# A rationale for conservation: alignments and divergences in defining the objectives of marine protected areas

Other tentative titles (90 characters with spaces):

* Marine conservation: bridging local knowledge and external expertise
* Implementing sustainability: bridging local knowledge and external expertise

Target journal: People and Nature?

**Authors:** Victor Brun, John R. Madarcos, Lota A. Creencia, Joachim Claudet

Affiliations:

Victor Brun, J. Claudet: National Center for Scientific Research, PSL Université Paris, CRIOBE, USR 3278 CNRS-EPHE-UPVD, Maison de l’Océan, 195 rue Saint-Jacques, 75005 Paris, France

**Abstract**

To halt the degradation of ecosystems and their subsequent impacts to human wellbeing, social and ecological interventions are proposed as “win-win” solutions for people and nature. Among them, marine protected areas are among the most commonly implemented in order to promote the sustainability of coastal social-ecological systems. Locally adapting these tools, often proposed and implemented by external actors, remains a challenge. Making explicit the objectives of these interventions – their expected outputs for people and ecosystems – also represents an often overlook necessity. Using a marine conservation project in the Philippines as a case study, we introduce a method to determine these objectives and build a rationale for these interventions. To do so, based on the literature on marine conservation, we assess the alignments and divergences of key stakeholders’ perceptions on four dimensions: i) environmental well-being, ii) environmental stressors, iii) available options, and iv) perception of marine protected areas. Making a synthesis of these synergies and potential conflicts is a way to define clearer objectives, adapt the implementation of planned interventions and measure their future benefits.

## 1. Introduction

Human health and well-being rely on ecosystems functioning (Hopkins et al., 2020), with some communities depending more directly on a healthy environment than others. Coastal fishing communities can be highly dependent on marine ecosystem services, making them particularly vulnerable to environmental degradation due to resources overexploitation, unsustainable coastal development or climate change (Ban, 2019; Cinner et al., 2018). => Anthropocene coral reefs (Williams et al 2019).

A great variety of approaches to support the sustainability of coastal social-ecological systems (SESs) have been identified including the use of area-based management tools (Reimer et al., 2020), vulnerability-based intervention portfolios (Thiault et al., 2019) or strategies to support adaptation (Cinner et al., 2018). However, there is an increasing recognition that success is lagging behind. Many of the proposed solutions to sustainability problems are designed externally and don’t capture adequately the local complexity of the social-ecological system (Oldekop et al., 2016; Sterling et al., 2017). Without a proper involvement of local communities, external actors can fail at implementing interventions and these can result in inequity among beneficiaries and conflicts (Aswani et al., 2017; Ban et al., 2009, 2019; Costello et al., 2016; Gill et al., 2019; Id et al., 2021; Melnychuk et al., 2021; Sykora-Bodie et al., 2021). + Bennett et al 2021.

Marine protected areas (MPAs) are among the most common of all interventions dedicated to improve the sustainability of coastal SESs. MPAs are often proposed and managed by external actors such as non-governmental organizations (NGOs). These actors can be helpful in enhancing the financial and legal capacity of MPAs and therefore better prevent the overexploitation of resources (Gill et al 2017, Basurto and Ostrom 2009, Coral Reef Governance 50 reeefs). However, tradeoffs exist and MPAs can become or be perceived as a factor of vulnerability when preventing fishers from accessing their fishing grounds (Canova Molina 2022). Top-down approaches have often been pointed as exclusionary; to be efficient where communities highly rely on marine resources, MPAs must be accepted by local users and their objectives should therefore have a sufficient degree of alignment with those of fishers and their communities. As the global coverage of MPAs is increasing and could reach 30% of the global ocean (Jefferson et al 2022), improving the way MPAs are created and managed in accordance to local social stakes will constitute a pillar of ocean justice and equity (Bennett 2022, Equity).

In this paper, we propose a framework to assess how MPAs are tailored to local social-ecological context, and, using perception surveys, apply it to study a conservation project undertaken in Palawan Philippines where an NGO is helping for the creation of community-based MPAs. Many conservation projects lack specific objectives clearly stating what they aim to tackle or achieve. The goal of our framework is therefore to explore local environmental issues, their implications for wellbeing, and the way conservation measures might, or might not tackle them.

