darling, E.S., Venter, O., Maron, M., Walston, J., Possingham, H.P., Dudley, N., Hockings, M., Barnes, M. and Brooks, T.M., 2016. Bolder science needed now for protected areas. *Conservation Biology*, *30*(2), pp.243-248.

[65] O'Leary, B.C., Winther-Janson, M., Bainbridge, J.M., Aitken, J., Hawkins, J.P. and Roberts, C.M., 2016. Effective coverage targets for ocean protection. *Conservation Letters*, *9*(6), pp.398-404.

restricting from various human uses, may be to shift the burden of proof onto human activities. Finally, impacts of scientific research itself must not compromise biodiversity objectives and consideration should be given to no-go zones that also prohibit research.

As networks of area-based conservation measures are established, and more areas set aside from industrial activities, there will likely be an increasing demand for adaptive management – particularly where fisheries resources are concerned, and biomass increases found within protected areas – or where climate change influences species distributions. More science is needed to inform adaptive management and develop clear objectives for when such adaptation – either in boundaries or in permitted use can occur. As the length of time from MPA establishment increases, there are opportunities to document trends in biodiversity outcomes and to conduct broader scale analysis over a number of MPAs and OEABCMS to better understand how outcomes are related to characteristics of the protected area.

9. Contrasts Between Marine and Terrestrial Environments

Part of the rationale to develop guidance for applying the IUCN protected area categories in marine protected areas was to account for the inherent differences between marine and terrestrial environments. Key contrasts include the multi-dimensional aspect of the marine environment, the dynamic nature of marine environment (e.g., currents and tides), lack of clear ownership in many areas and the multiple jurisdictional aspect of marine management, lack of visibility and/or remoteness of features being protected, boundary demarcation, and connectivity between ecosystems and habitats. [66] While the basic criteria and standards, as well as effectiveness evaluations, can be the same for both environments jurisdictional elements and ecosystem elements often require different approaches in marine and terrestrial environments.

From an economic perspective, area-based conservation measures in the marine environment are expected, in many cases to improve fisheries resources and restore productivity. In terrestrial environments, the focus is largely on protecting animals without the expectation that they can be harvested once populations increase. The concept of habitat fragmentation and connectivity is fundamentally different in marine environments, but also more well understood terrestrially.

From a primary production perspective, the standing stock in terrestrial environments is wide spread and structural– while in the marine environment, primary production is limited to the coastal zone for habitat forming species with phytoplankton distributed through the pelagic photic zone. There is much higher turnover in the primary production and it varies with annual cycles, directly tied to temperature and currents.

In terrestrial environments, the atmosphere is well mixed at a much broader scale, whereas mixing in marine environments can change within significantly smaller scales. Climate change impacts will also affect marine and terrestrial areas much differently -as coastal areas are subject to erosion and storm surges and protection efforts can be lost as the result of one large weather event. The pervasive impact of ocean acidification can impact the entire standing stock of primary productivity in one area, having knock-on effects throughout the food web.

The fluidity of the marine environment means that land-based pollution or marine derived pollution can spread to areas well outside of the initial area of impact – and it is harder to prevent these impacts within protected areas in the marine environment, than the terrestrial environment.

10. Gaps in Assessments and Indicators

[66] Day J., Dudley N., Hockings M., Holmes G., Laffoley D., Stolton S. & S. Wells, (2012). Guidelines for applying the IUCN Protected Area Management Categories to Marine Protected Areas. Gland, Switzerland: IUCN. 36pp.

While the WDPA provides a shared database and portal for States to submit information on protected areas, it is currently lacking in metrics for the quality of these protected areas as well as quantitative metrics on effectiveness and qualitative metrics on equity.

Evaluation of effectiveness is also hampered by achieving a balance between biodiversity outcomes, equity in governance structures and decision making where management decisions may be made to improve social outcomes at the expense of biodiversity outcomes. Comparing MPAs and OEABCMs in terms of objectives vs outcomes is highly dependent on management inputs, capacity for monitoring and the mechanism through which an OEABCM is achieving biodiversity outcomes. For example, a fisheries closure may be monitored as part of a larger science-based assessment where as a cable corridor or munitions dump may never be monitored for changes to biodiversity because the management tool does not require monitoring, but is based on prohibiting activity to protect a non-living structure.

Calls have been made to the wider scientific community to assist with establishing ecologically sensible protected area targets, to prioritize important biodiversity areas, identify comparable performance metrics of ecological effectiveness in order to standardize assessment towards ecological targets.[67] Bolder science could include recommendations for the amount of area that needs to be set aside from industrial activity to achieve a variety of biodiversity outcomes. Trade-offs on the management and capacity needs for monitoring and evaluation between smaller, multi-use areas and large no take areas or between comprehensive fisheries management measures and marine reserves should be assessed.

10.1 Scientific and Knowledge Gaps

Connectivity: There are several areas where progress is needed in order to better assess elements that are deemed important qualitative aspects of MPAs and OEABCMs. Some of these elements rely on ecological information and require further input by scientists as well as policy makers as not all States will have monitoring capacity to collect the necessary data. There are no globally agreed indicators to assess connectivity of MPAs or area-based conservation measures, as connectivity will depend on the type of ecosystem (i.e. coral reef, open ocean, coastal area, offshore bank) as well as the objectives of the measures.

Integration into the Seascape: Aichi Target 11 specifies that MPAs and OEABCMs should be integrated into the wider seascape, which implies marine spatial planning (MSP) and an understanding of the level of adherence to such plans on a sectoral basis, as well as assessment of cumulative impacts. Given that MSP is only beginning to take hold in a tangible way, there is a lack of agreed indicators to assess the integration of protected areas into a broader framework, and alignment of MSP objectives with objectives of area-based conservation measures cannot necessarily be expected. There are opportunities for further research in areas where MSP has been implemented and where area-based conservation measures are an aspect of such plans.

Climate change: While spatial protections are expected to mitigate impacts of climate change, and effectiveness may be best evaluated in coastal areas where erosion and storm surge damage can be quantified and compared between protected and unprotected areas, there are few broad indicators as to how MPAs and OEABCMs can demonstrably be shown to protect biodiversity and ecosystem function from the impacts of climate change. Quantitative indicators may be best assessed when there are enough large areas protected to better compare population levels of species that are vulnerable to climate related impacts such as ocean acidification and coral bleaching. There are also overarching indicators needed to ensure that climate change and connectivity indicators are addressed simultaneously.[68]

---

[67] Watson, J.E., Darling, E.S., Venter, O., Maron, M., Walston, J., Possingham, H.P., Dudley, N., Hockings, M., Barnes, M. and Brooks, T.M., 2016. Bolder science needed now for protected areas. *Conservation Biology*, *30*(2), pp.243-248.
[68] Magris, R.A., Pressey, R.L., Weeks, R. and Ban, N.C., 2014. Integrating connectivity and climate change into marine conservation planning. *Biological Conservation*, *170*, pp.207-221.

Linking with Traditional and Local Knowledge: A current challenge to the paradigm of conservation effectiveness and biodiversity protection is that quantitative assessments often focus on natural science outcomes, which require budget for monitoring and management. For community led MPAs or OEABCMs, additional provisions for the use of traditional and local knowledge is imperative in both setting objectives and assessing outcomes.

10.2 Governance Gaps

In addition to science-based indicators and assessments of effectiveness of MPAs and OEABCMs, there are gaps in governance and social indicators as well. Despite commitments made to assess effectiveness for 60% of protected areas by 2015, as set by CBD Decision X/31[69], only 17.5% have been assessed.[70] Part of the difficulty in reaching this target is that there is limited data on many protected areas and States differ in their processes for collecting and reporting on effectiveness, making comparisons and evaluation difficult.

Equity: Indicators for the assessment of equity also prove to be elusive, however there is progress in how Parties are measuring governance and the expansion of ICCAs and LMMAs including registering, reporting and convening around these systems is contributing to a community of practice around equity. There is an opportunity to use other international commitments, including United Nations Declaration on the Rights of Indigenous Peoples and the level of implementation of the FAO Guidelines on Small Scale Fisheries[71] to track governance, co-management and equity in protected and conserved areas. Efforts to assess equity of governance mechanisms OEABCMs – some of which may be also identified as ICCAs or LMMAs have yet to be made, and such assessment could be elaborated as part of proposed IUCN guidance on OEACMs.

11.0 Conclusions

Protected areas – and particularly large no take areas – are seen as an "insurance policy" with which multiple objectives can be achieved to mitigate the impacts of extractive human activity as well as build resilience against climate change. As 2020 approaches, States are taking action on implementing a range of MPAs and seeking to count what could be considered OEABCMs and there for contribute qualitatively and quantitatively to the 10% Target. Where biodiversity objectives and outcomes are not being met or are compromised by the lack management effectiveness, it can be expected that the benefits of these efforts will also be compromised.

While Aichi Target 11 sets out the basic expectations of these protected areas, there is a need to further refine and agree upon elements of what classifies a protected area as effective – from governance frameworks and biodiversity outcomes – and how these elements are measured. Perhaps most importantly, building the capacity for States to assess effectiveness and make decisions for marine protection to ensure the best outcomes for biodiversity is required in order to stem the tide of coastal and marine biodiversity loss.

The development of standards and guidance needs to be met with an equal amount of effort on ensuring that States are aware of the existing tools, and that efforts are made to increase capacity to implement them. Engagement with agreed processes for reporting on marine protection targets, as well as the effectiveness of these targets, is needed. While efforts to improve marine protected area standards and to adequately assess outcomes from other effective conservation measures are needed, these must be complimented by financial mechanisms as well as clear articulation of benefits. A model of continuous improvement and feedback mechanisms when objectives are not being met is also needed. Continued

[69] CBD Decision X/31 Para 19 (a) https://www.cbd.int/doc/decisions/cop-10/cop-10-dec-31-en.pdf
[70] Information provided by the CBD Secretariat.
[71] FAO (2015) Voluntary Guidelines for Securing Sustainable Small Scale Fisheries www.fao.org/3/a-i4356e.pdf

efforts are needed to engage States in enforcing existing protected areas and working towards continuous improvements in management, enforcement and monitoring.

There is also a need for improved, but easy to measure, scientific metrics for effectiveness that can be applied across ecosystems and scales of protection. Goals towards these metrics may be included in other Aichi Targets, as well as in national frameworks for ecosystem functioning and biodiversity protection. There also need to be mechanisms to jointly measure progress towards complimentary Aichi Targets.

Aichi Target 11 and the SDG 14 have provided a focus for global efforts for marine and coastal biodiversity conservation. Inclusion of OEABCMs may allow States to make further progress on biodiversity protection than focusing only on marine protected areas, and the inclusion of ICCAs can allow for indigenous rights to be upheld as well as progress on evaluating equity of protected areas. In many aspects, the 2020 Target of 10% is only the beginning, as it is clear that efforts are underway to exceed that target, and to ensure that more is done to strengthen existing protections and achieve higher standards of protection for new areas. The focus must continue past 2020 and be integrated into efforts to mitigate and reduce climate change impacts on the global ocean, with the appropriate financial assistance and capacity development to ensure success over the long term.

Appendix: Summary of Submissions to CBD Notifications related to the expert workshop

Table 1: Summary of Submissions by Parties, Other Governments and Organizations to Notification 2017-065

Country	Protected areas and other effective area-based conservation measures, taking into account the work of the International Union for Conservation of Nature and other appropriate expert bodies;	Additional measures to enhance integration of protected areas and other effective area-based conservation measures into the wider land- and seascapes;	Mainstreaming of protected areas and other effective area-based conservation measures across sectors to contribute, inter alia, to the Sustainable Development Goals and as natural solutions to combat climate change;	Effective governance models for management of protected areas, including equity, taking into account work being undertaken under Articles 8(j).
Australia	- under Australia's Strategy for the National Reserve System 2009-2030 the Govt and all state/territory govts agreed to a national approach to achieve a fully implemented reserve system by 2030 (includes protected areas and OEABCMs) ○ such as IPAs, private protected areas - Australian govt has direct mgmt. for 6 national parks. All other protected areas are owned and managed by state/territory govts, conservation orgs, and/or indigenous and private landowners - Heads of Parks Agencies Meetings – biannual meetings that provide for ongoing cooperation and knowledge sharing - In early stages of developing management effectiveness measures and reviewing monitoring parameters for PAs	- Zoning for the GBR: provide a range of ecologically sustainable uses - The GBR zones have been successful – notably for some fish populations - Also appear to benefit overall ecosystem health and resilience - Effectiveness of zoning depends critically on effective compliance - The zoning network provides a critical and cost-effective contribution to enhancing the resilience of the GBR	- Aust. Is committed to the 2030 Agenda for Sustainable Development – is supportive of work on the mainstreaming of biodiversity and integration of biodiversity in cross-sectoral policies - Australia's Biodiversity Conservation Strategy: promotes links between nature and human well-being. Also works with IPAs and Indigenous ranger programs - Australia's Threatened Species Strategy: outlines an action-based approach to protecting and recovering threatened plants and animals based on principles of science, action and partnerships - Threatened Species Prospectus: new financing model that extends species protection to the private sector. Designed to build partnerships and connect	**Terrestrial PAs** - Minimum standards for PA (long term, must contribute to the comprehensiveness, adequacy and representativeness of the national reserve system, follow one of the 6 IUCN PA categories) - Indigenous and publically protected areas - Indigenous protected areas are managed by Indigenous land managers which is built upon Indigenous traditional knowledge **MPAs** - Primary goal of National Representative System of MPAs is to establish and effectively mgmt. a CAR system of marine reserves to contribute to the long term conservation of marine biodiversity

			conservation partners with business	- Over 40 marine parks – many established after 2012 – working on mgmt. plans now for all of them - 36% of it marine jurisdiction is protected **Intergovernmental arrangements** - Ranges of intergovernmental agreements are in place to help support sustainable development and enviro mgmt. - E.g: GBR Intergovernmental Agreement provides a framework for the Australian Govt and Queensland Govt to work together to protect the GBR
Belgium	- Provides overview of Natura 2000 **Flanders** - Approx. 12.3% of territory of Flanders is Natura 2000 site - 38 special areas for conservation (SAC), 24 special protection areas (SPA) - Working to restore multiple habitats - Subsidies provided for nature mgmt. **Wallonia** - 13.11% of territory is protected - Network is based on the hydrological network so good connectivity b/w sites - Multiple habitats protected **Brussels Capital Region** - 3 sites designated as SAC – 14%	**Flanders** - Multiple different sites owned by govt, local govt, private (majority have mgmt. plans), closed military areas - 4 RAMSAR sites - Important inter-regional projects for the mgmt. of Natura 2000 with EU subsides: OZON project for the Sonien Forest, BNIP Integrated Project for Natura 2000 in Flanders-Wallonia-Federal marine - Flemish Ecological Network is adopted in the Spatial Structural Plan Flanders and comprises large natural units	**Flanders** - LIFE Nature and Biodiversity Projects: restoration and development of nature areas and connectivity zones. Aim is restoration of large grasslands and support climate adaption by restoring and enhancing green infrastructure - Sigma Plan : aim to protect Flanders against flood, natural flood plains being restored - Nature development in the harbor area of Antwerp: - Cooperation with business sector to enhance green spaces - Projects under the EU Rural Development Programme – work with framers in	**Flanders** - In framework for Natura 2000 a formal consultation process has been established (decides on nature objectives, approval of protection programmes, implementation of nature sites) - Consultation occurs at various levels, with strong stakeholder representation - Capacity building are organized to support private owners and other actors for the development and implementation of Natura 2000 sites **Wallonia** - Participative process on nature conservation

	of territory – working on mgmt. plans at the moment **Belgium part of the North Sea** - 4 Natura 2000 sites, 3 of them for the protection of birds, one for habitats Conservations objectives have been adopted and mgmt. plans are under development	and large natural units in development - Incentives are established to promote ecological quality in these supporting areas - The new spatial planning policy includes development of green-blue network systems between and within rural and urbanised areas - Main programs to enhance development or restoration of green infrastructure includes: Hoge Kempen National Park, Nature in your Neighbourhood **Wallonia** - Govt protects areas through: govt nature reserves, chartered nature reserve, forest reserve, wetlands of biological interest and underground cavity of scientific interest - The network of sites grows slowly and covers 0.9% of Walloon territory - PEFC certified forests cover nearly 54% of region's forest – owners engage in voluntary measures to diversify their forest, maintain wood patches **Brussels Capital Region** - Has 14 natural reserve and 2 forest reserve officially	developing agri-environment measures for the development and restoration of Natura 2000 sites **Walloon Region** - Water Code foresees the registry of protected zones – zones for protection of economically important aquatic species	- Organized mostly by local authorities **Brussels Capital Region** - Participative science to gather info Promotes multifunctional and participative mgmt. plans for green areas

		designated and protected at regional level - Green Infrastructure - aiming at connecting Natura 2000 sites, forest nature reserves, parks, to create green and blue corridors - Working on inner city connected sites ' **Federal- Marine area** Marine spatial plan combined with the Marine Strategy is leading to more integration and sustainable use of the marine enviro		
Benin	Same proposal submitted for the MPA question posed by the CBD (no new information			
Brazil	- National Action Plans for Endangered Species Conservation (PAN) is a public policy instrument complementary to protected areas that defines priorities and actions to improve the conservation of species and its environments by the integration of different sectors of the society.	**Carajas National Forest Mgmt Plan** - Use environmental licensing to promote economic growth with biodiversity conservation - Govt carried out a PA zoning negotiation, aim is to enable mining with no net loss of biodiversity	**Biodiversity Monitoring Program** in federal protected areas: - standardizes monitoring protocols - Aims is to evaluated the effectiveness of Brazilian PA, subsidize actions for climate change impacts and for general mgmt. activities, and to strengthen social participation in the mgmt. of biodiversity	- have participative processes - mgmt. plans can be established
Canada	- Uses the IUCN PA categories - Work is underway within Can to determine a Canadian approach to identifying OEABCMS - To meet Target 1 have engaged with the IUCN/WCPA Task Force **Terrestrial PAs and OEABCMs**	**Terrestrial PAs and OEABCMS** - Expert task teams have provided guidance to the National Advisory Panel on : PAs and OEABCMs, equitable mgmt. from a	**Terrestrial PAs and OEABCMs** - 2020 Biodiversity Goals and Targets for Canada – highlight Canada's biodiversity-related priorities - Established 18 biosphere reserves - each promoting	- 95% of PAs and OEABCMs are governed by Federal or prov/territory govts - Only 16% of terrestrial PAs and 28% of marine protected areas has up-to-date mgmt. plans

	- Working with govts (indigenous included) to reach Target 1 - A National Advisory Panel has been appointed by Min of Enviro an d CC - A key element of the Pathway to Target 1 is the Indigenous Circle of Experts – created to ensure Indigenous Advice is applied - ICE offering advice on how to incorporate IPCAs **MPAs and OEABCMS** - Reached 5% protection by end of 2017 - Multiple ways to protect marine enviro : MPAs, MWA,NMCAs – all with different agencies - Tabled Bill C-55 to amend Oceans Act and CPRA – amendments seek to improve MPA designation process (freeze the footprint) - MPAs are managed on a site-by-site basis each with their own mgmt. plan – along with surveillance in each - Developed guidelines for OEABCMs from CSAS advice - Fed govt meets regularly with all stakeholders to achieve MCTs	local community perspective, ecological representation, connecting conservation areas and integrating into landscapes, mgmt. effectiveness, areas for important biodiversity ecological reserves - Can conserve biodiversity more effectively through networks **MPAs and OEABCM s** - Developed the National Framework for Canada's Network of MPAs - A general national process has been defined for bioregional network development and national guidance has been developed to support DFO staff in the network development process - 5 bioregions are currently drafting network plans – OEABCMS will be a part of this! - Some existing area-based measures that do not qualify as OEABCMs can still potentially play a supporting role in strengthening bioregional MPA networks - Acknowledges that MPAs and MPA networks should be embedded within broader	biodiversity conservation and sustainable use o Used a multi-stakeholder approach - Mainstreams OEABCMs and PA through national municipal orgs such as the Federation of Canadian Municipalities – work to emphasize the value of biodiversity conservation in an urban context **MPAs and OEABCMS** - Increase public awareness of these areas – govt works with NGOs – "Musquash Paddle" - Interdepartmental Committees on Oceans are committees at several levels that serve as a forum for discussion and joint action on the development and implementation of ocean-related initiatives - DFO, PCA, and ECCC working collaboratively to mainstream protected areas - MPAs and regs are integrated into IFMPs - MPA regs and boundaries are presented to the coast guard and training on how to response to infringements - Fisheries Protection Program – partners with federal and provincial govts. to review sites, proposed works and establish guidelines and	- Nearly all PA organizations identified challenges related to mgmt. of PAs - Working with Indigenous communities and groups to create new protected areas and conserve biodiversity is integral to the PA strategy - reflected in Canada's 2020 Biodiversity goals and targets - Indigenous Ppls have had an increased level of participation in the decision-making process to related PAs **DFO Case:** - Report goes through the MPA designation process: collect data, engage with stakeholders, announce AOI, consultations, designation, etc. etc. - Example: in the case of Sgaan-Kinghlas Bowie Seamount MPA a MOU was signed between Can and the Council of the Haida Nation which confirms a mutual commitment for cooperative mgmt. and planning . Provides a process for parties to exchange views and provide advice to the govt - Example: Tarium Niryutait MPA – established together by the Inuvialuit and DFO is cooperatively managed with the FJMC. Inuvialuit are involved in mgmt. and monitoring of the

		spatial planning and ecosystem-based mgmt. regions to max. their contribution to ensure long-term sustainability	regulations	MPA - Canada requires formal impact, benefit and cooperative mgmt. agreements to provide a framework for collaboration b/w Indigenous Peoples and other forms of govt. – create a formal mech to ensure that Indigenous Peoples are receiving the benefits of PAs
Finland	- Finland's national PA network covers almost 16,000 sites and 4.6 million hectares – 12% of land and water - 95% of PA are state-owned - 40 national parks and almost 700 other statutory nature reserves - More than 85% of the Natura 2000 network overlaps with the national PA network. While Natura 2000 covers 14.4% of Finland's land area and 13.6% of marine area - Info on all protected areas is available in a national database - Finland has extended the national and international protected areas network through their National Nature Conservation Programmes (over 200 new state natures reserves) - Have continuously been enhancing info mgmt. on national PAs - Have assigned IUCN PA categories to national sites - Have been updating info on regional and international PAs	- Using the Zonation software to support forest and mire protection programmes - Development of national urban parks - River basin mgmt. planning: has approved 7 regional river basin mgmt. plans for 2016-2021 - Following the 2014 EU directive on MSP. Regions will complete their own MSPs by 2021	- Finland has created a working group for enhancing implementation of the National Biodiversity Action Plan - working group is entitled: "Saving Nature for People". The group will evaluated the implementation of the National Biodiversity Action plan - Implementation of other biodiversity related action plans: o Improving the state of threatened habitats o Protection of threatened species o Ramsar wetlands action plan - Developing PAs in the changing climate: conducting a study on assessing the sufficiency and the ability of the PA network to protect the enviro in the changing climate - Completed many studies highlighting the benefits of PAs	- the regional environmental admin is responsible for the regional implementation and development tasks of the central govt - municipalities manage their own nature reserves - private nature reserves, with the help of government agencies create their own site-specific provisions - have been applying the CBD's Akwe:Kon guidelines in the Sami Homeland Area : the process aims at safeguarding culture and traditional knowledge of the Sami - Akwe:Kon working group is an addition to the participatory planning system already in place. Increase's interaction b/w different stakeholders

	(Natura 2000 sites, HELCOM MPAs, Ramsar wetland sites) - In 2014 developed and released guidelines on the aims, functions and mgmt. of PAs - Created regional master plans for Natura 2000 sites - Have ensured the financial sustainability of PA administration and mgmt. and that it is cost-efficient		(E.g.: Economics of Ecosystems and Biodiversity) - Large citizen science campaigns	
France	- Links to multiple studies	-	-	-
Germany	- 2016 Federal Enviro Ministry launched the initiative for a broad process to further develop Germany's network of PAs - A number of regional strategies for PAs already exist and are being implemented	-	- A joint action plan on PAs will be developed by 2019 and will coordinate the broad range of activities for achieving target 11. Elements for securing increased acceptance will also be given consideration - Further goal is to enhance appreciation of the importance of the natural heritage represented within PAs and strengthen a sense of common responsibility	-
EU (Natura 2000)	- Natura 2000 covers 18% of the EUs land and 6% of marine territory - A network of core breeding and resting sites for rare and threatened species and natural rate natural habitat types - Stretches across all 28 EU countries - Aim of the network is to ensure long-term biodiversity	- Natura 2000 is not a system of strict nature reserves. Human activities occur within	- Natura 2000 Viewer is an online tool to view the sites, provides key info on species and habitats, conservation status and estimated pop size	- Within six years of designation there needs to be conservation measures adopted and be further designated as Special Areas of Conservation (SAC). - Conservation objectives should be met while taking into account economic, social, cultural, regional and recreational requirements - The EU has published many

	conservation - Natura 2000 is key to implement the EU Biodiversity Strategy: aim Is to halt the loss of biodiversity and ecosystem services			guidance docs on implementation and mgmt. - Review and evaluation does occur: Most recently the EU Habitats and Birds Directives. Provide a wealth of info and adaptive changes were made to improve the Directives
Iraq	- 28 proposed protected areas under Natural protected areas System No. 2	- Cooperation with local councils and environmental policy for protecting natural areas	- have a nomination form to nominate protected areas as a natural solution to combat the effects of climate change	-the mgmt. of protected areas will establish the mgmt. authority to work with the local population to protect sites and preserve heritage
Mexico	- Annex 2 - As of Dec 2016 the amount of terrestrial environment that counts towards Aichi Target 11: 15.91%, marine environ: 22.29% - Can find all protected areas on the "Geographic Database of State Protected Natural Areas" - The National Commission of Natural PAs has evaluated the effectiveness of the PAs (use a score card) - 3 different levels of implementation and mgmt.: Low, medium and high. The higher the better and the more likely conservation objectives will be met - Have a Rapid Assessment of Mgmt Effectiveness in MPAs : objective is to help marine managers determine how MPA mgmt. effectiveness (based on a questionnaire)	- have mapped out the corridors for connectivity between Protected Areas - have marine-coastal natural protected areas – the mgmt. programs allow artisanal or riparian fishing in certain subzones	- Annex 3 – list of contributions from the National Commission on Natural Protected Aras (CONANP) - CONANP has promoted the prep of C.C. Adaptation Plans for 29 Protected areas - CONANP has developed adaption measures based on ecosystems in PA which contribute to reducing socio-economic vulnerability through the prevention and attention of negative climate change impacts - CONANP has implemented an ambitious plan to mobilize funds to strengthen the mgmt. of Mexico's PA system - Economic valuation of - protection services against climate change has served as a tool to promote financing for adaption measures	- Mexican legislation establishes a requirement to have the sustainable development of ecosystems and the participation of society in the management of those policies - The Secretariat of Enviro and NR integrates consultations bodies for organizations/stakeholders to participate - have regulations to establish mgmt. plans, assist in the procurement of financial resource, technical and scientific assistance , support the participation of local society in conservation actions and contribute to the solution of socio-environmental problems - currently 91 advisory councils - created a Citizen Participation Index of the Environment Sector for the purpose of

			- Gender perspective for strengthening the mgmt. of PA in the face of climate change continues to develop - Coordinates with the universities to increase scientific understanding	measuring society's participation on conservation actions
Peru	- Have a National Strategy on Protected Areas – established guidelines for the management of national network of PAs - 9 different categories of PAs: National Parks, Historic Sanctuaries, National Sanctuaries, Reservations, Wildlife Refuges, Landscape Reserves, Communal Reserve and Game Preserves - 17.2% of land is protected - Using a regional approach for network planning. All bioregions exceed 10% representativeness - Biosphere reserves – promote conservation and certain socio-economic activities (i.e., Fairs, ecotourism, local markets) - Transboundary Biosphere Reserve b/w Peru and Ecuador: Forest of Peace	- Promoting systems operations – working with regional governments on this! - Successful Experience: Amazon Regional Conservation System: made up for different types of protected areas – very connected and high representability - Tri-National Program for Conservation and Sustainable Development Corridor Areas Protected Areas wildlife Reserve – working with Ecuador and Colombia on this. Joint management for the three border protected areas	- Discuss how Peru is meeting Target 15, but not Target 11. - No discussion of marine environments at all - Financial Sustainability Initiative for Effective Mgmt – implementing a fundraising strategy to mobilize resources so Peru can have effectively managed PAs - Managing PAs through conceptual models to ensure that conservation objectives are met with the impending impacts from climate change (looks at PAs vulnerability to climate change too) - Incorporating ecosystem services into network/PA planning	- PA contracts – mgmt. contracts where the govt works with communities, orgs, allies such as indigenous or NGOs to ensure the effective mgmt. of the PA (currently 7 areas with mgmt. contracts - Conservation agreements – involves local people that provides incentives for communities or businesses to be involved in conservation and make their work more eco-friendly - Monitoring to see how orgs and individuals are participating in PAs - Do have IPAs – work closely with Indigenous groups

Philippines	- Developed of a Guide to Local Conservation Area Mgmt Planning
	- Formulated the National Protected Area System Master Plan (systems approach to PA planning)
	- Improving Governance and Mgmt of Indigenous Ppls and Local Communities Conserved Areas
		- Pilot project: Integrated Ecosystem Mgmt approach to mgmt. of protection and conservation areas (completing in different provinces)
		- Integrating conservation concerns in the Land-use
			- Integration of Biodiversity Conservation into National and Local land-use planning
			  o Transboundary mgmt. plans, formulation of biodiversity responsive land-use plans, technical assistance to
				- Magsasaka at Siyentpilo para sa Pag-unlad ng Agrikultura (MASIPAG)
				  o Aim to empower resource poor farmers and improve their quality of life by farming traditionally

	and Territories project (spearheading the documentation and recognition/registration of Indigenous and local protected areas -	plan and development programs of local government units - Declaration of local conservation areas and possible up-scaling into critical habitats through the comprehensive land-use plan of local government units	local governments while designing land-use plans, etc. - Strengthening the policy framework for PAs and Biodiversity Conservation o Development of tools, manuals and case studies for establishment of local conservation areas, enactment of policies in support of local conservation areas, more financing for PAs - Strengthening the capacity and competency of PAs and PA managers o Development of competency standards for PA system mgmt. o Training stuff on PA mgmt. - Strengthening partnerships for PA Mgmt and Governance and Biodiversity Conservation o Partnerships with NGOs o Partnerships with national agencies in support of local conserved areas **Lessons learned:** - Keep an open mind to new ideas and opportunities - Some sites may take longer	- Conflict Sensitive Resource Asset Mgmt (COSERAM) o Seeks to introduce and strengthen governance that provides sustainable access to natural resources for marginalized pops o Indigenous ppls have become involved o Guides developed on how to document indigenous knowledge systems and practices - National Indigenous Peoples and Community Conserved Territories and Areas (ICCAs) Consortium o Aim is to undertake dialogues with govt and development partners to generate support for greater ICCA recognition in the country **Lessons Learned** - ICCA offers a very cost-effective approach for accelerating conservation - ICCAs offer an excellent win-win for indigenous communities and the govt pursing biodiversity conservation - Local conservation areas and ICCAs are not fully protected

			time and more resources for PAs to be established b/c of multiple factors - NGO partners have different levels of capacity and approaches to conservation. Work to harness the strengths of each - Need to gain trust with local communities - Huge gap in capacity development - Need support for local communities to implement plans - Need for info on the state of biodiversity resources	by law
Slovenia	- Nationally designated protected areas cover approx. 14% of territory - 9 nationally designed PAs, 4 have valid mgmt. plans and 4 mgmt plans are in preparation - Natura 2000 network covers app 38% of territory - Ecologically important areas cover 54% of territory and overlap with Natura 2000 network - For nationally designated PAs the IUCN is taken into account as much as possible (want to achieve IUCN standards) - Natura 2000 guidance docs are followed and delegated by the European Commission	- Established the network of Natura 2000 sites - New Spatial Development Strategy of Slovenia by 2050 is currently in preparation - will include green infrastructure	- Intergovernmental affairs ministry is using a system to integrate protected areas to policies in other sectors - Natura 2000 Management programme form 2015-2020 involved all relevant sectors - Protected areas are included in Slovenia's tourism strategy	- PA governance is completed by national or local govt. At national level special public organizations are established as mgmt authorities - Main financial source for management is state budget - Advisory bodies are created for PAs (required by law) - No indigenous groups are registered in Slovenia - The needs of women, local communities and vulnerable groups are taken into account in the planning and implementation of PAs
St. Kitts and	- 3 officially declared ecological	- Established the St. Kitts and	- National Biodiversity Strategy	- Mgmt. framework for protected

Nevis	conservation areas: Central Forest Reserve National Park, Royal Basseterre Valley National Park and the Brimstone Hill Fortress National Park - A draft PA systems plan does exist and draft PA management plans for selected site. H/w have not been implemented - Currently implementing the UNDP/GEF 'Conserving Biodiversity and Reducing Habitat Degradation in Protected Areas and Their Buffer Zones Project' – aim is to improve ecosystem representation in the country's protected area system, system PA mgmt., and strengthen institutional, policy and legislative, and financing frameworks for PA systems (scheduled to end in 2018	Nevis Marine Mgmt area – conserve biological resources in the area. Number of initiatives are being negotiated with the aim of establishing an effective mgmt. framework for the effective management of the MMA	and Action Plan (NBSAP) have proposed 12 national biodiversity targets – similar to Aichi Targets. - Anticipated that by the end of the Conserving Biodiversity Project in 2018, 2 new terrestrial areas will be declared - 3 earmarked marine protected areas would be co-managed as well - NBSAP provides guidance for mainstreaming and integrating biodiversity conservation into different sectors of national development (e.g. poverty reduction, agriculture, environmental protection, land and water resource mgmt., marine resource mgmt. etc.)	areas is outlined in the Protected Areas Systems Plan and other draft management plans - Ideally need protected areas legislation, and a sustainable finance mech **Lessons Learned** - PAs in the country are at its infancy stage - Roles and functions for PA mgmt. are not clearly defined - UNDP/GEP Protected Areas project is first of its kind - Exclusive reliance on external funding is a major challenge - Need long term measures to ensure sustainability
United Kingdom of Great Britain and Northern Ireland	**UK** - Nature Improvement Areas – of a 2014 evaluation all have reported to have good or satisfactory progress towards their objectives and ensuring connectivity - Improvement programme for England's Natura 2000 sites – will be creating individual site improvement plans to achieve broader biodiversity objectives **Wales** - Well-being of Future Generations Act includes a set of statuary sustainable development goals for	**UK** - Looking at Countryside Stewardship agreements where baseline environmental surveys are being carried out **Wales** See Nature Recovery Action Plan	**UK** - Benefits of Sites of Special Scientific Interest (SSSIs) 2011 Report: estimates the monetary value of SSSIs ecosystem services including regulating climate change , and cultural services - Under increased funding scenario, services were estimated to be worth an additional 769 million euros per year **Wales** -see nature recovery action plan	**UK** - Implementation of PA policy is largely devolved and involves a range of agencies - Work with stakeholders such as landowners, NGOs, etc. - The devolved approach, informed by the National Biodiversity Strategies/planning policy appears to be working well and is sufficiently flexible to allow for adaptive management - Recently focusing to accommodate a great emphasis

	Wales - call for the ecosystem approach, among many other things - Welsh Govt Nature Recovery Action Plan (NRAP): sets out specifically how Wales will address the CBD's Strategic plan for biodiversity and Aichi Targets - NRAP developed alongside the context of the Well-being of Future Generations Act - Biodiversity and Ecosystem Resilience Duty introduced to help drive biodiversity conservation actions within public authorities and assist them in meeting objectives - EU LIFE Program is the EU's funding instrument for the environment. Objective is to contribute to the implementation, updating and development of EU enviro policy and legislation: Wales has been a major supporter of this - Committed to delivering ecologically coherent system of MPAs (special areas of conservation, special protection areas, sites of special scientific interest, marine conservation zones and Ramsar sites - Supporting marine conservation and biodiversity protection through multiple measures: Marine and Coastal Access Act 2009,		**Northern Ireland** has an annual programme to assess the condition of sites. Largely carried out by scientists within the Department of Agri, Enviro and Rural Affairs	on the ecosystem/natural capital approach with governance arrangements **Wales** - See Nature Recovery Action Plan **Northern Ireland** Governance arrangements should be put in place to ensure that actions are integrated and coordinate to ensure the best use of available resources

	Well-being of Future Generations Act 2015 and Environment Act 2016 **Northern Ireland** - Focus is on mgmt. measures to maintain or improve overall condition of European sites. Will require greater coordination across stakeholders and govt Site info is collated by the Joint Nature Conservation Committee; condition statistics are produced each year			
Venezuela	- Have been making progress in planning, creating, expanding and strengthening the management of 49 protected areas - The project seeks improve the mgmt and operation of the Coastal Areas MPA - 5 new proposals in place to create protected areas, elaboration of plans for 3 protected areas, update of plans for 3 Pas and enlargement of 2 Pas Communities have participated in these processes	- Have expanded of the environmental monitoring system to help implement measures - Compilation and definition of a Master Plan which specifies how various stakeholders and users will interacted within the Marine-Coastal Protected Areas System Important component of the plan is the integration of conservation and economic considerations (look for synergies between sectors)	- Govt formally implemented a process for the integrated management of its coastal area in 2001 – aimed at strengthening institutional capacity, planning and competencies b/w organs of power - Led to the Plan of Management and Integrated Mgmt of Coastal Areas (POGIZC) - POGIZC establishes coordination mechs, programs for integrated mgmt., public domain, guidelines for mgmt., and financing mechs - 10 programs for integrated mgmt have been designed (conservation of natural and cultural spaces, public domain spaces, vulnerable areas, research, recovery and sanitation, enviro education, etc.)	- Governance of PAs is done through government - but working on shared management based on norms that promote greater participation and organization of indigenous peoples and local communities - Work is being completed to establish coordination mechs between entities of the State and different types of social organizations Work with indigenous communities to demarcate indigenous lands and how they overlap with protected areas

United States – report also contains reviews of case studies for different biospheres, reserves, national parks, biological stations – many with different forms of governance and landscape conservation. No marine areas were examined	**US National Park Service** activities - Central role in development of the IUCN best practice guidelines for climate adaption - Co-chairs multiple forums and works groups on climate change and protected areas through the IUCN **US Geological Survey** - Manages protected area database of US - Geodatabase illustrate public lands, management and other conservation lands, and private lands **NOAA** - MPAs in US. Have an MPA geospatial database - Active participant in IUCN task force on OEABCMs - Developed draft framework for assigning IUCN protected area categories to US MPAs	**US National Park Service activities** - Supported production of IUCN Best Practice Guidelines on climate adaption **US Geological Survey** - Nature's Network Conservation Design depicts an interconnected network of lands and waters that if protected will support a diversity of fish and wildlife - The design offers voluntary guidance to protect the irreplaceable, look ahead to make better decisions today, maximize limited resources **NOAA** - National Environmental Policy Act (NEPA) provides a useful framework for integration - E.g: Stellwagen Bank National Marine Sanc – worked with NOAA, coastal guard, shipping industry and IMO to move ship lanes - Connectivity is important but has not been widely implemented. NOAA has put out recs on how to improve **Other** - Have worked with Canada	**US NPS activities:** - Released a Cultural Resources Climate Change Strategy (2016) that establishes a framework for addressing the impacts of climate change on cultural heritage sites and drawing on these resources to inform climate change science, adaptation, mitigation and communication overall **US Geological Survey activities:** - Working toward identification and implementation of effective mgmt. practices to maintain or improve habitat conditions for the Sage Grouse and Sagebrush Conservation Planning **NOAA** - Published a summary on how MPAs can help build resilience to climate change impacts and established a Blue Carbon working group - 13 national marine sancs and 2 national monuments have taken the leadership role in piloting "climate smart conservation" – which aim is to mitigation and reduce the impacts of climate change **Other** - All protected areas have compliance report and within these reports they review their	**US NPS Activities** - Have started to incorporate TEK into mgmt. planning - In support of the broad goals to share diverse cultural perspectives on resource mgmt. NPS maintains a website which provides a forum for info, resources and discussion about TEK **US Geological Survey Activities:** - Building partnerships to assess tribal adaptation to climate change (partnering with universities **NOAA** - Active public engagement is essential and provides opportunities for ongoing public involvement in the mgmt. of sancs - Communities can submit nominations to designate an area as a National Marine Sanc **Other** - Strong push for community outreach and engagement activities through the NPS Biodiversity Discovery Program - such as citizen science

		and Mexico to review terrestrial conservation in NA	contribution to the SDGs	

Table 2: Summary of Submissions by Parties and Other Governments to Notification 2017-084

