What is the evidence documenting the effects of marine or coastal nature conservation or natural resource management activities on human well-being in South East Asia? A systematic map protocol

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Abstract

Background:

Conservation activities and natural resource management interventions have often aimed to tackle the dual challenge of improving nature conservation and human well-being, particularly in low and middle-income countries. However, there is concern over the extent to which this dual goal has been achieved, and to what extent there are trade-offs and synergies within and between aspects of each of the goals' targets. The amount and scope of the available evidence on the success of conservation and management interventions in both arenas has lacked documentation, for a number of reasons, including limited resources for monitoring and evaluation and the difficulty in bringing together a disparate evidence base. A systematic map was published in 2016 that attempted to provide a base understanding of the evidence base across all biomes. This protocol is for a systematic map which focuses on the effects of marine and coastal conservation and natural resource management activities on the health and well-being of coastal communities in South East Asia. This stakeholder-driven need stems from this region and biome being under increasing pressure from burgeoning demand for natural resources and the uncertain events that climatic change will bring. The systematic map described here will build and expand upon searches from the 2016 map, for relevance in the context described above.

Method:

We will undertake a search of bibliographic databases to find published literature. Supplementary searching will include canvassing key informants and searching institutional and organisational websites, where we will be looking for both published and unpublished (grey) literature. Inclusion criteria will be applied in two stages, title and abstract and full text, with repeatability checks. We will extract coded data on study design and characteristics. From the coded data we will produce visualisations and a database. The systematic map output can be used to inform on evidence gaps, and topic areas where the evidence base is ripe for synthesis.

Keywords

Biodiversity conservation, Marine Reserve, Marine Protected Area, Human welfare, Poverty, Human development, Sustainability, Livelihoods, Human health

Background

The importance of seas and coastal areas to environment and society

Seas and coastal areas provide coastal communities with numerous ecosystem services and benefits, from the provisioning of protein-rich food sources, the economic benefits of tourism and commercial fisheries, and socio-cultural benefits by providing leisure opportunities and access to open space. Seas and coasts also provide vital regulatory ecosystem services such as climate regulation and coastal flood and storm defences. These services are used (intentionally and passively) to support local economies and the health and well-being of coastal communities.

However, there is an increasing demand of these ecosystem services that the marine environment provides, along with a growing awareness that much of the marine environment is deteriorating. In response, a need for marine planning has grown globally to ensure sustainable use of marine space and extraction of its resources. This is particularly the case in low and middle-income countries, clustered around tropical biomes where biodiversity tends to be highest (Brown, 2014).

The need is also particularly evident in South East Asia, where conflicts over marine areas and resources are growing, added to by pressures of increased human populations, habitat fragmentation, invasive species, and climatic changes. Many people in developing countries in this region live by the coast (Neumann et al, 2015) and depend, directly (e.g. fishing, tourism) or indirectly (e.g. benefits of mangroves as natural storm surge defences) on coastal natural resources for their livelihoods and well-being. The South East Asia region therefore has a great need for learning from knowledge and experience to implement sustainable practice that is appropriate to the ecological and socio-cultural context.

Box 1. Definitions	
Marine environment	The species, habitats and landscapes that make up seas and oceans
Nature conservation	Actions taken to conserve biological entities (species, communities or ecosystems, or ecological and evolutionary phenomena/processes) Salafsky et al., 2008
Natural resources	Raw material resources originating from the Earth that cannot be manufactured by humans. Biotic natural resources include plant and animal material which are used as food, for textiles, for fuel. Abiotic natural resources include (amongst other things) water, oil, coal used for energy and for production of food.
Natural resource management	Human interventions that aim to regulate, protect or manage natural resources
Ecosystem services	The benefits that humans gain from the natural environment, e.g. clean drinking water, pollination, fertile soil and clean air.
Coastal areas	Areas adjacent to and heavily dependent on or impacted by the sea, in economic, socio-cultural or ecological terms

Coastal communities	Individuals, households or communities, living or working within coastal areas
Human health and well-being	The status of an individual or group of peoples' physical vitality and health, mental state, degree of social satisfaction and sense of fulfilment

The need for evidence of effects of natural resource management interventions

Many conservation management interventions have aimed to tackle the dual issue of nature conservation and human well-being, particularly in low and middle-income countries (Coulthard et al, 2011). Although purposeful interventions to sustainably manage marine and coastal resources have been common, particularly in the last 20 years, (Botsford et al, 2009), the extent of the evidence on the success of nature conservation or natural resource management in both spheres of conservation and human well-being has lacked documentation (Leisher et al, 2012; Woodhouse et al, 2015).

Evidence on the interaction is important because it is commonly given that nature conservation is compatible with sustainable development, in a win-win scenario (Bennett, 2015; Christensen, 2004; Svarstad et al, 2008). Indeed this has been the pre-dominant narrative around marine protected areas (Caveen et al, 2013). Yet such win-win scenarios, though seemingly universally upheld, often fall down on close scrutiny (Burke et al, 2011; Chaigneau & Brown, 2016). The impacts of nature conservation activities are likely to have nuances that require careful monitoring to fully understand. For example, marine protected areas may bring socio-economic benefits to some community members but not others (potentially widening health and social inequalities), ecological resilience may apply to some areas of protection but not all, and whilst some species may benefit from the intervention, others can be detrimentally affected. The geographical scope of the protected area, the degree of protection and compliance, and the timescales upon which implementation is built are likely to influence the degree and scope of impact. Figure 1 presents an example of how researchers may present the mechanisms by which a conservation intervention may lead to human well-being outcomes, in a theory of change or logic model.