* Argument to be explored: studies will either consider MPAs as being beneficial to everyone, or present them as a conflictual object, instead of showing what do different actors agree and disagree upon.
* “Overall, the different fishery management themes in Philippines are perceived to be more social and economic oriented, with limited effect on environmental goals.” (Tolentino 2022) => little study of environmental goals. It shows how disconnected the objectives can be from environmental matters, even though actions are eco-centric.
* Systematic conservation planning (McIntosh et al 2017, Alvarez-Romero et al 2018). + Absence of evidence of the benefits of conservation planning? (McIntosh et al 2018)

## Methods

**2.1. Framework**

In order to explore and classify the perceptions of local actors on marine conservation, we first built a framework including six dimensions important to define the objectives of marine conservation and assess future outcomes (Figure 1). To do so, we used literature focusing on the outcomes and drivers of success of environmental conservation. In particular, we used Ban et al. (2019) and Gill et al*.* (2019) as a rationale to capture the links between human well-being and marine conservation. In our framework, we termed those categories “environmental well-being” (1), “available options (4), and “external interventions” (5). Other studies such as highlighted the potential of perception to assess what we termed “environmental issues” (3), sometimes referred to as “stressors”, as in Bennett et al., 2015, and their link with ecosystem services (Cárcamo et al., 2014). Then, we developed the category “visions for the future” based on the visioning literature applied to sustainable development (Wiek & Iwaniec, 2014). Finally, the category “possible solution” represents a summary of the last categories and a rationale for conservation as an answer to the following question: *what is conservation supposed to tackle, and how will it benefit to the well-being of local communities?*

**2.2. Study site**

In Palawan, as elsewhere in the Philippines and South-East Asia, most of the population is coastal and depends on coral reefs for their nutritional security and livelihoods (Cabral & Geronimo, 2018). To prevent the depletion of coastal resources, administrations and non-governmental organizations (NGOs) have long promoted the implementation of local fishery management tools. Among these, community-based marine protected areas (MPAs) have been presented as particularly relevant, benefitting both coastal ecosystems and fishers (Alcala, 1998). Such projects in the Philippines are usually initiated by NGOs in partnership with local governments.

The Shark Fin Bay of Palawan hosts five coastal villages where fishing is with farming the main livelihood. An NGO, the Sulubaai Environmental Foundation (SEF), has been active in the area since 2011 and already helped the creation of an MPA around Pangatalan Island in 2016. It then started the “Sea Academy” project promoting the creation of new MPAs, environmental education in schools, alternative livelihoods and activities of ecological restoration. This project and the context make our case study representative of other situations in which coastal fishing communities are facing a depletion of their resources and are proposed to implement marine conservation.

**2.3. Open-ended questionnaire**

We developed an open-ended questionnaire in order to collect the perceptions of local people on environmental vulnerability, ecosystem well-being and marine conservation (see questionnaire in Appendix). 60 local respondents were randomly selected through snow-ball sampling in five villages (*barangay*): Batas, Depla, Mabini, Sandoval and Silanga, as well as 6 decision-makers and scientists from the municipalities of Taytay and Puerto Princesa. The interviews were conducted in Filipino or English depending on the respondent. All interviews were recorded with the prior informed consent of participants, then transcribed and translated in English.

**2.4. Content analysis**

We performed an inductive content analysis based on the transcripts of the interviews (REF). Individual codes, that represent a specific perception of a matter, were progressively identified and classified in the categories of our framework (see Appendix for a detail account of all codes and example of quotes). Then, these individual codes were grouped in themes (Table 1). This way, we could quantify the number of respondents that expressed a particular perception.