Country	MPA
Australia	- Marine parks are managed by the Commonwealth Director of National Parks. Zones set out what you can do in marine parks – there are 3 main types of zones: green, yellow, blue. All offer different forms of protection - Marine Parks cover 1/3 of Australian waters – 58 reserves in total. The reserves have been designed under the National Representative System of MPAs - In 2012 the govt introduced 40 new marine parks – all will have management plans, are included in a network of MPAs - GRBMPA uses a combo of statutory zoning plans an plans of management - Spatial fisheries closures are enacted to deal with fishing pressures - Case Study: Heard Island and McDonald Islands Marine Reserve o Managed by multiple government agencies - Objectives of Australia's Marine Parks is to provide for the protection and conservation of biodiversity and other natural, cultural and heritage values; and ecologically sustainable use and enjoyment of the natural resources they contain - MPAs can be found in multiple ecosystems throughout Australian waters. The goal of the National Representation system of MPAs was to established a comprehensive and representative system of marine parks - Marine parks can also be created under state and territorial govts - 37.2% of Australian EEZ is closed to bottom trawling by marine parks and 30.3% by fisheries closures - Have developed guidelines or "goals" for establishing MPAs - The development of marine parks is guided by a range of biophysical and socio-economic-cultural management operational principles. - Marine parks overlap with a variety of other measures such as fisheries, maritime, tourism, oil and gas, etc. - Public consultation is part of several management processes undertaken when designing marine parks - Australian marine parks were identified through a marine bioregional process in 2012. Have network plans for different regions – feedback was sought after the plans were released - Consultation is required by law and requires a min of 30 days for comment. Following this a draft management plan must be made public - Consultation is usually completed through comment periods and meetings with all stakeholders (fishing, energy, indigenous, NGO, science, tourism, transport, etc.) - Under draft Australian Marine Park management plans, a monitoring and evaluation framework is established – plans are formally reviewed at both 4 and 8 years - Too soon to assess progress towards Australian Marine Park objectives – h/w have identified that some stocks have been increasing - Adaptive management is a fundamental principle within the Australian Marine Parks Monitoring, Evaluation and Review Framework

	- There has been the relocation of certain industries – impacts are expected to be minimal - Australia does have sites where multiple designations overlap – and do complement one another (E.g., GBR Marine Park and the Great Barrier Reef Coast Marine Park - allows for seamless zoning arrangement between two different forms of govt) - Networks of Australian Mark Parks are designed using the CAR Principle (comprehensive, adequate and representative). Assessment of representativeness was undertaken a the design stage - Assessment of the success of Australian Marine Parks will form part of the monitoring and improvement framework set up at both the whole park and network scales
Benin	- Protected areas should be managed by a Management Committee which includes fisheries managers, research structures, stakeholder and local population - Goals of conservation include: integrated sustainable management of the coastal and marine area and increased yields of resources and vegetation cover - Two zones are proposed for protection - one of them overlaps with Togo. Not official yet but both will include the involvement of local communities - Research info is used to inform decisions - particularly EBSAs - All stakeholders play a joint role in MPA management - Currently an ongoing process towards achieving their conservation objectives
Brazil	- Marine area of 3.5 million km2, considered the "Blue Amazon" - Many economic sectors rely or come from coastal and marine areas: fishing, mining, oil and gas extraction - Current stressors on the marine environment: pollution, overfishing, urban occupation, oil exploitation - Measure of Target 11 is done through the Ministry of Environment using the National Register of Nature Conservation Units (Protected Areas) – created in 2000 by federal law - Have been studying MPAs and what would be the best options for Brazil. Have studied Species Conservation and Reproduction Areas and also Fishing Exclusion Zones - Aichi Targets are internalized in Brazilian legislation – they are national goals and guiding principles - The Govt uses three different tools to measure implementation and effectiveness of the nature conservation units to achieve their objectives: Tracking tool developed by Global Environmental Facility, Rapid Assessment and Prioritization of Protected Area Management developed by WWF and measured every 5 years and the System of Evaluation and Monitoring of Management developed by Chico Mendes Institute for Biodiversity Conservation - 257 different protected areas – only 2.8% of marine and coastal ecosystems are protected - Each new protected area must be supported by environmental, economic, and social studies that justify their limits as important for nature conservation and their management viability. - Proposal must be submitted for public consultation where all stakeholders can contribute - The science guiding the selection of measures stems from the 1999 public policy doc entitled Priority Areas and Actions for Conservation : Sustainable Use and Benefit Sharing of Brazilian Biodiversity – updated in 2007 and will be again in 2018

	- REVIMAR : Evaluation, Monitoring and Conservation of Marine Biodiversity – this initiative objective's is evaluating, monitoring and promoting the conservation of biodiversity of Brazilian marine ecosystems – attempts to make sure that protected area measures are complementary to one another - Have management councils for consultation of protected areas – depending on the type of protected area (E.g. Extractive Reserves vs. Parks) each of the different stakeholders play a different role - The National Register of Nature Conservation Units measures/assess protected areas and if they are achieving their conservation goals - Successful cases have been observed in locally managed areas - At ecosystem scale it is important to note that Brazil started to have the world's largest mangrove protection belt – 568,000 hectares of mangroves will benefit – results are in attached doc (there was not attached doc) - Within a protected areas there are different management zones – but measures try to complement each other as much as possible

Canada	- Look at WEBCA as an OEABCM – deems it to be successful and meets all of DFOs criteria
	  o Had to cut a scallop fishing area out of the closure as it was incompatible with the conservation objective
	  o WEBCA is within an EBSA
	  o Many different fisheries closures overlapped in the OEABCM
	  o science and data came from science staff and DFO science publications
	  o planning took place from 2016-2017. Consultation was over several months, through multiple mechanisms (Federal, Provincial, fishery advisory groups, indigenous).
	  o Consultation included: Prov govt, Indigenous groups, NGOs, and Industry and played a role in developing the conservation objectives for the measure
	  o Protected area has not been reviewed yet. H/w previous closures was assessed in 1998 and in 2011
	- Narwhal Overwintering and Coldwater coral zone
	  o Chose a geographic area where the intent was to enhance conservation of biodiversity
	  o Zone is an EBSA
	  o Different fisheries closures in the area – not all will count towards Target 11
	  o Science came from DFO science publications – and from working with a Marine Conservation Working Group which developed proposed adjustments to the Zone closures
	  o TEK was sought through a series of consultations on adjustments to the Zone closure
	  o Planning began in Oct 2016 and consultation in Jan 2017 – July 2017. All changes will be implemented on Jan 2018
	  o DFO sough the views of co-management orgs, indigenous partners, stakeholders and interested groups, territorial/provincial govts, and ENGOs. Primary avenue for consultation was through multi-stakeholder working groups
	  o Development of indicators and targets is currently under consideration
	  o Effectiveness of the Zone has been evaluated from a compliance, scientific and fishery management

	perspective o Additional time is needed to observe stock or ecosystem outcomes ▪ DFO is currently using tagging techniques to monitor Narwhal use and two research expeditions collected physical samples, photographs and video imagery of the benthic habitat in the Zone o Two fisheries had to change their operations: ground fish with fixed-gear was decreased by 6.2% and there will be minimal impact on the shrimp fishery o No info available on fishery performance for northern shrimp as closure was recent. Halibut fishing has noticed positive benefits h/w negative economic benefits were identified o Changes have been made/adapted since their initial implementation to improve ecological effectiveness and reduce impacts on fishery performance - Pacific Rockfish Conservation Area o 164 pacific rockfish conservation areas – located on Canada's west coast. Several fisheries occur within the RCAs o Approach was to use a spatial measure to address a specific conservation challenge for a specific fishery and set of interrelated fisheries. Closures were established in 2002 and 2007 o Meet all of DFO's OEABCM criteria besides the 5th : ecological components of interest are effectively conserved o Closures targeted depths and habitats known to be used by inshore rockfish species o Target adult inshore rockfish habitat, other benefits include: ▪ Numerous other species of fish and invertebrates have been observed within the RCAs o Numerous types of fishing methods are prohibited: bottom trawl, ground fish hook and ling, ground fish by trap, shrimp trawl, salmon fishing, jig, mooching and spearfishing o Other fisheries management measures include: accounting for all inshore rockfish catch, improve stock assessment and fishery independent monitoring, reduce total allowable catch of two species of rockfish o DFO work with Provincial govt to protect rockfish in multiple jurisdictions o DFO does play a role in examining activities/works that occur in or near water to ensure they do not cause serious harm to fish or fish habitat o Sites where chosen using DFO science and traditional knowledge was sought throughout ▪ Science and indigenous and local knowledge have not yet been sought as part of the review of RCAs against the MCT OEABCM criteria o Planning and implementation took place from 1999-2007, with consultations from 2001-2006. Three stages: Data gathering stage, internal DFO review, rockfish habitat analysis o Because of longevity and low productivity of rockfishes it will take 10-20 years for any detection, action, and response to the effects of management tactics o Monitoring program has not formally been pursued. Instead, progress has been assessed in an ad hoc manner via various academic research initiatives

	o Some evidence shows some RCAs are demonstrating an effect o Yes fisheries had to relocate – socioeconomic concerns where considered in determining RCA boundaries o All of this work has been based on the Inshore Rockfish Conservation Strategy and Ground fish Integration Program o RCA management measures have NOT been adapted since their final implementation in 2007 – an RCA review is planned to asses both the management measures within RCAs and their placement in the marine environment.
Costa Rica	- Multiple different types of reserves in Costa Rica: o Biological Reserves and Absolute Natural Reserves: very restrictive, does not allow development of tourist industry, fishing or any type of extraction o National Parks: restrictive. Permitted uses: ecotourism, research and education. There are 8 national parks that contain MPAs o Marine Management Areas: industrial fishing is prohibited or the use trawls. No oil and gas either. There are 2. Sustainable use zones are allowed - Each area has a fundamental management plan – based on science - Efforts are made to carry out joint patrols with other national authorities that usually have great capacity (e.g. Coast Guard) - Recent agreement has been reached to establish a network of radars to monitor any type of activity within the boundaries of MPAs - Tourism is huge within protected areas – monitoring is taking place to observe the negative impacts of tourism. Nearly all tourist operations follow the regulations set in place - Taking firm steps to establish ecological monitoring plans - The general management plans for MPAs in Costa Rica required consultation process at the local level. Workshops are always held to present the plans – same happens for the tourism and fishing industry o These plans must be approved by the Regional Council of Conservation Areas, which is made up of regional representatives. - Monitoring measures have recently been put in place – had to evaluate their effectiveness currently - Has a network of connected areas – need more info to designate more areas
Ecuador	- Navy does a lot of ocean science work for Ecuador – looking at the biota - No universal agreement to define marine-coastal ecosystems - Management plans can be built using a participatory process with local actors – work so that communities respect the type of protection - Traditional knowledge of fishermen and the scientific research is used to help designate protection areas - Committees evaluate management effectiveness for protected areas - Some progress has been made towards the goals of protected areas – e.g. protected beaches allow for greater nesting events

	- Claim that different types of measures do complement each other and support connectivity - A goal of the network in Peru is to make sure it is incorporated into the wider marine landscape. Not sure how it is evaluated. - Peru has sent over 7 peer-reviewed docs on oceanographic work completed in their waters. However – the above info represents their responses to the questions posed by the CBD.
European Union	- 2015 review showed that the EU Member states had designated 5.9% of their seas as MPAs – by 2017 this expanded more than 3100 marine Natura 2000 sites which cover approx. 7% of the total EU marine area - The EU has so far not considered criteria to differentiate b/w different types of measures or designations and whether they would count towards the achievement of Target 11. H/w recognizes the importance of OEABCMs - Can view all MPAs (higher proportion are coastal) through different databases – notably the Natura 200 Network viewer. RSCs also make an effort to make their data available through HELCOM MPA database, OSPAR MPA tool or MAPAMED - EU is using many tools to ensure proper follow-up to agreed targets – the most important ones being the EU "acquis" on environmental protection and fisheries, international agreements and other relevant policy initiatives: The Birds and Habitats Directives, Action Plan for Nature, People and the Economy, Marine Strategy Framework Directive, Common Fisheries Policy o All require the creation of protected areas that are based on science and have strong consultation processes - Directive to establish maritime spatial planning - each member state is to identify, by 2021, the spatial and temporal distribution of existing and future activities and uses in their marine waters, including nature and species conservation sites

Japan	- Japan uses a variety of ABMs to protection marine environments : Natural Parks and Natural Seashore Conservation Areas that aim to protect the natural landscape
	  o Nature Conservation Areas, Wildlife Protection Areas, Natural Habitat Conservation Areas that aim to protect the natural environment or the habitat or nursery ground of organisms
	  o Protected Water Surface that aim to protect and cultivate aquatic animals and plants, Coastline Marine Resource Development areas and other designated areas by different entities and governments
	- a large number of protected areas already exist in Japan
	- in designing MPAs Japan aims to develop a system of effective ecological networks
	- strong emphasis on community-based/fishermen –led MPAs or protected areas
	- continuous monitoring for adaptive management and review of measures based on assessment of the monitoring are extremely critical – a framework for such a system should be established
	- establishment of consultative bodies for relevant stakeholders to cooperate are being promoted – especially for Marine Park Areas

Mexico	- Areas of refuge (focuses mostly on fisheries) and safeguard areas (prohibits the exploitation of hydrocarbons) are used as ABMs\ - Propose of protection in Mexico is to :

	o Preserve natural environment of the different biogeographic regions o Safeguard genetic diversity, in particular species that are in danger of extinction o Ensure the preservation and sustainable use of ecosystems, their elements, and its functions o Provide an enabling field for scientific research o Protect natural historical, archaeological and monuments – as well as tourist areas, and other reasons of importance for recreation, culture, and indigenous peoples - So MPAs as a way to mitigate climate change - Have pursued the issues of connectivity and representability within protected areas but seems it is not binding by law or policy - Protect a diverse range of habitats: coastal dunes, mangroves, coral reefs, seagrass beds, pelagic areas, benthic areas. With coral reefs and mangroves as priority ecosystems - Work with fishermen so that the protected area contributes to maintain the fishermen's' livelihoods
Peru	- AMBTs used in Peru: there are 4 National Protected Areas that follow IUCN categories for classification – all followed a the "Protected Area Master Plan" for Peru that was adopted in 2016 - Each protected area has their own management document with a master plan that establishes objectives, goals for the protected area. It appears they are reviewed every 5 years - Protected areas cover a variety of ocean ecosystems (benthic and pelagic): warm temperate south eastern pacific, tropical - Science data and user data (fishermen, tourism operators) is gathered to inform MPA process and designation - Currently no other conservation-based measures that directly interact with MPAs – but it is possible - Consultation process before MPA is designated. There is a management committee composed of various public and private stakeholders - Participatory processes for approving management documents and implementing protected areas can vary - Opportunities for communities and stakeholders to implement MPA strategies - Protected areas are evaluated according to their management docs and plans. Different types of evaluation but all are either completed quarterly or semi-annually - Unsure how effective their protected areas have been - There are different forms of protection that complement each other in Peru. For example, law that protected natural bank scallops – some of these banks overlap with the Lobos Isla De Tierra sector that protects other marine organisms - Consider their 4 MPAs as a network that protect and conserve marine biodiversity of Peru – not sure how this is measured - Do take into account connectivity between the protected areas - Take into account how their protected areas contribute to Aichi Target 11. - Need more research into how monitoring systems, indicators, assessments of MPAs integrate with other protection measures

St. Lucia	- Do have MPAs – had issues in the past in making sure that infringements were not occurring within - fishermen lose prime fishing grounds - Have seen successes in protected areas with fish populations growing - Collaboration occurs through the formation of multi-sectoral technical advisory committees – as well as relevant governmental and NGO agencies - No national policy on protected area, lack of readily available consolidated data on protected areas at a national level – need an overarching law on protected areas to be develop which rationalizes the current multiple laws on protected areas - Several institutions involved in the designation and management of protected areas - Have marine reserves, marine management areas, marine management area/marine reserve, national park and marine management area, world heritage site, local fisheries marine management area, nature reserve and marine reserve - Need to establish a forum for all government agencies involved in protected areas to collaborate - Need to take into account the 2008 OECS Policy on Protected Areas Systems and the OECS Model Protected Areas Systems Act for developing the final protected areas network for Saint Lucia. - Unsure of any evaluation/assessment of protected areas - Unsure if Saint Lucia is monitoring their progress towards Target 11
Sweden	- Case Study 1: Fisheries Conservation Measures – Bratten MPA and Kosterfjorden MPA/group of MPAs o Focus on implementing fisheries conservation measures in MPAs to help establish a well-connected network of MPAs o Analysis of the network of MPAs was conducted in 2014 – found that in approx. 30 of 300 needed fisheries conservation measures to reach their objectives o Progress on implementing fisheries conservation measures have been done in two separate processes: through national fisheries legislation and secondly through agreeing on a joint recommendation, together with concern member states within EU o Focus protecting the most vulnerable areas in MPAs from mobile bottom contact fishing gear (lophelia reefs) , as seapens, sponge communities, coral gardens and big fish associated with reefs and cartilaginous fish o Both these MPAs/group of MPAs are located in areas with a high degree of fisheries activities o Bathymetrical data was used to identify areas with a presumed high biodiversity - fishermen identified areas with presumed high biodiversity o For Bratten MPA consultation focused on commercial fisheries stakeholders and was conducted within the framework of an EU interreg project with financial resources for staff and accommodation for stakeholders. For Kosterhavet group of MPAs there is a forum including local fisheries, agencies and scientists o Do have infringements on closed areas o Overlap between Natura 2000 sites and OSPAR MPAs and both complement each other – make a more

	coherent MPA network o Sweden is currently in the process of establishing a framework for MPAs that will allow for setting goals for ecological respresentativity, connectivity and functionality o The framework for MPA networks is intended to able to align with the work going on in green infrastructure, which would enable integration into the wider seascape - Case Study 2: Integrating MPAs in the Marine Spatial planning o MPAs shall be taken into account in the development of the Swedish marine spatial plans o Exploring possible ways and methods of using the concept of green infrastructure in Swedish marine spatial planning to secure connectivity
Togo	- 50 km coastline that is characterized by sandy supra-littoral - Many species along coast are in danger (5 of the 8 sea turtles can be found here!) - 2014 Togo developed a National Strategy and Plan of Action for Biodiversity - Does not have any MPAs. H/w it has an environmental law framework that works to limit pollution protect marine resources, and construct infrastructure. The Ministry of Enviro and Forest Resources works with NGOs within the framework to monitor sea turtles and marine mammals. - The Govt work with fishermen, who act as security officers, reporting when they see something illegal - Currently working with the German Cooperation of Togo to create a transboundary biosphere reserve on the Mono Delta (has been approved by UNESCO). Crosses boundaries with Benin. o Need strong financial support for a management plan, implementation, training, public awareness, - Trying to create an oceanography department at the University of Lomé to train capable marine managers - Need a sustainable financing plan for the management of marine and coastal biodiversity and the challenges related to the application of the law in biodiversity conservation - Need to build capacity and relationships between scientists and other stakeholders - Will to learn – particularly through the Western African MPAs network
United Kingdom of Great Britain and Northern Ireland	- UK Marine Acts call for a network of MPAs comprised of National and EU marine sites - UK's devolved administrations (N Ireland, Scotland, England, Wales) follow several key principles in their development of the MPA network – follow OSPAR guidance o Features, representivity, connectivity, resilience, management - 23% of UK waters are MPAs, 105 special areas of conservation with marine components, 102 special protection areas, 56 marine conservation zones, and 30 nature conservation marine protected areas o Boundaries of the MPAs in UK waters can be viewed on an interactive map o Sites of special scientific interest (SSSIs) will also form part of the UK's contribute to an MPA network
United States	- Uses a variety of ABMs (MPAs, Fisheries Management Areas, Security Zones, Shipping Lane and restrictions, oil and gas leasing exclusion areas - MPAs are established through many different federal and state authorities - Most MPAs have specific goals, objectives and outcomes (detailed mgmt. plan on websites)

	- Over 1700 areas that meet the US definition of an MPA (broader than IUCN)
	  o Includes MPAs in coastal areas, open ocean, estuaries, Great Lakes
	- Has completed an analysis of representativeness of the National System of MPAs – collection of some 437 sites (Monterey Bay National Marine Sanctuary, Papahanaumokuakea Marine National Mon,
	- Scientific and socio-economic info are applied in the MPA process through the National Environmental Policy Act. Traditional knowledge may be incorporated. Also look at local knowledge to inform decisions
	- Many area-based measures do interact in US waters. NOAA is working with Anthropocene Institute to develop a mapping website that includes both MPAs and other ABMTs. Also NOAA is developing a database DeFacto MPAs (has not been updated since 2005)
	- National Ocean Policy established under Obama calling for regional ocean planning. This process is now being led by states
	- Planning on consultation process depends on the authority used to establish an MPA
	  o At Fed level there is a process, where environmental impact statement maybe required
	  o Must be public scoping, public comment period
	  o Full process takes 3-5 years
	  o May consult with different agencies in government and with Indian tribes
	- Stakeholder engagement processes depend on the authority developing the MPA
	  o Community-based process (California MLPA)
	- Unsure how progress towards achieving conservation goals/objectives are assessed or how often it is complete. Examples were given however: National Park vital signs, Sanctuary condition reports (Links were broken)
	- Most data on MPA effectiveness is in peer reviewed scientific literature but has not been compiled or synthesized
	- Many MPA programs evaluate and adjust their mgmt. based on scientific or other info. MPA Federal Advisory Committee recently published guidance on adaptive management for MPAs
	  o Examples: Moved shipping lanes in a sanctuary and has resulted in reduced whale mortality (Stellwagen National Marine Sanctuary)
	- Overlap in different forms of protection with varying jurisdictions and levels of government exist throughout US waters (Florida Keys).
	  o Can lead to confusion regarding regulations. Not sure if the measures reinforce for complement one another
	- Most comprehensive MPA network is in California
	- In 2017 the US MPA Federal Advisory Committee developed guidance on how MPA programs can better integrated ecological spatial connectivity into their programs. This falls largely on the responsibility of states to implement

Table 3: Summary of Submissions by Organizations and by Indigenous Peoples and Local Communities in Response to Notification 2017-084

Organization	MPA
BirdLife International	- Over past 40 years BirdLife Int'l has identified over 12,000 Important Bird and Biodiversity Areas – IBAs - Recently invested in the identification, documentation and mapping of marine sites of c. 3000 marine sites of int'l important for birds - MIBAs are identified used a standardised set of data-driven criteria and thresholds. Take into account: o Important breeding colonies o Seaward extensions around breeding colonies o Non-breeding(coastal concentrations) o Migratory bottle necks and areas for pelagic species - IBAs capture a large and representative proportion of biodiversity - IBAs feed into Aichi Target 11 - BIrdLife Int'l has been working with CBD and national govts to established MPAs (provide workshops and data, capacity building as well) - Used Integrated Biodiversity Assessment Tool to help govts, business and conservation practitioners make informed decisions on development and conservation actions - IBA criteria are aligned with the EU's criteria for Specially Protected Areas (SPAs) - Have helped catalyze the SPA designation process - Marine IBAs have progress indicators against Aichi Target 11
Food and Agriculture Organization of the United Nations	- Continuously pushes for the application of the ecosystem approach to fisheries (EAF) - Use RFMOs to enact spatially managed measures - National fisheries authorities have shifted from a target species approach to a more ecosystem approach (NPOAs have helped with this) - On a community level spatial management measures have been particularly impressive – but have not been always recognized for well documented - Sees more work needs to be done surrounding no-take MPAs - Sees OEABCMs as beneficial at providing a wide range of biodiversity benefits that 'strict' MPAs may not be able to provide - OEABCMs can be more inclusive and not have numerous negative socio-economic impacts - OEABCMs: cross-institutional scale cooperation in mgmt. can be achieved at larger scales than can generally be achieved through no-take MPAs - OEABCMs offer greater spatio-temporal flexibility – can be more easily negotiated in response to change Different OEABCM measures - Spatial-temporal fishing closures: different types of measures and are used in national settings (Territorial Use rights for Fisheries (TURFs) and Locally Managed Marine Areas (LMMAs) - Areas Beyond National Jurisdiction: RFMO closures such as VMEs - No agreed system for OEABCM characteristics

	- Need to be careful of the negative social impacts of protected areas – need a strong consultative process with early stakeholder involvement
General Fisheries Commission for the Mediterranean (GFCM)	- Main spatial mgmt. tool is Fisheries Restricted Areas (FRAs) – ranges from total fisheries bans (no-take zones) to specific spatial limitations to fishing activities - Since 2005, eight FRAs have been established o 3 deep-sea sensitive habitats where fishing with towed dredges and bottom trawls is prohibited (e.g. Lophelia reef, The Nile Delta Area, and the Erastothenes Seamount) o FRA in the Gulf of Lion to protect spawning aggregations and deep seas sensitive habitats o Prohibition of trawl nets and towed dredges at depths below 1000m in the Mediterranean o Protection of 3 FRAs for hake and deep-sea water rose shrimp in the Strait of Sicily – has a mgmt. plan in place - Process for establishing FRAs requires the submission of the Standard form for the submission of proposals for GFCM FRAs in the Mediterranean and the Black Sea – lists the type of info needed to initiate the process. The info is validated by the Scientific Advisory Committee on Fisheries and then submitted to the annual GFCM session for consideration by contracting parties - In 2016 GFCM established a working group on VMEs – objective is to compile info on priority areas for the establishment of FRAs - In 2016 Mediterranean and Black Sea countries adopted the Mid-term strategy towards the sustainability of the Mediterranean and Black Sea Fisheries – which incorporates the objectives of the Aichi Targets and SDGs – also highlights the need to promote the identification and establishment of new FRAs
Indigenous and Community Conserved Area (ICCA) Consortium	- ICCAs are strongly tied to the rights of small-scale fishing communities to participate in and take responsibility for the governance and management of fisheries and the conservation of local biodiversity - ICCAs are locally governed and managed such that the social, economic nutritional and ecological benefits belong to the local people and community 3 Examples provided of their benefits: Marine Areas of Responsible Fishing in Costa Rica - Power and decision-making is shared with the government - Strong participation of artisanal fishers - Local leadership, understanding of the mgmt. process and formal mgmt. plans Marine Extractive Reserves in Brazil - Success occurs when there is increased indigenous involved in governance and mgmt. plans Kawawana – Senegal - Local fishermen created an ICCA with local governance - Allowed them to review and implement local traditional practices for the enforcement of their marine zoning and mgmt. plans – which includes no take areas Kawesqar Peoples Territory

	- Overlaps with Bernardo O'Higgins National Park in Chile - Auto-restoration of the Kawesqar culture and the protection of marine areas were achieved by bringing together Kawesqar traditional knowledge and leadership with science - Park now protected biodiversity and culture - Need the promotion of fair conservation governance and socially just actions in order for marine conservation to be both social acceptable and ecologically effective

International Seabed Authority	- Rules for the protection of the marine environment are adopted by the Authority and implemented by the Authority itself, states sponsoring activities in the Area and contractors that undertake those activities
	- The system relies on the application of the precautionary approach
	- The Authority is responsible for regulating, taking into account the best scientific info and for monitoring activities in the Area. Contractors are responsible for complying with the rigs. Sponsoring states must cooperate with the Authority
	- Under Article 145 of the Convention, the Authority is required to take necessary measures to ensure effective protection for the marine environment from harmful effects which may arise from activities in the Area. Therefore, the Authority is required to adopted appropriate rules, regs and procedures in order to do so
	- The law-making power of the Authority is vested in the Assembly and in the Council
	- The Legal and Technical Commission of the Authority is vested with the power to formulate environmental regulations
	- As of today, the Authority has adopted 3 sets of Regulations on Prospecting and Exploration
	  o Require PA, attempt to strike a balance b/w a PA to activities and an incremental approach to regulation, impose a duty on each contractor to take necessary measures to prevent, reduce and control pollution and other hazards to the marine environment
	  o Each contracting party must submit impact assessments – must also establish a carry out program to monitor and report on effects to the marine enviro
	  o CPs must also submit an annual report
	- The Authority can issue emergency orders to prevent serious harm to marine enviros
	- The Commission is required to prepare assessment of the environmental implications of activities in the Area – and must make recommendations to the Council on the protection of the marine enviro (Clarion-Clipperton Fracture Zone)
	- Clarion-Clipperton Fracture Zone – covers 13.5 million km^2 – Council approved the EMP in July 2012
	  o Use of spatial mgmt. tools – such as the protection of areas to be representative of the full range of habitats, biodiversity and ecosystem structure and functions within the mgmt. area.
	  o The plan identifies a network of 9 areas which area designated as areas of particular environmental interest (APEIs). – include a wide range of different habitat types and was based on scientific research
	- Commission is considering developing EMPs in other regions (Atlantic and Indian Ocean

Old Dominion	- Call for dynamic ocean management – need to adaptive, need to be fluid

University	- Dynamic management further complements existing management by increasing the speed at which decisions are implemented using predefined protocols
	- Examples demonstrate that dynamic mgmt. can successfully allow managers to rapidly respond to changes on-the-water
	- Gaps that need to be filled concerning dynamic ocean mgmt.:
	  o Enhancing legal instruments
	  o Incorporating ecological and socioeconomic considerations simultaneously
	  o Developing 'out-of-the-box' platforms to serve dynamic management data to users
	  o Developing applications broadly across additional marine resource sectors
	- Call for big pelagic marine protected areas (PMPAs) – the Big Ocean Network provides a forum for managers of large, mostly pelagic MPAs to communicate about challenges and successes in management
	- Need to ensure goals of the protected areas are clear
	- Use cost-effective approaches – it can identify the management action that ensures the most benefit to a range of factors
	- Need to think about how to deal with threats beyond PMPA boundaries
	- Need strong monitoring and enforcement – engage in participatory compliance – get stakeholders involved through participatory monitoring (e.g. peer reporting). Or enforcement partnerships (E.g. US Coast guard and the Us Navy)

United Nations Department of Economic and Social Affairs (UNDESA)	DOALOS
	- Emphasis on capacity building (Ee.g. Nippon Foundation and Hamilton Shirley Amerasinghe Memorial Fellowship)
	- Provide internships, opportunities, and increased skillsets for ocean law and policy
	- Capacity building at the individual level can have an impact on national and regional oceans-related efforts – contributing to the economic, social and environmental dimensions of sustainable development in different countries and regions
	- Case Study: Development of mariculture activities as an alternative livelihood option for coastal communities: Mtwara districts, Tanzania
	  o Capture fisheries were in decline, needed another option for local communities
	  o Promoted milkfish farming
	  o Strong welfare gains, stronger sense of community, improved food security, enhancing investments and savings
	- Case Study 2: Ban of queen conch harvesting fisheries: Banco Chinchoro, Quintana Roo, Mexico
	  o One of most valuable fisheries of Caribbean reefs, but in rapid decline
	  o Communities depend on the fisheries – limited other methods to generate income
	  o With little other options 3 cooperatives formed to manage the conch reserve – first stock recovery initiative in Mexico

	o Lead to increased compliance, sustained, long-term buy in form coastal communities, identified a clear legislative and policy framework o Established strong community-based measures – ended up being more effective International Atomic Energy Agency (IAEA) - Lessons Learned from dealing with ocean acidification on US west coast: primary mitigation measure for ocean acidification is CO_2 reduction - Cooperation and corrective action should take place at several levels and involve all stakeholders - Although a local and regional problem – the global dimension of OA required increased int'l cooperation and coordination to address and prevent ocean acidification IMO - Case Study: Alien invasive species and ballast water management in Turkey (e.g. Ccomb jelly) - IMO has been addressing alien species – through Ballast Water Mgmt Convention - GEF, UNDP and IMO joined forces and introduced the GloBallast Project - aim is to catalyse innovative global partnerships to develop solutions and help developed countries reduce the transfer of harmful aquatic orgs - Lessons learned: o Strategic investments in prevention measures are required – rather than post invasion damage control – need countries to ratify BWM Convention o National policy frameworks should meet international standards o Economic assessments of alien invasive species, their possible impacts and different mgmt. options can support strategic decisions regarding responses and facilitate national planning o Specific partnerships can be formed at the regional level (IMO- European Bank) United Nations Development Program - Case Study: Economic, social, and enviro benefits from sustainable mgmt. of tuna fisheries: the GEF/UNDP Pacific Islands Oceanic Fisheries Mgmt Project, Western Pacific - Through EEZ 15 PSIDS share jurisdiction over majority of the water surrounding them - depend heavily on marine resources (specifically tuna which has been declining) – OVEREXPLOITATION - Overcome this: the OFMP was created to support PSIDS in successful establishment of the WCPFC RFMO - UNDP-GEF support lead to a number of major institutional, legal and policy outcomes – monitoring and compliance programmes, regional satellite-based vessel tracking system, and the first regional high seas boarding and inspection programme - Lessons learned: capacity-building elements of the UNDP-GEF project have empowered PSIDS fishery managers and enabled them to present and negotiate their positions at Commission meetings and work to ensure sustainable mgmt. of the fisheries o Sustainable managed local fisheries too o Similar strategy should be replicated in other regions in the pacific and Indian ocean

	UNEP
	- Case study 1: marine litter, regional seas in Europe
	- Case study 2: ecosystem health report card for managing Chilika Lake of Odisha State: a collaborative approach, India
	- Case study 3: climate change adaption in Lami Town, Fiji
	World Tourism Organization (UNWTO)
	Case Study: Tourism development in coastal areas: promoting sustainability through governance and mgmt. mechs, Africa
	- Lessons learned
	  o Tourism operators should pursue sound environmental mgmt. practices and tourism related actions should improve the attractiveness and conservation of coastal enviros
	  o Need to be delivery of benefits to local communities
	  o Responsibility for actions to improve governance and mgmt. for sustainable coastal tourism should largely rest with govts
	  o Need a coherent policy framework to guide and drive action for sustainable coastal tourism
	  o Need effective engagement of stakeholders and multi-stakeholder destination mgmt. bodies
	  o Need integrated planning for tourism in a wider coastal mgmt. context
	  o Need effective EIAs to assess tourism developments
	  o Financial incentives – such as conditional tax relief
	  o NGOs and civil society have potentially very important roles to play in the areas of facilitation and capacity-building
	  o Use academic and research bodies
	UNDESA
	Recs for the integrated planning and sustainable mgmt. of coastal areas:
	- Listen to SIDS concerns and issues
	- Integrate coastal zone management strategies into national sustainable development strategies
	- Establish strong institutions
	- Make disaster risk and reduction and mgmt. an integral element of integrated coastal area mgmt.
	- Effectively apply an ecosystem-based approach and the precautionary approach
	- Apply a spatial approach to integrated coastal mgmt. in order to support policy integration and coherence among sectors within coastal areas with the aim of promoting sustainable activities
	- Take into account the land-sea interface
	- Implement water quality mgmt. and monitoring
	- Support the development of sustainable tourism
	- Use legislation that calls for EIAs
	- Involve all relevant stakeholders

	- Strengthen the science-policy interface to support evidence-based decision making - Strengthen the involvement of the private sector - Take into account the rights and concerns of local communities when approving a new development - Promote local ownership and awareness raising through the provision of incentives, the implementation of community measures and effective communication strategies - Promote public education and awareness on integrated coastal mgmt. - Enhance marine scientific research methods - Enhance the sharing of national data within countries, as well as regionally and inter-regionally – maintain databases too - Make better use of existing regional programmes, financing mechs, initiatives and networks in order to access info and resources - Enhance the building of local capacity and provide sufficient financial and technical resources, including for the implementation, monitoring and enforcement of existing regulations as well as CC mitigation and adaption measures - Develop partnerships and networks to support integrated planning and sustainable mgmt. of coastal areas at the national and regional level

Table 4: Summary of Submissions by Organizations to Notification 2017-065

Organization	Protected Areas
Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area (ACCOBAMs)	- Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area - Through the Scientific Committee of ACCOBAMs Parties have identified Cetacean Critical Habitats (CCHs) - Recent initiative to identify Important Marine Mammal Areas (IMMAs) was launched in the Mediterranean Sea - Focus on population level and interactions b/w cetaceans and humans to identify CCHs: o Conflicts b/w cetaceans and fishing activities o Significant or frequent bycatch of cetaceans is reported o Intensive whale watching or other marine tourism o Navigation presents a potential threat to cetaceans o Military exercises o Seismic activities - 22 CCHs were adopted in 2010 : 18 in Med Sea and 4 in Black Sea - Current imitative aimed at spatially mapping direct threats to cetaceans in ACCOBAMs is ongoing. Will lead to: o Creation of new specific MPAs o Extension of existing or neighboring MPAs o Implementation of other conservation tools – corridors, seasonal measures, PSSAs, Fisheries Restrictive Areas
BirdLife International	- Important Bird and Biodiversity Areas (IBAs) have identified over 13,000 sites worldwide - IBAs are directly related to Target 11 - IBAs form the most comprehensive network of sites worldwide and as such they are at the core of the network of Key Biodiversity Areas (KBAs) - Evidence suggests that species occurring in IBAs with greater protected-area coverage experienced smaller increases in extinction risk over recent decades - Long history of national govts establishing formal protected areas covering IBAs - One of the IBAs programmes main achievements is its close link to the Natura 2000 network in the EU - IBA criteria applied in the EU were deliberately aligned with SPA selection criteria - 66% of the terrestrial and 61% of the marine IBA network area in the EU is covered by SPAs - BirdLife International, UNEP, the Royal Society for the Protection of Bird, the IUCN and Cambridge Uni are currently undertaking a project to evaluate the role and relative effectiveness of OEABCMs in conserving important sites for biodiversity and achieving Aichi Target 11 ▪ The project will harness local knowledge mobilised through national conservation NGOs to

	assess the current role of OEABCMs in conserving the formally non-protected parts of KBAs ▪ Will assess the gaps that OEABCMs can fill and evaluate the effectiveness of different types of OEABCMs compared to formal PAs - BirdLife's Migratory Soaring Birds Project aims to identify the most sensitive sites for bird species and advocate for the integration of their conservation into relevant sector policies, such as energy, agriculture and waste disposal - BirdLife has also been working closely with mining companies to minimize the negative impacts for biodiversity - BirdLife's IBA network takes into account the impacts of climate change – - Pushes for local governance of protected areas – has bene extremely successful in Paraguay in San Rafael – site is managed with the Indigenous community
Conservation International	- **PADDD**: protected area downgrading, downsizing and degazettement – undermine progress towards Aichi Target 11 – have been happening more frequently - 3,200 enacted PADDD events have been identified – affecting over 2 million km2 of protected area estate over 70 countries - Another 700+ PADDD have been proposed - PADDD occurs in areas or regions of importance for biodiversity conservation – usually with strong economic development potential - CI's calls for a need to highlight patterns, trends and causes and risks from PADDDs - Current monitoring efforts focus primarily on state-designated protected areas and don't fully consider other types of environmental governance – such as OEABCMs – working on creating a new Conservation Atlas that doesn't just focus on "protected areas" - Lack of incentives to register Indigenous and Community Conservation Areas (ICCAs) – noting lack of funding capacity and that being registered does not lead to more secure protection **Recommendations:** - Recognize full range of approaches contributing to conservation targets - Encourage countries to properly doc and report different approaches - Engage multilateral and bilateral financial institutions to provide funding and resources to support the documentation, governance, mgmt., and monitoring of OEABCMs approaches - Engage the private sector to develop policies that respect OEABCMs - **CI** believes there should be a push to use SeaScapes – aims to improve ecological and socioeconomic outcomes at a significant scale. Working with coalitions of partners enables more resources to be mobilized, creates teams built of complementary strengths, and fortifies partner and govt institutions – more than 150 partners have engaged with the implementation of Seascapes

	- Analysis by CI finds that nearly 30% of the SDG targets are dependent on nature to be achieved – that is, there is a nontrivial dependency b/w natural ecosystems and those targets – PAs and OEABCMs can help reach those targets
	  o little guidance for countries on how to manage natural ecosystems to meet the target as outlined by the SDGs
	  o CI has worked with reps from 9 countries to identify national-level examples of the role of nature in achieving the goals, the policies in place at the national level to sustainably manage natural resources and the institutional structures in place to address this mgmt.
	- Adaption of PA systems and mgmt. is needed dot maintain protected area benefits to surrounding communities, climate change mitigation benefits and global biodiversity
	  o PAs therefore area at once important for mitigating climate change b/c of the large amounts of carbon they store, but are also vulnerable to climate change impacts and in need of adaption
	  o One project that may provide solutions is SPARC (Spatial Planning for PAs in Response to CC) – which is using big data approaches to bring answer to individual countries and sites. – project deploys a toolbox of CC techniques
	- New PAs are needed in the right places to respond to species movements and ecosystem change due to climate change
	- Strong push for community conserved areas – leads to better mgmt.
	- use of the Free, Prior and Informed Consent Principle (FPIC)
	- a clear vision for the mgmt. of the PA that includes not only the conservation of biodiversity but also the recognition of the interdependent nature of biodiversity and cultural practices and beliefs
	- Example: Kaasen Community-Owned Conservation Area (COCA) – developed a culturally relevant vision for the mgmt. of their PA that goes beyond the conservation of biodiversity – land is managed to conserved biodiversity and the traditional way of life

MedPan Mediterranean Protected Areas Network	- 2016 Status Report of Mediterranean MPAs - Review results of the 2013-2017 FFEM project – lead by MedPAN, WWF Mediterranean and Conservatoire du Littoral on "Management model of coastal, insular and marine areas in the Mediterranean" - Submission lists over 20 different articles, statements, brochures, proceedings and declarations to read
Organisation for Economic Co-operation and Development (OECD)	**OECD report " Marine Protected Areas: Economics, Management and Effective Policy Mixes"** - cumulative economic impact of poor ocean mgmt. practices is estimated to bin the order of USD 200 billion per year - discusses key pressures: overfishing, pollution, habitat destruction, climate change, invasive species - MPAs are one policy instrument to address the above threats (Other policy instruments include: MSP, fishing closures, standards, catch limits or quotas, licenses, planning requirements) o There are also economic instruments: taxes, charges, ITQ, reform of subsidies harmful to the marine

	enviro, payments for ecosystem service, biodiversity offsets, non-compliance penalties - PAs are growing – marine are going the fastest! – mostly in part to LSMPAs - Key design and implementation features for more effective MPAs: o Clearly defined goals and objectives o More strategic siting of MPAs is needed, to enhance the environmental as well as cost-effectiveness of MPAs o Increased monitoring and effective reporting – including via online databases with publically available info can help to increase transparency and enable the sharing of info o Strong compliance and enforcement – with approaches for assessing compliance techniques - Strong financing needed for MPAs. Different methods: o Domestic government govt o External development finance (E.g. ODA, NGOs) o Trust funds o User fees o Taxes and fines o Subsidies o Payments for ecosystem services o Marine biodiversity offsets - Need more than just MPAs to reach Targets – a full package of policy measures is needed to ensure the sustainable use of marine resources – such as policies that lie beyond the mandates of environment ministries (MSP, e.g. 2008 Marine Strategy Framework Directive 2008/56/EC from the EU – a comprehensive and integrated approach to the protection of all European coasts and marine waters - Good practices for effective MPAs: o Clear understanding of the state and pressures on particular marine and coastal ecosystems o Define the goals and objectives of the MPA o Estimate the expected costs and benefits of MPAs o Siting of MPAs needs to be undertaken in a more strategic manner o MPA management plans are enforced o Monitoring and reporting o Compliance and enforcement o MPA financing strategies o Put in place effective policy mixes
United Nations University – Institute for the Advanced Study of Sustainability (UNU-	**Socio-ecological Production Landscapes and Seascapes (SEPLS) as 'protected areas and other effective area-based conservation measures': A review of experiences under the International Partnership for the Satoyama Initiative (IPSI)** - There are several recs coming from the initiative: innovative measures such as "community-use zones" can

IAS)	enable a balance b/w conservation and ecosystem services in strictly protected areas
	- Subsidies can foster immaterial values that play a role in motivating ppl toward sustainable use in less-strictly PAs
	- Community involvement in creation of landscapes-strategy plans and agreements can ensure sustainable use in buffer zones and corridors
	- Market linkages must be considered and encouraged through policy and biodiversity-friendly products to succeed
	- Long-term monitoring and review are indispensable
	- Integrated landscape management approaches have been found to have benefits for protected areas in categories I through IV – where use is prohibited or restricted to greater or lesser degree
	  o Case Study 1: Community use zones in Crocker Range Park – Sabah Malaysia – NOT MARINE
	  o Case Study 2: Mountain pasture management in the Solktaler Nature Park, Styria, Austria – NOT MARINE
	- Discusses the benefits of OEABCMs when PAs are not possible. All terrestrial examples
	
	Info Paper on Food and Agriculture Organization of the United Nations (FAO) Globally Important Agricultural Heritage Systems (GIAHS) Programme
	- FAO launched in 2002, a global partnership initiative on conservation and adaptive mgmt. of "Globally Important Agricultural Heritage Systems (GIAHS)
	  o A GIAHS is a living, evolving system of human communities in an intricate relationship with their territory, cultural or agricultural landscape or biophysical and wide social environment
	  o GIAHS sites are resilient and are adapted to cope with climatic variability and change
	  o Encompass dynamic conservation strategies and process to allow maintaining biodiversity
	- Japan has an entire system of GIAHS
	- In relation to the CBD a major outcome of the GIAHS initiative is the contribution to the implementation of the CBD Article 10c: "protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements"

PART II
Other Effective Area-Based Conservation Measures (in Non-Fisheries Marine Sectors)—Delivering Outcomes Towards The Achievement Of Aichi Biodiversity Target 11

Prepared by Kamal Azmi (Australian National Centre for Ocean Resources and Security (ANCORS), University of Wollongong, Australia and Piers Dunstan (Oceans and Atmosphere Flagship, Commonwealth Scientific and Industrial Research Organisation (CSIRO)) as a background information document for the
CBD Expert Workshop on Marine Protected Areas and Other Effective Area-based Conservation Measures for Achieving Aichi Biodiversity Target 11 in Marine and Coastal Areas (6 - 9 February 2018 - Montreal, Canada)
As commissioned by the Secretariat of the Convention on Biological Diversity

Disclaimer: This paper is intended to stimulate discussion. It is not a position paper. It does not represent the opinions of the CSIRO or the University of Wollongong, or the positions of any national governments. Examples used for illustrative purposes in the paper should not be construed as reflecting an intention of the relevant national governments to declare the example areas as "other effective area-based conservation measures".

