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Methods

The contribution of Area-Based Fisheries Management Measures to Fisheries Sustainability and Marine Conservation: a global scoping review protocol

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Abstract

Objective: This scoping review (ScR) aims to identify and map the evidence base on the contribution of area-based fisheries management measures (ABFMs) to fisheries sustainability and marine conservation. Emphasis will be given to the research that has been conducted in terms of the methodologies applied and the key findings acknowledged.

Introduction: ABFMs have been used for centuries and are present in modern fisheries management plans and regulations. Although ABFMs are commonly related to the sustainable exploitation of the target species of the managed fishery, they may also be

considered as wider conservation measures, in the cases where their outcomes include the protection or reduction of impact on biodiversity or ecosystem structures and functions.

Inclusion criteria: Studies that perform an assessment of the contribution of ABFMs on either fisheries sustainability or on area-based marine conservation (or both) will be considered. All types of ABFMs in the marine realm globally, which are established as management measures by any type of designation authority or jurisdiction and for any type of fishing activity, gear, target species and/or habitats will be considered. Peer-reviewed and grey literature will be included. There will be no search limitations applied by year of publication. Studies in English, French, Greek, Italian, Spanish and Swedish will be reviewed.

Methods: The ScR will be conducted in accordance with the JBI (Joanna Briggs Institute) methodology. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) extension for ScRs will guide the protocol. The bibliographic databases to be searched include Scopus and Web of Science. Sources of grey literature will include databases, pre-print archives, organisational websites and web-based search engines. The design of the search strategy will be guided by a librarian/ information specialist. The Zotero software, Sysrev platform and EviAtlas tool will be used for data management, extraction and presentation. Data will be extracted by two reviewers. Tables, graphs and maps along with a narrative summary of the outcomes will be presented.

Keywords

area-based marine conservation; fisheries closures; fisheries restricted areas; fisheries spatial measures; fisheries spatiotemporal measures

Introduction

Area-based fisheries management measures (ABFMs) i.e. permanent or temporal restrictions on fishing activities applied at specific geographic areas, are formally established, spatially defined fishery management measures, implemented to achieve one or more intended fishery outcomes. The outcomes of these measures are commonly related to sustainable use of resources by the fishery (Rice et al. 2018). ABFMs have been used for centuries (e.g. in traditional fisheries management) and have been applied in most modern fisheries management plans and regulations (Garcia et al. 2020). Article 6.3 of the FAO Code of Conduct for Responsible Fisheries (FAO 1995) declares that "*states should prevent overfishing and excess fleet capacity and should implement management measures to ensure that fishing effort is commensurate with the productive capacity of the fishery resources and their sustainable utilization*". ABFMs are amongst other measures that can contribute towards achieving these objectives by limiting harvest of specific life stages, protecting depleted stocks and their habitats during the rebuilding phase of a fishery, protecting genetic reservoirs, protecting habitat that is critical for the sustainability

of fished populations or restraining fleet capacity and optimising the value of the catch (Hall 2009).

Although ABFMs are commonly related to the sustainable exploitation of the target species of the managed fishery, they are increasingly being considered as wider conservation measures, in the cases where their outcomes include the protection or reduction of impact on biodiversity components, non-commercial species at risk, habitats or ecosystem structures and functions (FAO 2019, Garcia et al. 2020, ICES 2021, Petza et al. 2019, Rice et al. 2018). Depending on their objectives, area-based measures may promote different forms of conservation, i.e. primary, secondary or ancillary (IUCN-WCPA 2019). Primary conservation outcomes may be promoted by ABFMs when the conservation benefits they produce are their intended and explicit primary objective, as in many Vulnerable Marine Ecosystems (VMEs) closed to bottom-contacting gears. Secondary conservation outcomes may be promoted when conservation benefits are ABFMs' intended and explicit, but secondary objective, as in many fishery closures is to regulate harvest, but positioned to also protect habitat features. Lastly, ABFMs may also promote ancillary conservation in the cases when the conservation benefits are explicitly intended to contributing to sustainable harvest of the target species, but de facto also reduce pressure on other biodiversity components, as in the case of many closures of areas to protect juveniles of a target species with no other biodiversity conservation objective, but nevertheless removing fishing pressure on all other species in the area. These ABFMs may potentially meet the definition of Other Effective Area-Based Conservation Measures (OECMs) of the Convention for Biological Diversity Decision 14/8 (CBD 2018) and contribute along with the Marine Protected Areas (MPAs) to the attainment of Aichi Target 11 of the Strategic Plan for 2011-2020 (CBD 2010), Target 14.5 of the 2030 Agenda for Sustainable Development (UN 2015) and the 2030 Action Target 2 of the Post 2020 Global Biodiversity Framework (CBD 2020). According to Target 3 of the First Draft of the Post-2020 Global Biodiversity Framework, actions should be taken by 2030 in order to "*Ensure that at least 30 per cent globally of land areas and of sea areas, especially areas of particular importance for biodiversity and its contributions to people, 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.*" (CBD 2021).