**2.5. Network representation**

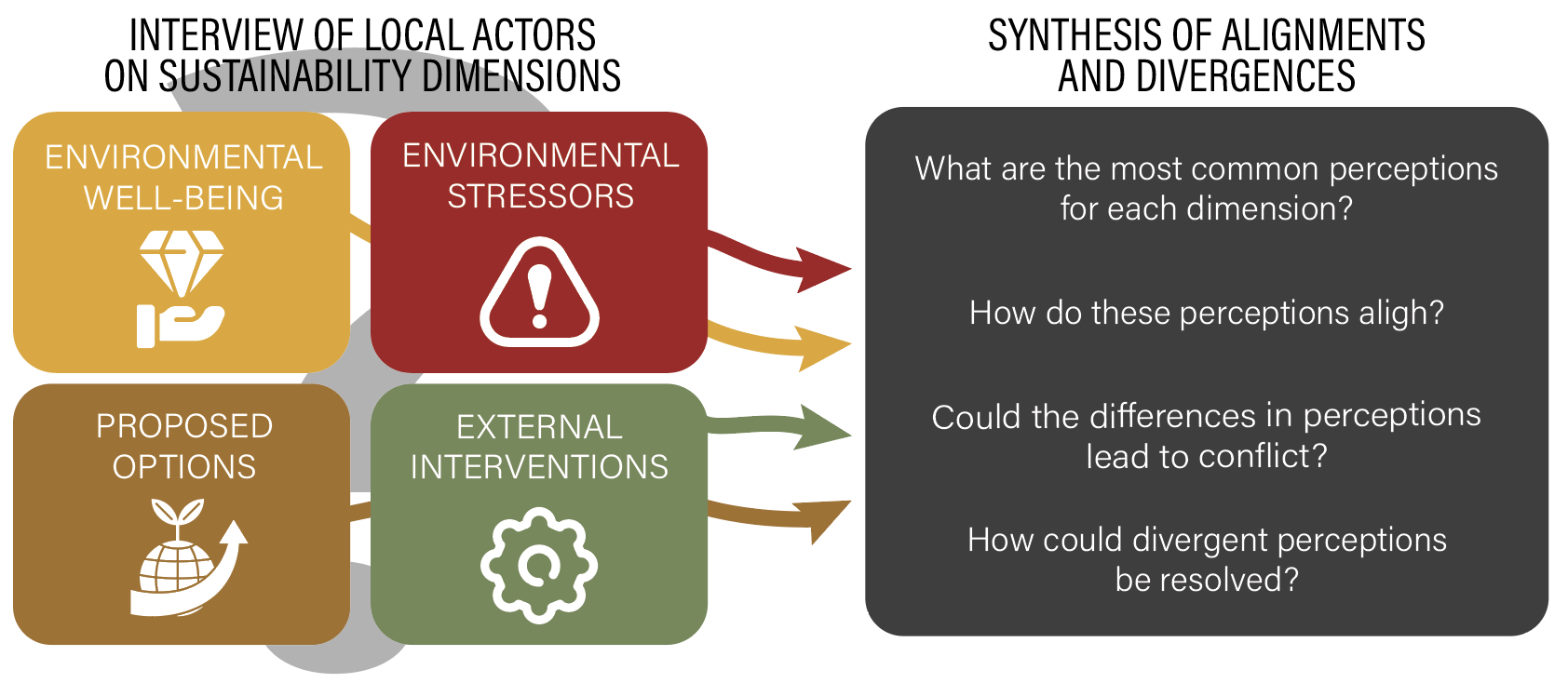
All data visualizations and statistical analyses were implemented in R (REF). We used igraph (REF), network (ref) and ggplot2 (REF) packages to build a bipartite network representation linking individual respondents to their perceptions, identified through content analysis (codes available on github). We used the Fruchterman-Reingold (REF) force-directed algorithm to produce a layout of our bipartite network where respondents that gave more similar responses appear closer to them and these responses.

**2.6 Statistical analyses**

In order to study the differences in perceptions between respondents that were closer to SEF and those that were less in contact with the NGO, we first represented the repartition of perceptions between groups. Then we performed a one-way ANOVA (vegan) and post-hoc Tukey test to test for the difference between groups in the number of individual themes identified by each respondent. Finally, we computed a PERMANOVA (using vegan package, adonis2 function) to test for the difference between groups in the composition of perceptions.

