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# 1 Assessing stakeholder perceptions to guide social and ecological fit of 2 marine protected areas

3

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14

## 15 **Summary**

16 Effective social and ecological interventions that can benefit both nature and people are  
17 needed to halt the degradation of ecosystems and subsequent negative impacts on human  
18 well-being. Marine protected areas (MPAs) are commonly used to foster the sustainability of  
19 coastal social-ecological systems. However, because MPAs are often proposed and  
20 implemented by external actors, ensuring they are fit to the local social and ecological context  
21 remains a challenge. Here, we introduce a framework to identify the place-based social and  
22 ecological goals for an MPA. We use a marine conservation project in the Philippines as a case  
23 study. We assess the perceptions of local communities and decision-makers across four  
24 categories: i) marine importance, ii) environmental stressors, iii) proposed management  
25 options, and iv) MPA goals and needs. Assessing these is a way to refine marine conservation  
26 goals locally, adapt the implementation of planned interventions, and monitor their future  
27 outcomes.

## 28 1. Introduction

29 Coastal fishing communities can be highly dependent on marine ecosystem services, making  
30 them particularly vulnerable to marine environmental degradation or changes in access to  
31 resources<sup>1-4</sup>. Improving the way coastal and marine resources are used is a great challenge as  
32 ocean-based activities such as coastal tourism, infrastructure development, and fishing are  
33 developing at an increasing pace<sup>5</sup>. A variety of approaches exist to identify sustainability  
34 interventions in coastal social-ecological systems (SESs) according to their expected  
35 outcomes<sup>6</sup> or local conditions<sup>7</sup>. However, the identification and implementation of  
36 sustainability interventions are often driven externally<sup>8</sup>, which can increase the likelihood that  
37 interventions are not fit to local contexts and fail to deliver expected positive social and  
38 ecological outcomes, or even lead to negative outcomes, including increased environmental  
39 degradation, social inequities, and conflicts<sup>4,9-18</sup>. The concept of social and ecological fit  
40 represents the idea that some governance arrangements and interventions are more  
41 adequately and specifically suited to the social and ecological characteristics of the  
42 environmental problem at hand<sup>19-21</sup>. It has been applied to study the relevance of  
43 sustainability interventions in the context of marine social-ecological systems and their ability  
44 to efficiently curb ecological threats and improve human well-being<sup>20,22</sup>.

45 Marine protected areas (MPAs), among other area-based management tools, are commonly  
46 used to improve the sustainability of coastal social-ecological systems<sup>23</sup>. MPAs can deliver  
47 benefits to people across diverse well-being dimensions (Ban et al. 2019) and, thus, can be  
48 appealing to local communities<sup>24</sup>. However, MPAs are also often proposed, implemented and  
49 managed by external actors, including non-governmental organizations (NGOs). While these  
50 actors can support the participation of local actors in resource governance<sup>25</sup> and enhance the  
51 financial and legal capacity of MPAs<sup>26,27</sup>, externally driven area-based conservation can create  
52 or exacerbate local vulnerabilities, for instance, when preventing fishers from accessing their  
53 fishing grounds<sup>4,14,28</sup>. Indeed, opposition to MPAs can arise when they do not meet local needs  
54 or their benefits are oversold<sup>29,30</sup>. Social and ecological fit should, therefore, be a top priority  
55 for all conservation initiatives<sup>20-22,31,32</sup>, if not a moral obligation<sup>33</sup>. As global coverage of MPAs  
56 is likely to increase at a fast pace to comply with Target 3 of the Kunming-Montréal Global  
57 Biodiversity Framework, improving the inclusivity and fit of MPAs constitutes a pillar of ocean  
58 justice and equity<sup>12,33</sup>.

59 Social assessments focusing on stakeholders' perceptions have widely been used for MPA  
60 planning and evaluation. The perceptions of stakeholders can be informative to support  
61 multi-level governance arrangements, where the motivations and actions of different actors  
62 can be highly contrasted and need to be integrated<sup>34</sup>. These can help evaluate local  
63 dependencies on marine ecosystem services<sup>35</sup>, assess threats to ecosystems<sup>36</sup>, help design  
64 the MPA<sup>37</sup>, understand barriers and levers to a specific MPA attribute such as the level of  
65 protection<sup>38</sup>, or assess local support for conservation<sup>39</sup>. However, a framework designed to  
66 jointly study local actors' perceptions on these different aspects that are of relevance to the  
67 social and ecological fit of MPAs is still lacking.