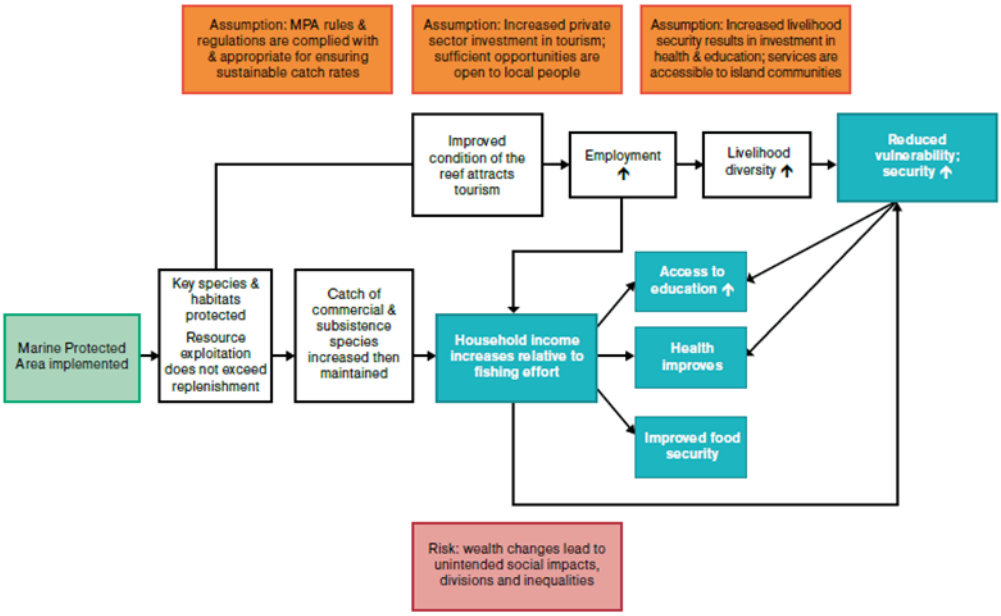

Figure 1. Example of Theory of Change for a Marine Protected Area. From: Woodhouse et al. 2016

Furthermore, the repetition of the win-win rhetoric encourages and raises expectations of such supposed universal benefits of conservation interventions (Chaigneau & Brown, 2016) that underpin reserve promotion and implementation (Agardy et al, 2003; Alcala & Russ, 2006). Such raised expectations, if not met, can lead to negative effects on attitudes and compliance within the communities the reserves target, that can be difficult to reverse (Chuenpagdee et al, 2013).

Evidence synthesis of conservation and human well-being

There is a clear need for understanding which marine resource management interventions have had impact on environmental and human well-being outcomes in contexts within South East Asia.

Until recently, the extent of the evidence on the success of nature conservation or natural resource management in both spheres of conservation and human well-being has lacked documentation. A systematic map was published in 2016 (McKinnon et al, 2016) attempted to address the knowledge need. The systematic map was a project undertaken for the Science for Nature and People Partnership (SNAPP, https://snappartnership.net) and it focussed on the question "What is the extent and occurrence of empirical evidence documenting nature conservation impacts on human well-being in developing countries?" The map included 1043 articles in an interrogatable database (http://www.natureandpeopleevidence.org/ebc-dataportal/). The included articles measured effects across eight nature conservation related interventions and ten human well-being related outcomes (see Table 1 for details). We will build and expand upon searches from the 2016 map, for relevance in the South East Asia context described above, which is predominantly composed of low and middle-income countries.

Stakeholder engagement

The systematic map which follows the protocol described here will inform a programme of research undertaken by partners from institutions in the UK, Vietnam, Malaysia, Indonesia and the Philippines, that uses marine reserve case studies to investigate the scope for integrated and community-focused marine planning. The ultimate goal of the wider Blue Communities programme is to build capacity for implementing marine planning throughout South East Asia that improves the integrated management of marine and coastal environments (http://www.blue-communities.org). The aim of integrated marine management is to reduce conflict between users, mitigate risks associated with expanded or new uses, and protect fragile ecosystems while supporting livelihoods, food security, health and well-being of coastal communities. Project partners (researchers and NGOs working in the region) and other stakeholders in South East Asia were involved in the discussions that focused the scope of the projects on the Blue Communities programme. They identified the need to understand what marine management interventions were being implemented elsewhere in the region, and in which situations the interventions were having impact on the protection of the environment and on human well-being. Stakeholders (researchers) were invited to suggest search terms for the search strategy of this systematic map. Stakeholders will be asked to provide comment on various other parts of the systematic map, as it progresses, for example, the appropriateness of the meta-data extraction spreadsheet.

Objectives

The objective of this systematic map is to provide an overview of the evidence on the impact of marine management and conservation interventions on human well-being in developing countries in SE Asia.

Primary question

What is the extent of evidence documenting the impact of marine or coastal nature conservation or natural resource management interventions on human well-being in SE Asia?

This question has the following components:

Population: Human populations in coastal areas in South-East Asia

Intervention: In-situ nature conservation or natural resource management interventions in marine or coastal areas

Comparator: Where present, the absence of intervention either between sites or groups, and/or over time (control), or comparison with another intervention (comparator).

Outcome: Any measure of human health or well-being

Secondary questions

What are the characteristics of evidence (frequency and type of intervention measures and of outcome measures, scale, geographic location, and study design)?

Where do gaps exist in the evidence base that represent primary research priorities?

What are promising areas for synthesis of the evidence?

Methods

We will use several approaches to capture the extent of the evidence on the systematic map topic. We will aim to obtain both published and unpublished (grey) literature, to be as comprehensive as possible. Some search methods may find more unpublished literature (e.g. website searching) and others more of the published literature (e.g. bibliographic database searching) These are represented in the schematic diagram in Figure 2.