## 2. A framework to assess the congruence between objectives of sustainability interventions and local expectations

The framework we have developed, based the literature on sustainability and marine conservation, is designed to assess the congruence between the objectives of marine protected areas and local expectations. It is structured around four dimensions: i) environmental well-being, ii) environmental stressors, iii) proposed options, and iv) external interventions.



*Figure 1. Conceptual diagram representing the framework to assess the congruence between objectives of sustainability interventions and local expectations.*

**3.1. Environmental dependance and attachment**

A first dimension we propose to explore is how the well-being of local communities depends on the environmental features subject to interventions (*e.g.*, a forest, a watershed, particular species). How to frame these values has caused intense debate (Betley et al., 2021; Ishihara, 2018; Peterson et al., 2018); but the different definitions hold in common the idea that disrupting ecological processes, or managing ecosystems will in turn affect human well-being. Many conservation initiatives have the objective to sustain or improve human well-being. In the case of MPAs, economic, governance and health benefits have been demonstrated, while negative effects have also been documented (Ban et al., 2019). The perspective we adopt here on well-being is one directly questioning the link between environmental features and elements of human well-being (Betly et al., 2021).

**3.2. Environmental stressors**

What is considered to constitute « environmental issues » is large and can vary between cultures and knowledge systems. By employing it, we precisely aim at collecting a wide range of information on what different stakeholders consider as an issue to the environment and the resources on which they depend. These can comprise stressors such as climate change, or various pollutions, but also the root-causes of these threats: more distal drivers such as urbanization, or poverty. Sustainability interventions are meant to target specific issues; questioning if what people consider as an issue fits their perimeter of action is a way to ensure that no one expects more than what is possible, or that potential benefits are not ignored.

**3.3. Proposed options**

We call « proposed options » what different stakeholders can bring up in the discussion as a solution to the environmental issues previously defined. Once they have identified a range of issues, we can then question them on the solutions they imagine are possible. If external interventions are planned, this is a way to ensure people bring them in the discussion and consider them as viable options. It also gives the opportunity to describe stakeholder’s understanding of these interventions and refine their objectives (Pajaro et al., 2010).

+ Here we can add that available options are measures of integrated coastal management that can complement MPAs, or different visions about MPAs.

**3.4. External interventions**

External interventions are the ones promoted by actors external to the system studied; in our case study, an NGO promoting the creation of MPAs. What is “internal” or “external” can be subject to debate and could also be seen as a continuous scale with resource users being considered the closest groups to the implementation measures, and national agencies, scientists, and NGOs being the most external groups involved. In the middle we could find provincial or municipal authorities, or residents of nearby villages.

Understanding how people perceive these proposed or implemented interventions allows to directly question potential oppositions and conflicts, as well as refining what is held as an objective by implementation bodies. In the case of an MPA, we know that many objectives would be proposed, such as improving the ecological resilience or promoting eco-tourism. Our goal is to question if the perception of these external interventions can match with other proposed options and efficiently tackle the environmental issues identified.

**3.5. Possible solutions: a synthesis of alignments and divergences**

Building on the five prior dimensions, the last step we propose is to integrate these results and build a rationale for conservation. This rationale, or narrative should include present objectives, future ones, resources, actors, and consider potential conflicts and trade-offs. Different visions should not always mean potential conflicts, but they should always be examined to stay assured that different objectives are compatible.

The method we propose is therefore exploratory and should guide later decision stages that would otherwise be potentially disorganized and blind. The way we propose to synthetize these results is to examine both alignments, building a shared narrative for these objectives, and divergences, pushing for further discussions between actors based on their potential conflicting visions.