Acknowledgements: This paper was supported by funding from the Government of Canada, CSIRO and an Australian Government Research Training Program Scholarship. The authors wish to thank Associate Professor Quentin Hanich (ANCORS), Mr Edward Kleverlaan, Dr Michelle Voyer (ANCORS) and Ms Brooke Campbell (ANCORS) for guidance and advice on various aspects of the paper. Any errors, inaccuracies or omissions are the authors'. Feedback on the paper is welcomed by email at kamalyazmi@gmail.com.

Table of Contents

1. Introduction

Aichi Biodiversity Target 11[72] states that

> "By 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape."

This target contributes to Strategic Goal C: "To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity".

Since 1993 when the Convention on Biological Diversity entered into force, marine protected areas have increased almost more than 20-fold, from 0.29% to 7.0%. Since the adoption, in 2010, of the Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity targets, the area of marine protected areas has more than doubled, from 2.4 to 7.0%. With commitments made as of today by a number of Parties to the Convention on Biological Diversity, an additional 3.4% percent of marine area will be covered by marine protected areas by 2020. Out of which 2.9% comes from additions in national waters, while 0.5% is from additions in areas beyond national jurisdiction (all in Antarctica). These national commitments include: increases in protected areas expected from projects already funded; national priority identified by countries under their plans submitted to the Convention; and voluntary commitments announced in advance of the UN Oceans Conference held in New York, June 2017. Three quarters of these new commitments have been made with implementation plans giving confidence that they will be carried out. Focusing only on areas under national jurisdiction, 16.0% are currently protected; this is projected to rise to over 23% by 2020.

As much of the growth in MPA coverage has been slow and localised, suggests that other effective area-based conservation measures (OEABCMs or OECMs) will play an important role in achieving the target.

Target 11 defines several qualitative elements that define how MPAs and OEABCMs should function, specifically: (1) areas of particular importance for biodiversity and ecosystem services; (2) management equity and effectiveness; (3) ecologically representative and well-connected; and (4) integrated into wider landscape and seascape. Submissions provided by Parties, other Governments and relevant organizations to the Secretariat of the Convention on Biodiversity (CBD) in response to notifications 2017-084 and 2017-065 reveal significant experience in understanding these elements from parties.

Areas of particular importance for biodiversity and ecosystem services have been identified through a number of different initiatives. The CBD criteria on Ecologically or Biologically Significant Marine Areas (EBSA)[73] provides a broad-based set of criteria that can be applied to many systems and are linked to other approaches to the identification of significant areas.[74] Other approaches include Key Biodiversity Areas (KBA), Vulnerable Marine Ecosystems (VME), World Heritage Sites, Ramsar Sites and Important Bird Areas. Submissions in response to the above-noted notifications suggest that many countries have applied similar criteria that have been adjusted for their respective circumstances. Some of the common elements among these approaches include the recognition of areas for reproduction of species, threatened and endangered species, and areas of high biodiversity or productivity. The synergy between the CBD EBSA criteria and other criteria, both global and national, suggests a convergence of certain approaches and key concepts among many countries. However, most of these do not explicitly capture ecosystem services.

---

[72] The Aichi Biodiversity Targets were adopted as part of the *Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets*, contained in the Annex to CBD (2010). *Decision Adopted by the Conference of the Parties to the Convention on Biological Diversity at its Tenth Meeting*. Nagoya, Japan, 18-29 October 2010. UNEP/CBD/COP/DEC/X/2. Adopted on 29 October 2010. Available at https://www.cbd.int/decision/cop/?id=12268. Accessed on 8 January 2018.

[73] See http://cbd.int/ebsa

[74] Dunn, D.C., Ardron, J., Bax, N., Bernale, P., Cleary, J., Cresswell, I., Donnelly, B., Dunstan, P., Gjerde, K., Johnson, D., Kaschner, K., Lascelles, B., Rice, J., von Nordheim, H., Wood, L., and Halpin, P.N. (2014). The Convention on Biological Diversity's Ecologically or Biologically Significant Areas: Origins, development, and current status. Marine Policy 49: 137-45

Operationalisation of ecosystem services into management is limited at this point and is primarily a scientific endeavour. As well, the submissions have generally not provided information on the assessment of ecosystem services.

Many countries are beginning to assess management effectiveness and equity in both their networks of MPAs and areas that are considered to be achieving conservation benefits. Management effectiveness is often assessed through the establishment of management plans, programs of reviews of those plans and monitoring of conservation outcomes derived from the plans. Relatively few countries have fully established management plans and monitoring, but many have indicated that they are working to achieve this. Programs to evaluate equity are less well-developed and are currently focused around stakeholder engagement, ensuring that all stakeholders including indigenous peoples and local communities are engaged in the planning and management process.

Ecological representativeness has been defined through a number of different approaches, depending on the scale. Many countries indicated that they have used measures of representativeness in their reserve planning process, including assessment of depth, bioregions, habitats, and ecological and physical features. These have been identified in different ways by various countries and in some cases are still being assessed. However, generally as MPA networks are established significant effort is made to ensure the representativeness of each different "type" of habitat/bioregion/feature is included in the network. In contrast, where only one or two MPAs within a jurisdiction have been established, representativeness is generally not considered as the MPAs are based in areas of high ecological or biological importance. Few submissions deal explicitly with connectivity with a protected area network and the science to support these type of integration is still in development.

MPAs are at the forefront of efforts to achieve Target 11. The primary objective of protected areas is conservation and they have often focused on restricting or regulating a broad set of extractive industries, but have struggled to respond to environmental damage can occur from other sectors which are not focused on activity within the MPA, such as pollutants and physical impacts as a consequence of marine activity.[75] Due to the breadth of potential activities in the marine environment, many different activities may be managed through sectoral agencies with specific responsibilities, even within MPAs. Integration of MPAs into the wider landscape and seascape by including the efforts of sectoral agencies provides an opportunity to build on the benefits of protected areas by providing a broader framework for management of marine resources. However, articulating when and how this integration should occur remains a significant problem for most states and can provide a basis for considering the roles of OEABCMs. One of the outcomes of management of sectoral activity may be the unintended, or secondary, positive environmental consequences of measures aimed primarily at achieving non-environmental objectives, such as security, recognition of traditional rights, or the protection of installations. It makes intuitive sense that, when defined spatially, some of these measures could be categorised as "other effective area-based conservation measures".

The purpose of this paper is to identify possible examples of measures that may qualify as OEABCMs and therefore could be considered as contributing toward meeting Aichi Target 11. It is intended to provoke creative thinking about how Target 11 can be achieved in a way that delivers Strategic Goal C. Consistent with the IUCN World Commission on Protected Areas' (WCPA) draft guidelines on OEABCMs,[76] the paper suggests that the primary objective of qualifying OEABCMs might not be conservation. This may mean moving toward a definition that focuses on the outcomes of an OEABCM, rather than the governance and management arrangements that apply to it.

---

[75] Spadi, F. (2000). Navigation in Marine Protected Areas: National and International Law. *Ocean Development and International Law* 31(3): 285-302, p285.

[76] IUCN WCPA (2017). *Guidelines for Recognising and Reporting Other Effective Area-based Conservation Measures*. IUCN, Switzerland. Version 1. Available at https://www.iucn.org/theme/protected-areas/wcpa/what-we-do/oecms. Accessed on 30 November 2017.

The rest of this paper outlines current approaches to the definition of an OEABCM. It then examines three examples of area-based measures that could qualify as contributing to Aichi Target 11. The paper concludes by posing some questions for consideration with regards to OEABCMs and their role in achieving Aichi Target 11.

2. Defining OEABCMs

Before defining OEABCMs, it makes sense to define protected areas. Definition of an MPA have focused on defining a set of criteria that define what an MPA is. The CBD's *Ad Hoc Technical Expert Group on Marine and Coastal Protected Areas* has defined marine and coastal protected areas as "any defined area within or adjacent to the marine environment, together with its overlaying waters and associated flora, fauna and historical and cultural features, which has been reserved by legislation or other effective means, including custom, with the effect that its marine and/or coastal biodiversity enjoys a higher level of protection than its surroundings."[77]

IUCN defines a protected area as "a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values." Most of this definition describes what an MPA is – the list of criteria that define an MPA, but includes a broad description of the desired outcome, the long term conservation of nature. The criteria that define an OEABCM might be varied, depending on the sector and jurisdiction, but outcomes should remain identical to fit under the definition of an area meeting Target 11.

At the time that the OEABCM provision was included in Target 11, there was not an agreed-upon definition in the context of the CBD. The IUCN-WCPA draft guidance on the definition of OEABCMs proposes that an OEABCM is a "geographically defined space, not recognised as a protected area, which is governed and managed over the long term in ways that deliver effective an enduring *in-situ* conservation of biodiversity, with associated ecosystem services and cultural and spiritual values."[78] IUCN notes that while this definition is similar to its definition of protected areas, the key difference is that it is not necessary that the primary objective of an OEABCM is conservation.[79] This definition of OEABCM reflects an apparent intention in the language of Target 11 that they are *additional* to marine protected areas (MPAs), not a subset of them.[80] It is also places less emphasis on inputs than the definition of an MPA and as a result, greater emphasis on outcomes. Defining an OEABCM as an outcome-based tool allows for two distinct strengths: first, it focuses on the outcomes that an OEABCM should produce and avoids the difficulties of pre-emptively defining what types of measures can be considered an OEABCM; and second, it implicitly prioritises monitoring, which is necessary to demonstrate a net positive conservation outcome.

With regards to the submissions provided in response to the CBD notification, the US and Canada have provided information on their work in identifying OEABCMs in marine areas. The US submission refers to,

---

[77] CBD (2003). *Marine and Coastal Biodiversity: Review, Further Elaboration and Refinement of the Programme of Work*. Report of the Ad Hoc Technical Expert Group on Marine and Coastal Protected Areas (13 February 2003), UNEP Doc. UNEP/CBD/SBSTTA/8/INF/7, para. 30. Available at https://www.cbd.int/kb/record/meetingDocument/4748?RecordType=meetingDocument&Event=SBSTTA-08. Accessed on 15 December 2017.

[78] IUCN WCPA (2017). *Guidelines for Recognising and Reporting Other Effective Area-based Conservation Measures*. IUCN, Switzerland. Version 1. p11. Available at https://www.iucn.org/theme/protected-areas/wcpa/what-we-do/oecms. Accessed on 30 November 2017.

[79] Ibid. For some insights into the development of this position, see Laffoley, D., Dudley, N., Jonas, H., MacKinnon, D., MacKinnon, K., Hockings, M., Woodley, S. (2017). An introduction to 'other effective area-based conservation measures' under Aichi Target 11 of the Convention on Biodiversity: Origin, interpretation and emerging ocean issues. *Aquatic Conservation* 27(S1): 130-137. p135. Note also that this position contrasts with earlier work to build consensus statements on OEABCMs in Canada, including that "Conservation of biodiversity is explicitly stated as the primary objective. A range of objectives may exist for the site, but in cases of conflict, conservation should prevail". See MacKinnon, D., Lemieux, C.J., Beazley, K., Woodley, S., Helie, R., Perron, J., Elliott, J., Haas, C., Langlois, J., Lazaruk, H., Beechey, T., Gray, P. (2015). Canada and Aichi Biodiversity Target 11: understanding 'other effective area-based conservation measures' in the context of the broader target. *Biodiversity Conservation* 24: 3559-81. p3571

[80] Laffoley et al. op cit. p133

among other things, a database of "de-facto MPAs" developed by the National Marine Protected Areas Center (NMPAC). NMPAC has identified 12 types of "de facto MPAs" established for military, public health or safety, or public and private infrastructure-related objectives. These include areas in which special navigational measures, anchorage restrictions, exclusion zones and restrictions on particular activities apply.[81] [82] Canada's submission contains descriptions of three examples of new, adjusted or proposed OEABCMs. Two of these relate, at least in part, to fisheries conservation objectives while one was directed at the protection of Narwhal overwintering and coldwater coral habitats.[83]

3. Selected potential OEABCMs

This section briefly outlines some selected examples of potential OEABCMs. Each example aims to achieve a non-conservation primary objective, but could be considered to achieve biodiversity conservation outcomes under certain circumstances. The detail provided is not intended to be a comprehensive analysis for each case, but rather a brief outline of some of the key issues intended to stimulate discussion about how these and other similar measures might be harnessed to achieve Aichi Target 11.

3.1 Submarine cable and pipeline protection zones

The primary objective of a submarine cable or pipeline protection zone is self-explanatory. They are not designed with the primary objective of conserving marine biodiversity. There are generally two types of area-based measures – wider protection zones and narrower protection corridors[84] – but the term protection zones will be used here to refer to both area-based measures.

Submarine cables carry over 95 percent of all international communication[85] and are therefore a vitally important economic asset. The most common causes of damage to submarine cables is fishing (most commonly, bottom trawling) and anchors. Submarine cables are widely regarded as causing minimal damage to marine ecosystems, particularly when they are not buried. Some minor damage to small areas may occur when cables are being maintained or repaired,[86] but over time, protection zones around them could have positive effects on marine ecosystems.[87]

Submarine pipelines pose a higher risk to the environment than cables due the potential for any damage to them to cause pollution in the marine environment. They are unlikely to be able to be constructed within an MPA. However, if a protection zone were to be established around a pipeline, that protection zone could provide protection against damage to marine ecosystems, particularly benthic habitats, from fishing and

[81] The 12 "de facto MPAs" are: anchorage ground; danger zone; lightering zone; prohibited area; regulated navigation area; restricted area; safety zone; security zone; shipping safety fairway; shipping safety anchorage; special anchorage area; and traffic separation scheme. Each is described in National Marine Protected Areas Center (NMPAC) (2008). *State of the Nation's De Facto Marine Protected Areas*. (R. Grober-Dunsmore and L. Wooninck, editors). Silver Spring, Maryland. p10, Box 4, Box 5. Available at https://nmsmarineprotectedareas.blob.core.windows.net/marineprotectedareas-prod/media/archive/helpful_resources/inventoryfiles/defacto_mpa_report_0608.pdf. Accessed on 21 Nov 2017

[82] The NMPAC report identifies 1200 de facto MPAs covering 3 percent of waters under US jurisdiction. See ibid p6

[83] ECCC (2017). Canadian submission in response to the CBD Secretariat's request for the "Submission of Information on National Experiences and Lessons Learned in the Development, and Effective and Equitable Management, of Marine Protected Areas and other Effective Area-based Conservation Measures" (CBD Notification 2017-084), Environment and Climate Change Canada, 2 October 2017.

[84] Protection zones are generally wider than protection corridors. China, Singapore, Indonesia, and Japan have legislated for the power to establish protection corridors, while Australia and New Zealand legislation provides for protection zones. Widths can vary from 50m in China to 3500m in Indonesia. Davenport, T. (2012). Submarine Communications Cables and Law of the Sea: Problems in Law and Practice. *Ocean Development and International Law* 43: 201-42. p217, footnotes 209, 210, 212

[85] Carter L., Burnett D., Drew S., Marle G., Hagadorn L., Bartlett-McNeil D., and Irvine N. (2009). Submarine Cables and the Oceans – Connecting the World. UNEP-WCMC *Biodiversity Series* No. 31. ICPC/UNEP/UNEP-WCMC, p8

[86] A useful summary of the potential environmental impacts of submarine cables can be found in Friedman, A. (2017). Submarine Telecommunication Cables and a Biodiversity Agreement in ABNJ: Finding New Routes for Cooperation. *The International Journal of Marine and Coastal Law* 32: 1-37, pp8-12

[87] Carter et al (2009) op cit. p37

anchors. However, very little if any research has been conducted into the impact on biodiversity and marine ecosystems of cable and pipeline protection zones.[88]

The current legal framework for protection of submarine cables is fragmented across different maritime zones. Under the Convention on the Law of the Sea[89] (LOSC), a coastal State's sovereignty extends to its internal waters, territorial sea and archipelagic waters and to the sea bed in those waters.[90] Coastal States have a right under LOSC Article 21(c) to establish rules for the protection of submarine cables and pipelines in relation to the innocent passage of foreign vessels through their territorial sea, and have a general competence to legislate for the protection of submarine cables and pipelines in those waters.[91] This means that they can impose penalties for intentional or unintentional damage to cables and pipelines and restrict activities that might damage pipelines and cables in specified areas near them.

All States have the right to lay submarine cables and pipelines on the bed of the high seas beyond the continental shelf,[92] on the continental shelf[93] and in the EEZs of another State.[94] However, protection of submarine cables and pipelines on the high seas and in EEZs is effectively limited to flag State jurisdiction.[95] All States are obliged to adopt laws and regulations to create an offence for a vessel flying its flag or nationals under their jurisdiction to wilfully or through negligence break or damage a submarine cable or pipeline.[96]

No provisions currently exist that would explicitly support the establishment of a protection zone in the EEZ or the high seas around a cable by a single State,[97] although it has been suggested that this may be possible if it is tied to the restriction of activities over which coastal States can exercise jurisdiction under LOSC in their EEZ or on their continental shelf.[98] For example, coastal States have the right to take reasonable measures for the prevention, reduction and control of pollution from pipelines on their continental shelf but with respect to cables, only in relation to the exploration of the continental shelf and the exploitation of its natural resources.[99] [100] It has been suggested that there may be an opportunity for reform to permit coastal States the right to protect submarine cables on environmental grounds.[101]

Multilateral cooperation is likely to be the only way that restrictions on the high seas, such as the imposition of a protection zone, may be possible.

In 2012 APEC reported that five member economies of the eight that responded to its survey had legislated for criminal penalties for damage to submarine cables. Australia and New Zealand have legislated for the establishment of submarine cable and pipeline protection zones and have established several such zones.

---

[88] A search using the Scopus and Science Direct databases using the search terms "submarine cable" or "submarine pipeline" and biodiversity yielded no relevant results.
[89] United Nations Convention on the Law of the Sea (LOSC). Agreed 10 December 1982, entered into force 16 November 1994
[90] In relation to the territorial sea LOSC Article 2; in relation to archipelagic waters Article 49;
[91] Davenport (2012) op cit. p217
[92] LOSC Articles 87(1)(c) and 112
[93] LOSC Article 79
[94] LOSC Article 58(1). These rights are subject to the same rules applying to cables and pipelines in the high seas, notably Article 113.
[95] Kaye, S. (2007). International Measures to Protect Oil Platforms, Pipelines and Submarine Cables from Attack. *Tulane Journal of Maritime Law* 31(2): 377-423. p419
[96] The key provision on LOSC is Article 113, although Articles 114 and 115 have some relevance.
[97] As Davenport (2012) op cit, p219, notes "cable protection zones in areas of high seas, where no state can subject any part of the high seas to its sovereignty, would not be consistent with UNCLOS"
[98] See the discussion in Davenport (2012) ibid, who cites Kaye, S. (2010), "The Protection of Platforms, Pipelines and Submarine Cables Under Australian and New Zealand Law" in Maritime Security: International Law and Policy Perspectives from Australia and New Zealand, eds. Natalie Klein, Joanna Mossop and Donald Rothwell. New York, Routledge, p192
[99] LOSC Article 79(2)
[100] See also: on the shortcomings of Article 79(2), Friedman, A. (2017). Submarine Telecommunication Cables and a Biodiversity Agreement in ABNJ: Finding New Routes for Cooperation. International Journal of Marine and Costal Law 32(1) 1-35, p17; and in relation to pipelines on the continental shelf, and the possible application of LOSC Article 79(4) in addressing pollution from damaged pipelines, Kaye (2007) op cit. p420
[101] Takei, Y. (2012). Law and Policy for International Submarine Cables: An Asia-Pacific Perspective. *Asian Journal of International Law* 2: 205-33, footnote 64, citing Kaye (2010) op cit. pp398, 422-3

The Australian and New Zealand frameworks have been recommended as models for adoption elsewhere.[102] Australia's legislation asserts a right to establish a cable protection zone within its EEZ and on the extended continental shelf.[103]

Similarly, New Zealand's Submarine Cable and Pipeline Protection Act 1996 includes powers to establish protection zones in its internal waters, territorial sea and EEZ.[104] It has established 10 submarine cable and pipeline protection zones.[105] Most cable protection zones in New Zealand prohibit fishing and anchoring[106] with exceptions for research and maintenance activities.

Restrictions are more flexible in the Hauraki Gulf and the Cook Strait.[107] For example, the Cook Strait cable protection zone permits fishing by vessels "being used to set or lift nets or rock lobster pots, or paua or kina fishing as long as all these activities are carried out in daylight hours and do not involve attachments to the sea bed" subject to specified spatial and temporal limitations.[108]

Some area-based restrictions may share similar outcomes to areas that meet MPA criteria. Eight of New Zealand's cable protection zones have similar outcomes to type 2 MPAs in accordance with the *Marine Protected Areas: Classification, protection standard and implementation guidelines*.[109] The standard focuses on the outcome – that is, "enabling the maintenance or recovery of the site's biological diversity at the habitat and ecosystem level to a healthy functioning state" – regardless of the tool or policy employed to achieve that outcome.[110] Similar restrictions apply to protection zones operating around pipelines.[111]

Issues for consideration:

- Can submarine cable protection zones compensate for any ecological damage from installation and maintenance?
- Are the measures in place in a cable or pipeline protection zone likely to provide sufficient protection for marine biodiversity?

---

[102] Beckman, R. and Davenport, T. (2010). *Workshop Report.* Workshop on Submarine Cables and Law of the Sea, 14 – 15 December 2009, Singapore, p44. Available at https://cil.nus.edu.sg/wp-content/uploads/2009/10/Workshop-Report-29-Jan-2010.pdf. Accessed on 30 Nov 2017

[103] *Telecommunications Act 1997* Schedule 3A Division 2 Subdivision A s4(1)

[104] *Submarine Cables and Pipelines Protection Act 1996-22*, s12(1). Available at http://legislation.govt.nz/act/public/1996/0022/latest/DLM375803.html?src=qs. Accessed on 22 Nov 2017

[105] Froude, V.A. and Smith, R., 2004. *Area-based Restrictions in the New Zealand Marine Environment*. Department of Conservation MCU Report. Available at http://www.doc.govt.nz/about-us/science-publications/conservation-publications/marine-and-coastal/area-based-restrictions/. Accessed on 28 Nov 2017

[106] *Submarine Cables and Pipelines Protection Act 1996-22*, s13(1)

[107] Froude and Smith (2004) op cit. p15

[108] Hauraki Gulf submarine cable Protection Zone (SCPP1001), *Submarine Cables and Pipeline Protection Order 1992* R2A(1),(4); Cook Strait Submarine Cable Protection Zone (SCPP1006), *Submarine Cables and Pipeline Protection Order 1992* R2A(3); both cited in Froude and Smith (2004) op cit. pp54, 95

[109] New Zealand Department of Conservation http://www.doc.govt.nz/nature/habitats/marine/type-2-marine-protected-areas/ accessed on 28 Nov 2017

[110] New Zealand Department of Conservation (2008). *Marine Protected Areas: Classification, protection standard and implementation guidelines*. pp10-1. Available at http://www.doc.govt.nz/about-us/science-publications/conservation-publications/marine-and-coastal/marine-protected-areas/marine-protected-areas-classification-protection-standard-and-implementation-guidelines/. Accessed on 28 November 2017.

[111] See for example the Oaonui pipeline protection zone (SCPP1007), which has similar protections to the Cook Strait Cable protection zone, compared to the more restrictive conditions for the Maui A and Maui B Pipelines. (The Oaonui pipeline protection zone (SCPP1007): "No fishing or anchoring except for (a) ships being used for research by or for the Ministry of Fisheries as long as the research is done without attaching any ship to the sea bed; (b) ships used for constructing, servicing, maintaining or repairing Maui gasfield offshore platforms, submarine pipelines and associated offshore facilities; (c) fishing vessels being used to set or lift nets or rock lobster pots, or paua or kina fishing as long as all these activities are carried out in daylight hours and do not involve attachments to the sea bed and are within 2 miles of low watermark of the North Island"; Maui A and Maui B Pipelines (SCPP1010): "This is a restricted area for all New Zealand ships except for those ships engaged in the construction, repair, maintenance, and servicing the Maui Gas field offshore platforms, submarine cables and associated offshore facilities."). Cited in Froude and Smith (2004) op cit. p99

- In what circumstances would a cable or pipeline protection zone be sufficient to achieve biodiversity outcomes sought under Aichi Target 11?
- What additional monitoring and evaluation would be required in a cable or pipeline protection zone to assess their positive or negative outcomes for biodiversity and who should be responsible for those assessments?

3.2. Particularly Sensitive Sea Areas

Shipping activity can affect marine areas through the effects of operational discharges, accidental or intentional pollution,[112] and physical damage[113] to habitats and marine organisms (IMO 2006: para 2.1).[114] While a range of navigational measures are available under international law to address maritime safety including measures applying to specific areas, the emergence of the Particularly Sensitive Sea Area (PSSA) concept in the early 1990s [115] highlighted the opportunity to apply navigational measures specifically to achieve ecological objectives.[116]

A PSSA is defined by the IMO as "an area that needs special protection through action by IMO because of its significance for recognized ecological, socio-economic, or scientific attributes where such attributes may be vulnerable to damage by international shipping activities".[117] PSSAs therefore do not necessarily need to have an explicit ecological objective but could contribute to the protection and maintenance of marine biodiversity, species and habitats.[118]

PSSAs can apply to areas both within and beyond the territorial sea[119] and must strike a balance between a coastal State's rights in each zone, and those of vessels flying the flag of another State.[120] Since their inception they have been viewed as a means of protecting a sensitive area where an individual State lacks competence to unilaterally impose restrictions.[121]

Spatial measures, however, are contemplated in Article 211(6) of LOSC which effectively requires a coastal State to seek the IMO's approval for additional mandatory vessel pollution measures with effect in a defined area within its EEZ. Such measures should be "required for recognized technical reasons in relation to its oceanographical and ecological conditions, as well as its utilization or the protection of its resources and the particular character of its traffic" and thus provides the basis for PSSAs. Such additional regulations may relate to discharges or navigational practices but not design, construction, manning or equipment standards other than generally accepted international rules and standards.[122]

---

[112] According to the IMO, substances released from vessels that may cause harm to the environment and marine living resources include "oil and oily mixtures, noxious liquid substances, sewage, garbage, noxious solid substances, anti-fouling systems, harmful aquatic organisms and pathogens, and even noise". See IMO (2005). Revised Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas. Resolution A.982(24). Adopted on 1 December 2005. para 2.2. Available at https://docs.imo.org/Category.aspx?cid=3. Accessed on 11 December 2017.

[113] Physical impacts can include "the smothering of habitats, contamination by anti-fouling systems or other substances through groundings, and ship strikes of marine mammals". Ibid.

[114] PSSAs therefore do not relate to damage caused by dumping, which are covered by the 1972 *London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter*, and the 1996 *Protocol to the London Convention*. See IMO (2005) op cit. para 4.2

[115] Peet notes that precursors to PSSA concept had been the subject of discussions since at least 1971, several PSSAs had already been designated before the formal adoption of the term in 1991 (IMO Assembly Resolution A720(17)). See Peet, G. (1994). Particularly Sensitive Sea Areas: A Documentary History. *International Journal of Marine and Coastal Law*. 9(4): 469-506.

[116] Edward Kleverlaan, personal communication, 4 January 2018

[117] IMO (2005) op cit

[118] Gjerde, K. and Freestone, D. (1994). Particularly Sensitive Sea Areas – An Important Environmental Concept at a Turning Point. *International Journal of Marine and Coastal Law* 9(4): 431-68. p436, referring specifically to UNCED Agenda 21 Chapter 17.7.

[119] IMO (2005) op cit. para 4.3

[120] Gjerde and Freestone (1994) op cit. p432

[121] Ibid. p433

[122] Article 211(6)(c)

An IMO member State or more than one member State with a common interest in the area in question can propose a PSSA.[123] Final authority for the approval of a PSSA rests with the IMO's Marine Environment Protection Committee (MEPC), although this is subject to a number of preceding steps and approvals by various organs of the IMO, including in some circumstances, the IMO Assembly.[124]

However, as the term is defined under an IMO Assembly Resolution, a PSSA is a non-binding designation and relies on states to implement measures.[125] This is not to say that they are without value – it has been argued that they signal to vessel operators the importance of applying caution or avoiding PSSAs, and provide a framework for an holistic, coordinated and integrated approach to marine environmental protection, and as an "…internationally acceptable mechanism for balancing concerns of environmental protection and freedom of navigation…".[126]

To operationalise a PSSA requires one or more associated protective measures (APM) "which meets the requirements of the appropriate legal instrument establishing such measure, must have been approved or adopted by IMO to prevent, reduce, or eliminate the threat or identified vulnerability."[127]

A proposed PSSA must meet at least one criterion contained in the IMO Guidelines. Criteria are grouped into three categories – (i) ecological;[128] (ii) social, cultural, and economic;[129] and (iii) scientific and educational.[130] This means that a PSSA may be established to achieve an objective other than an ecological one.

A PSSA proposal must also demonstrate that the attributes of the proposed area are vulnerable to international shipping activities, the vessel traffic and natural factors to be considered, and other information such as evidence of actual current damage or potential damage, historical incidents and their consequences, potential flow-on impacts from establishing the proposed PSSA, other environmental stresses, and any existing measures. The MEPC may establish a technical group, comprising experts in relevant environmental, scientific, maritime, and legal matters to assess proposals against the Guidelines and provide advice to the Committee.[131]

Finally, a proposal must identify the applicable APM(s) that will prevent, reduce, or eliminate the identified vulnerability.[132] APMs must be consistent with international law, in particular that they should not undermine the freedom of navigation.[133] However, APMs relating to maritime safety and navigation that have been properly endorsed by the IMO are likely to be considered to be consistent with LOSC.[134] Indeed, the need for consistency with international law means that, in practice, APMs that can be applied in relation to PSSAs are limited to those that have been or are to be adopted by the IMO (IMO 2006: para 6.1). The IMO Guidelines identify a range of APMs, including, inter alia:

---

[123] IMO (2005) op cit. para 3.1
[124] Ibid para 8.3
[125] Peet, G. (1994) op cit. p475
[126] Gjerde and Freestone (1994) op cit. pp450-1
[127] IMO (2005) op cit. para 1.2
[128] The ecological criteria include uniqueness or rarity, critical habitat, dependency, representativeness, diversity, productivity, spawning or breeding grounds, naturalness, integrity fragility and bio-geographic importance; these are explained in ibid paras 4.4.1 to 4.4.11
[129] The social, cultural, and economic criteria include social or economic dependency, human dependency, and cultural heritage; these are explained in ibid paras 4.4.12 to 4.4.14
[130] The scientific and educational criteria include research, baseline for monitoring studies, and education; these are explained in ibid paras 4.4.15 to 4.4.17
[131] Ibid para 8.3
[132] Ibid para 8.1
[133] ibid para 9.2
[134] Roberts, J., Chircop, A. and Prior, S. (2010). Area-based Management on the High Seas: Possible Application of the IMO's Particularly Sensitive Sea Area Concept. *International Journal of Marine and Coastal Law* 25(4): 483-522, p507

- designation of the area as a Special Area under MARPOL;[135 136 137]
- application of special discharge restrictions within the PSSA
- ships' routeing and reporting systems in or the near the PSSA, under the International Convention for the Safety of Life at Sea (SOLAS) and in accordance with the General Provisions on Ships' Routeing (GPSR)[138] and the Guidelines and Criteria for Ship Reporting Systems; or
- "measures aimed at protecting specific sea areas against environmental damage from ships, provided that they have an identified legal basis".[139]

Routeing measures that are were not originally intended to address environmental problems have evolved to address environmental objectives more explicitly. While originally established to address maritime safety, the IMO has, since 1992, explicitly incorporated environmental objectives into the rationale for routeing provisions under the GPSR, and since 1995 under SOLAS.[140] These include Areas To Be Avoided (ATBA), which are discussed further below, and traffic separation schemes, among others.[141] The IMO is the only international organisation authorised to adopt international measures on ships' routeing and areas to be avoided.[142]

While a coastal State has greater freedom to regulate routeing measures in its territorial sea, some aspects of navigation, such as compulsory pilotage, are more restrictive. A coastal State must work within the IMO to enforce compulsory pilotage within its territorial sea but, as Australia and Papua New Guinea have found, the IMO considers that there is no international legal basis to support compulsory pilotage in straits used for international navigation.[143]

ATBAs can exist independently or in association with PSSAs.[144] The first ATBA established for environmental purposes was around New Zealand's Poor Knights Islands group and is not associated with a PSSA. A marine reserve already surrounded the islands, covering a total marine area of 19.22km^2 in three separate portions,[145] extending 800m from the islands.[146] However the ATBA covers a much larger

---

[135] Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL), as amended by amendments of 1984 and 1985. *Australian Treaty Series* 1988 No 29. Available at http://www.austlii.edu.au/au/other/dfat/treaties/1988/29.html. Accessed on 15 December 2017.

[136] A special area is defined in MARPOL Annexes I, II, and V, as "[a] sea area where for recognised technical reasons in relation to its oceanographic and ecological condition ad to the particular character of its traffic the adoption of special mandatory methods for the prevention of sea pollution by oil, noxious liquid substances or garbage is required". See IMO (2002). *Guidelines for the Designation of Special Areas under MARPOL 73/78 and Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas*. A 22/Res.927, Annex I Guidelines for the Designation of Special Areas under MARPOL 73/78, para 2.1. Adopted on 29 November 2001. Available at https://docs.imo.org/Category.aspx?cid=3. Accessed on 18 December 2017.

[137] Protective measures for Special Areas under MARPOL must already exist where as APMs for PSSAs could be proposed for adoption by IMO. See further the comparison between Special Areas and PSSAs in UNEP-MAP-RAC/SPA (2010). *International legal instruments applied to the conservation of marine biodiversity in the Mediterranean region and actors responsible for their implementation and enforcement*. By Ben Salem, M. Ed. RAC/SPA, Tunis, pp13-4. Available at https://www.cbd.int/doc/meetings/mar/ebsaws-2014-03/other/ebsaws-2014-03-submission-rac-spa-9-en.pdf. Accessed on 11 Dec 2017.

[138] IMO (1995). Resolution A.572(14), *General Provisions on Ships' Routeing* (adopted 20th November 1985), as amended by Resolution A.827(19), adopted 23rd November 1995. Measures include "traffic separation schemes (TSS); two-way routes; recommended tracks; areas to be avoided; no-anchoring areas; inshore traffic zones; roundabouts; precautionary areas; and deep-water routes", noted by Roberts (2005) op cit. 137.

[139] IMO (2005) op cit. para 6.1.3

[140] See Roberts (2005) op cit. pp143-4

[141] For a brief description of these and other routeing measures, see http://www.imo.org/en/OurWork/Safety/Navigation/Pages/ShipsRouteing.aspx. Accessed 4 January 2018

[142] International Convention for the Safety of Life at Sea (SOLAS), Signed in London on 1 November 1974, entered into force 25 May 1980. Australian Treaty Series 1983. No.22. Regulation 8(b). Available at http://www.austlii.edu.au/au/other/dfat/treaties/1983/22.html. Accessed on 4 January 1974

[143] Roberts et al (2010). Op cit., p512; and Rothwell, D. and Stephens, T. (2016). *The International Law of the Sea*. Second edition. Oxford and Portland, Oregon, Hart Publishing, pp263-6

[144] A list of PSSAs adopted by the IMO can be found at http://www.imo.org/en/OurWork/Environment/PSSAs/Pages/Default.aspx

[145] For details see Protected Planet (webpage) (2017). Poor Knights Marine Reserve: WDPA ID 315471. Available at https://protectedplanet.net/poor-knights-islands-marine-reserve. Accessed on 19 December 2017

area,[147] in a triangular shape from the coastline of the North Island between Cape Brett in the north to Bream Head in the South.[148] The ATBA is entirely within New Zealand's territorial sea.

An example of an ATBA that is associated with a PSSA[149] can be found within Ecuador's EEZ around the Galapagos Archipelago.[150] Ecuador's proposal for a PSSA around the Galapagos Marine Reserve was approved by the MEPC in 2005[151] in accordance with the IMO's previous Guidelines.[152] The APMs include mandatory ship reporting systems, recommended tracks to allow vessels access to ports in the archipelago, and an ATBA.[153] The ATBA extends well beyond the PSSA area (see Annex 3 of Annex 23 of Resolution MEPC.13 5(53), and therefore, it appears, beyond the area of the Galapagos Marine Reserve. The ATBA thus acts as a buffer zone to protect sensitive ecosystems from damage caused by substances released from vessels.