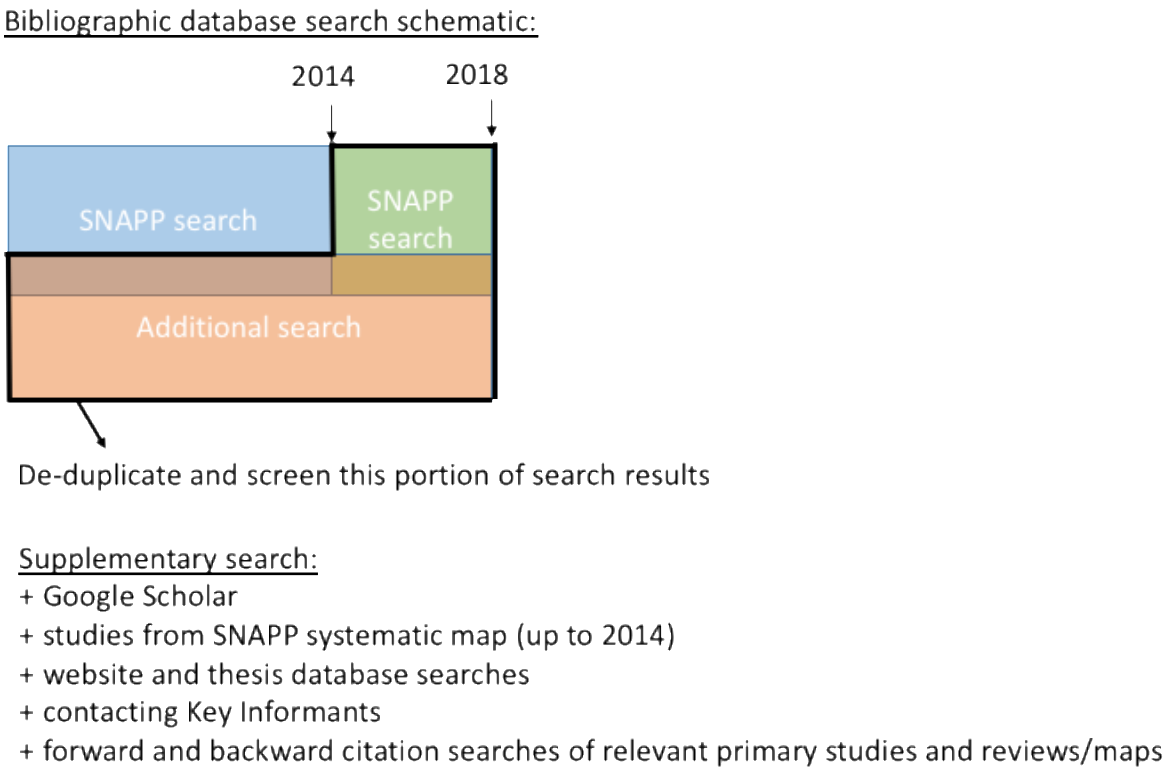

Figure 2. Schematic of the sources of database platform search results for the Blue Communities Systematic Map. SNAPP= Science for Nature and People Partnership

Bibliographic Database Searches

An initial set of 22 test articles was used in the testing of the search strategy. The scoping searches were undertaken in Medline and the first 2-500 hits screened at title and abstract for potential inclusion. The results of these scoping searches, along with the McKinnon et al. (2016) database search strategy and input from subject specialists was used by the information specialist to develop the Medline search strategy for this project.

Box 1. Results from database scoping, July-Aug 2018
Round 1. 13/200 6.5% relevant
Round 2. 7/300 2.3% relevant
Round 3. 20/500 4% relevant
Round 4. 20/200 10% relevant

The language used for bibliographic database searches will be English. This is based on advice from research project partners from the SE Asia region, indicating that the majority of research in the topic area is likely to be in English.

We will translate the Medline search strategies across another four bibliographic databases: Global Health (via Ovid), Web of Science Core Collection, SCOPUS and Environment Complete in Autumn 2018 to identify relevant literature. The searches from the SNAPP systematic map will be reproduced and run in the same databases as the original map, with a date limit (2014-present) and added to the body of literature to be screened, Figure 2. The list of test studies is provided in Appendix A.

For all database searches we will record the strategies used, along with the date the search was undertaken. This information will be collated in an Appendix for the systematic map report. We do not plan to update the searches during the map because we anticipate publishing the map report within 9 months of the searches.

Supplementary searching methods

Google Scholar search

We will search Google Scholar (www.scholar.google.co.uk), because it has been shown to identify additional grey literature in excess of that found by other supplementary search methods (Haddaway et al, 2015). The functionality of Google Scholar's search, particularly using Boolean operators has increased since the most recent analysis of its utility for evidence syntheses (Haddaway et al, 2015). We will use a modified version of the database search strings and use the first 1000 records retrieved by the search for title and abstract screening. These records will be integrated with those retrieved by the bibliographic database searches.

Organisational websites and online catalogues

We will maximise our coverage of the evidence base by extending our search to 41 relevant organisational websites and topical catalogues for any additional literature. Search strings for these sources will be adapted from the database search string and will reflect the search capabilities of each website. These websites are listed in Box 2.

Box 2. List of websites to search for relevant studies

- A Rocha International
- AidData – open data for international development
- Biodiversity Conservation Network
- Biodiversity Support Program (USAID)
- Birdlife International
- Campbell Collaboration
- CARE International
- Catholic Agency for Overseas Development (CAFOD)
- Centre for International Forestry Research (CIFOR)
- Collaboration for Environmental Evidence library

- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Conservation Evidence
- Conservational International
- Convention for Biological Diversity
- Coral Cay Conservation web library
- Department for International Development (DfID)
- Food and Agriculture Organization (FAO)
- Frontier web library
- Global Environment Facility
- Health and Environment Alliance
- International Institute for Environment and Development
- International Pole and Line Foundation
- International Union for the Conservation of Nature
- Locally-Managed Marine Area (LMMA) Network
- Operation Wallacea web library
- Packard Foundation
- RAMSAR
- Reef Check
- Royal Society for the Protection of Birds
- Swedish International Development Agency
- The Nature Conservancy
- UNEP – World Conservation Monitoring Center (UNEP-WCMC)
- UNESCO
- United Nations Development Programme (UNDP)
- United Nations Environment Programme (UNEP)
- United States Agency for International Development (USAID)
- USAID Development Experience Clearinghouse
- Wildlife Conservation Society
- World Bank
- World Neighbors
- Worldwide Fund for Nature International

An additional 35 region-specific organisational websites will also be searched. These organisations were primarily identified by topic area researchers in the South East Asia region (from the University of Malaya, the Western Philippines University, Universitas Nasional in Vietnam and the Hanoi National University of Education), and UK research partners on the Blue Communities programme (Plymouth Marine Laboratory, University of Exeter and the University of Plymouth) as well as Non-Governmental Organisations (Blue Ventures (www.blueventures.org). The search string from the database searches will be adapted to reflect the search functionality on each website. Where appropriate, local language (e.g. Filipino, Malay, Vietnamese, Indonesian) for search terms will be used.

Box 3. List of regionally relevant organisational websites to search for relevant studies

- AP2HI (Indonesian Pole & Line and Handline Fisheries Association)
- Bornean Biodiversity & Ecosystems Conservation Programme
- Carlos P. Romulo Library - Foreign Service Institute
- Center for Environmental Research and Education Vietnam
- Centre for Natural Resources and Environmental Studies
- Coral triangle initiative
- Department of Fisheries Sabah
- Environmental Protection Department
- Hanoi National University of Education (HNUE), Vietnam*
- Indian Ocean Tuna Commission (IOTC)
- Indonesian Institute of Sciences (LIPI)
- KKP (Ministry of Marine Affairs and Fisheries), Indonesia
- KLHK (Ministry of Environment and Forestry), Indonesia
- Malampaya Foundation
- Malaysia Marine Department
- Ministry of Environment and Forestry Indonesia
- Ministry of Science, Technology and Innovation, Malaysia
- Ministry of Tourism, Culture and Environment, Sabah (MTCE)
- Mongabay review on MPA effectiveness
- Palawan Council for Sustainable Development
- Philippine Commission on Women
- Philippine Institute for Development Studies
- Pilipinas Shell Foundation
- Reef Check Malaysia
- Sabah Environmental Trust
- Sabah Parks
- The Centre for Sustainable Energy and Resources Management, Universitas Nasional (CSERM-UNAS)
- Universiti Kebangsaan Malaysia*
- Universiti Malaysia
- Universiti Sains Malaysia
- University of Hasanuddin, Makassar*
- UNESCO Man And Biosphere
- Western and Central Pacific Fisheries Commission
- Western Philippines University Reports*

* Websites to be searched in local language

We will search 11 scholarly sites for relevant evidence, particularly theses and reports. The search string from the database searches will be adapted to reflect the search functionality of on each website.