ABFMs' performance may be assessed in relation to their contribution to fisheries' sustainability as well as to broader conservation. Assessing the contribution of ABFMs to fisheries sustainability, commonly the primary objective of a conventional ABFM, is of vital importance to evaluate its effectiveness and readjust the measures applied to obtain optimal performance in the context of the explicit management objective(s). According to article 7.6.8 of the FAO Code of Conduct for Responsible Fisheries, "*The efficacy of management measures and their possible interactions should be kept under continuous review. Such measures should, as appropriate, be revised or abolished in the light of new information*" (FAO 1995). Consistent with the Ecosystem Approach to Fisheries (FAO 2003), it is important to include an evaluation of the overall consequences of an ABFM, based on the biology of the species concerned and the nature of the fishery. The

success of spatial and temporal closures can be limited if their effect is merely to displace fishing activity and maintain or increase mortality on the same or other life history stages of the target species or other species elsewhere.

Besides contributing to fisheries sustainability, the contribution of ABFMs to marine conservation is also of great significance, especially within the OECMs concept. As is evident by the term and also by Criterion C of the CBD Decision 14/8 (CBD 2018), one of the basic components of a potential OE(effective)CM is that it should "*achieve sustained and effective contribution to in situ conservation of biodiversity*". It is challenging, however, to measure precisely the efficacy of ABFMs, as they are generally implemented as part of a mix of other management methods (inside and around the area where the ABFM is in place) and in the context of changes in broader environmental and socio-economic factors, which all complicate the identification of individual cause-effect relationships. In general terms, the performance of an ABFM depends on (Rice et al. 2018): (a) the overall state of the environment and its intrinsic oscillations, including climate change; (b) the adequacy of its parameters (e.g. space, time, fishing activities restricted etc.); (c) its intended purpose(s) when adopted and what fishery issues it is intended to address; (d) fishery governance, particularly community involvement, access rules, additional management measures, inside and outside the ABFM and enforcement; and (e) overall fishing pressure.

A preliminary search of Scopus and Web of Science was conducted and no current or underway systematic reviews focusing on both the fisheries sustainability and the marine conservation aspect of ABFMs, applied as purely fisheries management measures, were identified. Rice et al. (2018) have attempted to review the different types of ABFMs, with regard to how "effective" they are from a conservation perspective, in a working paper prepared to inform the CBD Expert Workshop on MPAs and OECMs for Achieving Aichi Biodiversity Target 11 in marine and coastal areas. Due to the nature of the scattered and incomplete literature available, the authors applied an illustrative rather than a systematic approach to review and synthesise the evidence available. On the other hand, there is extensive literature available regarding the assessment of the spatial (amongst others) measures performance applied within MPAs (i.e. as conservation management measures), in terms of specifying the types of biodiversity outcomes that could be indicative of improved conservation (Fulton et al. 2015, Spalding et al. 2016, Wells et al. 2016). Sciberras et al. (2015) have performed a systematic review on specific types of outcomes from the use of specific spatial conservation measures, i.e. by comparing partially to fully protected marine areas and open access areas to assess the potential benefits of different levels of protection for fish populations. However, that review did not explore in depth how various contextual factors (e.g. oceanographic characteristics, jurisdictions, governance regimes etc.) in the application of the spatial measures influences their outcomes.

A synthesis, simultaneously considering the fisheries sustainability and the marine conservation aspect of ABFMs, would be of high relevance and interest for both the fields of fisheries and environmental management and policy. Consequently, it was deemed essential to perform a scoping review (ScR), as a starting point for such an evidence-based synthesis path. ScRs can be conducted to meet various objectives, such as to map the key concepts underpinning a research area, as well as to clarify working definitions

and/or the conceptual boundaries of a topic (Arksey and O'Malley 2005). More specifically, ScRs may examine the extent (size), range (variety) and nature (characteristics) of the evidence on a topic or question, determine the value of undertaking a systematic review, summarise findings from a body of knowledge that is heterogeneous in methods or discipline or identify gaps in literature. All these results can aid the planning and commissioning of future research to focus on any one of these aims or all of them as a set (Peters et al. 2020, Tricco et al. 2018). The ScR was considered as the most appropriate method for this evidence synthesis as the overarching goal is to present a balanced and complete overview of literature on the topic of interest, by exploring the types of available evidence and examining how research has been conducted in terms of methodologies applied and outcomes achieved. The objectives of this ScR are to:

- identify and map the available evidence on how ABFMs applied purely as fisheries management measures have contributed to fisheries sustainability and area-based marine conservation,
- examine how research has been conducted to assess the contribution of ABFMs to fisheries sustainability and marine conservation in terms of the methodologies applied,
- provide a comprehensive summary of the key findings relevant to the contribution of ABFMs to fisheries sustainability and marine conservation and
- identify and discuss knowledge gaps in the existing literature.

The intent of this ScR is to provide insights into the evidence-based knowledge about ABFMs available to fisheries managers and policy-makers and also to provide information for the policy discussion of where an ABFM should be positioned along the continua of "effectiveness" in order to qualify as an OECM and contribute along with the MPAs to the attainment of the spatial targets set by CBD (CBD 2010, CBD 2020).

Review Question

The overall research question that will guide this ScR is: What is the current knowledge about the extent to which ABFMs as fisheries management measures contribute to fisheries sustainability and marine conservation at a global scale? More specifically, the ScR will attempt to answer the following sub-questions:

1. Which is the geographical distribution of the studies that have assessed the contribution of ABFMs to fisheries sustainability and/or marine conservation?
2. What are the characteristics of ABFMs studied in terms of typology (e.g. spatial and temporal type, duration, area etc), objectives, rationale, management, governance etc?
3. Which are the methodologies followed to assess the contribution of ABFMs to fisheries sustainability and/ or marine conservation?
4. What are their key findings?

Inclusion criteria

The inclusion criteria of the protocol, which provide the basis on which sources will be considered for inclusion by the ScR, were developed in correspondence with the "Participants, Concept and Context, PCC" mnemonic and are detailed below.

Participants

This review will consider all types of ABFMs which were established as purely fisheries management measures by national, regional or international fisheries management authorities or organisations to support fisheries sustainability or broader ecosystem reasons for any type of fishing activity, gear, target species and/or habitats. Given the large range of ABFMs due to their different potential purposes and contextual parameters, examples of ABFM types that will be considered by the current review may include, amongst others, no fishing areas, fisheries restricted areas, spatio/temporal closures to fishing activities, total gear bans, marine areas for responsible fisheries etc. (see Table 1 for an indicative list of ABFMs types and their constraints in space, time and fishing activities as proposed by Rice et al. (2018) along with their description as summarised for the purposes of the current study). Regardless of the measure's terminology, the two following critical criteria should be absolutely met by the area-based measure, in order to be considered as an ABFM and be eligible for the current scoping review: (a) the area-based measure is established by the fisheries sector and related directly to fisheries management, so as to satisfy the F(Fisheries) and M(Management) components of the term ABFM and (b) the area where the measure is applied is not currently recognised or reported as a protected area or as part of a protected area, so as to be able to be considered as a potential OECM (OECMs Identification Criterion A of the CBD Decision 14/8 (CBD 2018)). Any area-based measures related to fishing activities, which were established for purposes other than to support fisheries sustainability, such as cross-sectoral area-based measures to conserve or restore biodiversity (within MPAs or not) or for any other purpose, for example, to protect underwater archaeological heritages or to exclude fishing activities from ports, beaches, underwater pipe or cable areas, military areas etc., will be excluded from the ScR, as they do not meet the definition of ABFMs and thus fall out of the scope of the current study.

Concept

The concepts that will be studied in this ScR are fisheries sustainability and conservation of marine biodiversity and how the contribution of ABFMs to these two concepts has been addressed so far in the scientific literature. All studies that perform an assessment of the contribution of ABFMs on either fisheries sustainability and/or on marine conservation will be considered. All types of methodologies applied, metrics used (e.g. ecological, economic or social) and key findings recorded on the effectiveness of ABFMs for fisheries sustainability and/ or marine conservation will be reviewed.

Table 1.

Main types of Area-Based Fishery Management Measures (ABFMs) and their constraints in space, time and fishing activities as proposed by Rice et al. (2018) and their description as summarised for the purposes of the current study. Time: PERM= permanent; TEMP= temporal; SEAS=seasonal; RT= real time. Space closed: HS= High Sea, EEZ=exclusive economic zone; FG= fishing ground; PART= partial. Fishing Activities: TC= total closure; PC= partial closure.