Intuitively, PSSAs (and ATBAs) should provide some protection for ecosystems if they represent areas of ecological value, and the relevant APMs target real risks – as required by the IMO Guidelines. Again, however, research demonstrating the impact of PSSAs on biodiversity is scarce. While the IMO Guidelines provide for reviews and evaluations of existing PSSAs,[154] no formal evaluations have been conducted.[155]

Issues for consideration:

- Could PSSAs established on the basis of social, cultural, and economic criteria, or scientific and education criteria, also achieve biodiversity outcomes, even if biodiversity conservation is not an explicit or primary objective?
    - If not, could additional ecological criteria provide a valid basis for inclusion under Aichi Target 11?
- If an outcomes-based measure of the impact of a PSSA on biodiversity were employed, what criteria or indicators would provide a valid indication of its contribution of the PSSA to Aichi Target 11?

3.3. Traditional Use Areas

Traditional use areas can cover a wide range of area types where traditional users have some degree of priority and protection vis a vis other activities that may have a negative impact on traditional users, such as industrial scale fishing and other non-traditional uses. They could include areas governed under

---

[146] IMO-NAV (2003). *Routeing of Ships, Ship Reporting and Related Matters: Proposed area to be avoided*. Submitted by New Zealand to the Sub-committee on Safety of Navigation. NAV 49/3, 16 January 2003, para 6.3.1.1. Available at https://docs.imo.org/Category.aspx?cid=3. Accessed 4 January 2018.

[147] The area of the ATBA is roughly estimated by this author to be approximately 1100km^2, well over 50 times the size of the marine reserve

[148] Compare the sizes of the marine reserve and the ATBA in Annex 2 of NAV49/3, IMO-NAV (2003) op cit.

[149] A map depicting the APMs applied in the Galapagos Archipelago can be found at http://pssa.imo.org/galapagos/maps.htm. Accessed 18 December 2017)

[150] The *Marine Regions* website, managed by the Flanders Marine Institute, was used to judge whether the coordinates for the boundaries of the PSSA and ATBA fell within the EEZ. URL: http://www.marineregions.org/eezmapper.php. Accessed on 4 January 2018.

[151] IMO MEPC (2005). *Report of the Marine Environment Protection Committee on its Fifty-Third Session*. MEPC 53/24/Add.2 1 August 2005, Annex 23 Designation of the Galapagos Archipelago as a Particularly Sensitive Sea Area. Resolution MEPC.13 5(53), adopted on 22 July 2005. Available at https://docs.imo.org/Category.aspx?cid=3. Accessed 18 December 2017.

[152] IMO (2002) op cit. *Annex 2 Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas*. Available at https://docs.imo.org/Category.aspx?cid=3. Accessed on 18 December 2017. Annex 2 was superseded by new Guidelines approved under IMO Assembly Resolution A.982(24).

[153] The IMO website has a useful map illustrating the APMs applying in and around the Galapagos PSSA. Available at IMO http://pssa.imo.org/galapagos/maps.htm. Accessed 18 December 2017.

[154] IMO (2005). Op cit, para 8.4

[155] However, a few IMO members have carried out their own reviews of PSSAs within their jurisdictions. For example, Australia reviewed the Great Barrier Reef PSSA with para 8.4 in mind, prior to submitting a proposal to extend it to the south western Coral Sea, but did not submit the review to the IMO. Edward Kleverlaan, personal communication, 16 January 2018.

customary tenure,[156] areas managed by indigenous and non-indigenous local communities, or simply areas that have been traditionally relied upon for food security and livelihoods by particular groups.

Some traditional use areas have demonstrated that, as co-managed common property areas, communities are capable in some circumstances of developing effective management regimes without involvement by an external authority.[157] However, they can be vulnerable to external influences, such as technological change and the intrusions by external parties.[158] They also tend to perform less effectively as the size of the territory and/or membership of group increases,[159] and could also be eroded by the adoption of formal management arrangements that do not adequately take account of traditional forms of management, such as those under customary marine tenure.[160]

However, awareness has grown over recent decades of the role of traditional forms of management and traditional knowledge, not just in managing a fishery resource, but as an effective means of conserving biodiversity and protecting marine ecosystems. This has been accompanied by increased interest in approaches such as co-management,[161] and has facilitated greater integration of traditional practices into the broader formal legal and marine fisheries and ecosystem management frameworks.[162] It has been suggested that traditional management approaches could bridge the divide between "the all-or-nothing regime of commercial fisheries vs marine reserves".[163]

Such ideas have gained traction in UN-led conferences on sustainable development. Direct references to traditional uses can be found in binding and non-binding instruments agreed at, and subsequent to, the 1992 UN Conference on Environment and Development in Rio de Janeiro. For example, the Rio Declaration emphasised that "Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices...".[164] These themes were repeated and elaborated upon throughout Agenda 21,[165] including in Chapter 17 on protection of the oceans,[166] as well as in the CBD,[167] the 1995 UN Fish Stocks Agreement (UNFSA),[168] and the FAO Code of Conduct for Responsible Fisheries.[169]

---

[156] Aswani, S. (2005). Customary sea tenure in Oceania as a case of rights-based fishery management: Does it work? *Reviews in Fish Biology and Fisheries* 15: pp285-307

[157] Schlager, E. and Ostrom, E. (1992). *Property Rights and Natural Resources: A Conceptual Analysis*. Land Economics 68(3): 249-62

[158] Steelman, T.A. and Wallace, R.L. (2001): *Property Rights and Wrongs: Why Context Matters in Fisheries Management*. Policy Sciences 34: 357-79. p367

[159] Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge, UK, Cambridge University Press, p188

[160] Aswani, S. (2005). Op cit. pp285-307

[161] Steelman and Wallace (2001) op cit. p368-9, Table 1

[162] Aswani, S. (2005). Op cit. p301

[163] Stephenson, J., Berkes, F., Turner, N.J., & Dick, J. (2014). Biocultural conservation of marine ecosystems: Examples from New Zealand and Canada. *Indian Journal of Traditional Knowledge* 13(2): 257-65, p263

[164] Article 22, *Rio Declaration on the Environment and Development*, United Nations Conference on Environment and Development (UNCED), 14 June 1992, Rio de Janeiro, Brazil. Available at http://www.unep.org/Documents.Multilingual/Default.asp?documentid=78&articleid=1163. Accessed on 22 September 2015. The *Rio Declaration* also recognised in Article 6 the "the special situation and needs of developing countries", which are of particular, but not exclusive, interest to many developing countries.

[165] UNCED (1992). *Agenda 21*. United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, Brazil, 3 to 14 June. A/CONF.151/26. Available at https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf. Accessed on 2 August 2016.

[166] On the importance of sustainably managed marine ecosystems to indigenous and other local communities, see *Agenda 21* paragraphs 17.3, 17.15, 17.70, 17.79, 17.81, 17.82. On the value of harnessing and developing traditional knowledge in the pursuit of sustainable development see paragraphs 17.15, 17.74(b), 17.81(c), 17.92, 17.94, 17.99, 17.136

[167] Convention on Biological Diversity (CBD), Adopted on 22 May 1992 at the Nairobi Conference for the Adoption of the Agreed Text of the Convention on Biological Diversity. Opened for signature on 5 June 1992, entered into force on 29 December 1993. Text available at https://www.cbd.int/convention/text/. Accessed on 21 December 2017.

[168] Agreement for the Implementation of the Provisions of the United Nations Convention of the Law of the Sea 10 December 1982, Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNFSA).

The CBD recognises in its preamble that traditional knowledge contributes to biodiversity conservation and the sustainable use of its components.[170] Its substantive provisions contain a clear intention that States should protect, encourage and support the sustainable traditional use of biological resources[171] and the application of traditional knowledge to that end and for the conservation of biodiversity.[172]

Similarly, UNFSA lays a legal foundation, at least within the context of the management of straddling stocks and highly migratory fish stocks, for the protection of the interests of the communities that typically possess and use traditional knowledge, with a particular emphasis on those in small island developing States.[173]

Clearly there is an intention in international law to support the traditional use of marine resources in ways that protect those resources and the wider marine ecosystems in which they exist. However, they are more exhortations than firm enforceable rules. While LOSC does not refer at all to traditional uses of marine resources, it does provide a strong basis for coastal States to exercise almost exclusive jurisdiction over areas that are likely to be of interest to communities for whom traditional use is relevant – that is, within their internal waters, archipelagic waters and territorial sea.[174]

Despite a century or more of colonisation, traditional use areas, often underwritten by various forms of customary tenure, have been preserved in some form in various parts of the world. There is a rich history of traditional use areas and customary marine tenure in several Pacific island countries, many of which have survived colonisation, or gained stronger recognition since decolonisation,[175] in both developing

---

International Legal Materials 1995; 34: 1542. Opened for signature 4 August 1995. Entered into force on 11 December 2001. New York.

[169] FAO (1995). *Code of Conduct for Responsible Fisheries*. Adopted on 31 October 1995 at the twenty-eighth session of the FAO Conference by Resolution 4/95. Food and Agriculture Organisation of the United Nations. Rome. See for example paragraphs 6.4, 6.18, 7.66 and 12.12

[170] This is implicit in the CBD Parties' recognition in the Preamble of "the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, and the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components".

[171] CBD Article 10(c): "Each Contracting Party shall, as far as possible and as appropriate:…(c) Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements".

[172] CBD Article 8: "Each Contracting Party shall, as far as possible and as appropriate:… (j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices".

[173] UNFSA Article 24(2) requires States to "…take into account the special requirements of developing States", including "(b) the need to avoid adverse impacts on, and ensure access to fisheries by, subsistence, small-scale and artisanal fishers and women fishworkers, as well as indigenous people in developing States, particularly small island developing States".

[174] LOSC Article 2. The exercise of a coastal State's sovereignty is, however, subject to other provisions of the Convention, notably that it not hamper the innocent passage of foreign ships (Article 24(1)).

[175] Positive examples are well and truly matched by examples where colonisation has extinguished customary tenure. See Aswani, S. (2005) op cit. in particular pp287-9.

countries, such as Solomon Islands and Kiribati,[176] and developed countries, such as Australia,[177] Canada[178] and New Zealand.[179] [180]

Research into biodiversity outcomes in areas subject to community management and customary practices has been limited and inconclusive. Traditional use areas tend to be data-poor, and practices are typically context-specific.[181] Studies have more often focused on impacts of traditional practices on harvested species and governance processes, while those that have considered broader ecosystem impacts have drawn mixed conclusions.[182] Whether communities have been motivated to establish particular practices by conservation objectives or other aspects, such as food security, has also been the subject of much academic debate.[183]

The above observations suggest not that traditional use areas are flawed as an approach to conservation, but that more research is required to systematically analyse the circumstances in which community management and traditional practices can deliver effective biodiversity conservation, while also achieving other community objectives.

It is much clearer that conservation measures introduced from outside a community are less likely to succeed without that local community's involvement.[184] Indeed, ensuring that "modern" conservation methods are deliberately integrated with traditional practices, rather than seek to replace them, has strong support in the community fisheries literature.[185]

According to a distillation of data from the World Database of Protected Areas (WDPA) by the South Pacific Regional Environment Program (SPREP), Solomon Islands has 90 protected areas that include a marine component.[186] These carry the national designation of either a marine protected area (52), marine protected area/tabu (26), marine managed area (6), or a conservation area (1), while one is a World Heritage Site.[187] These cover just over 1900km^2 of marine area, or 0.12% of marine areas under Solomon

---

[176] See for example *Fisheries Act 2010* (Kiribati) s18, which prohibits persons who are not members of a local community (that is, persons who are not members of a kainga, utu or other division) from taking fish "in a sea or lagoon area or on a reef forming part of an ancient customary fishing ground" without a licence. Available at http://www.paclii.org. Accessed on 4 April 2017

[177] For example, Traditional Owners retain traditional harvesting rights in Australia, targeting, among other things, dugongs. Dugong populations and their habitats in the Torres Strait, where harvesting of "significant" numbers of dugongs has occurred for the past 400-500 years, are far healthier than those in the adjacent northern Great Barrier Reef area. Marsh, H., Grayson, J., Grech, A., Hagihara, R. and Sobtzick, S. (2015). Re-evaluation of a marine mammal harvest by Indigenous people using several lines of evidence. *Biological Conservation* 192: 324-30

[178] See for example the integrated approach to traditional use and biodiversity protection in British Colombia in: Marine Planning Partnership Initiative (2015). *Haida Gwaii Marine Plan*. Available at http://mappocean.org/wp-content/uploads/2015/09/HGMP-WEB-2015-07-08.pdf. Accessed on 3 January 2017.

[179] In New Zealand, Māitaitai reserves allow customary fishing and management but, according to the Department of Conservation, can be implemented so as to meet MPA criteria. See: http://www.doc.govt.nz/nature/habitats/marine/type-2-marine-protected-areas/. Accessed on 28 Nov 2017. See also Froude and Smith (2004). Op cit.

[180] On both New Zealand and Canada, see Stephenson, J., Berkes, F., Turner, N.J., & Dick, J. (2014). Op cit. pp257-65.

[181] Aswani, A., Albert, S., and Love, M. (2017). One size does not fit all: Critical insights for effective community-based resource management in Melanesia. *Marine Policy* 81: 381-91

[182] Cinner, J.E. and Aswani, S. (2007). Integrating customary management into marine conservation, *Biological Conservation* 140(3-4): 201-216, pp205-7

[183] See ibid, pp205-6; and Bartlett, C.Y., Pakoa, K., and Manua, C. (2009). Marine reserve phenomenon in the Pacific islands. *Marine Policy* 33(4): 673-8, p673

[184] Katikiro, R.E., Macusi, E.D., and Ashoka Deepananda, K.H.M. (2015). Challenges facing local communities in Tanzania in realising locally-managed marine areas. *Marine Policy* 51: 220-9; and Hill, L.S., Johnson, J.A., and Adamowski, J. (2016). Meeting Aichi Target 11: Equity considerations in marine protected areas design, *Ocean & Coastal Management* 134: 112-9

[185] See for example: Aswani, S., Christie, P., Muthiga, N.A., Mahon, R., Primavera, J.H., Cramer, L.A., Barbier, E.B., Granek, E.F., Kennedy, C.J., Wolanski, E., and Hacker, S. (2012). The way forward with ecosystem-based management in tropical contexts: Reconciling with existing management systems, *Marine Policy* 36(1): 1-10; and Aswani et al (2017). Op cit.

[186] UNEP-WCMC (2013). *WDPA Country Data Status Report: Solomon Islands*. Available at http://pipap.sprep.org/country/SB. Accessed on 22 December 2017. Queen Elizabeth National Park in Uganda has been erroneously included in Solomon Islands list of protected areas in the 2014 data (and continues to be included as such in 2017 WDPA data). It has been omitted from the number reported here. SPREP has been advised of this discrepancy

[187] Four protected areas have been omitted due to insufficient information or data errors (double counting). See https://protectedplanet.net/country/SB.

Islands' jurisdiction.[188] Notably, 58 marine protected areas and (including those designated MPA/tabu) are under indigenous or local community management.[189]

For example, access and harvesting rights are restricted to people with kinship ties and enforced locally in customary marine tenure areas in Roviana Lagoon in Western Province of Solomon Islands. Two of these areas – the overlapping districts of Kalikoqu and Saikile – in the eastern part of the Lagoon have been used as a basis upon which to establish marine protected areas.[190] In all, seven small MPAs have been established since 1999, ranging in size from 0.45 km^2 to 1.57km^2.[191] The success of MPAs in such areas has been shown to be dependent, in part, on the integration of customary tenure into the management regime. This was the case with the MPAs discussed here, which were established at a time when Solomon Islands' legislation was considered inadequate and customary tenure provided the only effective way to enforce rules.[192]

Solomon Islands' more recent Fisheries Management Act 2015[193] formally recognises and protects customary rights and customary rights areas,[194] and gives Community Fisheries Management Plans legal force.[195] The strengthened legal status of customary areas could conceivably support a widening of the protected area network through their recognition as OEABCMs beyond the formally designated MPAs.

Traditional use areas thus recognise communities' interests in marine resources and that their use of traditional knowledge can achieve biodiversity conservation and sustainable use, and as such are well-placed to ensure they are "equitably managed" as required by Target 11. They will be more effective when policy frameworks support and encourage the use and development of traditional knowledge for that purpose, and when legal frameworks protect communities' interests and their ability to apply traditional knowledge to achieve *in situ* conservation. However, further research would support a greater understanding of the circumstances in which traditional use areas can make a substantial contribution to biodiversity conservation, including through "hybrid" approaches with "modern" conservation methods to ensure that such areas are also "effectively managed".

Issues for consideration

- Is recognition of local management rights (including customary tenure) in domestic legislation a necessary condition for traditional use areas to be regarded as an OEABCM?
- What are some practical limitations on monitoring and evaluation in locally managed, traditional use areas and how might they be overcome?

---

[188] UNEP-WCMC (2017). *Protected Area Country Profile for Solomon Islands from the World Database of Protected Areas, December 2017*. Available at https://protectedplanet.net/country/SB. Accessed on 22 December 2017. Eighty-nine of Solomon Islands' terrestrial and marine protected areas had not been assigned an IUCN management category. For further information on IUCN management categories, see https://www.iucn.org/theme/protected-areas/about/protected-area-categories.
[189] Ibid
[190] Aswani, S. (2005).op cit. pp285-307
[191] These are Olive (WDPA ID: 555544155); Ha'apai (WDPA ID: 555544152); Kozou (WDPA ID: 555544150); Nusa Hope/Heloro (WDPA ID: 555544151); Nusa Hope Mangrove (WDPA ID: 555547873); Duduli Rerenghana (WDPA ID: 555547869); and Baraulo/Bule Lavata (WDPA ID: 555544148). Available at https://protectedplanet.net/country/SB. Accessed on 3 January 2018.
[192] Aswani, S. (2005). Op cit. pp303-4
[193] Available at http://www.paclii.org. Accessed on 24 July 2017.
[194] *Fisheries Management Act 2015* (Solomon Islands) ss2(1), 5(1), 21(1)
[195] *Fisheries Management Act 2015* (Solomon Islands) s18

4. Concluding notes

This paper has outlined three examples of types of marine management measures that may be considered as OEABCMs under the right circumstances. There are others that are equally worthy of consideration, including wreck sites and marine war graves, areas that are restricted for military or security purposes,[196] protection zones around offshore energy generation installations such as wind farms,[197] and spatially defined restrictions on land-based pollution and run-off.[198] In many cases a proposal to establish an MPA attracts concern from stakeholders that it will restrict human activities that may, in fact, be compatible with conservation and sustainable use. A more flexible approach that establishes arrangements that ensure human uses are compatible with biodiversity outcomes could help to give greater meaning to the requirement in Aichi Target 11 that protected areas and OEABCMs are "integrated into the wider landscape and seascape".

The examples used here apply to specific geographically defined spaces, are not generally recognised as marine protected areas and usually require active governance and a dedicated, ongoing management regime to achieve their primary (non-conservation) objective. It is less clear whether PSSAs and submarine cable and pipeline protection zones might offer protection for cultural and spiritual values, although as noted above PSSAs can be established for cultural heritage purposes. What is clear from these three examples is that the legal, regulatory, ecological and social characteristics of each potential area are diverse and trying to define specific characteristics common across all potential OEABCMs may result in potentially useful approaches being excluded from consideration.

While each example is *capable* of conserving biodiversity, they must, of course, *demonstrate* the achievement of *in situ* biodiversity conservation outcomes. On this, they are distinct from MPAs in that the measures in place within an OEABCM are not necessarily directed toward conservation objectives. It may not be appropriate, therefore, to rely on the implementation of the measures in place in the expectation that they will deliver a conservation outcome in an OEABCM. This suggests that, in an OEABCM, more emphasis should be placed on the outcome achieved by the measures employed.

Focusing on outcomes also means that: (1) the white list of relevant criteria for OEABCM can be shorter; (2) it implicitly prioritises monitoring to demonstrate the conservation outcomes; and (3) when linked to objectives it provides a timeframe over which the outcome can be achieved.

It also points to the need for adequate monitoring and evaluation frameworks to be built into the design of OEABCMs to build reliable evidence that they are achieving conservation outcomes. They will also require effective enforcement mechanisms, including by communities, where appropriate, to ensure that activities that are inconsistent with conservation are deterred, or dealt with appropriately when they occur. These requirements apply to all three examples presented in this paper, and any other type of measure that relies on demonstrable outcomes to qualify as an OEABCM that contributes to Target 11. Indeed, there is no reason why MPAs should not do the same.

---

[196] See the discussion of the ecological impacts of the security zone around Cape Canaveral in Florida, United States, in Bohnsack, J.A. (2011). Impacts of Florida coastal protected areas on recreational World records for spotted seatrout, red drum, black drum, and common snook. *Bulletin of Marine Science* 87(4): 939-70. Available at http://docserver.ingentaconnect.com/deliver/connect/umrsmas/00074977/v87n4/s12.pdf?expires=1511328824&id=0000&titleid=10983&checksum=488317B2D17EA2B5E7DD4C0476FBF1EC. Accessed 22 November 17.

[197] See Ashley, M.C., Mangib, S.C., Rodwell, L.D. (2014). The potential of offshore windfarms to act as marine protected areas – A systematic review of current evidence. *Marine Policy* 45: 301-9.

[198] Land-based run-off is identified as one of the greatest threats to Australia's Great Barrier Reef Marine Park but is outside the scope of the *Great Barrier Reef Marine Park Zoning Plan*. See GBRMPA (2014). *Great Barrier Reef Outlook Report 2014*. Great Barrier Reef Marine Park Authority. Available at. Accessed on 27 November 2017. pp342-3

In conclusion, it appears that there are many potential opportunities to operationalise the OEABCM concept by harnessing many area based measures that primarily serve non-conservation objectives but achieve demonstrated conservation outcomes. Individual States can achieve much within their territorial waters, and to some degree in their EEZs, all the better through international cooperation. Critical to their success will be to ensure that conservation outcomes are supported by strong evidence, and to allow greater flexibility to design context-specific measures that address more than one objective rather than rely on prescriptive input requirements.

References

Journal articles, books and reports

Agardy, T., Notabartolo di Sciara, G., Christie, P. (2011). Mind the gap: Addressing shortcomings of MPAs through large scale MSP. *Marine Policy* 35: 226-32.

Ashley, M.C., Mangib, S.C., Rodwell, L.D. (2014). The potential of offshore windfarms to act as marine protected areas – A systematic review of current evidence. *Marine Policy* 45: 301-9.

Aswani, S. (2005). Customary sea tenure in Oceania as a case of rights-based fishery management: Does it work? *Reviews in Fish Biology and Fisheries* 15: 285-30

Aswani, A., Albert, S., and Love, M. (2017). One size does not fit all: Critical insights for effective community-based resource management in Melanesia. *Marine Policy* 81: 381-91

Aswani, S., Christie, P., Muthiga, N.A., Mahon, R., Primavera, J.H., Cramer, L.A., Barbier, E.B., Granek, E.F., Kennedy, C.J., Wolanski, E., and Hacker, S. (2012). The way forward with ecosystem-based management in tropical contexts: Reconciling with existing management systems, *Marine Policy* 36(1): 1-10

Bartlett, C.Y., Pakoa, K., and Manua, C. (2009). Marine reserve phenomenon in the Pacific islands. *Marine Policy* 33(4): 673-8

Beckman, R. and Davenport, T. (2010). *Workshop Report. Workshop on Submarine Cables and Law of the Sea*, 14 – 15 December 2009, Singapore, p44. Available at https://cil.nus.edu.sg/wp-content/uploads/2009/10/Workshop-Report-29-Jan-2010.pdf. Accessed on 30 Nov 2017

Bohnsack, J.A. (2011). Impacts of Florida coastal protected areas on recreational World records for spotted seatrout, red drum, black drum, and common snook. *Bulletin of Marine Science* 87(4): 939-70. Available at http://docserver.ingentaconnect.com/deliver/connect/umrsmas/00074977/v87n4/s12.pdf?expires=1511328824&id=0000&titleid=10983&checksum=488317B2D17EA2B5E7DD4C0476FBF1EC. Accessed 22 November 2017.

Butchart et al (2015). Shortfalls and Solutions for Meeting National and Global Conservation Targets. *Conservation Letters* 8(5): 329-37.

Carter L., Burnett D., Drew S., Marle G., Hagadorn L., Bartlett-McNeil D., and Irvine N. (2009). Submarine Cables and the Oceans – Connecting the World. UNEP-WCMC *Biodiversity Series* No. 31. ICPC/UNEP/UNEP-WCMC.

Cinner, J.E. and Aswani, S. (2007). Integrating customary management into marine conservation, *Biological Conservation* 140(3-4): 201-216

Davenport, T. (2012). Submarine Communications Cables and Law of the Sea: Problems in Law and Practice. *Ocean Development and International Law* 43: 201-42.

Dunn, D.C., Ardron, J., Bax, N., Bernale, P., Cleary, J., Cresswell, I., Donnelly, B., Dunstan, P., Gjerde, K., Johnson, D., Kaschner, K., Lascelles, B., Rice, J., von Nordheim, H., Wood, L., and Halpin, P.N. (2014).

The Convention on Biological Diversity's Ecologically or Biologically Significant Areas: Origins, development, and current status. *Marine Policy* 49: 137-45

ECCC (2017). Canadian submission in response to the CBD Secretariat's request for the "Submission of Information on National Experiences and Lessons Learned in the Development, and Effective and Equitable Management, of Marine Protected Areas and other Effective Area-based Conservation Measures" (CBD Notification 2017-084), Environment and Climate Change Canada, 2 October 2017

Friedman, A. (2017). Submarine Telecommunication Cables and a Biodiversity Agreement in ABNJ: Finding New Routes for Cooperation. *The International Journal of Marine and Coastal Law* 32: 1-37.

Froude, V.A. and Smith, R., 2004. *Area-based Restrictions in the New Zealand Marine Environment*. Department of Conservation MCU Report. Available at http://www.doc.govt.nz/about-us/science-publications/conservation-publications/marine-and-coastal/area-based-restrictions/. Accessed on 28 Nov 2017

GBRMPA (2014). *Great Barrier Reef Outlook Report 2014*. Great Barrier Reef Marine Park Authority. Available at http://elibrary.gbrmpa.gov.au/jspui/handle/11017/2855. Accessed on 27 November 2017.

Gjerde, K. and Freestone, D. (1994). Particularly Sensitive Sea Areas – An Important Environmental Concept at a Turning Point. *International Journal of Marine and Coastal Law* 9(4): 431-68.

Hill, L.S., Johnson, J.A., and Adamowski, J. (2016). Meeting Aichi Target 11: Equity considerations in marine protected areas design, *Ocean & Coastal Management* 134: 112-9

ICPC (2016). *Submarine Cables and BBNJ*. Submission by the International Cable Protection Committee to the Preparatory Committee established by General Assembly resolution 69/292: Development of an internationally binding instrument under the United Nations Convention of the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction. Available at https://www.iscpc.org/publications/. Accessed on 8 January 2018.

Katikiro, R.E., Macusi, E.D., and Ashoka Deepananda, K.H.M. (2015). Challenges facing local communities in Tanzania in realising locally-managed marine areas. *Marine Policy* 51: 220-9

Kaye, S. (2007). International Measures to Protect Oil Platforms, Pipelines and Submarine Cables from Attack. *Tulane Journal of Maritime Law* 31(2): 377-423.

Kaye, S. (2010), "The Protection of Platforms, Pipelines and Submarine Cables Under Australian and New Zealand Law" in Maritime Security: International Law and Policy Perspectives from Australia and New Zealand, eds. Natalie Klein, Joanna Mossop and Donald Rothwell. New York, Routledge. Cited in Davenport (2012)

Laffoley, D., Dudley, N., Jonas, H., MacKinnon, D., MacKinnon, K., Hockings, M., Woodley, S. (2017). An introduction to 'other effective area-based conservation measures' under Aichi Target 11 of the Convention on Biodiversity: Origin, interpretation and emerging ocean issues. *Aquatic Conservation* 27(S1): 130-137.

MacKinnon, D., Lemieux, C.J., Beazley, K., Woodley, S., Helie, R., Perron, J., Elliott, J., Haas, C., Langlois, J., Lazaruk, H., Beechey, T., Gray, P. (2015). Canada and Aichi Biodiversity Target 11: understanding 'other effective area-based conservation measures' in the context of the broader target. *Biodiversity Conservation* 24: 3559-81.

Marine Planning Partnership Initiative (2015). *Haida Gwaii Marine Plan*. Available at http://mappocean.org/wp-content/uploads/2015/09/HGMP-WEB-2015-07-08.pdf. Accessed on 3 January 2017.

National Marine Protected Areas Center (NMPAC) (2008). *State of the Nation's De Facto Marine Protected Areas*. (R. Grober-Dunsmore and L. Wooninck, editors). Silver Spring, Maryland. Available at https://nmsmarineprotectedareas.blob.core.windows.net/marineprotectedareas-

prod/media/archive/helpful_resources/inventoryfiles/defacto_mpa_report_0608.pdf. Accessed on 21 Nov 2017

New Zealand Department of Conservation (2008). *Marine Protected Areas: Classification, protection standard and implementation guidelines*. pp10-1. Available at http://www.doc.govt.nz/about-us/science-publications/conservation-publications/marine-and-coastal/marine-protected-areas/marine-protected-areas-classification-protection-standard-and-implementation-guidelines/. Accessed on 28 November 2017.

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge, UK, Cambridge University Press.

Peet, G. (1994). Particularly Sensitive Sea Areas: A Documentary History. *International Journal of Marine and Coastal Law*.9(4): 469-506.

Roberts, J. (2005). Protecting Sensitive Marine Environments: The Role and Application of Ships Routeing Measures. *International Journal of Marine and Coastal Law* 20(5): 135-59.

Roberts, J., Chircop, A. and Prior, S. (2010). Area-based Management on the High Seas: Possible Application of the IMO's Particularly Sensitive Sea Area Concept. *International Journal of Marine and Coastal Law* 25(4): 483-522.

Rothwell, D. and Stephens, T. (2016). *The International Law of the Sea*. Second edition. Oxford and Portland, Oregon, Hart Publishing.

Scanlon (2017). Addressing pitfalls of exclusive flag state jurisdiction: protection of submarine cables. *Journal of Maritime Law and Commerce* 48(3): 295-340.

Schlager, E. and Ostrom, E. (1992). *Property Rights and Natural Resources: A Conceptual Analysis*. Land Economics 68(3): 249-62

Spadi, F. (2000). Navigation in Marine Protected Areas: National and International Law. *Ocean Development and International Law* 31(3): 285-302, p285.

Steelman, T.A. and Wallace, R.L. (2001): *Property Rights and Wrongs: Why Context Matters in Fisheries Management*. Policy Sciences 34: 357-79.

Stephenson, J., Berkes, F., Turner, N.J., & Dick, J. (2014). Biocultural conservation of marine ecosystems: Examples from New Zealand and Canada. *Indian Journal of Traditional Knowledge* 13(2): 257-65.

Takei, Y. (2012). Law and Policy for International Submarine Cables: An Asia-Pacific Perspective. *Asian Journal of International Law* 2: 205-33, footnote 64, citing Kaye (2010) op cit. pp398.

UNEP-MAP-RAC/SPA (2010). *International legal instruments applied to the conservation of marine biodiversity in the Mediterranean region and actors responsible for their implementation and enforcement*. By Ben Salem, M. Ed. RAC/SPA, Tunis, pp13-4. Available at https://www.cbd.int/doc/meetings/mar/ebsaws-2014-03/other/ebsaws-2014-03-submission-rac-spa-9-en.pdf. Accessed on 11 Dec 2017.

UNEP-WCMC (2013). *WDPA Country Data Status Report: Solomon Islands*. Available at http://pipap.sprep.org/country/SB. Accessed on 22 December 2017.

UNEP-WCMC and IUCN (2016). *Protected Planet Report 2016*. UNEP-WCMC and IUCN: Cambridge UK and Gland, Switzerland.

IUCN WCPA (2017). *Guidelines for Recognising and Reporting Other Effective Area-based Conservation Measures*. IUCN, Switzerland. Version 1. p11. Available at https://www.iucn.org/theme/protected-areas/wcpa/what-we-do/oecms. Accessed on 30 November 2017.

Domestic and International binding and non-binding legal instruments, resolutions and other documents

Convention on Biological Diversity, Adopted on 22 May 1992 at the Nairobi Conference for the Adoption of the Agreed Text of the Convention on Biological Diversity. Opened for signature on 5 June 1992, entered into force on 29 December 1993. Text available at https://www.cbd.int/convention/text. Accessed on 21 December 2017.

CBD 2003. *Marine and Coastal Biodiversity: Review, Further Elaboration and Refinement of the Programme of Work*. Report of the Ad Hoc Technical Expert Group on Marine and Coastal Protected Areas (13 February 2003), UNEP Doc. UNEP/CBD/SBSTTA/8/INF/7. Available at https://www.cbd.int/kb/record/meetingDocument/4748?RecordType=meetingDocument&Event=SBSTTA-08. Accessed on 15 December 2017.

CBD (2010). *Decision Adopted by the Conference of the Parties to the Convention on Biological Diversity at its Tenth Meeting*. Nagoya, Japan, 18-29 October 2010. UNEP/CBD/COP/DEC/X/2. Adopted on 29 October 2010. Available at https://www.cbd.int/decision/cop/?id=12268. Accessed on 8 January 2018.

FAO (1995). *Code of Conduct for Responsible Fisheries*. Adopted on 31 October 1995 at the twenty-eighth session of the FAO Conference by Resolution 4/95. Food and Agriculture Organisation of the United Nations. Rome.

Fisheries Act 2010 (Kiribati). Available at http://www.paclii.org. Accessed on 4 April 2017

Fisheries Management Act 2015 (Solomon Islands). Available at http://www.paclii.org. Accessed on 24 July 2017.

IMO (1995). Resolution A.572(14), *General Provisions on Ships' Routeing* (adopted 20th November 1985), as amended by Resolution A.827(19), adopted 23rd November 1995.

IMO (2002). *Guidelines for the Designation of Special Areas under MARPOL 73/78 and Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas*. A 22/Res.927, Annex I Guidelines for the Designation of Special Areas under MARPOL 73/78, para 2.1. Adopted on 29 November 2001. Available at https://docs.imo.org/Category.aspx?cid=3. Accessed on 18 December 2017.

IMO-NAV (2003). *Routeing of Ships, Ship Reporting and Related Matters: Proposed area to be avoided*. Submitted by New Zealand to the Sub-committee on Safety of Navigation. NAV 49/3, 16 January 2003, para 6.3.1.1. Available at https://docs.imo.org/Category.aspx?cid=3. Accessed 4 January 2018.

IMO MEPC (2005) *Report of the Marine Environment Protection Committee on its Fifty-Third Session*. MEPC 53/24/Add.2 1 August 2005, Annex 23 Designation of the Galapagos Archipelago as a Particularly Sensitive Sea Area. Resolution MEPC.13 5(53), adopted on 22 July 2005. Available at https://docs.imo.org/Category.aspx?cid=3. Accessed 18 December 2017.

IMO (2005). *Revised Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas*. Resolution A.982(24). Adopted on 1 December 2005. para 2.2. Available at https://docs.imo.org/Category.aspx?cid=3. Accessed on 11 December 2017.

IUCN WCPA (2017). *Guidelines for Recognising and Reporting Other Effective Area-based Conservation Measures*. IUCN, Switzerland. Version 1. Available at https://www.iucn.org/theme/protected-areas/wcpa/what-we-do/oecms. Accessed on 30 November 2017.

MARPOL – Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL), as amended by amendments of 1984 and 1985. *Australian Treaty Series* 1988 No 29. Available at http://www.austlii.edu.au/au/other/dfat/treaties/1988/29.html. Accessed on 15 December 2017.

SOLAS – International Convention for the Safety of Life at Sea, Signed in London on 1 November 1974, entered into force 25 May 1980. Australian Treaty Series 1983. No.22. Regulation 8(b). Available at http://www.austlii.edu.au/au/other/dfat/treaties/1983/22.html. Accessed on 4 January 1974

LOSC – United Nations Convention on the Law of the Sea. Agreed 10 December 1982, entered into force 16 November 1994

Rio Declaration on the Environment and Development, United Nations Conference on Environment and Development (UNCED), 14 June 1992, Rio de Janeiro, Brazil. Available at http://www.unep.org/Documents.Multilingual/Default.asp?documentid=78&articleid=1163. Accessed on 22 September 2015.

Submarine Cables and Pipelines Protection Act 1996-22 (New Zealand). Available at http://legislation.govt.nz/act/public/1996/0022/latest/DLM375803.html?src=qs. Accessed on 22 November 2017.

Telecommunications Act 1997 (Australia). Available at http://www.austlii.edu.au/cgi-bin/viewdb/au/legis/cth/consol_act/ta1997214/. Accessed on 22 November 2017

UNCED (1992). *Agenda 21*. United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, Brazil, 3 to 14 June. A/CONF.151/26. Available at https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf. Accessed on 2 August 2016.

UNFSA – Agreement for the Implementation of the Provisions of the United Nations Convention of the Law of the Sea 10 December 1982, Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. *International Legal Materials* 1995; 34: 1542. Opened for signature 4 August 1995. Entered into force on 11 December 2001. New York.

Other online sources

Convention on Biological Diversity, *Ecologically or Biologically Significant Areas*. http://cbd.int/ebsa

Flanders Marine Institute. *Marine Regions*. Available at http://www.marineregions.org/eezmapper.php. Accessed on 4 January 2018.

International Maritime Organisation. http://www.imo.org/en/OurWork/Safety/Navigation/Pages/ShipsRouteing.aspx. Accessed 4 January 2018; http://www.imo.org/en/OurWork/Environment/PSSAs/Pages/Default.aspx; http://pssa.imo.org/galapagos/maps.htm. Accessed 18 December 2017.

IUCN Protected Area Categories: https://www.iucn.org/theme/protected-areas/about/protected-area-categories.

New Zealand Department of Conservation. http://www.doc.govt.nz/nature/habitats/marine/type-2-marine-protected-areas/. Accessed on 28 Nov 2017.

Protected Planet. Poor Knights Marine Reserve: WDPA ID 315471. Available at https://protectedplanet.net/poor-knights-islands-marine-reserve. Accessed on 19 December 2017; https://protectedplanet.net/country/SB. Last accessed on 4 January 2017.

UNEP-WCMC (2017). *Protected Area Country Profile for Solomon Islands from the World Database of Protected Areas, December 2017*. Available at https://protectedplanet.net/country/SB. Accessed on 22 December 2017.

_____

PART III

Other Effective Area-Based Conservation Measures (OEABCMs) Used in Marine Fisheries: A Working Paper

Prepared by Jake Rice, Serge M. Garcia and Michel Kaiser, IUCN-CEM Fisheries Expert Group as a background information document for the
CBD Expert Workshop on Marine Protected Areas and Other Effective Area-based Conservation Measures for Achieving Aichi Biodiversity Target 11 in Marine and Coastal Areas (6 - 9 February 2018 - Montreal, Canada)
As commissioned by the Secretariat of the Convention on Biological Diversity

Table of Contents

Section

1. Introduction – Context of the Workshop

In 2020 the CBD COP will assess progress in the achievement of the 20 Aichi Biodiversity Targets adopted at CBD COP 10 in 2010. Although, operationally, the pursuit of each target must take into account the different ecological, economic and social circumstances of each Party, the intent of the Targets should be interpreted consistently. The language used in each target is an important guide to the intent of COP 10, when the targets were adopted. Target 11 is among the longest – "*By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes*."

In the case of the longer Targets, the complexity of language has two causes: the inherent complexity of the conservation challenges being addressed, and the need for consensus at the COP. In the case of Aichi Target 11, key complexities included first the need to address the different starting conditions for coverage of terrestrial and marine conservation areas. A second complexity is that, whereas on land (in most of the world) the ownership of a tract of land greatly influences how it can be used and conserved, in the ocean and coasts, specific areas are rarely "owned" in the same way, so different types of measures may be needed to achieve the same regulation of uses and conservation of ecosystem features. The phrase "*other effective area-based conservation measures*" allowed both terrestrial areas such as indigenous lands under traditional agroforestry practices, and marine spatial measures other than formal Marine Protected Areas to be included in the target. However, for this phrase to be applied consistently, there needs to be consistent interpretation of which area-based measures (other than MPAs) may be "conservation measures" and how such measures can be considered "effective".

In this Working Paper, we review the different types of area-based measures used in fisheries management, with regard to how "effective" they are at conservation. In this context "effectiveness" at conservation must consider both how much of the biodiversity characteristic of an area is being conserved, and how well protected it is. The intent is to inform a policy discussion of where a measure needs to lie along the continua of "effectiveness" in each in each of these two considerations, a before it is appropriate to include it in reporting on Target 11.

The Target also includes other terms that are important to Target 11 reporting, such as "equitably managed", "ecologically representative", and "well connected". However, these terms are applied both to the collection of protected areas and to areas considered to be "OEABCMs" and are considered to be out of scope for the Expert Workshop and this Working Paper.

Structure of the document

Section 2 clarifies the terminology used in the working.

Section 3 provides a review of area-based fishery management measures (ABFMs), their objectives and intended outcomes of sustainable use and biodiversity conservation, the factors of performance, a typology of ABFMs, and specific examples, with a summary of their track record in delivering their intended outcome and the factors enabling or limiting their effectiveness.