Box 4. List of academic thesis databases searched for relevant studies

- Cybertesis
- DART-Europe
- DiVA
- Ethos
- NARCIS
- National ETD
- National Library of Australia Trove Service
- NDLTD
- Proquest Dissertations and Theses Global
- Repositorio Cientifico de Acesso Aberto de Portugal
- Theses Canada

For all website and catalogue searches we will record the URL, the strategy or search terms used, the date the search was undertaken, the results, and the name of the reviewer undertaking the search. The information will be collated in an Appendix for the systematic map report.

Other methods of obtaining evidence

Key informants who are identified as being relevant to the South East Asia region will be contacted for any known sources of evidence. The authors will use Twitter to make an open call to their professional networks for submission of evidence to the systematic map. Where possible, non-English sources will be gathered, utilising language capabilities within the network of partners associated with this review and the Blue Communities programme.

We will undertake forward and backward citation searching of studies identified as relevant to our systematic map in the topic area using Web of Science and SCOPUS. This will aim to find further relevant studies, and additional information relevant to the same study provided in linked papers e.g. information about other outcomes for the same study. We will also search bibliographies of systematic maps or reviews and other evidence reviews that are focused on the topic area.

We will use a reference management software, such as Endnote, to store and collate the results from all the search methods. We will deduplicate the results and screen them for relevance (either in the reference management software, or in a separate systematic review tool, such as Colandr (Cheng et al, 2018), using the methods described below.

Article Screening and Study Inclusion Criteria

Search results from the five bibliographic databases, SNAPP update searches and from Google Scholar will be de-duplicated and each article will be assessed for relevance on the basis of its title and abstract (the latter being used where articles cannot be excluded on the basis of title alone). Reviewers will be inclusive wherever there is doubt as to the relevance of an article. Each article will be assessed by one of at least two trained reviewers, who will undertake a consistency check, using a subset of articles (c. 10%) to maximise the consistency of applying the inclusion criteria. We will use Kappa and percentage agreements to assess inter-reviewer consistency. Discrepancies will be discussed and clarifications in interpreting the inclusion/exclusion criteria to maximise the consistency for remaining studies.

Full texts of articles that pass the screening at title and abstract will be retrieved and screened on the basis of the full text and supplementary material. Again, each article will be assessed by one of at least two trained reviewers. The same procedure for consistency checking will be employed as for title and abstract screening (a subset of at least 10% of articles), and discrepancies dealt with using the same procedure as for title and abstract discrepancies.

Screening of search results from the supplementary searches will be undertaken by one reviewer, with a second reviewer checking c. 10% the website searches (approximately 9 website searches). Any discrepancies in agreement will be discussed and refinements made to clarify inclusion criteria.

During screening, we will retain systematic maps, reviews and literature reviews that are in the topic area for reference checking. We will keep a record of which maps and reviews are used for citation chasing and the outcome of the process, which will be presented as an Appendix in the final report.

Table 1 presents the inclusion criteria that will be used in this systematic map.

Table 1. Inclusion criteria

Relevant population	Individuals, households or communities, living or working within coastal areas in South East Asia. We will also keep a record of studies from all tropical regions (using a combination of tropical countries defined in Appendix B, and by Köppen climate classification, Peel et al 2014)[1]. Eligible countries in South East Asia are Brunei, Cambodia, East Timor, Indonesia, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam. Though Laos is in South East Asia, because the country boundaries are at least 40km from the coast, communities in the country are not eligible. We define coastal areas as those adjacent to and heavily dependent on or impacted by the sea, in economic, socio-cultural or ecological terms. Studies must clearly state a focus on the relevant population.
Relevant intervention	Establishment, adoption, or implementation of a specific, discrete intervention that aims to regulate, protect or manage biodiversity and natural ecosystems, or natural resources through in-situ activities in the sea or in coastal areas.[2] Activities that take place away from the sea or coastal areas are not eligible, even though these may have impacts on coastal communities e.g. management of agricultural run-off. Classifications of eligible interventions are based upon the International Union

[1] Relevant articles from all tropical regions will be recorded and stored separately, because we may expand out geographical inclusion to the wider tropics, depending on the size of the SE Asia evidence base (if it is small, we will include articles from all tropical regions, dependant on time and resources)

[2] Natural resource management must have the conservation of nature or biodiversity as one of the clear stated aims. Natural resource management for the sole goal of productivity (e.g. maximising economic gains from a fishery) is not an eligible intervention for this systematic map.

	for Conservation of Nature (IUCN) and Conservation Measures Partnership (CMP) typology of conservation actions (Salafsky et al, 2008).	
	Category/ sub-category	***Definition***
	1. Site protection	**Actions taken to establish, expand and maintain legally protected areas for conservation.**
	1.1 Site establishment/expansion *national parks, marine protected areas, legal designation of wild/scenic area, tribally-owned hunting grounds*	Establishing or expanding protected areas, parks, or reserves.
	1.2 Spatial site protection *fencing off areas, signing the area*	Actions that define/maintain a protected area and do not require a permanent human involvement.
	1.3 Human site protection *training rangers to protect site, deploying patrols*	Actions that define/maintain a protected area and require permanent human involvement.
	2. Habitat management	**Actions to manage or restore a habitat or site for conservation.**
	2.1 Habitat restoration *planting mangroves for fish nurseries, removing dams, creating forest corridors, liming acid lakes*	Actions taken to naturally restore a habitat to its previous state.
	2.2 Habitat mimicry *deploying artificial reefs, nitrifying soil, fish ladders*	Actions that mimic a natural environment or restore a habitat but are artificial in nature.
	2.3 Habitat management *beach cleans, controlled burning, oil spill cleans*	Human actions/ interventions to maintain a habitat or site, minimise degradation, or remove human impacts
	3. Species management	**Actions to manage, restore, or eradicate species' populations.**
	3.1 Species reintroduction *reintroduction of wolves, reintroduction of mangroves to previous forests*	Reintroducing a displaced species back into a habitat/environment that it once lived in but no longer does.
	3.2 Ex-situ conservation *benign introduction, gene banking*	Actions taken to conserve a species outside of its natural or 'home' environment.
	3.3 Species recovery *Planting mangroves to increase mangrove area,*	Actions taken to increase a species' population.