## 3. Case-study: implementing a network of marine protected areas in Palawan, Philippines

Using open-ended questionnaires, we investigated the perceptions of 66 local people, decision-makers and scientists of Palawan, Philippines, on local sustainability issues. After a content analysis, 174 perceptions were identified and grouped in 22 themes (Table 1, see Appendix for a list of perceptions identified). We analyzed the differences in perceptions between: i) local residents and external actors; ii) local residents from different villages and iii) local residents who were familiar with the projects of SEF, and those who were not in order to study the similarities and differences in their discourses. Due to relatively small sample size, quantitative analyses could only be performed for ii) and iii).

|  |  |  |  |
| --- | --- | --- | --- |
| Category | Theme | Description | Number of respondents |
| Environmental well-being | Livelihood | Marine ecosystems are valuable because people get their livelihoods and income from their resources. | 55 |
| Food and nutrition | Local people get affordable and healthy food from the sea, mostly fish but also shells, shrimps or seaweeds. | 47 |
| Tradition | People value marine ecosystems for their contribution to local traditions, for religious reasons and as a responsibility for future generations. | 11 |
| Other services | Other ecosystem services mentioned by respondents such as coastal protection, tourism, or charismatic species. | 10 |
| Environmental issues | Destructive fishing practices | A threat to marine ecosystems is the use of destructive fishing practices such as cyanide, dynamite, small-meshed nets or compressors. | 50 |
| Depletion of resources | Fishery resources have decreased and habitats noticeably damaged because of the increasing number of fishermen and use of destructive practices. | 46 |
| Terrestrial issues | On top of marine issues, people are facing terrestrial issues such as deforestation, invasions by pests, or the loss of terrestrial fauna. | 43 |
| Unmanageable issues | Unmanageable issues such as weather patterns, climatic events, or luck are other problems fishers have to face. | 14 |
| Other pressures | Diverse other pressures to marine ecosystems exist such as wastewater, other pollutions, climate change, or tourism. | 20 |
| Social issues | Environmental issues have root causes that can be found in social issues such as poverty, the lack of education and opportunities, or demography. | 17 |
| No issue identified | No environmental issue could be identified by the respondent. | 15 |
| Proposed options | Coercive social interventions | Coercive social interventions can be put in place such as reinforcing patrolling and arresting offenders. | 40 |
| Non-coercive social interventions | Non-coercive social interventions include the increase of education, better cooperation between stakeholders, or capacity building. | 28 |
| Ecosystem-based interventions | Ecosystem-based interventions such as marine reserves and ecosystem restoration activities can be efficient. | 15 |
| No option identified | No option to face environmental issues could be identified by the respondent. | 13 |
| External interventions | MPAs for ecological sustainability | The role of MPAs is to improve the state of ecological habitats, of their components including fishes, corals, shells, and functions such as nursery. | 52 |
| MPAs for local people | MPAs are made to benefit to local resource users. | 48 |
| MPAs as coercive instruments | The role of MPAs is to be coercive instruments facilitating patrolling and the enforcement of existing laws, for instance, on illegal fishing practices. | 37 |
| MPAs for fishery | The role of MPAs is to improve the state of fisheries through spillover and the protection of nursery grounds. | 36 |

*Table 1. List of the themes identified through content analysis and total number of respondents that quoted these themes (n = 66).*

**4.1. Alignments: when stakes and objectives meet**

Several themes identified were more commonly shared among all stakeholders (Table 1). Looking at them provides an idea on what are the more consensual elements of perception regarding marine conservation. The most common environmental well-being factors identified by respondents were linked to the contribution of marine ecosystem to people’s food and livelihood security (respectively by 41 and 50 respondents). In terms of environmental issues, destructive fishing practices were the most commonly identified, linked with their effect in depleting resources (42 and 38 respondents). Finally, the most common interventions identified were coercive ones (*e.g.*, more efficient patrolling) and marine reserves to promote ecological sustainability (33 and 46 respondents).

Identifying these conspicuous elements provides a rationale for future conservation measures, their objectives and expected outputs. We can contextualize the perceived local needs for conservation that should therefore target the nutrition and income of local people through regulating the activity of fishing; it also demonstrates the central position fishers should occupy in such a project.