Section 4 reviews published evidence on broader biodiversity conservation effects of the ABFMs listed in Section3, describing the approach used for the review, the empirical and model-based evidence available regarding impacts on non-targeted species, seabed integrity, and ecosystem structure and function, summarizing the potential contributions of the ABFMs reviewed in Section 3.

Section 5 proposes draft criteria for identifying fishery OEABCMs, with short guidelines on the conduct of their evaluation.

Section 6 contains a short synthesis.

2. Terminology

Article 2 of the Convention provides several helpful definitions.

2.1 In-situ conservation

"In-situ conservation *means the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.*" This definition makes clear that for areas to be included in reporting on Target 11, area-based measures have to be developed in an ecosystem context, and they must promote both natural features of the habitat and viable populations of species characteristic of those habitats. This definition does not necessarily require pristine habitats and populations at completely un-impacted states. It does require that the habitats have all "natural" features and are not undergoing degradation, and that the populations of the characteristic species either be viable or if they are depleted, they should be recovering.

The properties of ecosystems and natural habitats that need to be conserved can in turn be taken from the properties included in the Voluntary guidelines on biodiversity-inclusive impact assessment that were endorsed by the 8th meeting of the Conference of the Parties to the CBD in Curitiba, Brazil (20-31 March 2006) (CBD, 2006) and it foundation documents (CBD Decision VI/7-A, the Ramsar Convention on Wetlands Resolution VIII.9) and the Convention on Migratory Species Resolution 7.2) which refer to "biodiversity composition, structure and processes".

2.2 Protected area (PA)

The second important definition in the Convention (Article 2) is that, in a CBD context, "*Protected area' means a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives*". The definition specifies that the two criteria required for an area to be a PA are that the area must be geographically defined and it must have specific conservation objectives. Target 11 specifically refers *to protected areas* but adds *other effective area-based conservation measures*. This reflects the Parties consensual intent of going beyond solely the areas that meet those two PA criteria. Since "area-based" is explicitly included in the language of Target 11, consequently these "other areas" do not necessarily have to have explicit conservation objectives. Rather the conservation intent can be implicit, as long as the measures applied therein are effective at delivering the in-situ conservation outcomes.

2.3 Effective conservation

The term *"Effective"* is not defined in the Convention or in the Target itself, and is a major focus of this Working Paper.

Consistent with the definition of "in situ conservation", "Effectiveness" is viewed as a gradient of how probable a conservation outcome is, and not a binary (succeed or fail) term. Building on the Convention text and previous CBD COP decisions, "effectiveness" could be evaluated as the extent to which the area, with its measures, contributes to the central three objectives of the CBD: (i) *The conservation of biological diversity*, maintaining ecosystems, species and genetic diversity for human present and future well-being; (ii) *The sustainable use of its components*, i.e. *providing livelihoods to people, without jeopardizing future options*); and (3) *The fair and equitable sharing of benefits arising from the use of genetic resources*. In addition, CBD (2006) highlights that priority be given to the protection of: *threatened, declining or endemic ecosystems; ecosystem services; habitats that are unique or play a vital role in supporting seasonal or migrant species; endemic, threatened or declining species; species of known use or cultural value to society; irreplaceable biodiversity which cannot be found anywhere else*. CBD (2006) *also highlights that* priority is also given to *opportunities to enhance biodiversity through restoring, re-creating or rehabilitating natural habitat are used to optimum benefit* and to full compensation *of unavoidable negative impacts on biodiversity (no Net Loss*).

This CBD guidance means that using ecosystem considerations in choosing the area-based measure and tailoring its implementation can have three important positive consequences. Such measures can promote: (i) keeping habitats in the "natural" condition; and (ii) maintaining viable populations of the species characteristic of those habitats, and their recovery when depleted. As a result, area-based measures that are developed in an Ecosystem Approach context may be more "effective" relative to the first CBD objective. In addition, areas successfully managed for sustainable use with spatial measures not compromising the first objective (conservation of biological diversity) could also be part of the other areas effectively managed under the intent of Target 11, if they are developed within an Ecosystem Approach.

Many area-based measures are used in fisheries management, for many purposes. Most can be implemented in a variety of ways, depending on the specific intent of the fisheries policy-makers and managers. Some measures may be implemented in ways intended to resolve an operational issue like conflicts between gear sectors or communities about opportunities to fish. In such cases biodiversity benefits beyond the obvious benefit for the target may receive little consideration. In other cases, area-based measures may be chosen specifically because they offer protection to either a wide range of biodiversity, or key biodiversity features of special concern (e.g. areas dedicated to limit/reduce/eliminate bycatch, or avoid disturbance of a protected species). Many area-based measures are likely to have intermediate consequences – enhancing the conservation potential of some species or ecosystem features, leaving other features unprotected or possibly exposed to even greater pressure through factors such as displaced effort.

In practice, each of these types of situations warrants review. For example, measures to specifically restrict fisheries on forage species in the proximity of seabird breeding colonies may not be effective for seabird conservation unless, overall, the exploitation of the forage species was developed in an appropriately ecosystem-based framework. On the other hand, measures intended only to resolve gear conflicts between competing fisheries may, in fact, result in broad biodiversity benefits, if the individual fisheries then use their respective gears in more responsible manners and comply more fully with limits on catches, effort and bycatch. It is the case-specific context and outcomes –whether planned or emerging as collateral effects– that really reflect the "effectiveness" of each area-based measure in delivering conservation outcomes.

2.4 Area-based fishery management measure

An area-based fisheries management measure (ABFM) is a formally established, spatially-defined fishery management and/or conservation measure, implemented to achieve one or more intended fishery outcomes.

These outcomes are commonly related to sustainable use of the target species of the fishery, such as the protection of vulnerable life-stages or critical habitats or to allocation of space and resources among fishing communities or sub-sectors. However, increasingly the intended outcomes can include protection or reduction of impact on biodiversity components, habitats, or ecosystem structure and function, such as closures of Vulnerable Marine Ecosystem (VMEs) or exclusion of small-mesh fisheries within the foraging range of seabird colonies. Moreover, many of the measures that are intended primarily to deliver outcomes related to the target species also deliver additional biodiversity conservation outcomes relevant to Target 11. These area-based measures have an implicit or explicit time dimension (from permanent, to temporary, seasonal or real time).

Some area-based fisheries measures may be considered as OEABCMs if they fulfill the intent of Target 11 regarding in-situ conservation objectives and the goals of the CBD. However, there is not yet clear guidance on how to identify which area-based fisheries measures are appropriate for Target 11 reporting. Fisheries management agencies are increasingly specifying the objectives of their management plans explicitly (Mardle et al 2004, Hilborn 2007), but the practice is far from universal. Moreover, specific objectives are rarely matched to the individual measures in large management plans. Even when there are objectives for individual measures, these may not cover the outcomes of the measures comprehensively, and specified objectives of long-established measures are not retrospectively augmented to cover all the additional contributions the measure may be making to conservation of biodiversity and sustainable use. Consequently, the objectives alone are an incomplete guide to determine which sites where area-based fisheries management measures are in place could be included in Target 11 reporting. This Working Paper explores the relationship of area-based fisheries management measures to Target 11 reporting in more depth.

2.5 Other Effective Area-Based Conservation Measures (OEABCMs)

As implied by their name, the Other Effective Area-based Conservation Measures (OEABCMs) could be defined as *area-based measures, other than designated protected areas (PAs), used in various economic activities and which outcomes make an effective contribution to broad in-situ conservation of biodiversity composition, structure and function.*

The IUCN (2018) draft guidelines on Other Effective Conservation Measures (OECM) (Part B, Section 2) propose that: OECMs are "*a geographically defined space, not recognised as a protected area, which is governed and managed over the long-term in ways that deliver the effective in-situ conservation of biodiversity, with associated ecosystem services and cultural and spiritual value"*. Consistent with the arguments above, this IUCN definition notes that the difference between MPAs and OECMs is that the latter do not have conservation as primary objective but should deliver [as an outcome] effective in-situ conservation of biodiversity, regardless of their objectives.

From a fishery point of view, it may be important to stress that an OEABCM is a cross sectoral concept. Any proposal to include an area managed by fisheries *with effective contribution to broader conservation* will also be reviewed relative to other pressures either present or likely in the same area. The consequences of those other pressures will also be a consideration in Target 11 reporting.

3. Inventory of fishery closures

The spatial dimension is an essential aspect of fisheries, albeit often only implicit. Fish resources are distributed in space, and knowledge about the marine space, its resources and hazards is vital for fishers' performance and survival. With experience, fishers establish their individual fishing territories and seasonal trajectories between their fishing spots. The fishing mortality (F) they apply to the resource is proportional to the effort (f) deployed per unit area (F=q.f/A) with q as the catchability coefficient. Conventional fishery management measures such as input and output controls and gear regulations apply to specific fisheries and their resources in management units, hence within a space corresponding to the area of distribution of the stock, the fishing ground, or, for large distribution areas, a statistical division. In

modern fisheries management, the regulation of the amount and types of fishing pressures is increasingly space-based even though the precise stock structure (in terms of genetic sub-populations) may not yet be sufficiently identified to be fully effective in terms of maintaining biodiversity.

Contrary to common belief, fisheries are not free to roam the marine space, but rather face numerous constraints stemming from the specific designation of areas more formally allocated to other economic activities such as: extraction of oil, gas, diamonds, sand and gravel; aquaculture; renewable energy production, e.g. tidal power, aeolians and turbines; communication and electric cables; navigation channels; garbage dumping areas (where still practiced); and Navy firing range areas. There is very little fishery literature on the otherwise obvious impact of these non-fishery spatial constraints on fisheries operations and management.

In addition, No-Take-Zones, established as fully protected areas, are often established within fishery territories with nature conservation as prime objective (as for all MPAs) and sometimes with fisheries enhancement as secondary objective. Their positive impact on biodiversity inside the protected area has been well described. Their impact outside the MPAs on resources and fisheries is often difficult to measure and depends heavily on the ambient fishery management. Moreover, some *bona fide* MPAs are multiple-use MPAs (IUCN Category VI) that allow sustainable economic activities within them. The Australian Great Barrier Reef Marine Park is an iconic example. Large national marine parks have similar characteristics. All these areas, which are considered MPAs, are not examined in this document.

In the following sub-sections, we will provide a review of ABFMs, their objectives, performance and typology, summarizing the ways in which they are typically used and their intended outcomes regarding the sustainable use of the fishery target species and the mitigation of impact on the other components of biodiversity such as bycatch species and seabed habitats that might alter ecosystem structure and function. It will also give illustrative examples of fisheries and geographic locations where the types of closures have been used. This section also includes a summary of the general track record of the measures for delivering their intended outcomes, identifying also enabling and limiting factors which, make such measures likely to be either: (i) effective in delivering ecologically and socioeconomically sustainable fisheries; or (ii) ineffective or unnecessarily costly or disruptive of fishery operations.

3.1 Objectives of ABFMs

In order of priority, ABFMs usually aim at (based on Hall, 2009):

a. Optimizing the exploitation of the target species, as a complement to other fishery management measures controlling input and output, and economic incentives. They aim at protecting: (i) specific life stages (eggs, larvae, juveniles, spawners); (ii) depleted stocks or parts of stocks during rebuilding programmes; (iii) genetic reservoirs; (iv) habitats critical to fishery sustainability; and (v) reserves of food, particularly is small island countries communities (food security insurance). ABFMs have also been sometimes used to restrain fleet capacity and optimize catch composition and value, with mixed results.

b. Allocating space and resources, e.g. between small-scale fisheries (SSFs), large scale fisheries (LSFs), foreign fleets, and aquaculture, ensuring equitable distribution of access to space and resources, reducing conflict between socio-economic groups or gears as well as risk of collision between small and large fishing vessels.

c. Broader conservation, e.g. providing additional protection to species that are depleted, threatened, or emblematic, limiting bycatch and protecting vulnerable living habitats that are critical to fishery sustainability and ecosystem services needed for it.

Areas may also be closed to fishing for (i) sea food safety, when there is a risk of localized contamination of seafood; (ii) operational safety of fisheries and other economic activity such as in navigation channels, oil and gas fields, protection of submarine communication cables, tidal energy production installations,

aeolians or turbines. The latter affect fisheries but are not ABFMs and are most often established by non-fishery authorities other Ministries than fisheries.

3.2 Performance factors of ABFMs

ABFMs are used in lieu or as a complement to more conventional fishery management measures such as input/output controls and economic incentives. The possible advantages of ABFMs include: (i) conceptual simplicity: they can be easily understood; (ii) easier implementation in remote multi-gear, multi-species, small-scale fisheries; (iii) effectiveness and efficiency in protecting species of concern from bycatch; (iv) effective protection of benthic habitats from bottom-gear damage; (iv) easier monitoring of fishing impact. However, all ABFMs do not necessarily provide all these advantages all the time and are often adopted based on only a subset of them.

Some disadvantages of ABFMs may be that: (i) only the fishing activity can be controlled; (ii) their economic performance may be lower than that of more conventional measures or economic incentives and voluntary measures (Squires and Garcia, 2015, 2018); (iii) enforcement cost—Controlling entry into, and exit from, a closed area may be complicated and costly if Vessel Monitoring Systems (VMS) or on-board observers are not available.

ABFMs' performance is also affected by contextual factors such as the type of governance (e.g. top-down vs co-managed), the management performance (e.g. in control and surveillance) and the complexity of the jurisdiction (national, shared, straddling, High Sea)

ABFMs' performance may be assessed in relation to their contribution to fisheries' sustainability (their conventional primary objective) as well as to broader conservation. A significant difficulty, however, is in measuring precisely their impact, as they are generally implemented alongside a mix of other methods (such as gear selectivity, effort and catch controls, minimum landing sizes, etc.) and in the context of changes in broader environmental and socio-economic factors which complicates the identification of individual cause-effect relationships. In general terms, ABFMs' performance depends on:

- The overall state of the environment and its intrinsic oscillations, including climate change (that may affect the distribution or survival of the life cycle to be protected;
- The adequacy of its parameters (e.g. size, location, history, state, and general environment);
- Their intended purpose(s) when adopted (i.e. their objectives, whether explicit or implicit), and what fishery issues they are intended to address;
- Fishery governance, particularly community involvement, access rules, additional management measures, inside and outside it, and enforcement; and
- Overall fishing pressure (excess capacity will reduce the efficiency of most measures that do not directly reduce pressure, including those that are area-based).

3.3 Typology of ABFMs

ABFMs have three main dimensions of constraint: (1) Time: areas are closed to fishing permanently (reserves) or temporarily (seasonal, rotational, in real-time); (2) Space: closing the entire EEZ or all or part of a fishing ground within the EEZ; (3) Fishing activities: limitations may apply to all fishing or only to some gears, or some socio-economic categories. Measures affecting dimensions 1, 2 and 3, together with additional technical measures within the areas, can be used to achieve the purposes listed **Section 3.2**. The realm of possible ABFMs is illustrated in a 3-D diagram on **Error! Reference source not found.** and examples are given in **Table 1**.

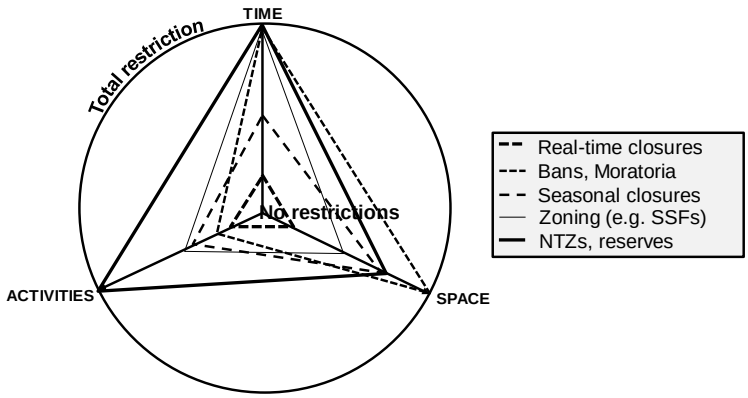

Figure 1: Different types of area-based fishery management measures (ABFM) according to the degree of restriction of time, space and types of activities (Redrawn from Garcia et al., 2013). The three axes range from zero restriction (at the center) to total restriction (on the circle). All these types may be implemented for different purposes (see text)

Table 1. Constraints in space, time and fishing activities in various ABFMs. BPA: Benthic protected area; CCA: Community Conserved Areas; FRA: Fishery Restricted Area; LMMA: Locally Managed Marine Areas; RTIs: Real-Time Incentives; RTSM: Real-Time Spatial Management; TURF: Territorial Use Rights in Fisheries. The characteristics of these and other areas is clarified below.

	DIMENSIONS CONSTRAINED									
	TIME				SPACE CLOSED				ACTIVITIES	
	Permanent	Temporary	Seasonal	Real time	High Sea	EEZ	Fishing ground	Partial	Total closure	Partial closure
Total gear ban										
Zoning										
Reserve, Sanctuary										
TURF										
VME; BPA										
FRA										
Ring fencing										
Moratorium										
MMA										
LMMA; CCA										
Rotational										
Closed season										
RTI, RTSM										
Move-on rule										

The degree of restriction in the three main dimensions leads to a large range of ABFMs when combined with the different potential purposes and contextual parameters related, for example, to the oceanographic characteristics (e.g., depth rage; inshore, coastal, or offshore; neritic or oceanic; benthic or pelagic[199]), jurisdiction (e.g., national jurisdiction, shared with neighboring States, straddling between jurisdictions, or in the High Sea), types of governance, etc.

Because of their multiple dimensions, ABFMs cannot be easily "boxed" into simple homogenous categories. Therefore, in the following sections, we will describe some main types of ABFMs along the "activities" dimension of Figure 1 and Table 1 (total and partial prohibition of fishing), identifying various examples that vary considerably (i) in the degree to which the other dimensions, in time and space, as restrained, and (ii) in their wide range of purposes.

3.4 "Total" closures to fishing

These ABFMs may ban: (i) all fishing activities, year-round and until the measure is revoked, e.g. in a reserve or sanctuary or (ii) to only a specific fishery, e.g. for the duration of a moratorium on a collapsed resource. The ban may apply to: (i) a very large area in the high Seas as in the Fishery Restricted Areas (FRAs) adopted by GFCM; (ii) to the entire EEZ (e.g. for dynamite or poison fishing); or (iii) to smaller areas (e.g. in reserves, Vulnerable Marine Ecosystems (VMEs) and Benthic Protected areas (BPAs). The total ban may also apply only to some problematic gear on specific habitats (e.g. trawls in deep-sea or coastal coral reefs) or to protect well-delimited and stable nursery areas or old spawners' refugia. Some examples are detailed below.

3.4.1 Total closure for food safety or security reasons

"No-Fishing" Areas

"No-fishing" areas can be instituted in a "zoning"[200] process of fishing and other economic activities in an EEZ, for different reasons. All fishing may be prohibited in areas so highly contaminated that eating seafood from them poses significant health risks (e.g. fishing for bivalves in contaminated lagoons and coastal areas or close to sewage effluents). Other closures might be instituted where there are operational security concerns due to other human activities in the same area (such as in major shipping lanes or around offshore windfarms or hydrocarbon facilities). These measures may apply to only some fisheries/gears in an area or to all fishing depending on the nature of the risk. The areas are usually established for the long-term. They might be re-opened to fishing if the risk disappears, e.g. if contamination is eliminated or oil operations ceased.

Fishing Zones

Fishing zones could fit in that group. They are often also established inside an EEZ to allocate the available space, and the resources therein, exclusively to types of fishing or fleets or to socio-economic groups, excluding all others. The purpose is to improve equity, allocate de facto some resources to some target groups, avoid conflict between fisheries using incompatible gears, and reduce the risk of dangerous collisions. For example, SSFs may be given exclusive access to the first 6 miles from the coast, while large scale national fisheries may be given access only beyond 6 miles, and foreign fleets operating under an access agreement authorized only beyond 12 miles. These distances may vary depending on national policy and the shelf width. They may also vary between regions in an EEZ, depending on the geography and habitats. Fishing "zones" of this kind are usually established for the long-term but might be modified, e.g. to account for the evolution of the sub-sectors (e.g. mariculture; foreign fishing). They are important for the orderly development of the sectors but have little direct impact on sustainability or conservation.

[199] Eventually sub-divided in epipelagic or mesopelagic)

[200] The term "zoning" is generically used for the process of designating different "zones" with different characteristics for different purposes (such as core reserves, buffer zones, sustainable fishing zones, protected nursery areas, etc.).

3.4.2 Total closures for fisheries management reasons

Total closures of fishing activities are rarely used in fishery management strategies, for obvious political and economic reasons. Therefore, such measures are usually adopted only when key target species are badly depleted or collapsed and other measures have not succeeded in limiting catches and rebuilding biomass, and hence the total range of the fishery is closed. Depending on circumstances, the area might be closed *sine die* or until the conditions that led to the closure disappear (e.g. in a rebuilding moratorium).
Total closures tend to be temporary. They may be established with a given duration, or with strict criteria for their closing and eventual re-opening (e.g. moratoria and other stock rebuilding closures). They are also primarily used when quotas for a season or fishing year have been exhausted for the target species (or for a quota-protected bycatch species) and the fishery is closed for the entire fleet for the rest of the year. Such closures commonly reopen when the next fishing season or year commences, and quota becomes available for sufficient stocks to support the fishery again.

If compliance is high, such closures can be very effective. However, to have high compliance, it is necessary to either have the tools for full surveillance and enforcement in the area that is closed, or high voluntary cooperation from the industry. Such cooperation requires that the industry have a shared understanding of the need for protecting the stocks from all harvest and that alternative, more selective measures are not available or unlikely to be effective at protected the key stocks. Alternative livelihoods for the fishers denied access to the fishing grounds also can contribute to improved compliance with such total closures. Conversely, poor buy-in by the fishing industry to the need for a total closure, limited capacity of management to enforce a total closure, and lack of alternatives for food or income are all factors that limit the effectiveness of total closures.

3.4.3 Total closures for ecosystem management reasons

Closures of large areas to all fishing can also be implemented by fishing authorities for broader ecosystem reasons, often for protection of some spatial ecosystem feature. These fishery "reserves" are thus often similar, in their intent, to MPAs (which, however, are cross-sectoral) about which there is a much literature. These "ecosystem" closures will be considered in **Section 4.** Their effects on affected fisheries and target species depend on where and how extensive the alternative fishing options are elsewhere, the fate of the fishing pressure excluded from the closed area, and the status of the targets species of those fisheries before the closure.

Vulnerable Marine Ecosystems (VMEs)

Closures of areas because of the risks incurred by Vulnerable Marine Ecosystems (VMEs) are probably the example best known to the broad CBD community, and are cases where both the identification and management frameworks have attracted more attention from the United Nations General Assembly (UNGA) since 2002, are specified most explicitly, and have drawn much media attention in the last decade**.** The UNGA Resolutions have called on States to apply a precautionary approach to management of bottom-contacting gear with significant adverse impacts on VMEs, identifying the vulnerable areas based on transparent criteria (similar to EBSAs criteria) and adopting protection measures (including move-on rules and exclusion of impacting gear). Guidance has been elaborated by FAO, (2008, 2009, Thompson et al., 2016) to qualify the significance of adverse impacts and is available on the FAO and other VME-dedicated websites[201]. Vulnerability has been defined as *the likelihood that a population, community, or habitat will experience substantial alteration from short-term or chronic disturbance, and the likelihood that it would recover and in what time frame (*FAO, 2008, Article 14). The actions expected from States, RFMO/As and fishers in case of encounter with a VME have been specified and a VME database has been

[201] Accessible at: http://www.fao.org/in-action/vulnerable-marine-ecosystems/vme-database/en/vme.html
http://www.fao.org/in-action/vulnerable-marine-ecosystems/en/
http://www.ices.dk/marine-data/data-portals/Pages/vulnerable-marine-ecosystems.aspx
https://www.nafo.int/Fisheries/VME
https://www.ccamlr.org/en/science/vulnerable-marine-ecosystems-vmes

developed (See Annex 1 for more detailed information). Performance assessment of deep-sea fisheries is systematically required (UNGA Resolution 61/105 (§83a); FAO Deep-Sea Fisheries Guidelines (§ 47, 49, 51, 52, and 83); CCAMLR, 2012; Thompson et al., 2016).

Benthic Protected Areas (BPAs)

In 2006, the Southern Indian Ocean Deepwater Fishers Association (SIODFA) members who have been fishing in the Indian Ocean since 1996, announced the voluntary closure to fishing to their own vessels of 11 high-seas Benthic Protected Areas (BPAs) representing 309 000 km2. Two more areas were announced in 2013. These BPAs include deep-sea benthic habitats representative of a wide zone across the Southern Indian Ocean and offer protection from SIODFA fishing vessels for the conservation of globally significant biodiversity such as deepwater corals and sponges as well as sharks, tuna, marine mammals and commercially important deep-sea fish species. The compliance of SIODFA vessels with the measure is deemed very good. The overall impact of this voluntary measure will depend on the behaviour of other fleets operating eventually in the same area in the future and the agreement is only binding on SIODFA vessels and on self-enforcement. A process of formalization and recognition of BPAs at international level has started in the Southern Indian Ocean Fisheries Agreement (SIOFA, http://www.siofa.org).

Ring-Fencing

This term was created apparently in South Africa (Augustyn et al., 2018). In its approach, this type of closure is the opposite of all other closed areas. Instead of closing some areas of the ecosystem to fisheries, it encloses a fishery in a delimited boundary beyond which it will not expand, limiting and containing the impact on biodiversity outside the boundary (within which other conventional ABFMs might also apply). The measure, that could be voluntary or imposed by States, delimits implicitly or explicitly the extent of the areas historically and currently exploited by (certain) fisheries and prohibits further development in all areas beyond that limit. Instead of protecting an area inside the fishing ground, it intends to limit expansion outside it.

Ring Fencing has been voluntarily adopted in South Africa by the hake trawl industry in 2008 (Augustyn et al., 2018). The fishing grounds historically used (since 1970) by the Hake industrial trawl fishery were delimited and the voluntary agreement of the Industry was to operate in the future only within these limits, without any further extension, *de facto* stopping the historical increase of the fishery's impact on the bottom and benthic habitat. The ring-fenced area is integrated with the Vessel Monitoring Systems (VMS) and Compliance is controlled by the South African Deep-Sea Trawling Industry Association (SADSTIA) and is now part of the permit conditions

At intergovernmental level a striking example of "ring-fencing" is given by the General Fisheries Commission of the Mediterranean (GFCM) which, in 2005, prohibited the use of towed dredges and trawls at depths below 1000 meters –i.e. beyond the presently exploited areas– in the entire Mediterranean Sea[202], with the view to protect little known deep-sea sensitive habitats such as VMEs from fisheries expansion (Thompson et al., 2016: 107, 111). In 2016, the whole area was declared a Fishery Restricted Area (FRA) (sea below).

A similar, but unilateral, regulation (EU 2016/2336) adopted in 2016 by the European Parliament and Council after lengthy negotiations with the sector, prohibits trawling for deep-sea stocks, at depths greater than 800 meters[203] to (i) the Union fishing vessels and third-country fishing vessels in Union waters of the North Sea, north-western and south-western European waters as well as Union waters of ICES zone IIa; and (ii) by Union fishing vessels in international waters of CECAF areas 34.1.1, 34.1.2 and 34.2.

[202] http://www.fao.org/gfcm/data/map-fisheries-restricted-areas/en/

[203] Article 8.4 states that *No fishing authorisation shall be issued for the purpose of fishing with bottom trawls at a depth below 800 metres*.

Fishery Restricted Areas (FRAs)

Since 2006, seven Fishery Restricted Areas (FRAs) have been adopted by the GFCM as multi-purpose spatial management tool to protect any kind of marine resource and habitat (e.g. aggregations of vulnerable sponges, seamount areas, coral reef building formations, seagrass meadows, spawning grounds and reproduction sites for fish resources, etc.) from relevant fishing activities, in EEZs or the High Sea, therefore following criteria in accordance to (but broader in scope than) those established for VMEs in the FAO deep-sea fisheries guidelines.

Enabling and limiting factors

Enabling factors for areas closed to fisheries for ecological reasons include: (i) explicit expansion of the mandate of Fisheries Management authorities to apply the Ecosystem Approach and protect marine habitats and ecosystems as part of managing fisheries under their authority (ii) efficient monitoring control and Surveillance (VMS, observers) (iii) sufficient data on spatial ecosystem features to identify areas of higher vulnerability (e.g. acquired through scientific or exploratory surveys; encounter protocols, and *ex-ante* Environmental Impact Assessment[204] and agreed measures to protect biodiversity features that would be considered vulnerable, when they are encountered by a fishery in areas left open (encounter protocols; thresholds and move-on rules, etc.). And, as with all area-based management, the size of the area may be important to its effectiveness.

Limiting factors for the effectiveness of such closures include: (i) adoption of an incomplete set of criteria to identify vulnerable habitats, as this would leave some of them inadvertently open to fishing; (ii) Difficulties inherent to Monitoring, Control and Surveillance (MCS)[205]; (iii) The limited "best evidence" available to assess significant adverse impacts in a VME; (iv) the long recovery-times of some species and habitats when an area meeting the vulnerability criteria is encountered in an area open for fishing.

These actions limit the continued spread of fisheries to new areas of the High Sea and protect biodiversity in those areas by either preventing fishing or placing the burden on the industry to demonstrate its operations are sustainable and do not cause serious adverse impacts on key ecosystem features. The increased emphasis on the need to minimize risk has also led to the development of fishing gear modifications, and the development of fishing technology to increase selectivity for targeted catch as well as adaptive fishing practices (e.g. aimed trawling), which increases both protection of biodiversity in areas let open to fishing and the sustainability of those fisheries.

Consequently, these area-based approaches simultaneously require fisheries management jurisdictions to be proactive in identifying areas that require enhanced conservation measures for a wide range of ecological reasons, while allowing fisheries that can demonstrate their sustainability on an ecosystem scale to continue to operate. They also provide incentives for fisheries to adopt gears and fishing measures that reduce impacts on habitats and non-target species, reducing the area closed to protect biodiversity considered to be vulnerable to fishing activities, and improving the overall fishery performance. To varying degrees, these ABFMs initially developed in the High Sea have been taken up by many States within their national jurisdictions (See **Section 4)**

3.5 Partial closures to fishing

In this group of ABFMs, some areas, with specific vulnerable characteristics are closed to specific fishing gear while fishing may continue with other less or non-impacting gears. Gear-specific closures are a common fisheries management tool (**Table 1**). They are commonly invoked to protect some ecosystem feature such as a vulnerable stage of the life-cycle of a species (e.g. a nursery, or spawning concentrations), or vulnerable (living) habitats like corals or seagrass beds which are particularly vulnerable to some specific gears and are critical for stocks productivity.

[204] *Ex ante* EIAs would be proactive and reduce or eliminate the risk of damaging habitats, inherent in the encounter and move-on protocols.

[205] Weak enforcement and low compliance with protection measures would disqualify the area for reporting under Target 11

Moving along the time dimension, partial closures of fishing activities could be rotational (usually multi-year), seasonal (annual), or real-time.

3.5.1 Rotational closures

Rotational closures are also "Partial" closures as only part of the fishing territory (or ground) is closed at any time. They involve temporary inter-annual and usually recurrent closures and re-opening of areas to specific fisheries or gears. In the long-term, all areas are fished on some pre-established multi-year schedule. They are often used, for example in some fisheries for sedentary benthic species such as bivalves or precious corals, when efficient harvesting can take most of the stock in a local area (and the local depletion rate cannot be really controlled), and renewal of the stock takes several years. Such fishing often has large impacts on the seabed as well, such as with Northeast Pacific geoduck, where the individual geoducks are dug out of sand as much as a meter below the seafloor. The length of the closed and open periods and the relative size of the open and closed areas depend on the re-growth capacity of the stock, and the depletion capacity of the fleet. As a compromise to allow efficient harvesting and localize habitat impacts, only a small fraction of the total range of the stock is open for fishing in a single year, with the expectation that the small open area will be nearly fully depleted, but with ample opportunity for subsequent recruitment from the large closed area.

In terms or enabling and limiting factors, substantial information on the life history and spatial distribution of the target species is needed to balance the depletion and rebuilding processes in the rotation design. Enforcement is also highly dependent on the nature of the stock and on the market because the incentive to poach in closed areas increases as the stock biomass and market value rebuild. Maintaining full closures in much of the range of stock is difficult if fishing gears and activities are easy to disguise, and with some area open for fishing each year there is a need for strong chain-of-custody of product from location of harvest to market to allow the full potential sustainable harvest to be taken.

3.5.2 Seasonal gear-specific closure

Seasonal closed areas are common in fisheries management. They are partial in that fishing is restricted only part of the year and often in part of the fishing area. These ABFMs close areas to a specific fishery or fishing gear for a period of time. The area and the time are usually the same every year, based on average time-space distribution of the element to be protected from targeted fishing or bycatch (e.g. juveniles or spawners of the target species; concentration of protected species). With short-lived animals, however, as in tropical penaeid shrimp fisheries, the closures might cover the entire EEZ (becoming a "closed season" more than a "closed area") and the exact dates might be fixed every year, based on pre-recruitment surveys. They may be established to either prevent fishing on a target stock during a specific period of its annual life history cycle or prevent fishing during a period when a dependent or associated species vulnerable to disturbance by the fishery (through bycatch, trophodynamic dependence, other types of disturbance) is especially exposed to fishing pressure. The latter cases will be addressed in **Section 4**. When seasonal closures are used to manage fishing pressure on the target species, they may apply to the total stock range, so no directed fishing (and sometimes indirect fishing as bycatch) can occur or may apply to a specific part of the species range where the life-history actions are centred (e.g. concentration of spawners or juveniles). In either case, the full range of the stock would be open to fishing at other seasons of the year, although the actual overall spatial distribution of the fishing effort would depend on the seasonal pattern of distribution of the stock. In general, seasonal closures based on life history vulnerability apply to one or a few related stocks or species, while fisheries for other species is allowed to continue in the same area, if the likelihood of incidental catches of the stocks protected by the closures is acceptably low. When seasonal closures are established for economic reasons (e.g., on periods of exceptional abundance or catchability to avoid gluts and decreased prices) or for social reasons (e.g., to reduce conflicts), the number of species or stocks included in the closures will depend on the features of the markets and the social characteristics of the fishing communities.

Seasonal closures can be very effective for the target species, in redirecting fishing effort to seasons when the stock (or some component of it) is less vulnerable to exploitation. However, there are several different aspects of "vulnerability" that may be the rationale for seasonal closures, e.g.: (i) to minimize disturbance of a species during spawning, especially of the eggs themselves are vulnerable to harm by the fishing gear; (ii) because the quality of the fish is low during or just after spawning; (iii) or sometimes, to spread fishing opportunities, for example when the stock (or the recruiting cohort) is exceptionally densely aggregated during the spawning (or recruitment) period, to avoid landing glut and market disruptions (or recruitment overfishing).

Key enabling factors are: (i) a clearly defined seasonal life history of the target species, so that the periods when life stages are most vulnerable to fishing pressure are concentrated in specific and predictable places; (ii) concentrated and less costly enforcement as closures are necessarily localized in space and time. If the fishery is able to take the full quota in seasons and places not closed, the impact on it (and on fishing mortality) is not serious. Although fishing may be prohibited at a time when catch rates are particularly high, fishing costs of seasonal closures can be particularly low if fishing in other seasons is economically viable. If fishing really does disrupt spawning (e.g. through disturbance of mating concentrations, or damage to eggs or spawning grounds) the seasonal closures can pay off significantly with subsequently improved recruitment.

Limiting factors, if the vulnerability of the stock to fishery impacts has little seasonal variation, the seasonal closures are unlikely to convey substantial conservation benefits for the stock, although seasonal closures might still have good justifications if the markets showed strong seasonality or if safety at sea varied seasonally. In addition, if the core problem with a fishery is overcapacity, seasonal closures are likely to simply shift the problems of overfishing or market inefficiencies of "glut and drought" to the period following the seasonal closure.

3.5.3 Real-Time Closures (RTCs)

RTCs are area-based measures that have been recently advocated in Dynamic Fishery Management (DFM). This term refers to a type of fishery management that *changes in space and time in response to the shifting nature of the ocean and its users based on the integration of new biological, oceanographic, social and/or economic data in near real-time* (Maxwell et al., 2015). DFM is in contrast with the conventional spatiotemporal management characterized by the use of historical data with low spatial resolution, slow acquisition of new data, delayed analyses and weakly responsive management decisions, usually associated with the use of static closed areas/seasons. DFM uses current, near real-time data, operates at much higher spatial resolution, undertakes near real-time assessments (often by third Parties) and allows high responsiveness to change, ensuring better and faster matching of fishing operations with the current state of Nature (the stock and the environment). This approach suits better for highly mobile resources with important and hardly predictable inter-annual variations in the timing and location of the elements to be protected.

Fishers are essential participants, in data collection, assessment and implementation, incentivized by systems of payments/credits and reduction of risk, to more fully use their knowledge and innovation capacity to optimize their operations (e.g. reducing opportunity costs and risk of premature closure of target fisheries because of bycatch) and reduce collateral impact on biodiversity (reducing bycatch or habitat degradation, the cost of which is internalized in the process).

The consequence is a dynamic area-based management system, resulting in mobile, continuously adapting closed/open areas, with interesting area-based outcomes for fisheries and conservation, without the need for, or as complement to, regulatory closed areas. As such, RTCs might not be among the expected "good candidates" to be considered under Target 11 Reporting (because of the difficulty in measuring conservation areas), particularly for 2020. However, the potential conservation benefits of this type of system are large, even if they do not exactly fit within an area-based framework as typically envisioned.

DFM has focused on three types of RTCs: grid-based closures, move-on rules and oceanographic closures (Dunn et al., 2016):

- Grid-based closures involve the overlaying of a grid on an area of interest and closing fishing in individual grid cells where bycatch has exceeded a threshold level. They have been implemented on a daily or weekly basis with cell sizes as small as ~50 km2.
- Move-on rules are also triggered by a threshold, but rather than moving out of a grid cell, fishermen must move a set distance away from the point of significant encounter of a species or habitat of concern. The result is a sort of real-time closure. Move-on rules have been widely implemented with real-time closures lasting days to weeks over distances as short as 2–10 km in radius (12-300 km2), with the potential to be implemented on temporal scales of days or hours if higher-resolution catch data are incorporated. In addition, as in the case of VMEs, move-on rules may trigger the establishment of long-term static VME closures.
- Oceanographic closures are mobile closed fishing areas defined by combining information on habitats requirements and conditions environmental conditions (e.g., sea surface temperature) to predict moving areas of concentration of biodiversity elements of concern (life stages or protected species) that fishers can voluntarily avoid catching. They have been implemented on a daily and biweekly basis. Such approach has been used in the Eastern Australia pelagic longline tuna fishery to reduce bycatch of southern bluefin tuna (*Thunnus maccoyii*) with closed areas based on temperature-at-depth data.

Examples of Real-Time Closures (RTCs) have been proposed, or de facto result from different schemes such as Real-Time Incentives (RTIs, Kraak et al., 2012) or real-time spatial management (Hobday et al., 2014; Dunn et al., 2016), differing in the degree to which the systems are "real-time" and the extent to which fishers are involved in designing and operating the management tools (Little et al., 2015). The response of the fishers to the information they generate and exchange on the biodiversity elements to protect (i.e. the movement away from problematic areas) may be based on space-based bycatch cap triggers activated by the central management system or on economic incentives (e.g. bycatch credits in RTIs).

Real-Time Spatial Management (RTSM)

This short section is a compilation of information elaborated in (Hobday et al., 2014; Lewison et al., 2015; Maxwell et al., 2015; Little et al., 2015; Dunn et al., 2016; Eliasen and Bichel 2016; Squires and Garcia, Forthcoming). RTSM proponents argue that permanent/static fishing closures are often poorly implemented, unresponsive to short-term stock dynamics, have significant opportunity costs in foregone catches and profits, and do not allow fine-tuning of management and fishers' behavior on the smaller time and space scales at which they would best achieve management and conservation objectives at least cost. However, RTSM has also a risk of free-riding on the voluntary management costs and may be more applicable in small homogenous and cohesive groups of operators (to reduce transaction costs) and in "high tech" fishery systems (to get and process the high-density data).

RTSM has been described mainly in the USA and Europe but also in Australia in a dozen of large-scale modern fisheries (Squires and Garcia, forthcoming). The distribution of fishing effort and catches in space and time is obtained influencing fishers' behaviour through economic incentives, increasing their collaboration, information sharing and innovation. High-density spatial information on resources and vessels, vessels monitoring systems (VMS) and/or on-board observers, and complex fishery models are needed for the fishers to optimize the distribution of their effort in space and time, reducing bycatch, and for overall performance assessment of the scheme. Third Party companies may be involved in collecting rapidly, processing, and re-distributing the information which allows fishers to adjust their fishing to avoid

bycatch species. In incentive-based management systems, fishers' fishing opportunities are then adjusted up or down depending on their performance in avoiding bycatch.

In the USA, RTFM, operating at high resolution, closing much smaller areas for much less time, has shown to be three times more efficient than large static closed area, at lower cost to the sector. It also reduced better the risk to reach the bycatch quota, prematurely closing the target fishery (Dunn et al., 2016).