	supplementary feeding, manual tree pollination	
	3.4 Species management *badger culls, tree felling quotas*	Actions taken to decrease a species' population or maintain a constant population.
	3.5 Species eradication *removal of vines from trees, invasive grey squirrel hunting*	Actions that are taken to remove a species' population from an environment or habitat.
	4. Law, regulations and policy	**Actions to make, implement, influence or change laws, policies, standards and regulations for conservation and the subsequent enforcement of these.**
	4.1 Legislation and policies *global conventions, national laws, local zoning regulations, species protection laws, tribal laws, sustainable harvest regulations, hunting laws*	Actions that make, implement, influence or change legislation or (legally/community enforceable) policies. All levels from international and governmental to local legislation.
	4.2 Standards and codes *Marine Stewardship Council Fisheries Standards, Forestry Stewardship Council certification, sustainable grazing practices*	Actions that make, implement, influence or change (typically private sector or voluntary) standards and codes that promote best practice.
	4.3 Private regulations *private restrictions on hunting activity, restricted seasons for accessing sensitive sites*	Rules and regulations made by a private (non-state) entity that applies only to their privately-owned areas.
	4.4 Enforcement and monitoring *monitoring of fishing activities, criminal or civil prosecution*	Enforcing and monitoring compliance of (state or private) laws, policies, standards, and regulations.
	5. Economic or livelihood incentives and alternatives	**Actions that provide incentives/alternative options with the goal of changing behaviours, practices and/or attitudes towards more environmentally sustainable or pro-conservation actions.**
	5.1 Alternative livelihoods *ecotourism opportunities, artisanal fishing, non-timber forest product harvesting, skills sharing in sustainable fishing techniques*	Developing/promoting alternative livelihoods. These may directly depend on the maintenance of healthy natural resources
	5.2 Alternative products/services *sustainably farmed fish (opposed to wild-caught fish), recycling and recycled materials*	Developing/ promoting/ incentivising the use of alternative, more environmentally-friendly/sustainable products.
	5.3 Conservation payments *sustainable resource*	Using (typically one-off) payments/ incentives for resource users to reward pro-

	incentives, rewards for developing sustainable practices	conservation behaviour or practice.
	5.4 Market forces and programs *encouraging product boycotts, valuation of ecosystem services, promotion of sustainable certification schemes to consumers, forest banking for resource users, natural resource tenures*	Using market forces to manipulate/ change behaviours, practices and attitudes of consumers or resource users. Schemes that allow resource users to gain legitimate access to use natural resources sustainably.
	5.6 Non-monetary incentives *cultural values, religious beliefs*	Using personal or intangible values to encourage behavioural/attitudinal changes.
	6. Capacity building	**Actions to create/ develop/ facilitate conservation groups or organisations.**
	6.1 Financing *NGO donations, local fundraising for conservation activities*	Raising/ providing funding to finance specific conservation activities or conservation groups or organisations.
	6.2 Organisational development *incorporating foundations, establishing non-profits, supporting community-based management groups, management and leadership training*	Creating, empowering or supporting development of good organisational infrastructure and practice. Includes grass-roots, community-led conservation groups.
	6.3 Partnership development *Inter-country networks, local networks*	Enabling/developing conservation partnerships between groups or organisations.
	7. Education, awareness and activism	**Actions to increase awareness and understanding of conservation with goal of change behaviours and attitudes.**
	7.1 Formal education *school curriculums, degree programs, skills-based training courses*	Enhancing knowledge/skills regarding conservation and/or environmental issues via education that provides a qualification Usually aimed at students or conservation managers/ practitioners.
	7.2 Informal education/training *Providing informative books, 'TED' talks, workshops in reserve design and biodiversity monitoring, manuals for conservation managers, learning networks*	Enhancing knowledge/skills regarding conservation and/or environmental issues without the learner gaining a qualification. Usually aimed at conservation managers/ practitioners.
	7.3 Awareness *social media campaigns, leaflets, door-to-door*	Raising conservation and environmental awareness using various forms of media. Usually directed to a group, community or

	canvassing, web blogs, radio soap operas	non-selected population.
	7.4 Activism *protest marches, tree sitting*	Using public activism and or civil disobedience to encourage support or action in others.
Relevant comparator	Where present, the absence of intervention either between sites or groups, and/or over time, or comparison with another intervention. Studies both with and without comparators are eligible.	
Relevant outcome	Measures or observes one or more domains of human health or well-being, listed below[3]. The domains below are adapted from a complementary set of typologies (McKinnon et al, 2016).	
	Category:	**Subcategory:**
	Economic living standards	Income, employment, employment opportunities[4], wealth/poverty, savings, payments, loans
	Material living standards	Access to and availability of food, fibre, fuel and basic infrastructure (electricity, water, telecommunications and transportation), provision of shelter, assets owned (e.g. television)
	Health	Physical health, mental health, balanced nutrition, longevity/life expectancy, maternal health, infant and child health, birth control provisioning, access to health care (antibiotics, transplants), occurrence of diseases, public health infrastructure (e.g. disease prevention, mental health support),
	Education	Education infrastructure (access to school, access to training, quality of education, classroom sizes, curriculum relevance and up-to-date); informal education (transfer of knowledge and skills includes livelihood skills, traditional knowledge and skills); formal education (degrees awarded, students enrolled)[5]
	Social relations	Interactions between individuals, within and/or between groups (communities, stakeholders, ethnic groups, gender); degree/frequency of conflict, strength of

[3] We will be inclusive where studies report that a relevant outcome has been reported to have/have not occurred e.g. where a study states that there has been increased awareness of the value of a natural resource (Education), even though no quantitative or qualitative data was collected.

[4] Catch Per Unit Effort (CPUE) is not an eligible outcome, because it is not a direct outcome measure for human health and well-being

[5] Knowledge about an intervention (e.g. the regulations around an MPA) is not an eligible human health and well-being outcome

		relationships and connectedness, ability to work together, ability to communicate, engage in debate, trust and help others
	Security and safety	Physical security (personal safety and security), security of access to resources; human rights; vulnerability, personal and community resilience and adaptive capacity
	Governance	Structures and processes for decision making including both formal and informal rules; includes participation and control in decision making, accountability, justice, transparency of governance
	Subjective well-being	Measures of happiness, Measure of quality of life, Measure of personal satisfaction supported by some value of ecosystem(s) and/or resources
	Culture and spirituality	Cultural, societal and traditional values of natural resources and nature to the community; sense of home or belonging; cultural identity and heritage; spiritual or religious beliefs and/or values
	Freedom of choice and action	Ability to pursue what you value doing and being; Freedom from norms e.g. gender expectations; Freedom of expression of opinion/beliefs
Relevant types of study design	Primary research study measuring effects of a program, activity or policy using observational or experimental data collected for the study. Quantitative, qualitative and mixed methods studies will be eligible. Systematic reviews and other reviews of evidence are not eligible. Theoretical articles, commentaries, editorials are not eligible.	