**4.2. Divergences and potential conflicts of perceptions**

Local respondents who were aware of SEF projects, as well as scientists and decision-makers had significantly different and more diverse perceptions on marine conservation themes (PERMANOVA result p<0.05). These respondents also identified, on average, more themes (ANOVA & Tukey test p<0.05). A first divergence in perceptions can therefore be found in the degree of familiarity with marine conservation themes, with some respondents adopting a discourse closer to the perceptions of scientists and decision-makers. To ensure a more consistent rationale for conservation and equity, management plans should include further discussions to understand if respondents that identified relatively less familiar with conservation matters would agree with the perceptions of others. In the project we studied, such discussions occurred during local public hearings for the designation of MPAs. These events showed that illegal fishing was conspicuous in discourses, while they confirmed a broad support for MPAs.

We found a second set of divergences in the definition of what MPAs are and their objectives. Most respondents conceptualized them as fishery management tools, made to replenish fishing grounds through adult and larval spillover. However, two villages showed significant exceptions. First, several respondents from Batas stated MPAs are made only to restrict outsiders from fishing, hence allowing locals to fish in their “own” sanctuary. Second, respondents from Silanga perceived that MPAs are made for tourists and did not immediately consider potential benefits for fishing and non-fishing local people; this could be explained by the presence of several nearby private MPAs created by island-resorts.

**4.3. Summary of options: a rationale for marine conservation**

We classified the different themes and codes identified in four categories (Appendix) as many elements feeding the local discussions on marine conservation, its objectives and expected outputs. The last category of our framework, “possible solution”, is a synthesis of these information into what we call a “rationale for marine conservation”. This rationale, or narrative, is a simple statement of what local actors expect from marine conservation in relation to environmental threats and well-being.

In our case study, we investigated how MPAs can fit to the local context in which they are supposed to be established. We could establish the following rationale:

*In the Shark Fin Bay, food security, livelihoods and local traditions depend on increasingly depleted marine resources. Destructive fishing practices, such as the use of dynamite and cyanide, but also overfishing are to blame for this decline. Social issues like poverty and the lack of livelihood opportunities represent root causes for these practices. Terrestrial issues including pollution and deforestation should also be considered as a threat to ecosystems and well-being. A desirable future would be one with productive fisheries; on the opposite, their decline would hinder the contribution of marine ecosystems to the wellbeing of future generations. Local actors identify several options to face that situation: non-coercive interventions (*e.g.*, alternative livelihood projects), coercive interventions (*e.g.*, patrolling and fines), and ecosystem-based interventions (*e.g.*, marine reserves). The specific role of MPAs, in order to fit with the objectives of local resource-users, must be to preserve fishery from illegal activities and help restoring stocks, not only for livelihoods, but also for food and nutrition security. These dimensions should be included in the management plan of the future MPAs in order to monitor their outcomes.*

**

*Figure 3. Differences in the perceptions of local people (n = 60) depending on their familiarity with the NGO and its projects.*

## 4. Discussion

**4.1. Overall convergence on management needs**

**4.2. Tailoring solutions to local contexts**

**4.3. Benefits of the framework**

**4.4. Opportunities from the support of external actors**

**4.5. Risks faced with external interventions**

* What is a community? What boundaries? Gurney et al 2017.
* Sense of place => understanding why people participate or not in management (Gurney et al 2017). Here we could say that a reason for participation, or non-participation, would be the alignment between external and local objectives.
* Urbanization changes preferences in ES (Lapointe et al 2020)

## Bibliography

Alcala, A. C. (1998). Community-based coastal resource management in the Philippines: a case study. *Ocean & Coastal Management*, *38*, 179–186.