68 Here, based on the literature on MPA governance and effectiveness (e.g. <sup>4,10,27,39-41</sup>), we  
69 develop a framework designed to understand and guide the fit of MPAs to the local social and  
70 ecological context by assessing stakeholders' perception across four categories: i) marine  
71 importance, ii) environmental stressors, iii) proposed management options, and iv) MPA  
72 goals. Assessing the perception of marine and coastal ecosystems is a way to identify which  
73 benefits MPAs aim to improve or sustain. Similarly, these communities' perceptions of  
74 environmental stressors are informative regarding threats expected to be curbed by MPAs.  
75 Proposed management options represent a portfolio of different interventions that can  
76 include but are not limited to MPAs. Finally, asking stakeholders about the specific goals they  
77 envision for MPAs is a way to dive deeper into what they are expected to achieve in relation  
78 to the three first categories.

79 In order to trial our framework, propose tentative methods for data collection and analysis,  
80 and demonstrate some of the results that can be obtained and their local relevance for  
81 management, we studied a conservation project undertaken in Palawan, Philippines, where  
82 a non-governmental organization (NGO) is promoting the creation of several community-  
83 based MPAs. We interviewed local resource users, researchers and decision-makers across  
84 the four categories of our framework and synthesized their perceptions to assess the  
85 challenges and opportunities for a local social and ecological fit of that area-based  
86 conservation project.

## 87 2. Results

### 88 2.1. A framework to assess the social and ecological fit of marine protected areas

89 We aimed to develop a framework designed to survey the expectations of local stakeholders  
90 and the goals for a project of new community-based MPAs to guide their social and ecological  
91 fit. The survey was designed to collect perceptions in the following four categories: i) marine  
92 importance, ii) environmental stressors, iii) proposed management options, and iv) MPA goals  
93 (Table 1). The results are intended to help ensure management is more likely to be locally fit,  
94 hence aligned with local values, needs, cultural and governance systems, which means a  
95 greater likelihood of local leadership, support, compliance, trust, and therefore social and  
96 ecological outcomes<sup>22,39,44</sup>. This framework can also be informative on social and ecological  
97 interactions, which is key to understand the conditions in which management can be  
98 (in)effective<sup>42</sup>. We believe the target audience of such assessment can be MPA managers,  
99 whether they are NGOs, government, or local community representatives. The following  
100 sections detail each category of the framework using existing literature, and provide examples  
101 of their use in the context of area-based marine conservation and its social and ecological fit.

#### 102 **2.1.1. Marine importance**

103 The first category we propose to explore is the perceived importance of the marine and  
104 coastal environment. The diversity of ways in which communities depend on environmental  
105 features constitutes an important part of their well-being, particularly in the context of  
106 coastal communities depending on fishing<sup>45</sup>. The framing of this dependence as ecosystem  
107 services or nature's contributions to people has caused some debate<sup>45-48</sup>; yet these  
108 definitions hold in common the idea that disrupting ecological processes or managing  
109 ecosystems will, in turn, affect human well-being either negatively or positively. Depending  
110 on contexts, MPAs can have positive or negative social outcomes on economic and health  
111 dimensions<sup>10,49,50</sup>, but also on non-material elements such as sense of place and spirituality<sup>51</sup>.  
112 Assessing marine importance can help for social and ecological fit<sup>19</sup>, as it is informative on  
113 where and how people value, use and hence benefit from marine ecosystems. In other words,  
114 it highlights the core values and relationships between ecosystems and human well-being in  
115 all its dimensions<sup>14,52</sup>. These dependencies indeed vary between contexts and within groups  
116 and are susceptible to radical change in time<sup>53-57</sup>. Finally, it is important to note that many of

117 the impacts of MPAs on people are direct and not mediated by changes in ecosystem  
118 services<sup>15</sup>, for example, the immediate loss of agency of local fishers linked to new fishing  
119 restrictions. These impacts can be critical motivators whether or not people support  
120 management and are important to consider when designing options to fit the social-  
121 ecological context.