TYPES OF ABFMS	DESCRIPTION	DIMENSION CONSTRAINED		
		Time	Space	Fishing Activities
Total closures for fisheries management reasons	Measures 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 (permanent) or until the conditions that led to the closure disappear (temporary).	PERM TEMP	HS, EEZ, FG	TC, PC
No-fishing areas	"No-fishing" areas can be instituted (a) in a zoning 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 or (b) where there are operational security concerns due to other human activities in the same area.	PERM	HS, EEZ, FG	TC, PC
Fishing zones	Measures to allocate the available space and the resources therein, exclusively to types of fishing or fleets or to socio-economic groups, excluding others with the purpose to improve equity, allocate *de facto* some resources to some target groups of fishers, avoid conflict between fisheries using incompatible gears and reduce the risk of dangerous collisions.	PERM	EEZ	PC
Vulnerable Marine Ecosystems (VMEs)	Closures of areas for the management of bottom-contracting gears because of the risks incurred by Vulnerable Marine Ecosystems (VMEs).	PERM	HS, PART	TC, PC
Benthic Protected Areas (BPAs)	Voluntary closure to fishing activities for the vessels of the Southern Indian Ocean Deepwater Fishers Association (SIODFA) in deep-sea benthic habitats representative of a wide zone across the South Indian Ocean for the conservation of globally significant biodiversity, such as deep-water corals and sponges as well as sharks, tuna, marine mammals and commercially-important deep-sea fish species.	PERM	HS, PART	TC, PC
Ring Fencing	Ring-fencing 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). It delimits implicitly or explicitly the extent of the areas historically and currently exploited by (certain) fisheries and intends to limit further development in all areas beyond that limit. Instead of protecting an area inside the fishing ground, it intends to limit expansion outside it. Established first by the sub-sector itself, it was later endorsed by the State.	PERM	EEZ, FG	PC

TYPES OF ABFMS	DESCRIPTION	DIMENSION CONSTRAINED		
		Time	Space	Fishing Activities
Fishery Restricted Areas (FRAs)	Multipurpose spatial management tools 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.	PERM	HS	PC
Rotational closures	They involve temporary inter-annual and usually recurrent closures and re-opening of a set of areas (in sequence) to specific fisheries or gears. In the long-term, all areas in the sequence are fished on some pre-established multi-year schedule. They are often used, for example in some fisheries for sedentary benthic species, when efficient harvesting can rapidly take most of the stock in a local area and renewal of the stock takes several years.	TEMP	EEZ, PART	PC
Seasonal gear-specific closure	Closed 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. 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, is especially exposed to fishing pressure.	SEAS	HS, EEZ, FG, PART	PC
Real-time spatial management (RTSM)	A dynamic type of fishery management where 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 and/or onboard observers and complex fishery models are needed. 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. Fishers' fishing opportunities are then adjusted up or down depending on their performance in avoiding bycatch.	RT	PART	PC
Move on rules for fishing (real-time exclusion)	They require set by set 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 stops and the vessel must move a specified distance before trying another fishing event. This continues until the monitoring shows that the trigger is no longer exceeded. The area is immediately signalled to the management authority and fishing is excluded in the area for all vessels. The exclusion may be temporary or permanent.	RT	HS, EEZ, FG, PART	PC

TYPES OF ABFMS	DESCRIPTION	DIMENSION CONSTRAINED		
		Time	Space	Fishing Activities
Real-time incentives	Economic instruments by which 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 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.	RT	PART	PC
Marine Managed Areas (MMAs) and Locally-Managed Marine Areas (LMMAs)	MMAs are 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. They differ significantly from MPAs in that 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 for permanence. LMMAs are 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 organisations and/or collaborative government representative who reside or are based in the immediate area. Some areas may be closed or opened as needed within the LMMA.	TEMP	PART	PC
Marine areas for responsible fishing (MARF)	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 for which the Costa-Rica Institute of Fisheries and Agriculture (INCOPESCA) can count on the support of coastal communities and/or other Institutions.	-	-	-
Refugia	Delimited areas established 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.	-	-	-
Territorial Use Rights in Fisheries (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, a cooperative, association or community.	PERM	PART	PC

TYPES OF ABFMS	DESCRIPTION	DIMENSION CONSTRAINED		
		Time	Space	Fishing Activities
Fishery community-based MPAs	Clearly identified marine area, which is managed through law or other effective means while giving consideration to the utilisation 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.	-	-	-

Context

Studies on ABFMs in marine realm worldwide will be considered by the ScR established in territorial, international waters or exclusive economic zones and in all depths. Studies on ABFMs in inland or transitional waters will not be considered.