Aswani, S., Albert, S., & Love, M. (2017). One size does not fit all: Critical insights for effective community-based resource management in Melanesia. *Marine Policy*, *81*(March), 381–391. https://doi.org/10.1016/j.marpol.2017.03.041

Ban, N. C. (2019). Fishing communities at risk. *Nature Climate Change*, *9*(7), 501–502. https://doi.org/10.1038/s41558-019-0506-9

Ban, N. C., Gurney, G. G., Marshall, N. A., Whitney, C. K., Mills, M., Gelcich, S., Bennett, N. J., Meehan, M. C., Butler, C., Ban, S., Tran, T. C., Cox, M. E., & Breslow, S. J. (2019). Well-being outcomes of marine protected areas. *Nature Sustainability*, *2*(6), 524–532. https://doi.org/10.1038/s41893-019-0306-2

Ban, N. C., Picard, C. R., & Vincent, A. C. J. (2009). Comparing and integrating community-based and science-based approaches to prioritizing marine areas for protection. *Conservation Biology*, *23*(4), 899–910. https://doi.org/10.1111/j.1523-1739.2009.01185.x

Bennett, N. J., Dearden, P., & Peredo, A. M. (2015). Vulnerability to multiple stressors in coastal communities: a study of the Andaman coast of Thailand. *Climate and Development*, *7*(2), 124–141. https://doi.org/10.1080/17565529.2014.886993

Betley, E. C., Sigouin, A., Pascua, P., Cheng, S. H., MacDonald, K. I., Arengo, F., Aumeeruddy-Thomas, Y., Caillon, S., Isaac, M. E., Jupiter, S. D., Mawyer, A., Mejia, M., Moore, A. C., Renard, D., Sébastien, L., Gazit, N., & Sterling, E. J. (2021). Assessing human well-being constructs with environmental and equity aspects: A review of the landscape. *People and Nature*, *January*, 1–18. https://doi.org/10.1002/pan3.10293

Cabral, R. B., & Geronimo, R. C. (2018). How important are coral reefs to food security in the Philippines? Diving deeper than national aggregates and averages. *Marine Policy*, *91*(December 2017), 136–141. https://doi.org/10.1016/j.marpol.2018.02.007

Cárcamo, P. F., Garay-Flühmann, R., Squeo, F. A., & Gaymer, C. F. (2014). Using stakeholders’ perspective of ecosystem services and biodiversity features to plan a marine protected area. *Environmental Science and Policy*, *40*, 116–131. https://doi.org/10.1016/j.envsci.2014.03.003

Cinner, J. E., Adger, W. N., Allison, E. H., Barnes, M. L., Brown, K., Cohen, P. J., Gelcich, S., Hicks, C. C., Hughes, T. P., Lau, J., Marshall, N. A., & Morrison, T. H. (2018). Building adaptive capacity to climate change in tropical coastal communities. *Nature Climate Change*, *8*(2), 117–123. https://doi.org/10.1038/s41558-017-0065-x

Costello, C., Ovando, D., Clavelle, T., Kent Strauss, C., Hilborn, R., Melnychuk, M. C., Branch, T. A., Gaines, S. D., Szuwalski, C. S., Cabral, R. B., Rader, D. N., & Leland, A. (2016). Global fishery prospects under contrasting management regimes. *Proceedings of the National Academy of Sciences of the United States of America*, *113*(18), 5125–5129. https://doi.org/10.1073/pnas.1520420113

Gill, D. A., Cheng, S. H., Glew, L., Aigner, E., Bennett, N. J., & Mascia, M. B. (2019). Social Synergies, Tradeoffs, and Equity in Marine Conservation Impacts. *Annual Review of Environment and Resources*, *44*(1), 347–372. https://doi.org/10.1146/annurev-environ-110718-032344

Hopkins, S. R., Sokolow, S. H., Buck, J. C., De Leo, G. A., Jones, I. J., Kwong, L. H., LeBoa, C., Lund, A. J., MacDonald, A. J., Nova, N., Olson, S. H., Peel, A. J., Wood, C. L., & Lafferty, K. D. (2020). How to identify win–win interventions that benefit human health and conservation. *Nature Sustainability*, *4*(April). https://doi.org/10.1038/s41893-020-00640-z

Id, S. E., Hausner, V. H., Gurney, G. G., Broderstad, E. G., Keller, R., Kristine, A., Id, L., Javier, F., Murguzur, A., Salminen, E., Raymond, C. M., Falk-andersson, J., & Fauchald, P. (2021). *Blue justice : A survey for eliciting perceptions of environmental justice among coastal planners ’ and small-scale fishers in Northern-*. 1–20. https://doi.org/10.1371/journal.pone.0251467