### 122 **2.1.2. Environmental stressors**

123 After documenting how marine ecosystem services contribute to local communities' well-  
124 being, we propose assessing what stressors are thought to potentially affect this contribution.  
125 Assessing environmental stressors can help guide the ecological fit of MPAs, defined as an  
126 *“alignment between the spatial, temporal and functional characteristics of biophysical*  
127 *problems and institutions”*<sup>19</sup>. The perception of environmental stressors in marine ecosystems  
128 varies between actors, cultures and knowledge systems<sup>58-61</sup>. These stressors encompass  
129 drivers linked to climate change or various pollution sources and their impacts, as well as the  
130 root causes of these threats, namely more distal drivers such as urbanization or poverty. Using  
131 the ecological knowledge of local stakeholders is a way to ensure MPAs can effectively tackle  
132 the threats at play in that particular ecosystem. It is also a step forward in assessing their  
133 expected future outcomes. For instance, if stakeholders consider the main impact to be  
134 tackled to be a decrease in the population of a specific group of species, subsequent  
135 monitoring could focus on that group of species.

### 136 **2.1.3. Proposed management options**

137 We refer to “proposed management options” as the ideas that different stakeholders bring  
138 up in the discussion as a potential solution to curb the stressors previously identified. When  
139 an MPA is planned or already exists, asking stakeholders to discuss all potential management  
140 options is a way to verify whether and in what context they mention MPAs (e.g., as a  
141 legitimate useful tool or as an intervention with limited potential). It also allows for a better  
142 understanding of stakeholders’ perceptions of MPAs, refining of specific MPA goals, and  
143 adaptive improvement of MPA management<sup>62,63</sup>. Leaving space for different stakeholders to  
144 make management propositions can be vital to increasing their support and legitimacy<sup>64,65</sup>. A  
145 crucial task to address this question lies in the delimitation of who community members and  
146 stakeholders are, which is typically done based on the degree and nature of their relation to  
147 local coastal and marine ecosystems<sup>66</sup>. “Stakeholders” can include actors who do not belong

148 to the community, such as provincial government representatives in charge of managing  
149 protected areas. Defining their roles in management and their role in decision-making is  
150 important to ensure coherence in the management propositions made.

#### 151 **2.1.4. MPA goals**

152 The goals of MPAs can be geared towards ecological outcomes, biodiversity outcomes, or  
153 both<sup>23</sup>. They can differ between community members and external actors<sup>67,68</sup>. Therefore, it is  
154 vital to make them explicit, and align them as well as possible with the underlying values of  
155 stakeholder, in the interests of achieving better outcomes from area-based management.  
156 Diving deeper into how community members perceive the goals of MPAs based on their use  
157 of marine ecosystems, allows us to identify potential issues of conflict. It can also help refine  
158 goals that were initially put forward by external actors.

#### 159 **2.1.5. Synthesis and rationale**

160 The last step is to build on the four above-mentioned categories, integrate these results, and  
161 build what we call a rationale for MPA management. A particular rationale, in the form of a  
162 synthetic narrative, can include present goals, future ones, resources, and actors, consider  
163 potential trade-offs and conflicts, and constitute a summarized statement on how this MPA  
164 should fit into the social and ecological context. The framework we propose is exploratory  
165 and should guide subsequent decision and conflict resolution stages. The way we propose to  
166 synthesize these results is to examine alignments, unveil a shared narrative for these goals  
167 and divergences, and push for further discussions between different actors based on their  
168 potentially conflicting visions. The destination and use of this synthesis will depend on  
169 contexts, but generally, we propose that it could be useful to MPA managers, typically in the  
170 context of co-management schemes.

## 171 2.2. Case study: creating a network of MPAs in Palawan, Philippines

172 Using structured interviews, we investigated the perceptions of 64 local stakeholders (53  
173 community members and 11 decision-makers in charge of environmental management) in  
174 Palawan, Philippines, on the creation of an MPA network. After content analysis, we identified  
175 151 individual perceptions and grouped them into 25 themes across the four categories of  
176 our framework (Table 1 & Figure 1). This allowed us to study how local stakeholders define  
177 the potential needs for and goals of MPAs. We then proposed a synthesis of these perceptions  
178 and a rationale for local marine conservation projects in the form of a narrative integrating  
179 those elements.

180

### 181 2.2.1. Background and study site

182 The Philippines has a long history of community-based marine conservation<sup>69-72</sup>. Most of the  
183 country's population is coastal and depends on coral reefs and associated ecosystems for  
184 their food security and livelihoods<sup>73,74</sup>. To counteract the depletion of coastal resources<sup>75</sup>,  
185 public actors and NGOs have long promoted the implementation of fishery management  
186 tools<sup>76</sup>. Among these, MPAs have been presented as particularly relevant, benefitting both  
187 coastal ecosystems and fishers<sup>77</sup>. Such projects in the Philippines are usually initiated by  
188 NGOs and researchers in partnership with local government units and local civil society  
189 organizations<sup>76</sup>.