Types of Sources

This ScR will consider peer-review literature (e.g. articles, reviews, book chapters, letters, editorials, books, data papers) retrieved by peer-reviewed literature databases and grey literature (e.g. non-published academic research, theses, policy papers, organisational papers and reports, conference abstract and papers) retrieved by pre-print archives, organisational websites and web-based search engines. Both experimental and observational studies will be reviewed. There will be no search limitations applied by year of publication, publication stage (final or in press), subject area and source type. All types of documents will be considered, except for evidence synthesis (e.g. systematic reviews, scoping reviews, rapid reviews etc.) or literature reviews. Language limitations will be applied in the literature search process to meet authors' language competence. Thus, studies published in languages other than English, French, German, Greek, Italian, Spanish and Swedish will be excluded from the ScR.

Methods

The proposed ScR will be conducted in accordance with the Arksey and O'Malley (2005) methodology, as advanced by Levac et al. (2010) and the JBI (Joanna Briggs Institute) methodology for scoping reviews (Peters et al. 2020). The ScR will be conducted in the following nine stages as proposed by the JBI methodology:

1. Defining and aligning the objective/s and question/s,
2. Developing and aligning the inclusion criteria with the objective/s and question/s,
3. Describing the planned approach to evidence searching, selection, data extraction and presentation of the evidence,
4. Searching for the evidence,
5. Selecting the evidence,
6. Extracting the evidence,

7.   Analysis of the evidence,
8.   Presentation of the results and
9.   Summarising the evidence in relation to the purpose of the review, drawing conclusions and noting any implications of the findings.
10. The development of review objectives and questions, ScR inclusion criteria and literature sources (including grey literature) have been undertaken together with topical experts. A librarian was consulted to help define an effective search strategy including key search terms and literature databases.

The Preferred Reporting for Systematic Reviews and Meta-Analyses extension for scoping reviews, PRISMA-ScR (Tricco et al. 2018) will guide the proposed ScR protocol (Table 2) and the forthcoming ScR. The SUMARI Protocol Template for Scoping Reviews in word format (JBI SUMARI 2021) was used for the reporting of the proposed scoping review. Any deviations from the protocol will be clearly detailed in the final ScR report, to maintain transparency.

Table 2.

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist. JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.* Where *sources of evidence* are compiled from, such as bibliographic databases, social media platforms and Web sites. † A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g. quantitative and/or qualitative research, expert opinion and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources*. ‡ The frameworks by Arksey and O'Malley 2005 and Levac et al. 2010 and the JBI guidance (Peters et al. 2020) refer to the process of data extraction in a scoping review as data charting. § The process of systematically examining research evidence to assess its validity, results and relevance before using it to provide information for a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g. quantitative and/or qualitative research, expert opinion and policy document). *From*: Tricco et al. (2018)

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results and conclusions that relate to the review questions and objectives.	1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	2

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g. population or participants, concepts and context) or other relevant key elements used to conceptualise the review questions and/or objectives.	4
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g. a Web address); and if available, provide registration information, including the registration number.	N/A this is a protocol
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g. years considered, language and publication status) and provide a rationale.	5
Information sources*	7	Describe all information sources in the search (e.g. databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	6
Search	8	Present the full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	7
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e. screening and eligibility) included in the scoping review.	7
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g. calibrated forms or forms that have been tested by the team before their use and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	8
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	8
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A this is a protocol
Synthesis of results	13	Describe the methods of handling and summarising the data that were charted.	N/A this is a protocol
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	N/A this is a protocol
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	N/A this is a protocol
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A this is a protocol
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	N/A this is a protocol
Synthesis of results	18	Summarise and/or present the charting results as they relate to the review questions and objectives.	N/A this is a protocol
DISCUSSION			

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Summary of evidence	19	Summarise the main results (including an overview of concepts, themes and types of evidence available), link to the review questions and objectives and consider the relevance to key groups.	N/A this is a protocol
Limitations	20	Discuss the limitations of the scoping review process.	N/A this is a protocol
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	N/A this is a protocol
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	9

Search Strategy

The search strategy will aim to locate both peer-reviewed and grey literature. An initial limited search in Scopus was undertaken to identify relevant articles. The text words, contained in the titles and abstracts of relevant articles and the index terms used to describe the articles, were used to develop a full search strategy for Scopus and Web of Science Platform – Core Collection (see Suppl. material 1). The search strategy, including all identified keywords and index terms, will be adapted for each included database and/or information source. For the identification of the set of search terms, the terminology and typology of ABFMs compiled by Rice et al. (2018) will be considered (Table 1). The reference lists of all included sources of evidence will be screened for additional studies that fall within the scope of the study.