Move-on Rules for fishing (real-time exclusion)

Move-on rules are mobile spatial tools that have limited roles as fisheries management tools for managing exploitation of the target species, but more extensive roles in managing ecosystem effects of fishing, as will be explained in **Section 4**. In general move-on rules require set by set (individual tows, deployments of a long-line, etc.) monitoring of a fishery, with a specific trigger for action specified in advance. If the monitoring finds the catch of a specific set exceeds the trigger, the fishing in that immediate area must stop and the vessel must move a specified distance before trying another fishing event. This process continues until the monitoring shows that the trigger is no longer exceeded and normal fishing operations can be resumed. The area is immediately signaled to the management authority and fishing is excluded in the area for all vessels. The exclusion may be temporary, e.g. when the trigger is about temporary coastal concentrations of juveniles or of a vulnerable bycatch species. It can be permanent, e.g. when the trigger refers to a permanent ecosystem element such as a coral or sponge reef (as for VMEs).

In target species fishery management, a common trigger for a move-on rule is the high proportion or number of undersized / immature fish of the target species present in the catch, or the high abundance of vulnerable protected bycatch species moving across a wide foraging range (Holmes, et al., 2011; Needle and Catarino, 2011; Dunn, et al., 2014). Such strategies are considered a more effective option than conventional fishery management measures when the feature of the target species used as the trigger is aggregated in space, but the location of such aggregations is hard to predict, either because of limited knowledge of its spatial distribution, and/or because the feature itself is mobile, as in the examples provided above (see also Dunn et al., 2011). Although those are a specialized set of conditions, they occur commonly enough that move-on rules are encountered in many jurisdictions (**Table 1**). Move-on rules can be a favoured management measure for both the industry and managers, if properly implemented, because they can allow substantial fishing to occur while maintaining a low fishery impact on some vulnerable property of the target or protected species. To be effective, they do require set-by-set monitoring on all vessels, and that fisheries management jurisdictions be organized so that information can be shared in real time among the full fishing fleet and the fleet can respond in near real-time to management directives.

The move-on rules, *de facto* require one impacting fishing operation (to detect the problem) and hence one occurrence of the undesirable fishery impact before the move-on action is triggered, which makes them suboptimal as a tool for avoiding extremely high-risk events. This short-coming can be mitigated by making the move-on trigger event (proportion of juveniles, or amount of bycatch species) set at a level well below that at which serious harm occurs, or requiring that the first tow with a mobile gear in a new area to be very short, e.g. to see if any corals or other vulnerable benthos are present in the small catch. Such highly precautionary triggers increase the possibility that fishing opportunities will be restricted, and costs of operations increased by frequent enforced moves while providing little incremental benefit to the resource. Their effectiveness for broader ecosystem properties is highly variable, but sometimes excellent, and will be discussed in **Section 4**.

In vulnerable habitats protection, move-on rules may also be the first step in designing more long-term closures like Vulnerable Marine Ecosystems (VMEs).

Real-time incentives (RTIs)

With these economic instruments, fishers are not formally excluded from operating in specific areas, but they pay for access to the areas they aim at, proportionally to the risk they create for the target or non-target resources. The payment is made with “impact credits” allocated to them which they can spend as

they wish, selecting the areas in which they want to fish balancing costs (in credits) and benefits. Fishing opportunities for the vessel are terminated when its credits are exhausted. The conventional problem of top-down control of capped catches is transformed into a problem of self-optimization by each vessel operator, of the bycatch credits allocated him (Kraak et al., 2012).

The expected result is that a complex grid of small areas, precisely located (but not a priori closed and needing enforcement) remain lowly fished or unfished, offering protection to vulnerable ecological elements, without need for costly top-down prohibitions. To our knowledge, this system has only been tested in simulations and not yet in reality. It is mentioned here only for completeness of the inventory of ABMs in fisheries and because of its possible application in market-based fishery management frameworks in the future.

Therefore, no empirical experience is yet available for its overall performance and costs. The spatial measure can only be used in cases where the management authority has a great deal of information about the spatial distribution of the properties of interest for conservation, and there the science-management-industry capacities and communications are well developed. The basic logic is that on a fine-scale grid of the full fishing area, probabilities of being able to fish without significant negative impacts on the target species (or ecosystem features) can be estimated for each grid cell. Based on these probabilities, fishing fees (tariffs) are assigned to each grid cell, for the target species and for the species of concern, with lowest fees for fishing in the areas where probabilities of negative impacts are lowest. The expectation then is that the economic aspects of fishing would provide incentives for the industry both to concentrate its fishing activities in areas where catches can be optimized to the lower environmental cost possible. The system would also incentivize fishers to innovate to reduce the gear impact in order to reduce the access cost to rich but problematic areas and to develop methods of fishing which minimized the likelihood of the consequences (such as bycatch of a prohibited species) on which the access price was based. In addition, where fisheries did choose to fish in higher risk grid cells because of the higher expected catches, the revenues from access payments could be used to fund additional conservation measures. With enough information, the system may be quite dynamic, adjusting the fishing pattern to eventual changes in abundance and risks due to climatic oscillations and change.

Success of this spatial measure would depend on the quality of information available for setting up the cost grid, and require a fishery with catch value high enough that individual fishers would be able to pay for the right to fish in any places. Hence it is likely to be used primarily in larger-scale commercial fisheries for high value species, in jurisdictions with high capacities in science and management. But for these fisheries, the spatial approach offers a potentially powerful way for economic concerns to be harnessed for conservation purposes. Potential opportunities to assess fishing costs on the basis of ecosystem properties other than parameters of the target stock will be discussed in **Section 4**.

3.5.4 Community-based fishing closures

Community-based closures are “partial” closures in that only part of the fishable territory is closed, and not always to all fishing activities and, usually not permanently. Community-based ABFMs are usually established in the long-term but may be opened and closed either regularly or in exceptional conditions. The term “community” is taken here in a broad sense including traditional communities, but also municipalities or other competent associative institutions (e.g. cooperatives, unions)

As fisheries management becomes decentralized in many jurisdictions, cases are occurring where traditional fishing areas are formally recognized or newly allocated to individual fishery “communities” who then have substantial flexibility to manage them, within the overarching regulatory framework of the government. Hence, the effectiveness at conserving the fishery target species, biodiversity and habitats within these areas depends on the measures the community chooses to apply and the type of governance. .

Non-centralized governance may be: (i) Delegated, i.e. transferred to peripheral institutions of the central administrations such as in national territories or regions; (ii) Decentralised, i.e. transferred to local communities; (iii) Sectoral, i.e. transferred to cooperatives or other associations; or (iv) Autochthonous, i.e. community-based, self-managed, usually by concession of the State (Garcia et al., 2013). Terminology varies between countries, between Federal States within countries, and even between the Ministries of fisheries and of environment, and hybrid governance solutions exist complicating classification and comparisons.

The underlying rationale for decentralization or devolution of management responsibilities is the expectation that the behaviours of fishers will be managed more effectively by community-scale social dynamics than by top-down regulation imposed by a governmental agency. It is also expected that the clear and equitable attribution or recognition of rights of access and management will increase the long-term perspective of the community and its stewardship and compliance, decreasing enforcement costs. For these expectations to be met, however, the social structure and processes in the "communities", needed for common decision-making, self-enforcement, etc., should be fully functional.

Some examples of community-based ABFMs, used usually for both fishery management and broader biodiversity conservation are described below.

Marine Managed Areas (MMAs) and Locally-Managed Marine Areas (LMMAs)

MMAs and LMMAs are abundantly referred to in the Pacific Ocean. While differing in their governance approach, they are both managed for a set of objectives covering sustainable use and conservation of marine resources (Govan et al., 2009).

Marine Managed Areas have been defined in various ways. In general, they aim at protection or management of marine resources (FGDC, undated). Other definitions may come closer to the definition of MPAs but differ significantly from it in that they MMAs may not be permanent but "*must provide the same protection, for any duration within a year, at the same location on the same dates each year, for at least two consecutive years*, even though they are expected to have continuity and the potential of permanence[206]. In that sense, they are close to ABFMs. In the Pacific Ocean they are typically considered as *areas of marine, estuarine, and adjacent terrestrial areas designated using federal, state, territorial, tribal, or local laws or regulations intended to protect, conserve, or otherwise manage a variety of resources and uses*. This indicates clearly that their governance may be centralized as well as partially or totally decentralized.

LMMAs[207] are defined as *areas of nearshore waters and coastal resources that are largely or wholly managed at a local level by the coastal communities, land-owning groups, partner organizations, and/or collaborative government representative who reside or are based in the immediate area* (Govan et al., 2008). Their objective, in addition to transferring management competence to local authorities, is to rebuild and maintain resources through strong community-based adaptive management, combining fishery management and biodiversity conservation.

MMAs have tended to be managed from the capital and through the local mediation of ENGOs. LMMAs, in reaction, have been more squarely managed locally and in cooperation between communities and local administrations (co-management) (Govan et al., 2008). The main driver for their creation, in most cases, is a community desire to maintain or improve livelihoods in front of perceived threats (including from NTZs) to local food security or economic revenue, in a traditional institutional context in which

[206] From: Marine Managed Area. marineprotectedareas.noaa.gov. *Marine Protected Areas Glossary*. NOAA National Marine Protected Areas Center. http://www.expertglossary.com/definition/marine-managed-area (accessed: January 28, 2018).
[207] LMMAs have local names (e.g.: ra'hui; tabu area; kapu zone; sasizen, bau zone, tambu zone) and may also be referred to as traditional reserves, community-protected areas, traditional or community-based MPAs, cultural marine conservation districts, no-take areas, multiple use MPAs, customary areas, marine sanctuaries; village-managed reserves etc. (Parks and Salaski, 2001).

conservation and sustainable use are often seen as inseparable as part of the surviving concepts of traditional environmental stewardship (Govan et al., 2008; 2009).

Marine areas for responsible fishing (MARF)

Marine Areas for Responsible Fishing (MARFs) have been established in Costa Rica. They are "*Areas with important biological and sociocultural characteristics, delimited by geographical coordinates and any other mechanisms identifying their limits, within which fisheries are regulated to ensure particularly the use of fishery resources in the long term, and for the conservation, use and management of which the Costa-Rica Institute of Fisheries and Agriculture (INCOPESCA) can count on the support of coastal communities and/or other institutions"*[208]. In the decree establishing them, "responsible fishing", and hence the MARF objective is defined *as the use of fishery resources in harmony with the environment; The use of fishing and aquaculture practices that are not noxious for the ecosystems, the resources, and their quality*.

Fishery management (and specific zoning of the areas) is undertaken with the local communities and is materialized in a management plan approved by INCOPESCA, complete with objectives, measures, enforcement, monitoring and evaluation. Enforcement is jointly undertaken by the communities and coast guards. There is an Oversight Commission. Tourism is not impeded unless specified in the Plan.

Refugia

A refugia is generally defined in dictionaries as "*An area inhabited by one or more relict species"*[209] *or "*An *area where conditions have enabled a species or a community of species to survive after extinction in surrounding areas*[210]. In conservation, the term "refugia" has been widely used to indicate temporal and/or spatial protection from disturbances such as predation, competition, or climatic events, but also areas legally or otherwise protected from anthropogenic disturbances (e.g. reserves, no-take areas) (Keppel et al., 2012). In fisheries, they have been defined in the South China Sea as "*spatially and geographically defined, marine or coastal areas in which specific management measures are applied to sustain important species [fisheries resources] during critical stages of their life cycle, for their sustainable use*" (Paterson et al., 2013). Broader conservation objectives are not explicitly mentioned. In Mexico "*zonas de refugio*" have been defined as *delimited areas established in waters under federal jurisdiction, with the primary objective to conserve and contribute, naturally or artificially, to the development of fisheries resources, their reproduction, growth or recruitment, and to preserve and protect the surrounding environment*[211]. Conservation objectives are explicitly included.

Considered as potentially useful in intensive small-scale fishery management systems in which typical effort and catch controls were not easy to implement, they have been re-promoted in the South China Sea (Pernetta et al., 2007; Paterson et al., 2013) as a management instrument, and a regional system integrating fisheries management and biodiversity conservation implemented by or in cooperation with empowered coastal and fishing communities.

AS described in southeast Asia, e.g. in Paterson et al. (2013) they: (i) are not NTZs; (ii) aim at sustainable use; (iii) protect areas of critical importance to the life cycle of a species or group of species, including spawning and nursery grounds, or areas of habitat required for the maintenance of brood stock; (iv) have different characteristics according to their purposes and target species or species groups, and various management measures may apply within them including access rules and vessels and gear exclusions or regulation. While apparently initially promoted and developed centrally with participation of relevant

---

[208] Translated from Decree N° 35502-MAG of 2008, from the President of the Republic and the Minister of Agriculture and Cattle-raising of Costa Rica.
[209] American Heritage® Dictionary of the English Language, Fifth Edition. Copyright © 2016
[210] Random House Kernerman Webster's College Dictionary, © 2010
[211] http://www.dof.gob.mx/nota_detalle.php?codigo=5442227&fecha=23/06/2016&print=true
http://www.dof.gob.mx/nota_detalle_popup.php?codigo=5313972
http://dof.gob.mx/nota_detalle.php?codigo=5280841&fecha=30/11/2012

stakeholders and strong collaboration of NGOs, steps were considered for delegating their management to local authorities under co-management arrangements.

Territorial Use Rights in Fisheries (TURFs)

This section is built on Christy (1982) seminal analysis of TURFs. There is no generally agreed definition for TURFs. A TURF intends to remove the condition of common property of the resources in a territory, allocating use and management rights explicitly to its owner, which can be an individual, a private enterprise (Costello and Kaffine, 2017), a cooperative, association or community. While the definition could apply to an EEZ, we will consider here only TURFS owned by communities. A TURF may relate to the surface, the bottom, or to the entire water column within an area. Its size depends on local conditions and its performance depends on its size relative to the distribution area of the resources to be managed. A TURF may enclose only part of the resource implying that its performance depends on management in neighbouring TURFs or open access areas. The rights allocated to the TURF owner include the rights to use and manage (including a right of exclusion) but may be differently defined in different countries and depending on the resource(s) concerned. The length of tenure may vary but should at least be sufficient to allow the owner to capture a satisfactory return on any capital investments he has made. In the case of a community-owned TURF, the tenure may be in perpetuity and this has clear advantages in terms of habitats management.

Generally, a TURF may be effective if: (i) it covers a relatively small and clearly distinguishable territory; (ii) provides rights of exclusion and determination of kind and amount of use and rights to extract benefits; (iii) is relatively specific in its ownership; (iv) is not much affected by other uses outside the TURF; and (vi) resources are resident (with little movement out of the TURF).The effectiveness of a TURF in generating broad biodiversity conservation outcomes Intended or not) would depend on its objectives, measures, management effectiveness.

Advantages of a TURF include: (i) locally determined objectives; (ii) a more economically efficient use of the resources; (iii) welfare opportunities for small-scale fishing communities; (iv) increased management capacity; (v) development of stewardship (including in relation to broader ecological considerations) and community empowerment; (vi) buy-in and self-enforcement.

The main issue may be the initial allocation of coastal resources among potential TURF's holders, the definition of the resources includes in the TURF, the size of the TURFs (equity issue), and the agreement on national management and conservation overarching norms.

TURFS are used abundantly in Chile since 1991 (Gonzalez et al., 2006; Gelcich and Donlan, 2015). Locally called "Áreas de Manejo y Explotación de Recursos bentónicos" (AMERBs) or Management and Exploitation Areas for Benthic Resources (MEABR, in English) they were established primarily as a response to increasing conflicts between mobile harvesters roaming in the coastal area, exploiting resources traditionally supporting resident communities. Presently, TURFs are being developed combining harvest and management rights and NTZs (reserves) within TURFs, with the full involvement of the communities concerned, to enhance the broad biodiversity benefits of the TURFs in addition to fishery ones (Aflerbach et al.; 2014; Gelcich and Donlan, 2015).

Fishery community-based MPAs

These "Fishery MPAs" are very widespread in Japan. Voluntary, autonomous and self-managed, they are small areas managed by local fishing communities for both nature protection and fisheries sustainability. These are defined as a "*clearly identified marine area, which is managed through law or other effective means while giving consideration to the utilization form, with the aim of conserving the biodiversity that supports the healthy structure and function of marine ecosystems and/or ensuring sustainable use of ecosystem services*". The definition explicitly inspired from the IUCN MPA definition, indicates its clear conservation purpose but also sustainable use ones, in line with most community-based closed areas. Over 1100 community-based MPAs exist in Japan and 30% of them have been self-imposed by fishing

cooperatives within a State-guaranteed tenure system. They are autonomously managed by them, using conventional fishery management measures, no-take-zones, stock enhancement, and habitat restoration (e.g. for eel-grass or corals). Self-enforced management and restoration costs are paid by fishing communities. The effectiveness is not always known and future evaluation standard for conservation activities are expected to cover institutions, monitoring, participation mechanism, and outcome on both stock rebuilding and ecosystems rehabilitation (Yagi, 2010). These ABMs provide flexibility in protecting migratory species and, for example, in the sand eel fishery in Ise bay, the area protected area coverage changes weekly to allow timely escapement of moving fish stocks (Matsuda et al, 2010).

Conclusions on community-based fishing closures

Generalizations are always dangerous. Nonetheless, in most cases, in establishing community-based closures, the local communities wanted more ownership of the local resources on which they depended, and greater flexibility in regulating how the resources would be use. In these areas, they set implicit or explicit objectives for providing livelihoods and restoring and securing food sources as a major priority. Conservation purposes are expressed in some cases, but the degree to which these constitute prime or sufficient community motivation or reflect priorities of international NGOs and donors it is rarely clear, particularly for externally-driven initiatives such as MMAs (Govan, 2009: 48).

Key implicit or explicit objectives of communities in MMAs may include: (i) prevention of access from neighboring village; (ii) restriction of access to immigrants; (iii) protecting the source of income for custom owners; and (iv) establish property rights to reef/land areas. However, surveys indicate that in many areas, beyond the focus on livelihoods, community members assign a relatively high value to preserving the ecosystem for use by future generations, independent of their own use of the ecosystem (bequest value), reflecting a community sense of "duty of care" and conservation ethic (Govan, 2009: 49; See also Jupiter et al, 2014; Cohen et al., 2014).

The management measures applied to deliver these objectives on local scales include permanent, seasonal or temporary (rotational) spatial closures that can be total or gear-specific, and refugia (*sensu-stricto* MPAs) as well as conventional fishery management instruments such as effort and size limits, landing controls, and ecological measures including habitat rehabilitation, predator control, and restocking. Access and enforcement are socially-controlled (Govan, 2009).

The outcomes of such community-based management initiatives is easier to evaluate if the harvested resource is relatively sedentary, because more sedentary local populations will reflect the consequences of locally applied management measures more than more migratory species or stock will. More mobile populations are likely to be exposed to the harvesting activities of multiple communities, each functioning in its own space. Without some mechanisms to coordinate the activities of all the community spatial allocations impacting single target stocks or other ecosystem properties, the sustainability of the aggregate outcomes is not assured for the stocks or whole ecosystem features, even if each community individually is acting sustainably within their spatial allocation. Consequently, the effectiveness of this set of spatial management measures cannot be evaluated separately from the management measures used within the individual allocations and the formal or informal measures used to coordinate management of fisheries across allocations.

The enabling factors are like those for total closures: a sufficient capacity for surveillance and enforcement of the gear closures, and incentives for the excluded fisheries to comply with the exclusions, including alternative fishing opportunities elsewhere. Limiting factors, related to poor governance, include the lack of transparency in the exclusion decisions, leading to perceptions of favouritism and inequity among types of fishers (métiers).

Properly implemented, however, gear-specific closures can be an effective tool for making the use of the target species more sustainable in all dimensions (stock status, economic returns, social coherence), but the broader biodiversity consequences (including on benthic habitats) will be considered in **Section 4**.

4 Literature review of broader biodiversity consequences of space-based fisheries management measures

Spalding at al. (2016) review the performance of space-based measures for delivering biodiversity outcomes. Although their review focused on marine reserves, it provides a systematic analysis of why space-based management measures may fail to be effective. Key causes of poor performance are: (i) inadequacy of design and (ii) failure of implementation and particularly governance process, and enforcement. It was useful in identifying properties to look for while reviewing the literature specifically on area-based fisheries measures, rather than marine reserves.

4.1 Approach - Evidence sought in the literature

A full evidence-based assessment of effectiveness of area-based measures would use an empirical meta-analysis of an extensive literature of case histories. This has been done to some extent with systematic reviews of specific types of outcomes from use pf specific measures, such as responses of fish populations to full and partial closures (Sciberras et al. 2015). However, such meta-analyses have not been undertaken comprehensively for the range of possible biodiversity outcomes of area-based fisheries measures in general. For such a meta-analysis the biodiversity outcomes expected in the 3-dimensional space shown in **Figure 1** would need to be examined systematically along all three axes. For a full grid of locations in the 3-D space, the literature would be used to document:

a) what aspects of biodiversity are affected by the type of spatial measure being applied

b) what is the nature and magnitude of the response of the aspects in a) to the measure

c) how reliable are the responses in b).

These documented outcomes would be evaluated against standards for "effective conservation" which would also have to be developed. When the same type of spatial measure, corresponding to a position in the 3-D space, would have been implemented in different fisheries, the comparison of the outcomes would allow inferences to be drawn about the expected outcomes of such a measure and their variability. The inferences could be presented in terms of what aspects of biodiversity received conservation benefits, and what factors would potentially enhance or compromise the reliability or magnitude of those benefits. These inferences could become benchmarks and guidance for decisions on whether a spatial fisheries management measure was an OEABCM.

Unfortunately, the nature of the literature available did not allow such a systematic evaluation of all possible spatial fisheries management measures. Most of the relevant information is scattered in primary papers and government and organization reports not directly examining the question of what constitutes an OEABCM; and very few studies examine the broader biodiversity impacts of various types of fisheries measures, particularly beyond the specific area where the measure is applied. These challenges with the literature are likely to persist for some time because of (i) a lack of mandate for agencies to conduct such larger studies even under and Ecosystem Approach to Fisheries (FAO 2003), (ii) the inherent complexity of quantifying the full range of possible biodiversity outcomes of any measure., and (iii) the difficulties of attributing causality of documented changes in biodiversity properties to any single management measure (Rochet et al. 2010)

4.2 Approach – Information available from the literature

For the reasons mentioned above, it is necessary to take a more opportunistic approach to use the scattered and incomplete literature. A general approach could be developed starting with established knowledge of marine ecology, marine community dynamics, etc. and results from increasingly powerful models contrasting baseline and scenario projections (e.g. Fulton et al.) Similar approaches have been taken recently by other expert teams, in particular Wells et al. (2016) and Spalding et al (2016) both developing frameworks for considering the future of MPAs. These reviews correctly highlight that there need to be

operational standards for differentiating which subsets of areas with spatial conservation measures in place would be appropriate for Target 11 reporting, and that these standards should be based on performance.

To use an inferential approach to the literature review, based on ecological knowledge, it is necessary to specify the types of biodiversity outcomes that would be indicative of improved conservation. Spalding et al (2016) and Wells et al. (2016) have considered this issue with regard to MPAs. Both reviews call attention to the seven criteria [212] that the CBD has already adopted for assessing marine areas as Ecologically or Biologically Significant Areas (EBSAs) (CBD Decision IX/20, Annex I). These criteria could be used to prioritize the types of ecological properties that would indicate that a measure is contributing to conservation. In both this evaluation and in the identification of EBSAs in the CBD regional workshops (COP IX/29), the criteria are not used as present/absent properties, but as gradients of ecological significance, derived from an expert process to assess how much a given area stands out from the background setting, and how important an area is to ecosystem processes.

The sustainable use objective of the CBD also brings in the importance of areas for the conservation of the ecosystem services (ES) on which such uses are based. Spatial measures that are shown to enhance a range of ESs –including but not limited to food provisioning, a central concern for fisheries–may contribute to Target 11 and could therefore be considered as OEABCM candidates. However, there are many competing definitions and classifications of ecosystem services (Potts et al. 2014), making it harder to identify a single set of ES-based criteria against which to evaluate the broader conservation outcomes of the uses of spatial measures in fisheries.

In the review, 67 papers (listed in **Annex 1**) were examined primarily published since 2010, when adoption of Target 11 may have provided a greater incentive to report biodiversity outcomes of fisheries measures. This reflected a concern about publication biases in the literature - both a positive bias towards reporting successes more often than failures, and a negative bias if fisheries researchers focus on stock or ecosystem features intended to receive conservation benefits and not evaluate a wider range of possible consequences. Several older papers were also included, where they brought together important overviews of potential consequences of area-based fisheries measures. All reported on one or more of the following:

- Outcomes of spatial management measures used in managing fisheries;
- Patterns and trends in biodiversity features in areas where fisheries pressures and potential impacts were a direct or indirect consideration;
- Model results from analysis of expected outcomes of use of spatial measures to manage the activities of fisheries (and sometimes other sectoral activities as well).

For each paper/area there we made an attempt to tabulate the following information:

- Geographic area and jurisdiction;
- Target-species (one or multiple) and gears affected by the measure(s);
- Time, space and sectoral scale of the measure(s);
- Intended purpose/objective of the measure(s), whether explicit or inferred form the rationale for its choice;
- Impacts on fishery performance;
- Biodiversity features that changed and in what ways (whether attributed as impacts of the measure or not);

[212] These are: 1. Uniqueness or Rarity. 2. Special importance for life history stages of species. 3. Importance for threatened, endangered or declining species and/or habitats. 4. Vulnerability, Fragility, Sensitivity, or Slow recovery. 5. Biological Productivity. 6. Biological Diversity. 7. Naturalness

- Factors that were considered by the authors to have influenced effectiveness in producing the fishery and biodiversity consequences noted in the two above bullets; and
- Whether social and economic consequences of the measures were explicitly considered in design and/or evaluation of the measure(s).

Almost none of the papers had all the above information, and many required substantial breadth of interpretation of the information in the manuscript. Combined with the unquantifiable effects of the reporting biases noted above, this would make quantitative tabulations of results of the literature review of very low rigour and possibly misleading. Consequently, the best that could be done was to summarise observations extracted from the review, as a basis for generalizations about effectiveness of the types of area-based fisheries measures and the factors that influence their effectiveness.

4.3 Inferences from publications on modelling studies

Modelling studies were more prevalent than actual field studies of the consequences of spatial measures. This was the case both for uses of MPAs to reduce fisheries impacts on biodiversity and for assessing the effectiveness of fisheries measures and is consistent with the frequent observations that marine biodiversity is under-sampled on all scales (MIloslavitch et al., 2016: Chapter 33) and there is inadequate attention to validation of the effectiveness of management actions.

The expression "modelling studies" includes a vast range of scientific efforts. For biodiversity conservation spatial planning tools such as MarxAn (Ball and Possingham, 2000; Smith et al., 2009) are in wide use. It is sometimes possible to draw inferences between the nature of the closures being optimized or otherwise explored in these models and the outcomes for fisheries and those biodiversity aspects included in the models. Fisheries assessment and management models with spatial structure are still uncommon (Berger et al., 2017) and rarely address biodiversity features, but the few relevant publications provide some partial insights into biodiversity consequences of fisheries measures. On the other hand, Management Strategy Evaluations (MSEs) are becoming increasingly used as a basis for selecting fisheries management strategies, using results from complex end-to end models (e.g. in Fulton et al., 2014). These models often allow fairly extensive (but model-based) explorations of biodiversity outcomes expected by various spatial fisheries management measures.

4.3.1 MSE and end-to-end fishery models[213]

End-to-end models (such as Atlantis) have been used to explore ecological responses to spatial measures, including no-take-reserves, in a few areas. The most thorough modelling studies are of the continental shelf and slope off New South Wales (Australia), combining bio-physical and fishery models. These studies are reviewed in Fulton et al (2014, 2015). Key conclusions of these and other simulation studies (e.g. Buxton et al., 2006; Savina et al., 2013) include:

- Spatial closures have mostly direct positive effects on most biodiversity measures in scenarios when fishing pressure had been very high before the closure;
- Spatial closures have mixed effects when the fishing pressure had been modest before the closure. There are direct positive effects on top predators such as sharks and rays and significant indirect negative effects on preys, through trophic cascades that affect both commercial and non-commercial species;
- Whether fishing pressure was high or moderate before the closure, there was a weak but consistent indication that larger reserves might have greater consequences than smaller ones;
- Trade-offs may exist not only between fisheries and conservation objectives, but also among conservation objectives;

[213] In all three types of models described below, individual inferences are not tied to specific papers. Rather, in all cases, efforts were made to find synthetic conclusions consistent with all papers reviewed and explicit in at least a few of them.

- Static fishery closure designs were unlikely to achieve desired conservation objectives when applied to mobile species or when challenged by climate-related ecosystem restructuring and range shifts;
- High coverage of closed areas would result in four-fold increases in CPUE for key target, but also to significant industry and human cost, and high levels of competition among fishers on open fishing grounds, High conservation performance with areas closed for fishing required integrated management to deal with issues not well addressed by the closures alone;

4.3.2 Uses of other spatial models in fisheries management

Studies have used spatial fisheries models to assess effort displacement from areas closed seasonally or wholly to fishing, and to design fishery closed areas for optimal balance of protection of benthic biodiversity or specific features such as spawning grounds, while minimizing impacts of economic performance of the fishery (Bode et al., 2015; Emery et al., 2016; Eno et al., 2001; Costello and Kaffine, 2017; Kerr et al., 2016; Neumann et al., 2017; Hiddink et al. 2006) Conclusions emerging from these studies generally include those from the larger-scale end-to-end models. Their narrower scope showed additional more specific patterns, including:

- Assumptions about fishers' responses to many types of closures had large, often dominant, effects on the type and magnitude of both fishery and biodiversity outcomes. It is necessary to include estimates of patterns of fishing effort displacement in any analysis of the consequences of fishery closures;
- Similar sized closures located in different fishing grounds might have either net positive or net negative outcomes depending on the pattern of displaced fishing effort, assuming no reduction in fishing capacity was implemented;
- Real-time closures (and adaptive dynamic management) could provide substantially greater benefits to fisheries performance than static closed areas, particularly when the closed areas could only be sub-optimally located. They also could provide greater benefits to mobile biodiversity components than static closed areas because they result in full harvest of the quotas with substantially less total fishing effort. The benefit for the broader biodiversity will depend on the objective of the dynamic closures. If directly aiming at reducing bycatch of vulnerable species, they will benefit fishers directly, helping them to meet their conservation constraints. If aimed at improving the target species yield, their incidental incremental benefit to broader biodiversity can be expected to be less important, but not necessarily negligible.
- Rotational closures on longer time scales produced better fishery and biodiversity outcomes than seasonal closures for most biodiversity components except for very long-lived and sedentary species
- For longer-lived species taken as target species or bycatch, population recovery would be possible but limited with only the use of no-take reserves as a management measure. Without improved management outside the reserves, the incremental benefit from the reserves would be small and transitory

4.3.3 Uses of models in biodiversity conservation

Modelling approaches for design of reserves and networks of closed areas often require substantial quantitative work outside the model itself. These tasks commonly include both (i) setting the weighting vectors to be used for competing management objectives and priority of spatial features, and then (ii) assigning qualitative or quantitative values for those features to the grids being optimized. If this supporting work included parameters relevant to fisheries management and the biodiversity features affected by fisheries, then inferences can be drawn of how different configurations of closed areas would affect both fishery performance and biodiversity conservation. Such studies are common in the

conservation biology literature. However, the realism of the treatment of fisheries activities in the presence of the closures is challenged in some cases. Illustrations from the literature include: Schmiing et a. 2015; Young and Carr, 2015; Yates et al., 2015; Sutcliffe et al., 2015; Gurney et al., 2015; Nenadovik et al. 2012; and Tulloch et al., 2017; Richardson et al. 2006). Typical emergent conclusions include:

- Extensive consultation and inclusive design processes greatly improve performance of these models, as measured by coherence of final designs with users' expectations;
- Data on fine scales allows the design models to produce outputs with much higher spatial precision, but greatly increase costs. Moreover, as such spatial planning models are run at increasing fine spatial scales, it becomes increasingly necessary to interpolate data from coarse field sampling to the finer spatial grids of the model. Errors of inaccurate interpolation compound much faster than the likelihood of missing areas important to biodiversity is reduced;
- Performance of these approaches requires all objectives to be made explicit at the outset of the initiative, with the addition of new objectives late in the process sometimes being disruptive;
- When there are multiple objectives, there even have to be trade-offs among conservation outcomes, as well as between conservation and fishery outcomes;
- When models are used to design spatial management approaches, very good biotic data are necessary before model performance (in terms of amount of biodiversity protected) is improved over using physical habitat surrogates for biodiversity features;
- Inclusion of biodiversity and socio-economic data can lead to very different modelled network designs that achieve conservation objectives and that minimise cost to resources users.

These general findings from the network or MPA design models generally highlight the importance of data quality and resolution for effective modelling, the importance of community engagement in the objective setting and model development processes, and the increasing necessity to confront trade-offs as the diversity of objectives increases. All these general insights have come to fisheries management over the decades as well, as has the difficulties in going from awareness of these issues to incorporating them into practice.

4.4 Inferences from publications on empirical / field studies

4.4.1 Structured empirical performance assessments

With a structured meta-analysis of the literature made difficult by the reporting and interpretation challenge explained in **Section 4.3**, an inferential approach was necessary. To provide some benchmark for such an approach, we first present the major findings of other empirical meta-analysis of spatial measures, including MPAs, experimental gear closures, and habitat-species exclusions of fisheries. These narrower but more structured reviews show evaluations of effectiveness focused on specific area-based management measures usually applied in specific conditions, against which the inferential results found in the results that follow can be contrasted.

Sciberras et al. (2015) undertook a systematic review and meta-analysis of the response of marine communities to either full or partial protection from fishing activities. The response to protection was examined in relation to MPA parameters and the exploitation status of fish. While partially protected areas significantly enhance density and biomass of fish relative to Open areas, no-take reserves yielded significantly higher biomass of fish within their boundaries relative to partially protected areas. The positive response to protection was primarily driven by target species. There was a large degree of variability in the magnitude of response to protection, although the size of the partially protected area explained some of this variability. The findings in this paper are similar to those reported by Lester and Halpern (2008). A key problem with all these assessments is that the majority tend to focus on fish species,

especially target species of fisheries, with very little systematic reporting of the responses of other fish, invertebrates, plants and algae very much in the minority (Stewart et al. 2009).

Blyth-Skyrme et al. (2006) assessed empirically the impact of gear restrictions in temperate closed areas, comparing trends in sportfishing catches of nine fish species in an area influenced by a large (500-km2) towed-fishing-gear restriction zone and in adjacent areas under conventional fishery management controls. Over three decades (1973-2002) the analysis showed that: (i) In the areas most influenced by the gear restriction area, the mean reported weight of trophy fish of early-maturing species with limited home-range was highest, and declined less and more slowly, than in other areas; (ii) The mean reported weight of trophy fish of late-maturing species with extended home-rang declined at the same rate in all areas, indicating that these species would require protected areas over 500 km^2 for effective protection; (iii) fish species with a localized distribution or high site fidelity may require additional protection from sport fishing (other than just the closed area) to prevent declines in the number or size of fish within the local population. In a related study of the same management system, the same authors found that diversity and biomass of benthic invertebrates were significantly higher (compared with open access areas) in areas from which towed bottom fishing gear were prohibited (although the areas were subject to static trap fishing on the seabed). Areas that were subject to a six-month rotation between towed and static bottom fishing gear, had a higher diversity of species relative to open access areas, but the biomass of these species showed no sign of recovery. This is a good example where the rotational frequency is too frequent to enable community recovery (biomass) (Blyth et al. 2004).

Cinner et al, (2005) reported on performance of periodically re-opened reef areas under community-based management. They found that: periodic closures (and hence re-openings) had positive effects on reef resources and found that both the biomass and the average size of both long lived and short-lives species of fishes commonly caught in Indo-Pacific subsistence fisheries were 17-37% greater inside areas subject to periodic closures compared to sites with year-round open access. No significant differences in abundance of target species and on biodiversity (hard and soft corals, sponges, sea grasses, gorgonians, zooanthids, anemones, ascidians, bryozoans, fleshy algae, turf algae, encrusting red algae, coralline algae, etc.) or species richness were detected between managed and control sites. The reasons are not fully understood and may relate to lower fishing mortality in periodically open areas than permanently open ones as well as behavioural change in fish (less elusive behaviour after a closure) or even attracting power of closed areas, especially of large, longer-lived predators. The overall impact of this management system on the resources overall, at ecosystem level, is not known either. This work indicates, however, that, in such socio-ecological contexts (tropical reef ecosystems, with modest fishing pressure on species with limited home-range), periodically closing and re-opening of fishing areas (as practiced in many community-based management areas and in rotationally closed areas) yield some localized positive results for fisheries and food security but no clear impact on broader biodiversity.

4.4.2 Inferential findings from a review of the broader literature

In addition to studies based on modelling results, a number of the papers we reviewed report results of empirical studies of the outcome of area-based fisheries measures. The papers were less numerous than studies based primarily on modelling results, and also likely to be highly selective in terms of outcomes reported. Moreover, the division between the empirical studies and modelling studies is not rigid, since many empirical studies use models as a framework to develop the predicted values against which field data are compared. Nevertheless, these field-based reports present real-world sampling results and thus are less dependent on assumptions underlying the model construction, as compared to completely model-based analyses, where the outputs of the models are presented as the results of the studies.

Empirical studies are not immune to assumptions like those in all modelling studies, however. , The expectations of the researchers will influence what is measured in the field, and the expectations can be based on non-validated or incomplete theory, preconceptions and advocacy goals, or both. These issues are also not immune to the publication biases mentioned above (**Section 4.2**), favouring studies that show

major differences over studies showing little effect of treatments like management measures. This is particularly an issue when reporting changes in biomass rather than abundance, as biomass tends to inflate the size of response effects more than measures of abundance (Stewart et al. 2009). In addition, all these types of studies must confront the challenges noted in **Section 4.1** about attributing causality in a fisheries management regime where many policy, social, economic and environmental circumstances are changing at the same time, and with the standard problems of lack of ideal statistical baselines in these BACI (Before-After-Control-Impact) study designs. All these concerns need to be considered when interpreting these summaries of findings, just as they must be when interpreting the findings in **Section 4.3**.

Empirical studies have looked at the issue of biodiversity outcomes of fishery area-based measures from both fisheries and conservation perspectives. On one hand, there are studies of how a particular fisheries management measure, applied under a fisheries management jurisdiction, has actually affected some aspects of biodiversity or ecosystem structure and function. In many cases these studies were guided by some expected outcome of the measure, (often the measure was implemented with the intent of delivering that specific outcome), and only those specific biodiversity features were investigated. Studies which investigate possible biodiversity outcomes of area-based measures implemented by fishery management agencies just to manage fisheries, are far less common, but are reported separately below.

On the other hand, another set of studies focus on a particular biodiversity property, examine how it is changing, and then may attribute the pattern of changes to some specific fishery area-based measure. Such studies are particularly vulnerable to the BACI and attribution-of-causality challenges. However, the studies do focus their examination of the conservation or sustainable use on biodiversity or ecosystem properties of priority concern. Still, though, such individual studies tend not to look at biodiversity and sustainable use comprehensively, so general inferences must be built-up over the suite of studies examined.

A. From empirical studies of intended biodiversity impacts of ABFMs

The studies of the intended effects of spatial fishery management measures on broad biodiversity conservation almost always focused on specific biodiversity features, directly expected to benefit from the measures being applied. Therefore, they may underestimate the full range of outcomes of these spatial measures, by looking preferentially for outcomes of the specific biodiversity expected to benefit from the measure, and potentially missing other benefits. It is rare that fisheries management measures are implemented to intentionally have negative effects on biodiversity or ecosystem structure and function. Such measures are not unknown, such as the efforts that have been made to deter marine mammal predation on both target and non-target fish stocks (Brandt et al. 2013, Goetz & Janik 2013). General inferences emerging from studies (such as Kaiser et al., 2018; Lancaster et al. 2015; Daley et al. 2015; Becker et al. 2016; Armstrong et al. 2013; van der Lee et al., 2013; Miethe et al.2017; Kaplan et al., 2012; Oliver et al., 2015; McAllister et al., 2015; Sys et al. 2017; Mangubhai et al. 2015; Richardson et al., 2006; Kerr et al. 2016; Galaiduk et al. 2017; Smolowicz et al. 2016. Claudet et al., 2008; Mangano et al., 2013**)** include:

- Spatial measures can greatly improve population status of the target species and other species being affected by fisheries, if fishing pressure is high and the spatial measures are appropriately located;
- The use of inclusive and consultative decision-making processes during the design of spatial fisheries measures can greatly improve both their design and compliance of fishers with the measures. Either types of improvement can increase their effectiveness;
- The impacts of spatial measures on fishery performance ranges from negligible to very large, depending on some obvious factors such as size of the area and scope (duration and gears) of the exclusions of fishing, and some less obvious factors such as dominant oceanographic conditions, proximity to alternate landing sites for catches etc.;

- Implementation and compliance is higher when all gears taking a particular stock are affected by a spatial measure than when only selected gears are covered by a spatial measure. This can be a serious challenge when the concern prompting the measure is an impact of a specific single type of gear;
- If the species intended to benefit from spatial protection are moderately mobile or migratory, only very large areas of protection, or use of spatial measures in combination with other measures, is likely to produce measurable benefits to the population;
- The location of boundaries of spatial measures may be better based on habitat variables than on species distribution data, unless the population distribution data are very good;
- The redistribution of fishing effort after a spatial measure is implemented is often hard to predict, even if spatial data on the target species distribution are available. However, such redistribution of effort can reduce and sometimes completely negate any expected benefits for biodiversity or sustainable use;
- Ontogenetic niche and habitat shifts –if not foreseen in the measures design– may reduce or negate the expected benefits of a spatial measure applied in fisheries, whether the measure is intended for the target species or other species affected by the fishery;
- Even when spatial measures are carefully designed before implementation, time and spatial boundaries need to be reviewed and adjusted, as appropriate, on decadal scales, to respond to the many changes that are occurring in coastal marine ecosystems.