190 In the Shark Fin Bay locality, our case study site, there are about 7000 inhabitants spread  
191 around five coastal districts. Fishing and farming represent the main sources of livelihood. An  
192 NGO, Sulubaai Environmental Foundation (SEF), has been active in the area since 2011 and  
193 has promoted the development of marine conservation initiatives. What started as a private  
194 endeavor with the 2016 creation of the Pangatalan Island Marine Protected Area managed  
195 by SEF then evolved into a project involving more local communities and decision-makers  
196 from the Municipality of Taytay, in charge of decisions related to coastal and marine  
197 ecosystems. The interviews used for this study were conducted between 2019 and 2020. The  
198 relevance of this case study to trial our framework aiming to determining locally fit goals for  
199 MPAs lies in the specific management situation in which Shark Fin Bay was at the time: SEF  
200 was starting the Sea Academy project aiming at creating new community-based MPAs and



201 shifting from a private to a collaborative governance arrangement. At that time, the objective  
 202 was to better include local communities and decision-makers in MPA co-management; hence,  
 203 there was a crucial need to scrutinize the range of relevant goals for these stakeholders.  
 204

Category	Theme	Description
Marine importance	Livelihood	Marine ecosystems are valuable because people get their livelihoods and income from them.
Marine importance	Food and nutrition	Local communities get affordable and healthy food from the sea, mostly fish but also shells, shrimps and seaweeds.
Marine importance	Cultural services	Local communities value marine ecosystems for their contribution to local traditions, for religious reasons and as a responsibility for future generations.
Marine importance	Other services	Other ecosystem services mentioned by respondents include coastal protection, carbon capture, and tourism.
Marine importance	Intrinsic value	Respondents mentioned the intrinsic value of nature, biodiversity or particular species.
Marine importance	No value identified	The respondent could not identify any ecosystem service.
Environmental stressors	Destructive fishing practices	A threat to marine ecosystems is the use of destructive fishing practices such as cyanide, dynamite, small-meshed nets or compressors.
Environmental stressors	Depletion of marine resources	Fishery resources have decreased, and habitats have been noticeably damaged because of the increasing number of fishers and the use of destructive practices.
Environmental stressors	Deforestation	Respondents described issues such as deforestation for timber, slash-and-burn agriculture ( <i>kaingin</i> ), or mangrove cutting for charcoal ( <i>uling</i> ).
Environmental stressors	Social issues	Environmental issues have root causes that can be found in social issues such as poverty, lack of education and opportunities, or demography.
Environmental stressors	Pollutions	Pollutions such as plastic pollution, wastewater, solid waste, pesticides, and fertilizers are perceived to be stressors to terrestrial and marine ecosystems.
Environmental stressors	Climate change and disasters	Climate change, changes in weather patterns, and disasters such as typhoons and floods are affecting ecosystems and the well-being of coastal communities.
Environmental stressors	No issue identified	No environmental issue could be identified by the respondent.
Environmental stressors	Land-based stressors	Some land-based stressors, such as mining, erosion, the development of infrastructure, tourism, and pearl farms, are affecting terrestrial and marine ecosystems.
Environmental stressors	Agriculture and water	Pests are affecting plantations, and water appears to be more and more scarce.
Environmental stressors	Marine conservation	Marine conservation, particularly MPAs, is perceived as a vulnerability factor.
Proposed management options	Legal instruments & enforcement	Coercive social interventions can be put in place, such as reinforcing patrolling and arresting offenders.
Proposed management options	Capacity building & alternative livelihoods	Non-coercive social interventions include the increase of education, better cooperation between stakeholders, or capacity building.
Proposed management options	Ecosystem-based interventions	Ecosystem-based interventions such as marine reserves and ecosystem restoration activities can be efficient in responding to environmental stressors.
Proposed management options	No option identified	The respondent could not identify any options for facing environmental stressors.
Marine protected areas	MPAs for ecological sustainability	The role of MPAs is to improve the ecological habitats of their components, including fishes, corals, shells, and functions such as nurseries.
Marine protected areas	MPAs for local actors	MPAs are made primarily to benefit neighboring communities.
Marine protected areas	MPAs for fisheries & food	The primary goal of MPAs is to improve the status of fisheries and the food security of coastal communities.
Marine protected areas	MPAs as coercive instruments	MPAs are seen primarily as coercive tools, guarded areas expected to expel illegal fishers, and can be a tool to apply existing fisheries regulations.