We will provide a list of articles excluded at full text with reasons for exclusion. We will keep a database of the studies that are excluded for the reason of not being based in SE Asia and those excluded for being OECD countries, but that are otherwise eligible, because these may be of use to other researchers in this topic area.

In the event that a relevant study authored by one of the reviewers requires screening, the reviewer in question will not make inclusion decisions for any of their own work.

Meta-data extraction

Studies that pass the relevance assessment at full text will have meta-data extracted into a spreadsheet by a trained reviewer. Where possible, the meta-data will be coded for the following broad categories:

- Unique study identification
- Bibliographic information
- A structured statement summarising the study design, setting, intervention, comparator and outcome types
- Intervention type, according to classifications in Table 1, above.
- Human well-being outcome type, according to domains in Table 1, above.
- Study design
- Spatial scale
- Geographical location (latitude and longitude)
- Temporal scale (length of intervention)
- Data type (quantitative, qualitative, mixed)
- Nature conservation or natural resource management outcome (i.e. reporting on intervention meeting the nature conservation/management objectives)
- Comparator type, if present (temporal control, spatial control, both)
- Method of assigning intervention/comparator (randomised, purposeful/matched, none, mixed)

The meta-data extraction sheet will follow the format of that shown in Appendix C, subject to alterations which may be necessary based on the type of evidence found through our searches. The form field codes in Appendix C have been piloted on studies known to be relevant to the map, was informed by the forms used in (McKinnon et al, 2016), and has gone through a process of refinement. The form shows the variables that are to be coded, and those that have the option for free text entry. Each comparison i.e. intervention and outcome will be recorded on a separate row, such that for any one study, there may be multiple rows to reflect where multiple interventions and/or multiple outcomes were investigated. In studies in which multiple interventions were undertaken simultaneously and in the same site, we will note this in a column, because the combined effect of both interventions together will likely have

Each study will be assessed by one of two trained reviewers, and this information added to the study coding. A random subset of studies (5-10%, depending on resource availability) will be used to check for consistency in the completion of the coding spreadsheet, with two reviewers completing each of the studies in the subset and comparing their completed coding. Discrepancies will be discussed and clarifications in interpreting the coding documented to maximise the consistency in the coding for remaining studies. In the event that a relevant study authored by one of the reviewers requires meta-data extraction, the reviewer in question will not undertake this for their own work.

Study quality assessment

To maximise the resource efficiency of this systematic map, we will not undertake a formal quality assessment for each study.

Meta-data coding will include the recording of study design elements, such as the type of comparator and the assignment method for intervention and comparators. This information will be used to indicate the relative numbers of studies that fall into a typology of study design categories that are of different rigour, though such a classification does not in itself allow studies to be defined as a particular quality. The coding will take place as part of the meta-data extraction, and repeatability of the study design categorisation will be assessed during that process.

Study design categories will depend on the range of evidence that we find, and are likely to include, but not restricted to those detailed in Table 2.

Table 2. Typology of study designs to be used in meta-data coding. B-A = before-after; C-I= control-impact; BACI= before-after-control-impact.

Type of comparator	**Assignment method for intervention/ comparator**	**Study design category**
Temporal (before intervention)	Randomised[6]	Randomised B-A study
	Purposeful[7]	Quasi-experimental B-A study
	Already in place[8]	Observational B-A study
Spatial (separate control or comparator site)	Randomised[9]	Randomised C-I study
	Purposeful/matched[10]	Quasi-experimental C-I study
	Already in place[11]	Observational C-I study
Temporal and spatial (before intervention and separate control or comparator site)	Randomised[7]	Randomised B-A-C-I study
	Purposeful/matched[8]	Quasi-experimental B-A-C-I study
	Already in place[9]	Observational B-A-C-I study
None (no control or comparative intervention)	Randomised[4]	Non-comparative with randomised intervention
	Purposeful[5]	Non-comparative with purposeful intervention
	Already in place[6]	Non-comparative observational study

[6] Site was randomly assigned to the intervention from a pool/area of potential sites
[7] Intervention site was purposefully, prospectively chosen for the purpose of the study
[8] Site was already receiving the intervention before the study was conceived or began
[9] Sites were all randomly assigned to intervention and control/comparator treatments
[10] Intervention and control/comparator sites were purposefully, prospectively chosen for the purpose of the study, or, a control/comparator site was chosen to match an already in-place intervention site
[11] Both the intervention and/or control/comparator sites were already in-place before the study was conceived or began

The categorisation of study designs will be one of the elements of meta-data that will be included in the data portal (meta-data extraction tables and geographical map) that will be the outputs of this systematic map.

Study mapping and presentation

A freely accessible online data portal will present the studies and the meta-data that accompanies them. The software used to create the data portal may use EviAtlas (https://github.com/ESHackathon/eviatlas) or eSpatial (www.eSpatial.com). The data portal will include a structured matrix, which provides a graphical illustration of the distribution of studies across the nature conservation interventions and the human well-being outcomes. This will show which linkages between intervention and outcomes have been studied. We will also show the frequency and distribution of comparative studies and of studies assessing both well-being and conservation outcomes. We will plot the geographical location of each study (along with meta-data associated with each study) using the available information (latitude and longitude), in an interactive map, providing another format by which a user can access the evidence base covered in this systematic map.

We will provide a narrative synthesis to synthesise the evidence, comparing the extent of the evidence for each intervention and for each outcome. We will also compare the extent of each of the linkages shown in matrices of intervention and comparator. These linkage maps will be used to identify and prioritise key knowledge gaps and clusters. Stakeholders will be invited to input on the prioritisation.

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and material

Not applicable

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

The manuscript was drafted by JE. Both authors read and approved the final manuscript.

References

Agardy, T., Bridgewater, P., Crosby, M. P., Day, J., Dayton, P. K., Kenchington, R., Laffoley, D., McConney, P., Murray, P. A., Parks, J. E. & Peau, L. (2003) Dangerous targets? Unresolved issues and ideological clashes around marine protected areas. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 13(4), 353-367.

Alcala, A. C. & Russ, G. R. (2006) No-take Marine Reserves and Reef Fisheries Management in the Philippines: A New People Power Revolution. *AMBIO: A Journal of the Human Environment*, 35(5), 245-254.