For peer-review literature, the bibliographic databases to be searched include Scopus and Web of Science (Core Collection). Sources of grey literature to be searched will include grey literature databases (e.g. OpenGrey), pre-print archives (e.g. ArchivX), organisational websites (e.g. IUCN, FAO, ICES, NAFO, NEAFC, GFCM, WWF, Oceana, Greenpeace etc) and web-based search engines (e.g. Google). In web-based search, the first 500 hits will be screened. The design, development and execution of the search strategy will be guided by a librarian/ information specialist.

Study/Source of Evidence Selection

Following the search, all identified citations will be collated, uploaded to Zotero open-source reference management software (Zotero 2021) and duplicates removed. Two reviewers will conduct the systematic review. A pilot testing of source selection will be performed to allow the reviewers to refine the selection procedure. To this end, a random sample of 25 titles/abstracts will be selected, both reviewers will screen these studies using the eligibility criteria, discuss discrepancies and make modifications to the eligibility criteria. The reviewers will start screening the articles when 75% (or greater) agreement has been achieved (otherwise the pilot testing will be repeated). Following the pilot test, titles and

abstracts will then be screened by the two reviewers for assessment against the inclusion criteria (see section Inclusion Criteria; Table 3). Potentially relevant sources will be retrieved in full and their citation details imported into the SysRev 2021 Insilica LLC (SysRev 2021). The full text of selected citations will be assessed in detail against the inclusion criteria by the two independent reviewers. Reasons for exclusion of sources of evidence that do not meet the inclusion criteria will be recorded and reported in the scoping review. Any disagreements that will arise between the reviewers at each stage of the selection process will be resolved through discussion by consensus or by the decision of an additional reviewer. The results of the search and the study inclusion process will be reported in full in the final scoping review and presented in a Preferred Reporting Items for Systematic Reviews and Meta-analyses extension for scoping review (PRISMA-ScR) flow diagram (Tricco et al. 2018).

Data Extraction

Data will be extracted from papers included in the ScR by the two independent reviewers using a data extraction tool, i.e. a charting table aligned to the objective and the questions of the ScR (Suppl. material 2). The data extracted will include specific details about the participants, concept, context, study methods and key findings relevant to the review objective. The data extraction tool inserted in the Sysrev platform will facilitate data extraction consistency as well as reviewers' cooperation and interaction.

The initial data extraction tool will be modified and revised when deemed necessary during the process of extracting data from each included evidence source. Modifications will be detailed in the final reporting of the ScR. If necessary, corresponding authors of papers will be contacted to request missing or additional data, where required.

Data Analysis and Presentation

The evidence synthesised by the ScR will be presented in correspondence to the review objective and questions. The data will be presented in both graphical and tabular form. The inclusion of the default graphical and tabular outputs provided by Sysrev (SysRev 2021) will be considered, while the ones that adequately and effectively describe the evidence synthesis outcomes will be presented at the final reporting of the ScR. In addition, the outcomes will be mapped via the EviAtlas tool for visualising evidence synthesis databases (Haddaway et al. 2019). A narrative summary will accompany the tabulated and/or charted results and will describe how the results relate to the reviews' objective and question/s.

Table 3.

Inclusion and exclusion criteria for the Scoping Review in correspondance with the "Participants, Concept and Context, PCC" mnemonic and evidence types and sources.

		Inclusion criteria	Exclusion criteria
PARTICIPANTS	**Area-based fisheries management measures (ABFMs)**	• ABFMs established as purely fisheries management measures • ABFMs established by national, regional or international fisheries management authorities or organisations • ABFMs for any type of fishing activity, gear, target species and/or habitats	• Any restrictions to fishing activities established for purposes other than to support fisheries sustainability, i.e. to conserve or restore biodiversity (within MPAs or not) or for any other purpose e.g. to protect underwater archaeological heritages or to exclude fishing activities from ports, beaches, underwater pipe or cable areas, military areas etc.
CONCEPT	**Contribution of ABFMs to fisheries sustainability and marine conservation**	• All studies that perform an assessment of the contribution of ABFMs on fisheries sustainability and/or on marine conservation • All types of methodologies applied, metrics used and key findings recorded on the effectiveness of ABFMs for fisheries sustainability and/or marine conservation	---