Marine protected areas	MPAs for external actors	MPAs are primarily made for external actors, in particular tourists and resort owners.
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205

## 206 **2.2.2. Perceptions of stakeholders across the four categories**

### 207 2.2.2.1 Marine importance

208 The main benefits of marine ecosystems identified by respondents were provisioning  
 209 ecosystem services, particularly those related to fisheries. 83% of respondents considered  
 210 that the value of marine ecosystems came from their importance for local livelihoods, and  
 211 52% emphasized their importance for food security. For instance, a respondent from Depla  
 212 (farmer) said: *“The very first and original way of subsistence here is the sea, our sea.”* The idea  
 213 of subsistence is usually completely linked to the tradition of fishing, a sentiment of  
 214 ownership, and generational aspects: *“The ocean is very valuable, especially for the next  
 215 generations. If it is damaged (...), they will not have a fishery and a beautiful environment  
 216 anymore”* (respondent from Depla, civil servant). The most notable divergence between  
 217 respondents lies in the identification of other ecosystem services, such as coastal protection,  
 218 carbon sequestration, or tourism, mainly mentioned by the decision-makers from Taytay.  
 219 Only one respondent (a farmer from Mabini) could not think of any value pertaining to marine  
 220 ecosystems.

### 221 2.2.2.2. Environmental stressors

222 Dynamite and cyanide fishing and their effects on marine ecosystems were central in  
 223 respondents' discourses when asked about environmental stressors: 73% of them talked  
 224 about destructive fishing practices, and 70% said they observed a depletion in fish resources.  
 225 *“A lot of people here are using sodium [cyanide]. It kills the small fish... I think there is no other  
 226 issue here; this is what is causing damages”* (respondent from Mabini, fisher and farmer). This  
 227 perspective is shared among decision-makers: *“The main issue here is illegal fishing: dynamite  
 228 and cyanide fishing, using compressors”* (respondent from Taytay, decision-maker).  
 229 Respondents widely agreed on the impact of illegal practices, along with the increasing  
 230 number of (legal) fishers and associated fishing efforts: fish stocks are decreasing, and it is a  
 231 cause of concern for food and livelihood security. Deforestation was also an important source  
 232 of discussion, in particular mangrove cutting. Many respondents noted the connectivity  
 233 between ecosystems and the importance of mangrove forests as nurseries for many fish

234 species. Some underlying social issues were described by respondents, such as poverty,  
235 increasing demography, or lack of agency. Although most respondents proposed similar  
236 descriptions of the situation, there were also some differences in interpretations. Illegal  
237 fishing, for instance, was considered to be decreasing in frequency by 9% of respondents;  
238 some also said that overfishing outweighed the effect of illegal practices. 23% of respondents  
239 could not point to any environmental stressor; some respondents explained this could be  
240 interpreted as apprehension to talk about themes such as illegal fishing and potentially  
241 pointing at other members of the community, often relatives and close friends. Some simply  
242 state they had no idea what could constitute environmental stressors in the province or the  
243 area.

#### 244 2.2.2.3. Proposed management options

245 Respondents proposed a wide array of options to counteract the issues identified. We  
246 clustered them into three distinct groups (Table 1): legal instruments and enforcement,  
247 capacity building and alternative livelihoods, and ecosystem-based interventions. 20% of  
248 respondents did not identify any potential management option or considered there was none  
249 available. The most common one, identified by 62% of respondents, was to reinforce law  
250 enforcement in order to fight illegal activities: *“When it comes to illegal activities, there should*  
251 *be more law enforcement. One of the best ways is to establish MPAs”* (respondent from  
252 Taytay, decision-maker). 35% of respondents linked MPAs to more efficient law enforcement.  
253 Ecosystem-based interventions and socio-centric interventions, such as alternative  
254 livelihoods or capacity building, were more frequent among the respondents who had  
255 typically been involved in NGO and government sustainability projects: *“The solution is to give*  
256 *a proper livelihood to people and illegal fishers. Give them a proper job to make a living”*  
257 (respondent from Batas, fisher). Others tended to insist more on law enforcement: *“Maybe*  
258 *some guards could catch [illegal fishers]. The police could also arrest them; they could be sent*  
259 *to jail”* (respondent from Batas, fisher).