Bennett, N. (2015) Win-win or trade-offs?: the study of conservation and development at local, national and global scales, in Bennett, N., Roth, R. (ed), *The conservation social sciences: what?, how? and why?: a report for conservation organizations, foundations, practitioners, agencies and researchers.* University of Victoria, Victoria, British Columbia, Canada., 44-49.

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. *Reviews in Fish Biology and Fisheries*, 19(1), 69-95.

Brown, J. H. (2014) Why are there so many species in the tropics? *Journal of biogeography*, 41(1), 8-22.

Burke, L., Reytar, K., Spalding, M. & Perry, A. (2011) *Reefs at risk revisited*.Washington, DC.

Caveen, A. J., Gray, T. S., Stead, S. M. & Polunin, N. V. (2013) MPA policy: What lies behind the science? *Marine Policy*, 37, 3-10.

Chaigneau, T. & Brown, K. (2016) Challenging the win-win discourse on conservation and development: analyzing support for marine protected areas. *Ecology and Society*, 21(1).

Cheng, S., Augustin, C., Bethel, A., Gill, D., Anzaroot, S., Brun, J., DeWilde, B., Minnich, R., Garside, R. & Masuda, Y. (2018) Using machine learning to advance synthesis and use of conservation and environmental evidence. *Conservation Biology*.

Christensen, J. (2004) Win-Win Illusions: Over the past two decades, efforts to heal the rift between poor people and protected areas have foundered. So what next? *Conservation in Practice*, 5(1), 12-19.

Chuenpagdee, R., Pascual-Fernández, J. J., Szeliánszky, E., Alegret, J. L., Fraga, J. & Jentoft, S. (2013) Marine protected areas: re-thinking their inception. *Marine Policy*, 39, 234-240.

Coulthard, S., Johnson, D. & McGregor, J. A. (2011) Poverty, sustainability and human wellbeing: a social wellbeing approach to the global fisheries crisis. *Global Environmental Change*, 21(2), 453-463.

Haddaway, N. R., Collins, A. M., Coughlin, D. & Kirk, S. (2015) The role of Google Scholar in evidence reviews and its applicability to grey literature searching. *PloS one*, 10(9), e0138237.

Leisher, C., Sanjayan, M., Blockhus, J., Larsen, N. & Kontoleon, A. (2012) Does conserving biodiversity work to reduce poverty? A state of knowledge review. *Biodiversity conservation and poverty alleviation: exploring the evidence for a link*, 143-159.

McKinnon, M. C., Cheng, S. H., Dupre, S., Edmond, J., Garside, R., Glew, L., Holland, M. B., Levine, E., Masuda, Y. J. & Miller, D. C. (2016) What are the effects of nature conservation on human well-being? A systematic map of empirical evidence from developing countries. *Environmental Evidence*, 5(1), 8.
Neumann, B., Vafeidis, A. T., Zimmermann, J. & Nicholls, R. J. (2015) Future coastal population growth and exposure to sea-level rise and coastal flooding-a global assessment. *PloS one*, 10(3), e0118571.
Peel, M. C., Finlayson, B. L., & McMahon, T. A. (2007). Updated world map of the Köppen-Geiger climate classification. *Hydrology and earth system sciences discussions*, *4*(2), 439-473.
Salafsky, N., Salzer, D., Stattersfield, A. J., HILTON-TAYLOR, C., Neugarten, R., Butchart, S. H., Collen, B., Cox, N., Master, L. L. & O'connor, S. (2008) A standard lexicon for biodiversity conservation: unified classifications of threats and actions. *Conservation Biology*, 22(4), 897-911.
Svarstad, H., Petersen, L. K., Rothman, D., Siepel, H. & Wätzold, F. (2008) Discursive biases of the environmental research framework DPSIR. *Land Use Policy*, 25(1), 116-125.
Woodhouse, E., Homewood, K. M., Beauchamp, E., Clements, T., McCabe, J. T., Wilkie, D. & Milner-Gulland, E. (2015) Guiding principles for evaluating the impacts of conservation interventions on human well-being. *Phil. Trans. R. Soc. B*, 370(1681), 20150103.

Appendix A List of 22 test articles used in comprehensiveness test of bibliographic database search. Key articles used for backward citation chasing were from McKinnon et al 2016.

Source	Test article citation
Backward citation chasing	Fabinyi, M. (2008). Dive tourism, fishing and marine protected areas in the Calamianes Islands, Philippines. Marine Policy, 32(6), 898-904.
Backward citation chasing	Pita, C., Pierce, G. J., Theodossiou, I., & Macpherson, K. (2011). An overview of commercial fishers' attitudes towards marine protected areas. Hydrobiologia, 670(1), 289.
McKinnon et al 2016	Aldon, M. E., Fermin, A. C., & Agbayani, R. F. (2011). Socio-cultural context of fishers' participation in coastal resources management in Anini-y, Antique in west central Philippines. Fisheries research, 107(1-3), 112-121.
McKinnon et al 2016	Baticados, D. B., & Agbayani, R. F. (2000). Co-management in marine fisheries in Malalison Island, central Philippines. International Journal of Sustainable Development & World Ecology, 7(4), 343-355.
McKinnon et al 2016	Bennett, N. J., & Dearden, P. (2014). Why local people do not support conservation: Community perceptions of marine protected area livelihood impacts, governance and management in Thailand. Marine Policy, 44, 107-116.
McKinnon et al 2016	Pomeroy, R. S., Oracion, E. G., Pollnac, R. B., & Caballes, D. A. (2005). Perceived economic factors influencing the sustainability of integrated coastal management projects in the Philippines. Ocean & Coastal Management, 48(3-6), 360-377.
Backward citation chasing	Pomeroy, R. S., Pollnac, R. B., Katon, B. M., & Predo, C. D. (1997). Evaluating factors contributing to the success of community-based coastal resource management: the Central Visayas Regional Project-1, Philippines. *Ocean & Coastal Management*, *36*(1-3), 97-120.
Backward citation chasing	Pollnac, R.B., Pomeroy, R.S., 2005. Factors influencing the sustainability of integrated coastal management projects in the Philippines and Indonesia. Ocean Coastal Manage. 48, 233–251.
Backward citation chasing	Oracion, E.G., Miller, M., Christie, P., 2005. Marine protected areas for whom? Fisheries, tourism, and solidarity in a Philippine community. Ocean Coastal Manage. 48, 393–410.
Backward citation chasing	Carlos, M. B. and Pomeroy, R. S., A review and evaluation of community based coastal resource management projects in the Philippines, 1984-1994. International Center for Living Aquatic Resources Management, Manila, 1996.
Backward citation chasing	Depondt F, Green E. Diving user fees and the financial sustainability of marine protected areas: opportunities and impediments. Ocean & Coastal Management 2006;49(3–4):188–202.
Backward citation chasing	Pollnac, R., B. Crawford & M. Gorospe, 2001. Discovering factors that influence the success of community-based marine protected areas in the Visayas, Philippines. Ocean & Coastal Management 44: 683–710.
Backward citation chasing	Webb, E., Maliao, R., Siar, S., 2004. Using local user perceptions to evaluate outcomes of protected areas management in the Sagay Marine Reserve. Philippines. Environmental Conservation 31 (2), 138–148.