B. From empirical studies of unintended biodiversity impacts of ABFMs

Fewer studies of broader biodiversity effects of ABFMs when such effects were not an explicit objective of their implementation (unintended effect) were found in the review. However relevant incidental information could also be extracted from many of the studies reported under **Section 4.4.2.A.** In such cases researchers conducting field studies to evaluate expected biodiversity consequences of an area-based measure had to have observed and reported on a broad range of biodiversity features or patterns in the data that had changed when the measure was implemented. Such reports usually came from studies with fairly comprehensive monitoring of areas however, rather than field programs focused solely on the specific biodiversity benefits expected from an area-based measure. Some studies did look directly or indirectly for aspects of these "unintended consequences", including some or all the results of Frank et al. (2000), Kenchington et al. (2006), (Gruss et al.2014), Clark et al. (2015), Kaplan et al. (2012) and McAllister et al. (2015) **,** but many of the inferences are drawn from material in the studies listed in the section above. Some of these effects were at least moderately large and reliable.

Moreover, because in many cases these were not just "un-designed" outcomes but also unplanned ones, it is likely that the literature review underestimates the frequency and, possibly, the magnitude of these consequences of area-based fisheries management measures. Both underestimations are possible because with the multiple possible causes of changes in marine ecosystems and populations, other possible causes of the observed changes might get priority. In addition, if biodiversity benefits are found without the spatial tool being specifically designed or optimized to provide them, it is possible that with greater attention to possible biodiversity benefits when the measure is designed, the benefits could be even larger. In contrast, overestimates of benefits of spatial fisheries measures are less likely to occur unless evaluations of ecosystem dynamics show a rush to attribute all observed positive changes to such measures, a pattern not observed in the literature.

Most of the inferences in **Section 4.4.2.A** also seem to apply to the more limited information about the "un-designed effects" of fisheries, particularly with regard to:

- The importance of the linkages between exact location of the spatial measures and the places where the benefits are observed;
- The importance of consultation with fishers, communities and biodiversity conservation experts in the design of spatial measures, who may think of ways to include a greater number of biodiversity considerations in a management tool designed primarily for a specific fishery outcome;
- The importance of effort redistribution after a spatial measure is implemented;
- A greater likelihood of un-planned and unexpected biodiversity benefits from larger spatial measures; and
- In addition, it is important to consider unplanned negative effects of spatial measures (such as spatial gear restrictions) on biodiversity components such as seabirds, which may forage extensively on discards and face reduced foraging success when discards are reduced.

C. From empirical studies of biodiversity and sustainable use of ecosystem features exposed to spatial fisheries management measures.

Many studies of changes in biodiversity or resources being extracted in delineated spaces are available, and a fair proportion of them at least discuss the impacts of fisheries. A subset of those go on to discuss the role of fisheries management measures, including spatial measures, in managing – or not managing – those impacts. Only a small proportion of those studies actually match the scales of the biodiversity / resource concerned and those of the spatial fisheries measures being applied. Consequently, most of these studies face the joint challenges of attributing causality for any observed biodiversity pattern to any particular management measure when these scales do not match, and multiple changes may be occurring in the fishery and in other uses of the same area. The number of such reports is large enough that when specific patterns and relationships among measures and trends in biodiversity or resources appear repeatedly, inferences can be drawn cautiously about at least the likelihood of these trends being linked to the measures.

Carefully designed experiments to test the effectiveness of particular area-based measures for producing particular outcomes, would be the most appropriate approach to obtain results that would be unambiguous to interpret. However, many spatial fisheries management policies are implemented across a fishery, or across an entire area of special conservation concern. In most cases this allows only opportunistic monitoring and before-after comparisons without parallel monitoring of control areas. In such cases, reported consequences of the measure on the protection of biodiversity features reflects the core interests of the research team, and the full range of biodiversity consequences of the measure may be reported incompletely.

In the body of literature reviewed, studies such as Girardin et al. 2015, Samy-Kamal et al.2015, Farmer et al. (2016), Tancel et al. (2016), Vincent et al. (2016), Cabral et al. (2017), Magris et al. (2017), Canessa et al. 2017, Fidler et al. (2017), Sciberras et al. (2013) all lend themselves to be viewed from the biodiversity-to-measure perspective. Inferences from those studies, in combination with relevant information from the studies that were the basis for **Section 4.4.2.A** include most of the same inferences listed for **4.4.2.B,** particularly with regard to inclusiveness of processes for designing the measures, plus:

- The behaviour of fishers is resistant to change yet also is opportunistic. Fishers are reluctant to change grounds or behaviours without strong incentives to do so, but can be quick to take advantage of new fishing opportunities when they are presented;
- Few benefits accrue to benthic biodiversity from short (<3 months) seasonal fishery closures, but substantial benefits can accrue to mobile fish, seabirds or mammals that are particularly aggregated during the periods of closures;

- Seasonal closures in areas of the seabed exposed to high energy environmental perturbations (e.g. strong wave or current activity) that exceed the magnitude of fishing disturbance may yield positive responses in the target species but not in biodiversity attributes, given most fauna resident in high-energy environments are resilient to background levels of natural disturbance.
- Seasonal spatial measures intended to protect mobile species from bycatch (including entanglements) can improve conservation performance if timing can be adjusted to match interannual variation in ocean conditions. However, these types of adjustments can be disruptive to fishery performance if not made with care and in consultation with fishers;
- For highly mobile species, any spatial measures, including those applied by fishery agencies, need to be coordinated across multiple jurisdictions if strong conservation outcomes are to be realized;
- Broadly-inclusive consultative processes can develop integrated multiuse areas where conservation is enhanced compared to areas outside the planning zone, with each sector, including the fishery sector, using spatial measures it designed to deliver the common objectives. However, when conservation objectives are not met, attribution of responsibility for errors of planning or implementation is difficult to resolve;
- Sometimes, unexpected environmental events (e.g. storms), or unexpected impacts of populations growing quickly due to high protection, generate feed-back that diminish or negate some benefits expected from implementation of spatial measures;
- Suites of area-based fisheries measures focused on increasing protection of priority species and habitats do not necessarily improve resilience or connectivity at larger network scales. However, fisheries increasingly acknowledge the importance of protecting the priority species or places. Many fisheries are increasingly willing to accept additional spatial restrictions on their activities to deliver these higher-level outcomes, and to design them in cooperation with other area-based measures developed by conservation agencies
- Where overfishing has been difficult to manage, a stepwise process implementing, first, spatial measures that result in spill-over or improved recruitment of targeted species with direct benefits to fish harvesters and, subsequently, measures aimed at broader biodiversity benefits may gain support.

4.5 Messages emerging from overview or synthesis papers

Although this literature review intentionally focused on publications presenting field or model-based evidence for consequences of spatial fisheries measures, there are many overview and synthesis papers on spatial measures in general. The ones mentioned above by Spalding et al. (2016) and Wells et al. (2016) are current, well focused, and provided the basis for much of the framework adopted here. Many of the synthesis messages on those reviews echo the results of the review conducted here. Where they raise other points, these sometimes may reflect the particular intent for the review –just as the present review focuses specifically on spatial measures used in fisheries management. In other cases, the additional points may be emergent considerations that individual studies might not report.

Drawing from Spalding, Wells, Clark, Agardy, Devilliers and others, it is important simply to reinforce that any quantitative target for coverage of protected-areas is not, in itself, an assurance that full biodiversity conservation and sustainable use are achieved if the target is met, nor that conservation is compromised and uses are unsustainable if the target is not met. The location, nature and size of the closure as well as the management in and around the area, and the socio-economic context have more relevance that the percent coverage. A primary goal of the CBD, and of sectoral agencies as well, is that uses of ocean resources are sustainable everywhere. In addition, almost all fisheries management agencies endorse and have mechanisms to deliver enhanced protection and conservation to priority places and species, and use tools, including area based fisheries management measures to deliver both sustainable use

and, where appropriate, enhanced protection (see **Section 3**). There are varying perspectives in the publications regarding whether all areas managed to contribute to those joint outcomes should be called "Protected Areas" of some classification status or another (Wells et al 2016, and Spalding et al 2016). However, the "other effective area-based conservation measures" combined with whatever range of areas are considered as "Protected Areas" by the reporting authority, should cover all the areas that receive some degree of enhanced protection compared to a background of global sustainable use of marine natural resources.

4.6 Summary: potential contributions of fishery ABFMs to OEABCMs and performance factors

Section Error! Reference source not found. provided a typology of spatial management measures used in managing fisheries and ecosystem effects of fishing in a three-dimensional system of restrictions of space, time and fishing activities in an area. We will look here at some of the combinations of types and degrees of restrictions that are frequently encountered. These do not correspond to discrete categories of areas, as many intermediate combinations of degrees of restriction on each dimension can be implemented by a fisheries management authority. In addition, in their various implementations in different fisheries of the world, they are accompanied by and surrounded by different sets of measures that affect their performance. Nonetheless, their potential consequences and enabling and limiting factors give a workable view of the panorama of area-based measures used by fisheries that might be considered as candidates for inclusion in Target 11 reporting as OEABCMs.

For each spatial measure (defined in space, time and activities restricted) presented below this section tries to summarize:

a. The nature and relative magnitude of the benefits to conservation of biodiversity or enhanced sustainable use that could arise if the type of measure were applied; and
b. The enabling factors that could increase the likelihood of more effective measures and greater benefits, as well as any limiting factors that could diminish the likelihood or extent of the benefits.

Enabling and limiting factors may often be symmetrical, depending on whether the factors are present or absent; high or low. For example: (i) Closed areas often are effective if fishing pressure has been very high before their establishment, and often have little effect (aside from displacing effort) in the opposite case; (ii). Similarly, good governance and effective enforcement are enabling factors if present but limiting ones if missing. However, these factors are often thought of from one direction or the other. A very common property of an ecosystem or social-economic setting will often be noted as limiting if absent, whereas its presence is merely assumed to be the "norm". On the contrary, a property that is not widespread in such settings may be unnoticed if absent but considered enabling when present.

4.6.1 Total closures to fishing

As noted in **Section 3.4**, total closures of an area to fishing can occur for several reasons, and the reason can influence the likelihood of biodiversity conservation benefits or increases in the sustainability of resource utilisation. Closures due to food safety reasons are likely to be centered on areas of serious and persistent contamination and be unlikely to be preferred candidates for biodiversity conservation. Short term closures to all fishing due to factors like red tides or domoic acid might still have some enhanced biodiversity value, but if the closures only last as long as the episodic outbreak of the causal factor (usually lasting weeks to months), it would not last long enough to count towards a decadal-scale conservation target.

Total fishery closures for safety reasons are usually to avoid conflict with some other use of the ocean space that is incompatible with fishing, such as requiring fisheries to avoid shipping lanes or avoidance of energy-generating platforms. Within these areas, fishery impacts on biodiversity and ecosystem structure and function are negligible, so they could be candidates for OEABCMs *solely* from the perspective of fisheries measures. However, all biodiversity and ecosystem properties in these areas would be fully

exposed to whatever other activities are permitted in the area closed to fishing. Only if those activities were also managed in ways that greatly reduced aggregate pressure on the biodiversity and ecosystem structure and functions, would the area be suitable to consider as *effectively managed* for conservation. If other activities are also effectively managed, then consideration could proceed, accounting for the factors as described in **Section** Error! Reference source not found..

For areas closed to fishing on ecological considerations (as fishery reserves, VMEs, BPAs, FRAs, etc.), most or all could be considered for inclusion as OEABCMs if not subject to any other negative impact. The "ecological considerations" used in selecting the area for closure would be a factor in the case-specific evaluations. However **Section** Error! Reference source not found. documents that the ecological considerations used in such fishery closures are generally very similar to the considerations used by other authorities, including conservation agencies, to select areas for use of their own spatial measures; for example presence of fragile or uncommon habitats, importance to a species of high conservation priority, or importance to the life history of a species where alternative areas for the life history function are uncommon or less suitable. In the subsequent evaluation, it may be found that other anthropogenic activities pose risks of unsustainable pressure on the ecosystem features of the area, and the area would not be considered an OEABCM. However, where fishing is the major pressure on biodiversity or ecosystem structure and functions, these areas could be candidates for OEABCM, if the factors referred to in **Section** Error! Reference source not found. are adequate.

In terms of enabling and limiting factors in these areas, above all, compliance with the total closure would have to be high. As noted in the conclusions of **Section 3.5.4**, to have high compliance it is necessary to either have the tools for full surveillance and enforcement in the area that is closed, or else high voluntary cooperation from the industry. Such cooperation requires that the industry has a shared understanding of the need for protecting the area from all harvest and that alternative, cost-effective, conventional measures are not available or are unlikely to be effective at protecting the key features of concern (e.g. effort reduction measures). Alternative livelihoods for the fishers denied access to the closed part of the fishing grounds also can contribute to improved compliance with such total closures. Conversely, poor buy-in by the fishing industry to the need for a total closure, limited capacity of management to enforce a total closure, and lack of alternatives opportunities to obtain food or income are all factors that limit the effectiveness of total closures. As with any spatial measure, to provide effective conservation, such closed areas also should be large enough that: (i) the habitat protected or catch prevented is large enough to be considered a meaningful contribution to conservation or population viability; and (ii) the species or life history function is spatially stable enough that protecting an area contributes to the function.

4.6.2 Gear specific closures

These measures are widely used in fisheries management with the intent to protect specific habitat, species, or biotic community features. Many RMFO closures of Vulnerable Marine Ecosystems to bottom-contacting gears, required under UNGA Resolution 61/105, may allow fishing the areas with static or midwater gears. Reviews have found effectiveness of VME closures to vary (Thompson et al., 2016) with the completeness of implementation of the closures. However, when VME identification has been undertaken carefully, and compliance with the closures is high, the measures are very effective. They may provide the possibility for recovery from damage to habitats of fish populations done by fisheries before the gear-specific closures were implemented, but cannot, in themselves, undo such damage. However, that is true for any type of spatial measure, including Protected Areas.

The VME experience is reflected as well in the other literature reviewed above in **Sections 4.3 and 4.4**. There have been both successes and failures for using gear-specific closures to increase protection of priority habitats such as corals and seamounts, and priority species including marine mammals and seabirds. Moreover, in some cases investigations have found the conservation benefits do extend to species associated with the protected habitat or species, and not just the ecosystem feature that was the focus of the

management measure. This includes cases such as juvenile fish closures to mobile gears, where the benthos showed increases in abundance, biomass or diversity.

Potential for gear substitutions also need to be considered with gear-specific closures. If the gear exclusions are to reduce pressure on a target species of the fishery, increasing use of other gears that are allowed can reduce or negate the expected benefits or be compatible with the desired reduction in fishing pressure. Outcomes depend on whether the new gears take a different size, age or sex distribution in their catches, and on any changes in effort needed to take the catch allowed from the area. In addition, changes from one type of gear to another will change the nature of the potential ecosystem impacts that may occur. For example, mobile bottom-contacting gears may be excluded to remove their impacts on benthic communities but replacing them with static gears may increase in risks of entanglements of seabirds and marine mammals, changing but not eliminating biodiversity impacts from fisheries. These types of considerations are necessarily case-specific and may be mitigated or eliminated with foresight in planning for gear-specific exclusions.

It appears that three conditions need to be met for the gear-specific closures to be effective.

- The gears excluded must be those linked to the unsustainable pressure on the ecosystem feature(s) to be protected. Excluding some gears that have unsustainable impacts of ecosystem features while allowing other gears may be ineffective in avoiding or mitigating harm to the ecosystem feature(s), if the other gears still impact those features directly or indirectly.
- The areas of the gear exclusions must coincide well with the features that are intended to receive benefit from not being exposed to the gear. If the gear closure zones are too small or poorly placed, the ecosystem features may still be exposed to unsustainable pressure from areas where the gear can still be used. If the areas are too large the negative impacts on fishery performance will increase, new ecosystem/biodiversity risks from displaced effort may arise, and compliance may be undermined, with little incremental benefit to the ecosystem features of concern.
- Compliance with the closures must be high. Poor compliance will mean the pressure from the gear impacts will not be reduced to the amount expected, and possibly not at all.

Some enabling factors are similar to those for total closures – capacity for surveillance and enforcement of the gear closures and incentives for the excluded fisheries to comply with the exclusions, including alternative fishing opportunities elsewhere. Fine resolution data of the features intended to benefit from gear specific closures can also improve performance, for two reasons. The first reason is because it is important that the ecosystem feature to be protected is adequately covered by the closure, and the second is that since the management interventions will target specific gears and fishers, the rationale for exclusion needs to strong if the fishers are to consider the exclusion fair and work to comply with it. Similarly, implementation is improved with good ability to document how the specific gears to be excluded are linked to specific negative impacts on the stock or ecosystem features. Both of those considerations are consistent with the general negative factor of resistance or low compliance by fishers when there is a lack of transparency in decision-making, so different gear sectors may feel favouritism is being shown. Another limiting factor would be little capacity for the excluded gears to relocate outside the area from which they are excluded. If relocation is difficult because of management regulations, increased costs of fishing elsewhere (including longer travel times or lower catch rates), or lack of suitable places to fish elsewhere, the gear-specific spatial measure is actually a measure to reduce the use of the gear overall in the fishery and should be approached as such.

4.6.3 Gear and season-specific closures

These area-based measures have many similarities with the circumstances and outcomes associated with gear-specific closures (**Section 4.6.2**), except that they are in place for only part of each calendar year. This means that their effectiveness is low with regard to avoiding or mitigating impacts on static ecosystem features, including structural habitat features and sessile species. However, their effectiveness can be high

when the stock or ecosystem features intended for protection are aggregated in particular places and times of the year. This has been shown for both target species of fisheries, such as spawning closures when a stock is densely aggregated and especially vulnerable to fishing effort, and for ecosystem features, such as excluding small-mesh trawling near seabird colonies during their breeding season, when their foraging range is limited while food demands are high, so the seabirds are particularly vulnerable to depletion of their prey.

Even though seasonal closures are is usually justified by a small number of stock or ecological reasons, all species and ecosystem properties impacted by the fishing gears that are excluded experience reduced pressure during the period of the closure. There are many documented cases where dense aggregations of fish, for seasonal spawning, foraging or other life history functions, either aggregate to take advantage of seasonally aggregated prey –such as "spring bloom" effects (Grebmeier et al., 2006; Stock et al. 2014)– or themselves attract high concentrations of predators, or both. The seasonal gear closures reduce pressure on all the ecosystem features particularly aggregated in the place and times of the closures, and these potential consequences need to be considered in evaluating the effectiveness of seasonal closures.

The same three general considerations in 4.6.2 also apply to seasonal closures, whether for all gears or for just some, and additional considerations are typically important as well, including:

- The stock or ecosystem features to be protected by these seasonal spatial measures need to actually have times of the year when they are particularly vulnerable to the gear or gears being prohibited. Otherwise the benefits that may accrue during the period of closure are dissipated as soon as the closure is over. This increased vulnerability is usually caused by either a life history activity that requires atypical aggregation or exposure to the fishing gear(s), or an environmental condition that increases vulnerability, such as water temperatures becoming unfavourable for large areas and concentrating the stock or ecosystem feature in only part of its typical range.
- Because these fishery measures are seasonal and area-based, it is important consider potential patterns of effort redistribution in both space and time. If the exclusions are in a period of typically high catch rates for the target species, in fisheries with output controls (e.g. quotas) they will usually result in more fishing effort being necessary to take the full allowed catch. If the catches are maintained within the season (desirable for supply to steady markets), there will be more fishing outside the exclusion zone, and disproportionately increasing pressure in other places. On the other hand, if effort is displaced to other seasons, different impacts of the same fishery may arise, if other features of the ecosystem also vary seasonally. Both types of effects have been reported at least incidentally.

The most important enabling factor is that the features intended to benefit from the reduction in fishing pressure have a clearly defined seasonal pattern of occurrence and/or aggregation, and that these periods are predictable in time and space. This requires substantial knowledge of the ecology of those features intended to benefit from the measures. The use of local community knowledge has been shown to often improve conservation outcomes of such measures – both through better design of the places and times to exclude the relevant fisheries, and through higher compliance due to the fishers' better understanding of the reasons for the closures. A key limiting factor is when there is substantial interannual and/or spatial variation in when and where the aggregations or periods of high vulnerability will occur. Trying to address low predictability by large and long duration seasonal closures has been shown to increase the risk that fishers' responses in redistributing effort in space and time will result in increased risk of other unstainable pressures being imposed on the stocks and ecosystems. In such circumstances of low predictability of the time or place of higher aggregation or risk, several cases have found real-time "seasonal" closures with pre-agreed triggers for closing and opening are more effective at delivering the desired conservation outcomes with fewer negative impacts on both other ecosystem features and fishery performance.

4.6.4 Rotational closures

From a broad biodiversity and sustainable use perspective multiyear rotational closures have both a potential great advantage and a corresponding limitation. The potential is that in any single year of a multiyear rotational schedule, all the fishery is restricted to only a limited portion of the total potential area in which the fishery could operate, and that proportion is smaller the longer the rotational cycle is. Thus, in each year most of the total area for which the fishing plan is implemented is not exposed to any fishing activity, so the population and all ecosystem features in the majority of the total area is not impacted by the fishery. This allows for the population and ecosystem features to be on a trajectory of recovery from any impacts of past openings. The corresponding limitation is that every place in the total management area is open for fishing at some point in the rotational schedule and is exposed to the concentrated impact of the entire fishery. For such rotational harvesting systems to confer a conservation benefit, there needs to be an adequate understanding of the recovery time for the biodiversity components of the system, not just the target species, as the latter may recover considerably more quickly than many biodiversity features (Kaiser et al. 2018).

Such rotational closures are usually implemented for fisheries on sedentary target species. If they are implemented in fisheries on species that move widely around their total range, it is usually to spread fishing opportunities among communities where the fishers themselves may have limited mobility for social, technological or management-imposed reasons. Incremental biological benefits to the mobile stocks are not expected, as long as each area in the rotational cycle presents relatively equal catch opportunities when opened (usually a necessary precondition for such rotational plans). Comparably, biodiversity features – populations, species and communities - that are mobile would not be expected to gain substantial benefits from rotational closures. Each year the likelihood that the mobile population or community would encounter the open area in some part of the year is equal (assuming that the rotationally open areas are generally comparable). When the mobile population or community enters an area that the rotational schedule has allowed to be open, the total fishing effort sustainable for the target stock would be concentrated in that area, so the full impact of the fishery could be imposed in a short time.

For sedentary ecosystem features, however, all areas would be ensured long periods with minimal disturbance from the fishery. The amount of recovery that could occur during this period of "protection" would be strongly dependent on the life histories of the sedentary species (e.g. Sciberras et al. 2013; Kaiser et al. 2018). If the intervals of openings in the rotational schedule are scheduled far enough apart in time to allow recovery of the exploited target stock to a highly productive state (so overall yield from the resource is kept high), then all sedentary species in the area with comparable or "faster" recovery times would also reach their carrying capacity. Longer-lived sedentary species, however, would continually be knocked back by re-exposure to fishing pressure during each opening, such that over time the community would come to be dominated by the more disturbance-tolerated species. In addition, in all cases the "recovery benefits" of the longer periods of closure between openings would only occur if recruits could colonize readily from outside the area at the end of its rotational opening, when the fishery was again excluded from the area for a longer period. However, for many sedentary marine species recruitment products disperse widely so this is rarely a constraint in practice (but see Kaiser et al. 2018).

Thus, for mobile species and many sedentary species, rotational closures would frequently not be good candidates for Target 11 reporting. The exception would be when a sedentary species with a "faster" life history than the target species of the fishery being managed with the rotational closures is also a priority species for conservation. This may occur, but many authors have highlighted that it is the long-lived, later-maturing species that are more often of priority for conservation. Such species would be the least likely to benefit from rotational closures *unless* the rotational schedule was timed for the life history of the species or ecosystem feature of conservation importance rather that for the target species of a fishery. Such an approach would be possible in practice and may be attractive by ensuring most of the population of the priority species was undisturbed by the fishery for long periods. However, this would restrict the fishery itself to very small areas of operation each year or to an infrequent periodicity of fishing. The fishery

would have to be able to harvest the target species very efficiently with the limited areas of opening and have markets able to accept volatile supplies (as the target species came and went in the small areas where fishing was allowed) for this to be a viable management approach from the perspective of the fishery.

The conditions are met for relatively few stocks. In some jurisdictions rotational spatial openings in an otherwise closed stock range may be one of few options available to fisheries managers to regulate harvesting, particularly when enforcement capacity is limited or when harvesting requires substantial habitat impacts. However, if the knowledge of stock life history and/or spatial densities by location is weak, then the harvesting protocols must be highly precautionary to ensure sustainability of the target stock, and such protocols are likely to be inefficient at allowing the full potential sustainable harvest from the stock to be taken. In addition, the attractiveness of the closed area for illegal fishers increases with the period during which the areas has been closed for rebuilding. Thus, if surveillance and enforcement are not highly effective, any biodiversity benefits accumulating during the closure would be a risk of dissipation faster than the rotational schedule might imply.

4.6.5 Community allocations of space

The nature of community-based fisheries management areas are so diverse that only broad generalizations about effectives for conservation and sustainable use can be made. Moreover, community conservation initiatives are increasingly common within the conservation biology community, and they are equally diverse. Both are inherently area-based approaches to management, and both assume that the behaviours of all community members, including fishers, will be managed more effectively by community-scale social dynamics than by top-down regulation imposed by a governmental agency.

To the authors' knowledge there have been no efforts to systematically differentiate properties between community-based fisheries management regimes and community-based biodiversity and sustainable use regimes. However, reports of community-based fisheries management initiatives and community-based conservation initiatives both general emphasis that these initiatives start with a process for identification of community objectives. In both cases most reports also say the resultant objectives include both minimizing impacts on some ecosystem properties of interest to the community and ensuring sustainable livelihoods from the resources in the area. For both community-based conservation areas and community-based fisheries management areas many publications focus primarily or exclusively on their processes of establishment and implementation. Most follow-up studies that report outcomes of the community fisheries management regimes do report some form of "improved" status for aspects of the marine or coastal ecosystem as well as for the performance of the fishery. Similarly, most studies of the community conservation initiatives do not just report "improved" status for key ecosystem features like seabed habitat, aquatic vegetation and fish populations, but also improve livelihoods for communities that are dependent on the marine and coastal resources.

Thus, there is no evidence that would indicate a need to evaluate the appropriateness of community-based fishery initiatives for inclusion under Target 11 reporting using standards of evaluation fundamentally different from those used to evaluate community-based conservation initiatives. In both cases, necessary standards and quality of evidence for "success" of these initiatives is highly variable among jurisdictions and should be accounted for on a case-by-case basis. However, there are several studies that report that if the fundamental social structure of the communities is being undermined either by immigration to the coastal areas by people not assimilated into the community, or by external influences of money or attention (whether from commercial markets for harvest or influxes of "donor funding for conservation projects), then the social dynamics making these community-based conservation or fisheries management initiatives effective are likely to be undermined. As has been learned in cases like the Chilean TURFs, areas where communities show success in improved stock and ecosystem status within the space that they manage become increasingly attractive to poachers and intruders who do not respect the community standards of behaviour (Gelcich et al. 2004).

4.6.6 Move-on Rules

Areas that fishers leave because of move on rules would rarely be candidates for inclusion under Target 11 reporting. If the trigger for relocation of the fishing effort is a fixed feature of the seabed or benthic ecosystem, the move on rule itself does not prevent the initial impact between the fishing gear and the ecosystem feature of concern. Consequently, there is no a priori improved conservation outcome produced by simply adopting move on rules. Once the first encounter with a fixed habitat or benthic feature has occurred, it is the response of the fisheries management authority or the fishers themselves that determines the appropriateness of the area for inclusion in Target 11 reporting.

If nothing further is done by the fisheries authority or fishery itself, then the likelihood of future encounters is not changed and there is no conservation benefit. However, if a measure is then implemented in the area detected through the move-on rule, that greatly reduces the likelihood of any further encounters with the feature, then it would be appropriate to evaluate the area concerned for target 11 reporting. However, that evaluation would be based on the properties of the measure then implemented, and not in the fact that the adoption of the measure was the result of a move-on rule having been triggered.

Not all move-on rules are triggered by impacts with sedentary benthic or seabed features. Move-on rules can be triggered by bycatch amount or type being recorded in a fishing event. These can be very effective at reducing bycatch of priority species when the bycatch species of concern is highly aggregated, but the locations of the aggregations are unpredictable. One fishing event in an area provides evidence of the presence of the species of concern, and if all effort relocates away from the area in real time, there is evidence that substantial reductions in bycatches can be achieved. The distance necessary to relocate and time before the fishery would be allowed to return are both case-specific, and, for effective design, requires good information on the temporal patterns of distribution of the species of concern. However, even with the necessary information, these cases still might not be appropriate for Target 11 reporting. The size, their number and the time they would be in place would all be changing in any fishery, the long-term effectiveness of the strategy for keeping bycatch low for the priority would have to be demonstrated, and the benefits would only be accruing to the trigger species and species very closely associated with it, so the conservation benefits would be limited. The species would have to be of very high conservation priority before the reduction in bycatch mortality would be considered an important conservation outcome.

5 Potential criteria and guidelines

From **Sections 3, 4 and 5** three key conclusions emerge that set the overall conceptual boundaries within which areas where area-based fisheries management measures are in place could be evaluated for inclusion in national reporting on Target 11. First, the range of variation in types of spatial fisheries management measures means the measures are not readily sorted into a small number of internally homogenous categories. Rather there is a complex typology of implementation of spatial measures for fisheries management, with continua of variation in size of area, duration of application, and extent of activities excluded or carefully regulated by the measure(s). Second, measures characterized by any single combination of size, duration, and degree of restriction of fisheries can vary widely in performance for promoting protection of biodiversity and sustainability of the uses of resources in the area. Third, multiple internal and external factors may contribute to the variability on performance, and therefore potentially their "effectiveness", including type of governance (top-down, co-managed, community-based), socio-economics of the fishery (export markets, local consumption, large or small-scale, etc.) the environmental and oceanographic characteristics (coastal or offshore, pelagic / demersal / benthic), and the jurisdiction and legal frames (national, shared, straddling, high seas). All these dimensions may affect to varying extents the performances of fishery spatial measures, and therefore their "effectiveness".

Taken together, these three conclusions mean that a simple set of typological categories of area-based fisheries measures cannot provide a sound basis for robust general conclusions about their performance with regard to broad biodiversity conservation, or even fisheries management. They also mean that

evaluations of any specific areas for inclusion in Target 11 reporting should be case-specific, and not just be inferred from a few characteristics that would result in an area being placed in a particular category. Such a case-by-case approach would nevertheless have to be systematic (i.e. following agreed criteria of evaluation) if a consistent reporting standard is to be maintained. As with other such systematic evaluations, such as the description of areas that meet the EBSA criteria, the exact standards that need to be attained are policy choices, but the relevant factors that should be considered should have a strong foundation in science and knowledge systems. Some of the factors that should be considered may function better as criteria to be evaluated directly in terms of whether or not an area is relevant to furthering the objectives of the CBD and intent of Target 11. The others might better be used as contextual considerations that influence the effectiveness of the measures but not necessarily their relevance to Target 11 reporting.

5.1 Potential criteria for OEABCMs identification

It is the prerogative of States to decide what areas within their national jurisdictions they wish to evaluate as OEABCMs. However if the intended rationale is that the area has conservation and sustainable use benefits due to application of a spatial fisheries measure, consistent evaluation criteria would be useful, as would guidance on how to take into account factors affecting effectiveness of implementation As noted in Section 1 and 2 of this Working Paper the language of Target 11 and the Definitions in the Convention itself provide starting points for developing criteria for evaluating whether an area subject to an area-based fisheries management measure could qualify for inclusion in Target 11 reporting. The focus should be on how well the area contributes to the core CBD objectives. There can be a primary focus on direct conservation of biodiversity, but contributions to sustainable use could also be considered as long as biodiversity was not being degraded and "in situ conservation" was being supported.

Potential criteria for describing areas as being OEABCMs might include:

1. **For species that have been detrimentally impacted** by natural or anthropogenic pressures (including but not exclusively fisheries) there is evidence or an ecological basis to expect that area-based fisheries management **measures have or will contribute to increases in abundance and biomass (including SSB) of populations, species and recovery** of age/size composition, recruitment, and other relevant population or community parameters;

2. **For species or populations considered to be healthy**, there is evidence or an ecological basis to expect the area-based fisheries management measures **have or will increase the likelihood of maintaining or safe-guarding the healthy state** of the populations or species, including their genetic diversity.

3. **For marine habitats** – particularly but not exclusively the seafloor and substrate - there is evidence or an ecological basis to expect the area-based fisheries management **measures have or will protect habitat features from degradation and allow previously disturbed biotic or biogenic features to recover** in ecologically appropriate time frames.

4. **For natural communities that have been disturbed** by natural or anthropogenic pressures (including but not exclusively fisheries) there is evidence or an ecological basis to expect the area-based fisheries management **measures have or will contribute to improvements in community structure and increases in function** (including food webs, size spectra, etc.), or reduce fishing pressure that could cause further degradation, until more complete recovery programs are in place.

5. **For critical or preferred habitats** of target species of fisheries, the area-based fisheries management **measures make an important contribution to protecting the features of the habitat that are important** for specific life history functions, do not interfere with the suitability of the habitat for other species expected to use such habitats, and contribute to the conservation of ecosystems and natural habitats

6. **For priority species or habitats for conservation** the area-based fishery management **measures substantially reduced pressure of the fishery on the species or habitat,** whether by reducing likelihood of bycatch, reducing likelihood of depleting a key prey species or type, reducing likelihood of vessel strikes or gear entanglements, or protecting essential habitat for the priority species or features of the priority habitat.

For measures that focus on the target species of a fishery, it is likely that any area-based fisheries management measure for a target stock would be intended to contribute to conservation and sustainable use of that particular species. For many involved in negotiating the language of Target 11, those consequences alone would fall short of the expected outcomes of the Target.

Here, the Convention definition of "in situ conservation" provides valuable context, in particular the explicit inclusion of "*conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings*". Thus, the justification for inclusion of areas solely on the first two criteria is weak unless there if there is evidence or an ecological basis to expect that: (i) Many other species or stocks characteristic of the general area would also benefit from the area-based fisheries measure, particularly priority species for conservation; and (ii) Implementation of the measure itself was unlikely to render the area unsuitable for biodiversity components for which the area would be considered "natural surroundings".

It is neither necessary nor likely that application of any single area-based fisheries management measure would meet all six criteria, just as most MPAs would not, and just as few or no areas would be expected to meet all EBSA criteria.

5.2 Context for applying the criteria

Evaluation of the criteria for OEABCMs should be context specific. The information in this Working Paper, particularly regarding the enabling and limiting factors of the possible measures, highlights many of the relevant contextual features. These contextual features may be useful in both pre-screening areas for more in-depth evaluation and should be used in the inevitable judgements that have to be made about effectiveness of a measure. They include:

1. EAF-basis. Does the area-based fisheries management measure and its implementation fit within an Ecosystem Approach to fisheries management and conservation? The more this is the case, the more likely the area will contribute to "conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings"

2. Best scientific evidence. Is selection of the measure and planning of its implementation the based on the best scientific evidence available (including social sciences), and make full use of available indigenous and local knowledge? The more this is the case, the greater the likelihood that the measures will deliver the outcomes intended.

3. Integration. Does implementation of the measure integrate explicitly fisheries management and biodiversity conservation? The more the implementation of the measure brings these two streams together the greater the likelihood there can be synergies between the fisheries policies and management actions and the policies and actions intended for biodiversity conservation.

4. Precautionary approach. Is the area-based fisheries management measures and its implementation consistent with the Precautionary Principle/Approach, explicitly considering the sources and magnitudes of uncertainties and the risks and consequences of both errors of inaction (ecological "misses") and errors of unnecessary restriction of fully sustainable ocean uses (ecological "false alarms")?

5. Degree of protection. How fully or partially do the area-based fisheries management measures offer the protections intended by the relevant criteria, including (i) area covered by the area-based fisheries measure relative to the size of the population or ecosystem features to be protected, (ii) the timing of the protection offered by the area-based fisheries management measures (seasonal, year-round) relative to the presence of the pressure(s) being managed with the measure and vulnerability of the feature(s) being protected, and (iii) expected duration of protection (likely to be temporary, rotational, or not expected to change without substantial performance evaluation and consultation)?

6. Degree of consultation with the full range of interested stakeholders. This includes fishers likely to be affected by the measure (so they understand the reasons for and goals of the measure and are more likely to comply with it), with conservation biology interests (so they have confidence that the measures will protect and where necessary improve the status of species and habitats of priority for conservation), and local communities, particularly indigenous peoples, who may have concerns about their rights being respected by the measures.

7. Capacity for monitoring, surveillance and enforcement, including community-based approaches. This would affect the likelihood that the area-based fishery measures would actually produce the intended results, by encouraging high compliance by fishers and rapid identification of and response to violations.

8. Management within and around the area and compatibility between the area-based fisheries management measures and the measures used in conventional fisheries management outside the area. The more compatible the measures are inside and outside the area the more likely that the resources and ecosystem as a whole will benefit from the measures.

5.3 Conducting the evaluations

Evidence-based evaluations of areas under these criteria and taking the additional factors into account can require time and expert effort in complex fisheries and marine systems, where impacts of specific measures may be hard to disentangle. Guidance for some degree of pre-screening areas for more thorough evaluation could be helpful but must weighed against two major findings from our literature review:

1 The typology of area-based measures used in fisheries is too complex for the determination of a few typical categories that would be meaningful and facilitate robust and rapid evaluations. Although we describe some general types of measures heuristically in the Working Paper, the intent is illustrative to keep the points being made from being too abstract.

2 Even where similar area-based measures may be adopted in different EEZs or fishing grounds, differences in the context factors (Section 5.2) can dominate strongly over any similarities in what is written in a management plan about a measure adopted.

Given these two conclusions, we advise against trying to create categories of spatial fisheries management measures that would be used as a basis for deciding that all members of some categories would be eligible for inclusion in Target 11 reporting, and all members of other categories would be ineligible. Nevertheless, the literature review indicated that for many combinations in the typology, some of these measures were likely able to provide conservation benefits if properly implemented, even though we also found but no spatial measures were so predictably effective as to that they produced substantial benefits in every application.

We also observed in the literature review that some enabling and limiting factors for effectiveness of area-based fishery measures seemed to be influential very frequently. This allows two broad generalizations, with exceptions: First certain types of area-based fisheries measures seem to be easier to implement successfully than others. Second, certain enabling factors, if present, are more likely than others to broadly

increase effectiveness of a measure whereas certain limiting factors, if present, are likely to reduce or negate effectiveness. These general patterns can help guide choices of which area-based fishery measures, implemented in which contexts, are good candidates for further evaluation as potential OEABCMs. They can also assist in the planning process for increasing the chances of success if an authority wants to implement a type of area-based measure to address a particular type of fisheries management challenge. For example

- The more exclusionary a measure is, the more likely it is to provide desired broader biodiversity benefits, but the more disruptive it is likely to be to fisheries performance;
- The more consultative the process for selecting measures and designing their implementation, the more likely there will be compliance with the measure subsequently;
- If serious structural problems exist in a fishery, such as substantial over-capacity and excessive fleet size and effort, few spatial measures can perform to their full potential, and many will have limited or no effectiveness until the structural problems are addressed;
- Inability to provide some form of effective monitoring, surveillance and enforcement of area-based measures (including community-based for small scale fisheries), is likely to weaken or negate the effectiveness of any area-based fisheries measure;
- Spill-over benefits to fisheries from areas where the fisheries are excluded depend greatly on the status of the target stocks before the closures, with substantial benefit possible for depleted target species that do well within the closed area, but limited or no potential benefits for stocks that were maintained in a healthy condition (say, near Bmsy) throughout their range before the closure (although the closures to protect particular life history functions of the target species may still be effective)

These types of considerations can be used as subjective pre-screening criteria, to pick more likely candidates for more thorough evaluation.

5.4 Information needed for applying criteria and addressing context

These potential evaluation criteria and considerations suggest some information that would be appropriate for proposals for evaluation and for justifications of areas for inclusion in Target 11 reporting. To the fullest extent possible, the material in the proposals and rationales should be evidence-based and documented, and the material peer reviewed by appropriate experts (usually both natural and social scientists and holders and/or experts in indigenous and local knowledge).