		Inclusion criteria	Exclusion criteria
CONTEXT	**Global marine realm**	Studies in: • marine realm, • globally, • national, international water or Exclusive Economic Zones all depths	Studies in: • inland or transitional waters
EVIDENCE TYPES & SOURCES		• peer-review literature • grey literature • all years of publication • all publication stages, subject areas and source types • experimental and observational studies • studies in English, French, German, Greek, Italian, Spanish and Swedish languages	• evidence synthesis • literature reviews

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Conflicts of interest

The authors declare that there is no conflict of interest.

References

- Arksey H, O'Malley L (2005) Scoping studies: towards a methodological framework. International Journal of Social Research Methodology 8 (1): 19-32. https://doi.org/10.1080/1364557032000119616
- CBD (2010) The Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets. UNEP/CBD/COP/DEC/X/2. Convention on Biological Diversity. URL: https://www.cbd.int/doc/decisions/cop-10/cop-10-dec-02-en.pdf
- CBD (2018) Protected areas and other effective area-based conservation measures. CBD/COP/DEC/14/8. Convention on Biological Diversity. URL: https://www.cbd.int/ doc/decisions/cop-14/cop-14-dec-08-en.pdf
- CBD (2020) Zero Draft of the Post 2020 Global Biodiversity Framework. CBD/POST2020/PREP/2/1. Convention on Biological Diversity. URL: https://www.cbd.int/doc/c/3064/749a/0f65ac7f9def86707f4eaefa/post2020-prep-02-01-en.pdf
- CBD (2021) First Draft of the Post-2020 Global Biodiversity Framework. CBD/WG2020/3/3. Convention on Biological Diversity. URL: https://www.cbd.int/doc/c/abb5/591f/2e46096d3f0330b08ce87a45/wg2020-03-03-en.pdf
- FAO (1995) Code of Conduct for Responsible Fisheries. Food and Agriculture Organization of the United Nations, Rome. URL: http://www.fao.org/3/i1900e/i1900e.pdf
- FAO (2003) The ecosystem approach to fisheries. FAO Technical Guidelines for Responsible Fisheries. 4(2). FAO Fisheries Department, Rome, 112 pp. URL: http://www.fao.org/3/y4470e/y4470e.pdf
- FAO (2019) Report of the Expert Meeting on Other Effective Area-Based Conservation Measures in the marine capture fishery sector. FAO Fisheries and Aquaculture Report No. 1301. URL: http://www.fao.org/documents/card/en/c/ca7194en/
- Fulton E, Bax N, Bustamante R, Dambacher J, Dichmont C, Dunstan P, Hayes K, Hobday A, Pitcher R, Plagányi É, Punt A, Savina-Rolland M, Smith AM, Smith D (2015) Modelling marine protected areas: Insights and hurdles. Philosophical Transactions of the Royal Society B: Biological Sciences 370 (1681). https://doi.org/10.1098/rstb.2014.0278
- Garcia SM, Rice J, Charles A, Diz D (2020) OECMs in Marine Capture Fisheries: Systematic approach to identification, use and performance assessment in marine capture fisheries. Fisheries Expert Group of the IUCN Commission on Ecosystem Management. URL: https://ebcd.org/wp-content/uploads/2018/09/Systematic-Approach.pdf
- Haddaway N, Feierman A, Grainger M, Gray C, Tanriver-Ayder E, Dhaubanjar S, Westgate M (2019) EviAtlas: A tool for visualising evidence synthesis databases. Environmental Evidence 8 (1): 22-22. https://doi.org/10.1186/s13750-019-0167-1
- Hall S (2009) Area and Time Restrictions. In: Cochrane K, Garcia SM (Eds) A Fishery Manager's Guidebook. FAO and Wiley-Blackwell [ISBN 978-1-4051-7085-7].
- ICES (2021) ICES/IUCN-CEM FEG Workshop on Testing OECM Practices and Strategies (WKTOPS). ICES Scientific Reports 3 (42): -195. https://doi.org/10.17895/ices.pub.8135
- IUCN-WCPA (2019) Recognising and reporting other effective area-based conservation measures. World Commission on Protected Areas Task Force on OECMs https://doi.org/10.2305/IUCN.CH.2019.PATRS.3.en