Ishihara, H. (2018). Relational values from a cultural valuation perspective: how can sociology contribute to the evaluation of ecosystem services? *Current Opinion in Environmental Sustainability*, *35*, 61–68. https://doi.org/10.1016/j.cosust.2018.10.016

Melnychuk, M. C., Kurota, H., Mace, P. M., Pons, M., Minto, C., Osio, G. C., Jensen, O. P., de Moor, C. L., Parma, A. M., Richard Little, L., Hively, D., Ashbrook, C. E., Baker, N., Amoroso, R. O., Branch, T. A., Anderson, C. M., Szuwalski, C. S., Baum, J. K., McClanahan, T. R., … Hilborn, R. (2021). Identifying management actions that promote sustainable fisheries. *Nature Sustainability*, *4*(5), 440–449. https://doi.org/10.1038/s41893-020-00668-1

Oldekop, J. A., Holmes, G., Harris, W. E., & Evans, K. L. (2016). A global assessment of the social and conservation outcomes of protected areas. *Conservation Biology*, *30*(1), 133–141. https://doi.org/10.1111/cobi.12568

Pajaro, M. G., Mulrennan, M. E., Alder, J., & Vincent, A. C. J. (2010). Developing MPA Effectiveness Indicators: Comparison Within and Across Stakeholder Groups and Communities. *Coastal Management*, *38*(2), 122–143. https://doi.org/10.1080/08920751003633094

Peterson, G. D., Harmáčková, Z. V., Meacham, M., Queiroz, C., Jiménez-Aceituno, A., Kuiper, J. J., Malmborg, K., Sitas, N., & Bennett, E. M. (2018). Welcoming different perspectives in IPBES: “Nature’s contributions to people” and “Ecosystem services.” *Ecology and Society*, *23*(1), art39. https://doi.org/10.5751/ES-10134-230139

Reimer, J. M., Devillers, R., & Claudet, J. (2020). Benefits and gaps in area-based management tools for the ocean Sustainable Development Goal. *Nature Sustainability*, *20*(Umr 228). https://doi.org/10.1038/s41893-020-00659-2

Sterling, E. J., Filardi, C., Toomey, A., Sigouin, A., Betley, E., Gazit, N., Newell, J., Albert, S., Alvira, D., Bergamini, N., Blair, M., Boseto, D., Burrows, K., Bynum, N., Caillon, S., Caselle, J. E., Claudet, J., Cullman, G., Dacks, R., … Jupiter, S. D. (2017). Biocultural approaches to well-being and sustainability indicators across scales. *Nature Ecology and Evolution*, *1*(12), 1798–1806. https://doi.org/10.1038/s41559-017-0349-6

Sykora-Bodie, S. T., Álvarez-Romero, J. G., Adams, V. M., Gurney, G. G., Cleary, J., Pressey, R. L., & Ban, N. C. (2021). Methods for identifying spatially referenced conservation needs and opportunities. *Biological Conservation*, *260*(April). https://doi.org/10.1016/j.biocon.2021.109138

Thiault, L., Gelcich, S., Marshall, N., Marshall, P., Chlous, F., & Claudet, J. (2019). Operationalizing vulnerability for social–ecological integration in conservation and natural resource management. *Conservation Letters*, *September*, 1–13. https://doi.org/10.1111/conl.12677

Wiek, A., & Iwaniec, D. (2014). Quality criteria for visions and visioning in sustainability science. *Sustainability Science*, *9*(4), 497–512. https://doi.org/10.1007/s11625-013-0208-6

# Appendix

Table A1. Open-ended questionnaire used to collect the perceptions of local actors on marine conservation.

Table A2. List of individual perceptions identified in content analysis (n=174) and quotes supporting them.

Figure A1. NMDS to ordinate the respondents and their responses. Two groups emerge and the difference in the composition of their perceptions is significant (PERMANOVA p<0.05)