Proposals should probably include:

1. The location and the description of the area and its geographical coordinates and extent;
2. A review of its specified fishery and conservation objectives (if any) and broader biodiversity conservation outcomes that are desired;
3. An assessment of current/foreseen threats to the general area, with particular attention to any specified objectives and outcomes (see 2, above);
4. The relative coverage (in %) provided by the measure, relative to the total relevant area of the ecological feature, where an area-based measure is intended to protect only a portion of a larger feature (such as part of a nursery or spawning ground);
5. The typical migration or movement patterns of the species (particularly priority species for conservation) the spatial measure is intended to protect, and the justification for expecting the spatial measure to contribute to the conservation of that species.

6. A management plan for the area-based measures or the management plan within which they operate, containing (i) The objectives of the plan; (ii) The measures adopted to counter/mitigate these threats within the OEABCM; and (iiI) The expected outcomes of these measures (extent, probability, timing) in relation to the sustainable use objective of the target species and in relation to additional conservation outcomes, whether explicit or implicit.

6 Synthesis of Key Points

The findings in this working paper can provide the elements of a framework for evaluating the effectiveness of areas where area-based fisheries management measures are in place. The framework can be used from two different perspectives:

- There is interest in using a particular spatial measure in managing a fishery, initially for reasons of delivering outcomes about the fishery and the target stock(s). However, there is also an interest in understanding what other biodiversity outcomes may be achieved or expected.
- There is a specific biodiversity concern associated with a specific fishery – usually an ecosystem impact that should be reduced or eliminated. There is an interest in knowing how well various spatial measures both might address the biodiversity concern and might affect the fishery.

Key Messages

- The typology of how area-based measures are used in managing fisheries is multi-dimensional, with key axes of area, time, and degree of restriction. Fisheries measures include so many combinations along these axes that establishing "categories" of measures would not adequately reflect practice. Rather, for any specific area, the combination of features of the closure should be considered
- For any specific type of area-based fisheries measure (area, duration and degree of restriction), performance in terms of protecting biodiversity and allowing sustainable fisheries is highly variable. The variation is due to both the ecological, socio-economic, and governance context of the area, and the nature of implementation of the measure.
- Although as a broad generalization, as the area, duration, and degree of restriction increase, the protection of many biodiversity components also increases. However, the ecosystem impacts of the fisheries activities displaced by the exclusions also increase in the areas where the fisheries continue to operate. Effective overall conservation planning needs to include all these considerations.
- Well-designed and implemented measures can be effective even if the areas are not large and with permanent severe restrictions, and poorly designed or implemented measures can be ineffective, regardless of their scale.
- The four points above underscore that evaluation of effectiveness of area-based fisheries management measures must be done on a case-by-case basis. The evaluation should take into account the characteristics of the measure(s) being implemented, the context in which it is implemented, and the likely responses of the fisheries affected by the measure.
- The key features of the area to consider in the evaluation of specific applications of an area-based fisheries management measure include:
    - The ecological components of special conservation concern in both the specific area and the larger region, and how the measure could contribute to their conservation;
    - The size, duration, extent of restrictions and placement of the area;
    - The ability of the management authority to implement the measure if adopted, and monitor and provide enforcement in area while the measure is in place;

  - The structure of the fisheries that would be excluded by the measure, including how their likely responses to the measure could impact the effectiveness of the measure at providing biodiversity outcomes;
  - The potential contributions the measure could make to overall performance of the fishery.
- Important attributes of the context in which the measure would be applied, that also should be taken into account in the case-by-case evaluations, include:
  - The extent to which the measure(s) were developed within Ecosystem Approaches to both fisheries management and conservation of biodiversity, and are well integrated with the other measures being used to manage the fisheries and achieve the biodiversity conservation outcomes;
  - The extent to which the measure(s) were developed using the best scientific information and indigenous and local knowledge available, and an appropriate application of precaution;
  - The degree of protection that the measure(s) offers to the biodiversity components of high priority, taking into account other imminent or plausible threats in the same area, and, when relevant, outside the area;.
  - The governance processes leading to development and adoption of the measure, and their implications for compliance and cooperation with the measure(s).
- The two lists immediately above are not proposed as pass/fail criteria. Rather they provide a basis for the case-by-case evaluations of individual areas where area-based fisheries management measures are in place. They can guide both the gathering of the necessary information to evaluate and the drafting of rationales for the conclusions reached about "effectiveness" of the measures.

Acknowledgments
The authors express their grateful thanks to Daniel Dunn, Assistant Research Professor at Duke University, for his useful comments and suggestions regarding mainly dynamic ocean management, real-time measures and move-on rules.

7. References

Ainsworth, C. H., Morzaria-Luna, H.; Kaplan, I. C.; Levin, P. S.; Fulton, E. A.; et al. 2012. Effective ecosystem-based management must encourage regulatory compliance: A gulf of California study. Maine Policy, 36: 1275–1283

Ball, I., & Possingham, H. 2000. Marxan (v1.8.2)—Marine Reserve Design using Spatially Explicit Annealing. University of Queensland, Brisbane, Australia. 69 pp

Berger, A.M., Goethel, D.R. & Lynch, P.D. 2017. Introduction to "Space Oddity: Recent Advances Incorporating Spatial Processes in the Fishery Stock Assessment and Management Interface' Can. J. Fish. Aquat. Sci. 74: 1693–1697.

Blyth R.E., Kaiser M.J., Edwards-Jones G. & Hart P.J.B. 2004. A gear-restriction commercial fishery management system incorporating temporal zonation of fishing effort: Implications for benthic communities. Journal of Applied Ecology 41:

Blyth-Skyrme, R.; Kaiser, M. J.; Hiddink, J. G.; Edwards-Jones, G. & Hart, P. J. B. 2006. Conservation Benefits of Temperate Marine Protected Areas: Variation among Fish Species. Conservation Biology, 20 (3): 811-820

Bode, M., Tulloch, A.I.T., Mills,M., Venter, O. & Ando, A.W. 2015. A conservation planning approach to mitigate the impacts of leakage from protected area networks. Conservation Biology 29: 765–774

Botsford, L. W.; Brumbaugh, D. R.; Grimes, C.; Kellner, J. B.; Largier, J.; O'Farrell, M. R.; Ralston, S.; Soulanille, E. & Wespestad, V. 2009. Connectivity, sustainability, and yield: bridging the gap between conventional fisheries management and marine protected areas. Rev. Fish. Biol. Fisheries, 19: 69–95.

Brandt, M.J., Hoschle, C., Diederichs, A., Betke, K.,Matuschek, R. & Nehls, G. (2013). Seal scarers as a tool to deter harbour porpoises from offshore construction sites. Mar. Ecol. Prog. Ser. 475, 291–302.

Buxton, C.; Barret, N.; Haddon, M.; Gardner, C. & Graham, E. 2006. Evaluating the efectiveness of marine protected areas as a fisheries management tool. Australian Government. Fisheries Research and Development Corporation. FDRC Final Report 1999/162: 393 p.

Caddy, J. F. & Garcia, S. M. 1986. Fisheries thematic mapping. A prerequisite for intelligent management and development of fisheries. Océanographie Tropicale. 21(1): 31-52

CCAMLR. 2012. Report on bottom fisheries and vulnerable marine ecosystems. Hobart, Australia. www.ccamlr.org/en/system/files/appF_8.pdfwww.ccamlr.org/en/system/files/appF_8.pdf

Cinner, J., M. J. Marnane, T. R. McClanahan, & G. R. Almany 2005. Periodic closures as adaptive coral reef management in the Indo-Pacific. *Ecology and Society* **11**(1): 31. [online] URL: http://www.ecologyandsociety.org/vol11/iss1/art31/

Cohen, P.J. & Foale, S. J. 2013. Sustaining small-scale fisheries with periodically harvested marine reserves. Marine Policy, 37: 278–287

Cohen. P.J.; Jupiter, S., D.; Weeks, R.; Tawake, A.; & Govan, H. 2014Is community-based fisheries management realizing multiple objectives? Examining evidence from the literature. SPC Traditional Marine Resource Management and Knowledge Information Bulletin, 34: 3-12

Dunn, D.C.; Boustany, A.M. & Halpin, P.N. 2011. Spatio-temporal management of fisheries to reduce by-catch and increase fishing selectivity. Fish and Fisheries, 12: 110-119. DOI: 10.1111/j.1467-2979.2010.00388.x.

Dunn, D.C., Boustany, A.M., Roberts, J.J., Brazer, E., Sanderson, M., Gardner, B. & Halpin, P.N. 2014. Empirical move-on rules to inform fishing strategies: A New England case study. Fish & Fisheries, 15: 359–375

Dunn, D. C., Maxwell, S. M., Boustany, A. M. & Halpin, P. N. 2016. Dynamic ocean management increases the efficiency and efficacy of fishery management. Proceedings of the National Academy of Sciences of the United States of America (PNAS), 113(3): 668-673. DOI 10.1073/pnas.1513626113

Emery, T.J., Hartmann, K. & Gardner, C. 2016. Management issues and options for small scale holobenthic octopus fisheries. Ocean & Coastal Management 120: 180-188/

Eno, N. C.; MacDonald, D. S.; Kinnear, J. A. M.; Amos, S. C.; Chapman, C. J.; Clark, R.A.; Bunker, F. S. P. D. & Munro, C. 2001. Effects of crustacean traps on benthic fauna. ICES Journal of Marine Science, 58, 11–20.

FAO. 2003. Fisheries management. 2. The ecosystem approach to fisheries. FAO Technical Guidelines for Responsible Fisheries, 4 (suppl. 2): 112 p.

FAO. 2009. International Guidelines for the Management of Deep-sea Fisheries in the High Seas. Rome, FAO: 73p.

Fulton, E.A.; Bax, N. J.; Bustamante, R. H.; Dambacher, J. M.; Dichmont, C.; Dunstan, P. K.; Heyes, K. R.; et al. 2015. Modelling marine protected areas: insights and hurdles. Phil. Trans. R. Soc. B 370: 20140278. http://dx.doi.org/10.1098/rstb.2014.0278

Fulton, E.A.; Smith, A. D. M.; Smith, D. C. & Johnson, P. 2014. An integrated approach is needed for Ecosystem Based Fisheries Management: Insights from ecosystem-level management strategy evaluation. PLoS ONE 9(1): e84242. doi:10.1371/journal.pone.0084242

GFCM. 2007. Report of the tenth session of the Scientific Advisory Committee, Nicosia, Cyprus, 22−26 October 2007. FAO Fisheries Report No. 856, FIEL/R856 (Bi), 153 p. http://gfcmsitestorage.blob.core.windows.net/documents/web/ftp/docrep/fao/010/a1579b/a1579b.zip).

GFCM. 2016. Fisheries Restricted Areas (FRAs). www.fao.org/gfcm/data/map-fisheries-restricted-areas/en

GFCM. 2016a. Standard format for the submission of proposals for GFCM Fisheries Restricted Areas (FRA) in the Mediterranean: 21 p. www.fao.org/fileadmin/user_upload/faoweb/GFCM/excels/NewForm_FRAsSubmission adopted_by_SAC16_.docx

GFCM. 2016b. Report of the 40th session of the Commission. St Julian's, Malta, 30 May–3 June 2016. Rome, FAO. GFCM Report, 40: 144 p. www.fao.org/3/a-i6700e.pdf

Gelcich S., Edwards-Jones G., Kaiser M.J. & Watson E. 2005. Using discourses for policy evaluation: the case of marine common property rights in Chile. Society and Natural Resources 18: 377-391.

Goetz, T. & Janik, V.M. (2013). Acoustic deterrent devices to prevent pinniped depredation: efficiency, conservation concerns and possible solutions. Mar. Ecol. Prog. Ser. 492, 285–302.

Govan, H., Aalbersberg, W., Tawake, A. & Parks, J. 2008. Locally-Managed Marine Areas: A guide for practitioners. The Locally-Managed Marine Area Network: 70 p.

Govan, H. et al. 2009. Status and potential of locally-managed marine areas in the South Pacific: Meeting nature conservation and sustainable livelihood targets through wide-spread implementation of LMMAs. SPREP/WWF/WorldFish-Reefbase/CRISP: 95p + 5 annexes

Grebmeier, J.M., Cooper,L.W.,Feder,H.M.,Sirenko,B.I.,2006.Ecosystem dynamics of the Pacific-influenced northern Bering and Chukchi Seas in the Amerasian Arctic. Prog.Oceanogr.71,331–361.

Hall, S. J. 2009. Chapter 8 - Area and time restrictions: 196-219. *in*: Cochrane, K.L. & Garcia, S.M. (Eds.) *A fishery's manager guidebook*. Chichester (UK) and Rome (Italy). Wiley-Blackwell and FAO. 2nd Edition: 518 p.

Halpern, B,S, 2003. The impact of marine reserves: Do reserves work and does reserve size matter? Ecological Applications 13: S117-S137

Hannesson, R. 1998. Marine reserves: what would they accomplish? Marine Resource Economics 13, 159-170.

Hannesson, R. 2002. The Economics of Marine Reserves. Natural Resource Modeling 15(3), 273-290.

Hiddink J.G., Hutton T., Jennings S. & Kaiser M.J. 2006. Predicting the effects of area closures and fishing effort restrictions on the production, biomass, and species richness of benthic invertebrate communities. ICES Journal of Marine Science 63: 822-830. doi:10.1016/j.icesjms.2006.02.006

Hilborn, R. (2007). Defining success in fisheries and conflicts in objectives. Marine Policy, 31(2), 153–158.

Hobday, A. J. et al. 2014. Dynamic ocean management : Integrating scientific and technological capacity with law, policy and management. Stanford Environ Law J., 33(2): 125–165.

Holmes, S.J., Bailey, N., Campbell, N., Catarino, R., Barratt, K., Gibb, A. & Fernandes, P.G. 2011. Using fishery-dependent data to inform the development and operation of a co-management initiative to reduce cod mortality and cut discards. ICES J. Mar. Sci., 68: 1679–1688.

Jennings, S. & Kaiser, M. J. 1998. The effects of fishing on marine ecosystems: 203-354, *In* Blaxter, J. H. S.; Southward A. J. & Tyler P. A. (Eds.). *Advances in Marine Biology*, 34. Academic Press, London, UK

Jennings, S.; Pinnegar, J. K.; Polunin, N. V. C. & Warr, K. J. 2001. Impacts of trawling disturbance on the trophic structure of benthic invertebrate communities. Marine Ecology Progress Series, 213: 127–142.

Jupiter S.D., Cohen P.J., Weeks R., Tawake A. & Govan H. 2014. Locally managed marine areas in the tropical Pacific: Diverse strategies to achieve multiple objectives. Pacific Conservation Biology 20(2):165–179.

Kaiser, M. J., Collie, J. S., Hall, S. J.; Jennings, S. & Poiner, I. R. 2002. Modification of marine habitats by trawling activities: prognosis and solutions. Fish and Fisheries, 3: 114–136.

Kaiser M.J., Hormbrey S., Booth J.R., Hinz H. & Hiddink J.G. in press. Recovery linked to life-history of sessile epifauna following exclusion of towed-mobile fishing gear. Journal of Applied Ecology DOI: 10.1111/1365-2664.13087

Kinnear, J. A. M.; Barkel, P.J.; Mojsiewicz, W. R.; Chapman, C. J.; Holbrow, A. J., Barnes, C. & Greathead, C. F. F. 1996. Effects of Nephrops Creels on the Environment. Report No. 2/96. Scottish Office, Agriculture, Environment and Fisheries Department, Aberdeen, UK

Kaplan, I. C.; Horne, P. J. & Levin, P. S. 2012. Screening California Current fishery management scenarios using the Atlantis end-to-end ecosystem model. Progress in Oceanography, 102: 5–18.

Keppel, G.; Van Niel, K.P.; Wardell-Johnson, G.W.; Yates, C.J.; Byrne, M.; Mucina, L.; Schut, A.G.T.; Hopper, S.D. & Franklin, S.E. 2012. Refugia: identifying and understanding safe havens for biodiversity under climate change. Global Ecology and biogeography, 686: 393-404

Kerr, L. A., Hintzen, N. T., Cadrin, S. X., Clausen, L., Worsøe Dickey-Collas, M., Goethel, D. R., Hatfield, E. M.C., Kritzer, J. P., & Nash, R.D.M. 2016. Lessons learned from practical approaches to reconcile mismatches between biological population structure and stock units of marine fish. – ICES Journal of Marine Science, 74: 1708–1722.

Lester, S. E. & Halpern, B. S. 2008. Biological responses in marine no-take reserves versus partially protected areas. Marine Ecology Progress Series, 367: 49-56

Lewison R, et al. 2015. Dynamic ocean management: Identifying the critical ingredients of dynamic approaches to ocean resource management. Bioscience, 65(5): 486–498.

Little, A.S.; Needle, C.L; Hilborn, R. Holland, D.S. & Marshall, C.T. 2015. Real-time spatial management approaches to reduce bycatch and discards: Experiences from Europe and the United States. Fish & Fisheries, 16(4): 576–602.

Mangano A.C., Kaiser M.J., Porporato E. & Spano N. 2013. Evidence of trawl disturbance on mega-epibenthic communities in the Southern Tyrrhenian Sea. Marine Ecology Progress Series 475: 101-117 DOI 10.3354/meps10115

Mardle, S., Pascoe, S., & Herrero, I. (2004). Management objective importance in fisheries: An evaluation using the analytical hierarchy process (AHP). Environmental Management, 33: 1–11.

Matsuda, H., Makino, M, Tomiyama, M., et al. 2010. Fishery management in Japan. Ecological Research 25: 899-907.

Maxwell, S.M. et al. 2015. Dynamic ocean management : Defining and conceptualizing real-time management of the ocean. Marine Policy, 58: 42–50.

Miloslavich, P.; Webb, T.; Snelgrove,P.; Vanden Berghe, E.; Kaschner, K.; Halpin, P.N.; Reeves, R.R.; Lascelles, B. et a. 2016. Chapter 35 Extent of Assessment of Marine Biological diversity. *In* Inniss, L. & Simcock, A. (coordinators) et al. *The First Global Integrated Marine Assessment. World Ocean Assessment I.* United Nations

Needle, C.L. & Catarino, R. 2011. Evaluating the effect of real-time closures on cod targeting. ICES J. Mar. Sci., 68: 1647–1655.

Neumann, H., Diekmann, R., Emeis, K.-C., Kleeberg, U., Moll, A., & Kroncke, I. 2017. Full-coverage spatial distribution of epibenthic communities in the south-eastern North Sea in relation to habitat characteristics and fishing effort. Marine Environmental Research 130: 1-11.

Parks, J. E. & Salafsky, N. (Eds). 2001. Fish for the future? A collaborative test of locally managed marine areas as a biodiversity conservation and fisheries management tool in the Indo-Pacific region: Report on the initiation of a learning portfolio. World Resources Institute and Foundations of Success: 70 p. Available at: http://www.lmmanetwork.org/pdfs/fish_for_the_future.pdf

Paterson, C. J.; Pernetta, J. C.; Siraraksophon, S.; Kato, Y.; Barut, N.C.; Saikliang, P.; Vibol, O.; et al. 2013. Fisheries refugia: a novel approach to integrating fisheries and habitat management in the context of small-scale fishing pressure. Ocean & Coastal Management, 85: 214-229

Pernetta, J.C.; Paterson, C.J. & S. Siriraksophon. 2007. Fisheries refugia and marine protected areas: can theu help sustain the contribution of fisheries towards food security in Southeast Asia? SEAFDEC. Fisheries for the people: 1-9

Potts T, Burdon D, Jackson E, Atkins J, Saunders J, Hastings. E, Langmead O. 2014. Do marine protected areas deliver flows of ecosystem services to support human welfare?. Marine Policy 44: 139–148.

Savina, M.; Condie, S. A. & Fulton, E. A. 2013. The role of pre-Existing disturbances in the effect of marine reserves on coastal ecosystems: A modelling approach. PLoS ONE 8(4): e61207. http://doi:10.1371/journal.pone.0061207http://doi:10.1371/journal.pone.0061207

Richardson E.A., Kaiser M.J., Edwards-Jones G. & Possingham H.P. 2006. Incorporating socio-economics in marine reserve design: low-resolution data results in expensive mistakes. Conservation Biology 20: 1191-1202.

Rice, J.C., Lee, J., & Tandstad, M. 2014. Identifying Special Places: Criteria and processes for CBD's EBSAs and FAO's VMEs. Pp 195-209 in Garcia, S.M. et al.. (eds). Governance for Marine Fisheries and Biodiversity Conservation: Interaction and coevolution. Wiley InterScience

Rochet, M.J., Trenkel, V.M., Carpentier, A., Coppin, F., de Sola, L.G., Le´ aute, J.-P., Mahe´, J.-C., Maiorano, P., Mannini, A., Murenu, M., Piet, G., Politou, C.Y., Reale, B., Spedicato, M.-T., Tserpes, G., & . Bertrand, J.A. 2010. Do changes in environmental and fishing pressures impact marine communities? An empirical assessment. Journal of Applied Ecology 47: 741–750

Ruiz-Frau A., Kaiser M.J., Edwards-Jones G., Klein C.J., Segan D. & Possingham H.P. 2014. Balancing extractive and non-extractive uses in marine conservation plans. Marine Policy 52: 1-18.

SCBD. 2004. Technical advice on the establishment and management of a national system of marine and coastal protected areas. Montreal (Canada). Secretariat of the Convention on Biological Diversity. Ad Hoc Technical Expert Group (AHTEG) on Marine and Coastal Protected AreasCBD Technical Series, 13: 43 p

Sciberras, M., Jenkins, S.R., Mant, R., & Kaiser, M.J. 2015. Evaluating the relative conservation value of fully and partially protected marine areas. Fish and Fisheries 16: 58-77.

Shotton, R. (Compiler). 2006. Management of demersal fisheries resources of the southern Indian Ocean. FAO Fisheries Circular, 1020: 103 p.

Smith, R. J., Eastwood, P. D., Ota, Y., & Rogers, S. I. 2009. Developing best practice for using Marxan to locate Marine Protected Areas in European waters. – ICES Journal of Marine Science, 66: 188–194.

Smolowitz, R., Siemann, L.A. Huntsberger, C., & Boelke, D. 2016. Application of seasonal closures to reduce flatfish bycatch in the US Atlantic sea scallop fishery. Journal of Shellfish Research. 35: 475-480.

Squires, D. & Garcia, S.M. (eds.) 2013. Ecosystem-Level Impacts Of Fisheries Bycatch On Marine Megafauna: Biodiversity: Conservation Through Mitigation, Policy, Economic Instruments, And Technical Change Report of an IUCN-CEM-FEG Scientific Workshop IUCN, Gland, Switzerland, 7-10 October 2013.

Squires, D. & Garcia. S.M. 2018, Conservation and Management of Fisheries Bycatch and Megafauna in Marine Ecosystems: Policy, Economic Instruments, and Technical Change. Oxford University Press

Stewart G.B., Kaiser M.J., Côté I.M., Halpern B.S., Lester S.E., Bayliss H.R. & Pullin A.S. 2009. Evaluating the effectiveness of temperate marine reserves exposes critical knowledge gaps. Conservation Letters 2: 243-253.

Stock, C.A., Dunne, J.P. & John, J.G. 2014. Drivers of trophic amplification of ocean productivity trends in a changing climate Biogeosciences, 11, 7125–7135,

Sys, K., Van Meensel, J., Polet, H. & Buysse, J. 2017. A temporal race-for-fish: The interplay between local hotspots of flatfish and exploitation competition between beam trawlers after a seasonal spawning closure. Fisheries Research 193: 21–32.

Thompson, A.; Sanders, J.; Tandstad, M.; Carocci, F. & Fuller, J. 2016. Vulnerable marine ecosystems. Processes and practices in the high seas. Rome, FAO. FAO Fisheries and Aquaculture Technical

Paper, 595: 200 p. http://www.fao.org/in-action/vulnerable-marine-ecosystems/background/deep-sea-guidelines/en/

ANNEX 1. List of the references used as the information base for the inferences presented in Section 4.

Agardy, T., Claudet, J. & Day, J.C., 2016. Dangerous Targets' revisited: Old dangers in new contexts plague marine protected areas. Aquatic Conserv: Mar. Freshw. Ecosyst. 26 (Suppl. 2): 7–23.

Agence des aires marines protégées. 2017. Marine Protected Areas Dashboard. Iroiase Sea. www.aires-marines.com/.../Marine-protected-areas-dashboard/Marine-protected-areas-...

Armstrong, M.P., Dean, M.D., Hoffman, W.S. Zemeckis, D.R., Nies, T.R., Pierce, D.E., Diodati, P.J. &. McKiernan, D.J. 2013. The application of small scale fishery closures to protect Atlantic cod spawning aggregations in the inshore Gulf of Maine. Fisheries Research 141: 62– 69.

Becker, E.A., Forney, K.A. Fiedler, P.C., Barlow, J.,Chivers, S.J. Edwards, C.A., Moore, A.M. & Redfern, J.V. 2016. Moving Towards Dynamic Ocean Management: How Well Do Modeled Ocean Products Predict Species Distributions? Remote Sens. 8: 149; doi:10.3390/rs8020149

Blyth R.E., Kaiser M.J., Edwards-Jones G. & Hart P.J.B. 2004. A gear-restriction commercial fishery management system incorporating temporal zonation of fishing effort: Implications for benthic communities. Journal of Applied Ecology 41: 951-961.

Bode, M., Tulloch, A.I.T., Mills,M., Venter, O. & Ando, A.W. 2015. A conservation planning approach to mitigate the impacts of leakage from protected area networks. Conservation Biology 29: 765–774

Cabral, R.B., Gaines,S.D., Johnson, B.A., Bell, T.W. & White, C. 2017. Drivers of redistribution of fishing and non-fishing effort after the implementation of a marine protected area network. Ecological Applications, 27: 416–428.

Canessa, M., Montefalcone, M., Bavestrello, G., Povero, P., Coppo, S., Morri, C., & Bianchi, C.N., 2017. Fishery maps contain approximate but useful information for inferring the distribution of marine habitats of conservation interest. Estuarine, Coastal and Shelf Science 187: 74-83.

Clark, M. R., Althaus, F., Schlacher, T. A., Williams, A., Bowden, D. A., & Rowden, A. A. 2015. The impacts of deep-sea fisheries on benthic communities: a review. – ICES Journal of Marine Science, 73: 51–69.

Clarke, J., Bailey, D. M., & Wright, P. J. 2015. Evaluating the effectiveness of a seasonal spawning area closure. – ICES Journal of Marine Science, 72: 2627–2637.

Claudet, J., Osenberg, C.W., Benedetti-Cecchi, L., Domenici, P., García-Charton, J.-A., Pérez-Ruzafa, A., Badalamenti, F.; et al. 2008. Marine reserves: size and age do matter. Ecology Letters 11: 481-489.

Claudet, J., Osenberg, C.W., Domenici, FP., Badalamenti, F., Milazzo, M., Falcón, J.M., Bertocci, I. et al. 2010. Marine reserves: Fish life history and ecological traits matter. Ecology Letters 20: 830-839.

Costello, C. & Kaffine, D. 2017. Private Conservation In Turf-Managed Fisheries. Natural Resource Modeling 30: 32-51.

Daley, R.K. Williams, A., Green, M., Barker, B. & Brodie, P. 20`5. Can Marine reserves conserve vulnerable sharks in the deep sea? A case study of Centrophorus zeehaani (Centrophoridae),examined with acoustic telemetry. Deep-Sea Research II 115: 127–136.

Devillers, R., Pressey, R.L., Grech, A., Kittinger, J.N., Edgar, M.J., Ward, T. & Watson, R. 2014. Reinventing residual reserves in the sea: are we favouring ease of establishment over need for protection? Aquatic Conserv: Mar. Freshw. Ecosyst. 25: 480–504.

Driscoll, J. 2017. Using individual vessel quotas to manage coral and sponge bycatch: the case of the British Columbia groundfish bottom trawl fishery.

Emery, T.J., Hartmann, K. & Gardner, C. 2016. Management issues and options for small scale holobenthic octopus fisheries. Ocean & Coastal Management 120: 180-188/

Farmer, N.A., Gowan, T.A., Powell, J.R & Zoodsma, B.J. 2016. Evaluation of Alternatives to Winter Closure of Black Sea Bass Pot Gear: Projected Impacts on Catch and Risk of Entanglement with North Atlantic Right Whales *Eubalaena glacialis*. Marine and Coastal Fisheries, 8: 202-221.

Fidler, R.Y., Turingan, R.G., White, A.T. &. Alava, M.N.R. 2017. Reef-wide beneficial shifts in fish population structure following establishment of marine protected areas in Philippine coral reefs. Marine Ecology Progress Series. 570: 187–202.

Frank, K. T., Shackell, N. L., & Simon, J. E. 2000. An evaluation of the Emerald/Western Bank juvenile haddock closed area. – ICES Journal of Marine Science, 57: 1023–1034.

Frid, A., McGreer, M., Haggarty, D.R.,Beaumont, J. &. Gregr, E.J. 2016. Rockfish size and age: The crossroads of spatial protection, central place fisheries and indigenous rights. Global Ecology and Conservation 8: 170–182.

Galaiduk, R., Radford, B.T., Saunders, B.J. Newman, S.J., & Harvey, E.S. 2017. Characterizing ontogenetic habitat shifts in marine fishes: advancing nascent methods for marine spatial management. Ecological Applications 27: 1776–1788.

Girardin, R., Vermard, Y., Thebaud, O., Tidd, A. & Marchal, P. 2015. Predicting fisher response to competition for space and resources in a mixed demersal fishery. Ocean & Coastal Management 106: 124-135.

Gorelli G., Blanco M., Sardà F., Carretón M., & Company J.B. 2016. Spatio-temporal variability of discards in the fishery of the deep-sea red shrimp Aristeus antennatus in the northwestern Mediterranean Sea: implications for management. Sci. Mar. 80: 79-88.

Gru¨ss, A., Kaplan, D. M., & Robinson, J. 2014. Evaluation of the effectiveness of marine reserves for transient spawning aggregations in datalimited situations. – ICES Journal of Marine Science, 71: 435–449.

Gurney, G.G., Pressey,R.L., Ban, N.C.,´Alvarez-Romero, J.G., Jupiter, S. & Adams, V.M. 2015. Efficient and equitable design of marine protected areas in Fiji through inclusion of stakeholder-specific objectives in conservation planning. Conservation Biology 29: 1378–1389.

Hiddink J.G., Hutton T., Jennings S. & Kaiser M.J. 2006. Predicting the effects of area closures and fishing effort restrictions on the production, biomass, and species richness of benthic invertebrate communities. ICES Journal of Marine Science 63: 822-830. doi:10.1016/j.icesjms.2006.02.006

Kaiser M.J., Hormbrey S., Booth J.R., Hinz H. & Hiddink J.G. in press. Recovery linked to life-history of sessile epifauna following exclusion of towed-mobile fishing gear. Journal of Applied Ecology DOI: 10.1111/1365-2664.13087

Kaiser, M.J. Hilborn, R., Jennings, S & 62 additional authors. 2016. , Prioritization of knowledge-needs to achieve best practices for bottom trawling in relation to seabed habitats. Fish and Fisheries 17: 637–663.

Kaplan, D. M., Chassot, E., Amande´, J. M., Dueri, S., Demarcq, H., Dagorn, L., & Fonteneau, A. Spatial management of Indian Ocean tropical tuna fisheries: potential and perspectives. – ICES Journal of Marine Science, 71: 1728–1749.

Kenchington, E.L.R., Gilkinson, K.D., MacIsaac, K.G., Bourbonnais-Boyce, C., Kenchington, T.J., Smith, S.J., & Gordon, D.C., Jr. 2006. Effects of experimental otter trawling on benthic assemblages on Western Bank, northwest Atlantic Ocean. Journal of Sea Research 56: 249–270.

Kerr, L. A., Hintzen, N. T., Cadrin, S. X., Clausen, L., Worsøe Dickey-Collas, M., Goethel, D. R., Hatfield, E. M.C., Kritzer, J. P., & Nash, R.D.M. Lessons learned from practical approaches to reconcile mismatches between biological population structure and stock units of marine fish. – ICES Journal of Marine Science, 74: 1708–1722.

Kincaid, K. & Rose< G.A. 2017. Effects of closing bottom trawling on fisheries, biodiversity, and fishing communities in a boreal marine ecosystem: the Hawke Box off Labrador, Canada. Can. J. Fish. Aquat. Sci. 74: 1490–1502.

Lancaster, D., Haggarty, D.R. & Ban, N.C.. 2015. Pacific Canada's Rockfish Conservation Areas: using Ostrom's design principles to assess management effectiveness. Ecology and Society 20(3):41.

Le Port, A., Montgomery, J.C., Smith, A.N.H., Croucher, A.E., McLeod, I.M. & Lavery, S.D.. 2017 Temperate marine protected area provides recruitment subsidies to local fisheries. Proc. R. Soc. B 284: 1300.

Magris, R.A., Pressey, R.L., Mills, M., Vila-Nova, D.A. & Floeter, S. 2017. Integrated conservation planning for coral reefs: Designing conservation zones for multiple conservation objectives in spatial prioritisation. Global Ecology and Conservation 11: 53-68.

Mangubhai, S. Wilson, J.R., Rumetna, L., & Maturbongs, J.P. 2015. Explicitly incorporating socioeconomic criteria and data into marineprotected area zoning. Ocean & Coastal Management 116: 523-529.

McAllister, J. D., Barnett, A., Lyle, J. M., & Semmens, J. M. 2015. Examining the functional role of current area closures used for the conservation of an overexploited and highly mobile fishery species. – ICES Journal of Marine Science, 72: 2234–2244.

McGowan, J. , Bode, M., Holden, M.H., Davis, K., Krueck, N.C., Beger, M., Yates, K.L., & Possingham, H. P. 2018. Ocean zoning within a sparing versus sharing framework. Theoretical Ecology xxx 10pp

Miethe, T., Bastardie, F., von Dorrien, C. & Nielsen, J.R. 2014. Impact assessment of a fisheries closure with effort and landings spatial analyses: A case study in the Western Baltic Sea. Fisheries Research 157: 170–179

Miotto, M.L., Maichak de Carvalho, B., & Spach, H.L. 2017 Does the closed fishing season influence the ichthyofauna consumed by *Larus dominicanus*? Brazilian Journal of Oceanography, 65: 9-18.

Nenadovic, M., T. Johnson, & J. Wilson. 2012. Implementing the Western Gulf of Maine Area Closure: the role and perception of fishers' ecological knowledge. Ecology and Society 17: 20. 1-15.

Neumann, H., Diekmann, R., Emeis, K.-C., Kleeberg, U., Moll, A., & Kroncke, I. 2017. Full-coverage spatial distribution of epibenthic communities in the south-eastern North Sea in relation to habitat characteristics and fishing effort. Marine Environmental Research 130: 1-11.

O'Boyle, R. 2011. Benefits of marine protected areas and fisheries closures in the Northwest Atlantic. Can. Tech. Rep. Fish. Aquat. Sci. 2948: iii + 68 p.

Oliver, T.A., Oleson, K.L.L., Ratsimbazafy, H., Raberinary, D., Benbow, S., & Harris, A. 2015. Positive Catch & Economic Benefits of Periodic Octopus Fishery Closures: Do Effective, Narrowly Targeted Actions 'Catalyze' Broader Management? PLoS ONE 10(6): e0129075. doi:10.1371/journal.pone.0129075.

Ono, K., Punt, A.E. & Hilborn, R. 2015. How do marine closures affect the analysis of catch and effort data? Can. J. Fish. Aquat. Sci. 72: 1177–1190.

Pons. T., Branch. T.A.,Melnychuk, M.C., Jensen, O.P., Brodziak, J., Fromentin, J.M., Harley, S.J., Haynie A.C., Kell, L.T., Maunder, M.N., Parma, A.M. Restrepo, V.R., Sharma, R., Ahrens, R., & Hilborn, R. 2017. Effects of biological, economic and management factors on tuna and billfish stock status. Fish and Fisheries 18: 1–21.

Richardson E.A., Kaiser M.J., Edwards-Jones G. & Possingham H.P. 2006. Incorporating socio-economics in marine reserve design: low-resolution data results in expensive mistakes. Conservation Biology 20: 1191-1202.

Richerson, K. & Holland, D.S. 2017 Quantifying and predicting responses to a US West Coast salmon fishery closure ICES Journal of Marine Science, 74: 2364–2378,

Rincoân B., & Kenchington, E.L. 2016. Influence of Benthic Macrofauna as a Spatial Structuring Agent for Juvenile Haddock (Melanogrammus aeglefinus) on the Eastern Scotian Shelf, Atlantic Canada. PLoS ONE 11(9): e0163374. doi:10.1371/journal.pone.0163374

Ruiz-Frau A., Kaiser M.J., Edwards-Jones G., Klein C.J., Segan D. & Possingham H.P. 2014. Balancing extractive and non-extractive uses in marine conservation plans. Marine Policy 52: 1-18.

Samy-Kamal, M., Forcada, A. & Sánchez Lizaso, J.L. 2015. Effects of seasonal closures in a multi-specific fishery. Fisheries Research 172: 303–317.

Savina M., Condie, S.A. & Fulton, E.A. 2013. The Role of Pre-Existing Disturbances in the Effect of Marine Reserves on Coastal Ecosystems: A Modelling Approach. PLoS ONE 8(4): e61207. doi:10.1371/journal.pone.0061207

Schmiing, M., Diogo, H., Serra˜o Santos, R., & Afonso, P.2015. Marine conservation of multispecies and multi-use areas with various conservation objectives and targets. – ICES Journal of Marine Science, 72: 851–862.

Sciberras M., Hinz H., Bennell J., Jenkins S.R., Hawkins S.J. & Kaiser M.J. 2013. Benthic community response to a scallop closure in a dynamic seabed habitat. Marine Ecology Progress Series 480: 83-98.

Spalding, M.D., Meliane, I., Bennett, N.J. Dearden, P., Patil, P.G., &. Brumbaugh, R.D. 2016. Building towards the marine conservation end-game: consolidating the role of MPAs in a future ocean. Aquatic Conserv: Mar. Freshw. Ecosyst. 26 (Suppl. 2): 185–199.

Stewart G.B., Kaiser M.J., Côté I.M., Halpern B.S., Lester S.E., Bayliss H.R. & Pullin A.S. 2009. Evaluating the effectiveness of temperate marine reserves exposes critical knowledge gaps. Conservation Letters 2: 243-253.

Sutcliffe, P.R., Klein,C.J., Pitcher,C.R. & Possingham, H.P. 2015. The effectiveness of marine reserve systems constructed using different surrogates of biodiversity. Conservation Biology, 29: 657–667.

Sys, K., Van Meensel, J., Polet, H. & Buysse, J. 2017. A temporal race-for-fish: The interplay between local hotspots of flatfish and exploitation competition between beam trawlers after a seasonal spawning closure. Fisheries Research 193: 21–32.

Tancell, C., Sutherland, W.J. & Phillips R. 2016. Marine spatial planning for the conservation of albatrosses and large petrels breeding at South Georgia. Biological Conservation 198: 165–176.

Tulloch, V.J., Klein, C.J., Jupiter, S.D., Tulloch, I.T.T., Roelfsema, K., & Possingham, H.P. 2017. Trade-offs between data resolution, accuracy, and cost when choosing information to plan reserves for coral reef ecosystems. Journal of Environmental Management 188: 108-119.

van der Lee, A., Gillis, D.M., Comeau, P., &. Hurley, P. 2013. Fishing the line: catch and effort distribution around the seasonal haddock (Melanogrammus aeglefinus) spawning closure on the Scotian Shelf. Can. J. Fish. Aquat. Sci. 70: 973–981.

Vincent, C., Ridoux, V., Fedak, M. A., McConnell, B. J., Sparling, E. E., Leaute, J.-P., Jouma'a, J., & Spitz, J. 2016. Foraging behaviour and prey consumption by grey seals (*Halichoerus grypus*)—spatial and trophic overlaps with fisheries in a marine protected area. – ICES Journal of Marine Science, 73: 2653–2665.

Wells, S., Ray, G.C. Gjerde, K.M., White, A.T., Muthiga, N., Bezaury Creel, J.E., Causey, B.D., Mccormick-Ray, J., Salm, R Gubbay, S. Kelleher, G., & Reti, J. 2016. Building the future of MPAs – lessons from history. Aquatic Conserv: Mar. Freshw. Ecosyst. 26 (Suppl. 2): 101–125.

White, C.J., Beger, M., Grantham, H.S., Halpern, B.S., Klein, C.J., Mumby, M.J., Tulloch, V.J.D., Ruckelhaus, M. & Possingham. H.P. 2015. Fisheries and biodiversity benefits of using static versus dynamic models for designing marine reserve networks. Ecosphere 6 :182. 1-14. http://dx.doi.org /10.1890/ES14-00429.

Yates, K.L., Schoeman, D.S. & Klein, C.J. 2015. Ocean zoning for conservation, fisheries and marine renewable energy: Assessing trade-offs and co-location opportunities. Journal of Environmental Management 152: 201-209.

Young, M., & Carr, M. 2015. Assessment of Habitat Representation across a Network of Marine Protected Areas with Implications for the Spatial Design of Monitoring. PLoS ONE 10(3): e0116200. doi:10.1371/journal.pone.0116200.

_____