- JBI SUMARI (2021) JBI SUMARI Scoping Reviews Protocol Template. https://sumari.jbi.global/. Accessed on: 2021-4-25.
- Levac D, Colquhoun H, O'Brien K (2010) Scoping studies: Advancing the methodology. Implementation Science 5 (1). https://doi.org/10.1186/1748-5908-5-69
- Peters M, Godfrey C, McInerney P, Munn Z, Trico A, Khalil H (2020) Chapter 11: Scoping Reviews. In: Aromataris E, Munn Z (Eds) JBI Manual for Evidence Synthesis. JBI https://doi.org/10.46658/jbimes-20-12
- Petza D, Chalkias C, Koukourouvli N, Coll M, Vassilopoulou V, Karachle P, Markantonatou V, Tsikliras A, Katsanevakis S (2019) An operational framework to assess the value of fisheries restricted areas for marine conservation. Marine Policy 102: 28-39. https://doi.org/10.1016/j.marpol.2019.01.005
- Rice J, Garcia SM, Kaiser M (2018) Other Effective Area-Based Conservation Measures (OEABCMs) Used in Marine Fisheries: A Working Paper. 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. CBD/MCB/EM/2018/1/INF/4. Convention on Biological Diversity. URL: https://www.cbd.int/doc/c/0689/522e/7f94ced371fa41aeee6747e5/mcb-em-2018-01-inf-04-en.pdf
- Sciberras M, Jenkins SR, Mant R, Kaiser MJ, Hawkins SJ, Pullin AS (2015) Evaluating the relative conservation value of fully and partially protected marine areas. Fish and Fisheries 16 (1): 58-77. https://doi.org/10.1111/faf.12044
- Spalding M, Meliane I, J. Bennett N, Dearden P, G. Patil P, D. Brumbaugh R (2016) Building towards the marine conservation end-game: consolidating the role of MPAs in a future ocean. Aquatic Conservation: Marine and Freshwater Ecosystems 26: 185-199. https://doi.org/10.1002/aqc.2686
- SysRev (2021) SysRev. Pro. Insilica LLC. URL: https://sysrev.com/
- Tricco A, Lillie E, Zarin W, O'Brien K, Colquhoun H, Levac D, Moher D, Peters MJ, Horsley T, Weeks L, Hempel S, Akl E, Chang C, McGowan J, Stewart L, Hartling L, Aldcroft A, Wilson M, Garritty C, Lewin S, Godfrey C, Macdonald M, Langlois E, Soares-Weiser K, Moriarty J, Clifford T, Tunçalp Ö, Straus S (2018) PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. Annals of Internal Medicine 169 (7): 467-467. https://doi.org/10.7326/M18-0850
- UN (2015) Transforming our world: the 2030 Agenda for Sustainable Development. United Nations General Assembly A/RES/70/1 URL: https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E
- Wells S, Ray GC, Gjerde K, White A, Muthiga N, Bezaury Creel J, Causey B, McCormick-Ray J, Salm R, Gubbay S, Kelleher G, Reti J (2016) Building the future of MPAs - lessons from history. Aquatic Conservation: Marine and Freshwater Ecosystems 26: 101-125. https://doi.org/10.1002/aqc.2680
- Zotero (2021) Zotero. 5.0. Corporation for Digital Scholarship. URL: https://www.zotero.org/

Supplementary materials

Suppl. material 1: The contribution of Area-Based Fisheries Management Measures to Fisheries Sustainability and Marine Conservation: a global scoping review protocol - Search Strategy `doi`

> **Authors:** Petza D., Anastopoulos P., Coll M., Garcia S.M., Kaiser M., Kalogirou S., Lourdi I., Rice J., Sciberras M., & Katsanevakis S.
> **Data type:** Search Strategy
> **Brief description:** The entire search strategy (query string) applied in Scopus at 11 June 2021 and search results (number of articles retrieved).
> Download file (20.84 kb)

Suppl. material 2: The contribution of Area-Based Fisheries' Management Measures to Fisheries Sustainability and Marine Conservation: a global scoping review protocol - Data Extraction Tool `doi`

> **Authors:** Petza D., Anastopoulos P., Coll M., Garcia S.M., Kaiser M., Kalogirou S., Lourdi I., Rice J., Sciberras M., & Katsanevakis S.
> **Data type:** Data Extraction Tool
> **Brief description:** A charting table aligned to the objective and the questions of the ScR, including specific details about the participants, concept, context, study methods and key findings relevant to the review objective.
> Download file (19.55 kb)