Backward citation chasing	Alcala, A.C. (1998). Community-based coastal resource management in the Philippines: a case study. Ocean & Coastal Management, 38, 179-86
McKinnon et al 2016	Garces, L. R., Pido, M. D., Tupper, M. H., & Silvestre, G. T. (2013). Evaluating the management effectiveness of three marine protected areas in the Calamianes Islands, Palawan Province, Philippines: process, selected results and their implications for planning and management. Ocean & coastal management, 81, 49-57.
McKinnon et al 2016	Gunawan, B. I., & Visser, L. E. (2012, July). Permeable boundaries: outsiders and access to fishing grounds in the Berau marine protected area. In Anthropological Forum (Vol. 22, No. 2, pp. 187-207). Routledge.
McKinnon et al 2016	Gjertsen, H. (2005). Can habitat protection lead to improvements in human well-being? Evidence from marine protected areas in the Philippines. World Development, 33(2), 199-217.
McKinnon et al 2016	Setiawan, A., Cinner, J. E., Sutton, S. G., & Mukminin, A. (2012). The perceived impact of customary marine resource management on household and community welfare in northern Sumatra, Indonesia. Coastal Management, 40(3), 239-249.
McKinnon et al 2016	Svensson, P., Rodwell, L. D., & Attrill, M. J. (2010). The perceptions of local fishermen towards a hotel managed marine reserve in Vietnam. Ocean & Coastal Management, 53(3), 114-122.
McKinnon et al 2016	Vicente, J. A., & Cerezo, R. B. (2010). The Socio-Economic Contributions of Marine Protected Areas to the Fisherfolk of Lingayen Gulf, Northwestern Philippines. International Journal of Environmental Research, 4(3), 479-490.
McKinnon et al 2016	Webb, E. L., Maliao, R. J., & Siar, S. V. (2004). Using local user perceptions to evaluate outcomes of protected area management in the Sagay Marine Reserve, Philippines. Environmental Conservation, 31(2), 138-148.
McKinnon et al 2016	Ring, M. W. (1998). Analyzing co-management in Cogtong Bay, Philippines.

Appendix B. List of tropical countries

Agalega Islands	**Lakshadweep**
Algeria	**Laos**
American Samoa	**Liberia**
Andaman and Nicobar Islands	**Louisiade Archipelago**
Angola	**Lybia**
Anguilla	**Macau**
Antigua and Barbuda	**Madagascar**
Australia	**Malawi**
Bahamas	**Malaysia**
Bangladesh	**Maldives**
Barbados	**Mali**
Belize	**Mariana Islands**
Benin	**Marquesas Islands**
Bermuda	**Marshall Islands**
Bolivia	**Mauritania**
Botswana	**Mauritius**
Bougainville	**Mexico**
Brazil	**Montserrat**
British Indian Ocean Territory (Chagos Archipelago)	**Mozambique**
British Virgin Islands	**Namibia**
Brunei	**Nauru**
Burkina Faso	**Navassa Islands**
Burma	**Netherlands Antilles**
Burundi	**New Caledonia**
Cameroon	**Nicaragua**
Canton and Enderbury Islands	**Niger**
Cape Verde	**Nigeria**
Cargados Carajos	**Niue**
Caroline Islands	**Oman**
Cayman Islands	**Panama**
Central African Republic	**Papua New Guinea**
Chad	**Paraguay**
Chile	**Peru**
China	**Philippines**
Christmas Islands	**Pitcairn Islands**
Clipperton Islands	**Puerto Rico**
Coca, Isla del	**Réunion**
Coco Islands	**Rodrigues**
Cocos Islands	**Rwanda**
Colombia	**Sao Tomé and Príncipe**
Comoro Islands	**Saudi Arabia**

Congo	**Senegal**
Cook Islands	**Seychelles**
Coral Sea Islands	**Sierra Leone**
Costa Rica	**Singapore**
Cuba	**Society Islands**
D'Entrecasteaux Islands	**Socotra**
Djibouti	**Solomon Islands**
Dominica	**Somalia**
Dominican Republic	**Sri Lanka**
Easter Island	**St Kitts-Nevis**
Ecuador	**St Lucia**
Egypt	**St Vincent**
El Salvador	**Sudan**
Equatorial Guinea	**Suriname**
Ethiopia	**Taiwan**
Fiji	**Tanzania**
French Guiana	**Thailand**
Gabon	**Togo**
Galápagos Islands	**Tokelau**
Gambia	**Tonga Trinidad and Tobago**
Gambier Islands	**Trobriand Islands**
Ghana	**Tromelin**
Glorieuses, Iles	**Tuamotu Archipelago**
Grenada	**Tubuai**
Guadeloupe and Martinique	**Turks and Caicos Islands**
Guam	**Tuvalu**
Guatemala	**Uganda**
Guinea	**United Arab Emirates**
Guinea-Bissau	**United States Virgin Islands**
Guyana	**United States: Miscellaneous Islands**
Haiti	**Vanuatu**
Hawaii	**Venezuela**
Honduras	**Venezuela: Islands Vietnam**
Hong Kong	**Wake Island**
India	**Wallis and Futuna**
Indonesia	**Western Sahara**
Ivory Coast	**Western Samoa**
Jamaica	**Yemen Arab Republic**
Johnston Island	**Yemen, Democratic**
Kampuchea	**Zaire**
Kenya	**Zambia**
Kiribati	**Zimbabwe**

Appendix C. Pilot meta-data extraction form fields

Reviewer name
Publication type
Authors
Publication year
Title
Journal
Relevant to BC?
Reason for non-relevance
Structured statement
Study country/ies
Latitude N
Longitude E
Coordinate Notes (multiple sites)
Marine or Mangrove?
Population
Intervention type
Comparator type
Assignment method
Well-being outcome type
Well-being outcome notes
Conservation outcome reported?
Spatial scale
Temporal scale
Data type
DOI
Hyperlink
Notes
Multiple concurrent interventions?