#### 260 2.2.2.4. MPA goals

261 MPAs were most commonly perceived as a tool to increase the sustainability of marine  
262 ecosystems (79% of respondents) and fish stocks (52% of respondents) to the benefit of local  
263 communities (71% of respondents), in particular fishers. A respondent from Depla (farmer  
264 and pastor) explains: *“The purpose [of MPAs] is to offer the fish a nursery ground. And of*

265 *course, that will produce more fish*", and later adds that MPAs are made for *"the people of*  
266 *Barangay Depla: the fishers. But not only the fishers, other people too because they will eat*  
267 *the catch."* Along with this discourse, many respondents pointed out that MPAs need the  
268 capacity to be efficient, in particular, legal and financial capacity: *"We have a marine*  
269 *sanctuary here in Mabini. But our problem is sustaining it: we cannot sustain it because the*  
270 *Barangay's funds are too little"* (respondent M13, elected official). Some respondents, in  
271 particular decision-makers, pointed out the need for monitoring. Aside from this more  
272 common discourse, two divergent and more marginal definitions of MPAs should be noted.  
273 First, 3% of respondents identified MPAs as a potential threat to livelihood, such as this  
274 respondent from Silanga (elected official and fish trader): *"[Fishers] have to go far to fish now*  
275 *because there are protected areas."* The example of Silanga is evocative because several  
276 nearby island resorts created private MPAs, which are now perceived by many as instruments  
277 to serve tourism rather than improve fisheries. This discourse, sometimes expressed in more  
278 neutral words, without hostility towards resort owners, was more common in Silanga, where  
279 relatively fewer people considered MPAs as dedicated to local communities. The second  
280 divergent discourse that can be noted was found in Batas and is a conception of MPAs as a  
281 way to ban fishers coming from other districts or municipalities: according to their vision, local  
282 fishers could still fish inside using a hook-and-line. A Batas (fisher) respondent explains: *"The*  
283 *goal of marine sanctuaries is to avoid having people from other places fishing here. For them,*  
284 *it is forbidden to fish here in our place."* This discourse reveals the common perception that  
285 local communities own a resource despite the legal fact that marine resources are managed  
286 at a larger municipal scale and officially shared by different districts.

#### 287 2.2.2.5. Synthesis of a rationale for conservation

288 Based on the discourses of local stakeholders, we established a rationale in the form of a  
289 simplified narrative summarizing the main results with the objective to guide further  
290 discussions pertaining to marine conservation in the area:

291 *In Shark Fin Bay, food security, livelihoods and local traditions depend on marine resources*  
292 *that are increasingly depleted. Destructive fishing practices, such as the use of dynamite and*  
293 *cyanide, and overfishing are to blame for this decline. Underlying social drivers like poverty*  
294 *and the lack of livelihood opportunities represent the root causes of these practices. Terrestrial*  
295 *drivers, including pollution and deforestation, should also be considered as a threat to marine*

296 *ecosystems and well-being. Local stakeholders identified several management options to face*  
297 *that situation: legal instruments and coercive measures (e.g., improving legislation and*  
298 *patrolling), initiatives to improve capacity and shift to alternative livelihoods, and ecosystem-*  
299 *based interventions (e.g., MPAs). Some stakeholders cannot identify any particular option. The*  
300 *specific role of MPAs, in order to fit with the objectives of local resource-users, must be to*  
301 *preserve fisheries from illegal activities and help restore stocks, not only for local livelihoods*  
302 *but also for the food and nutrition security of local communities. Because some fishers*  
303 *perceive MPAs as dedicated to tourists and resort owners or as a potential threat to livelihood,*  
304 *any entity proposing the creation of an MPA should ensure the rights of local communities are*  
305 *respected and their voices heard.*

### 306 3. Discussion

307 Our framework helped us identify a strong overall convergence on the need for diverse and  
308 well-enforced management options. It provided concrete recommendations to foster the  
309 social and ecological fit of the MPA network project studied. In particular, it helped us  
310 conceptualize MPAs in Shark Fin Bay first and foremost as fishery management tools while  
311 highlighting their expected benefits for food security. It also showed that MPAs are locally  
312 considered by most respondents as a relevant tool, which is not the case for all contexts<sup>40</sup>.  
313 This is in line with other studies conducted in the same province where environmental  
314 stressors such as overfishing and illegal fishing make local communities, along with NGOs,  
315 researchers and local governments, call for better management<sup>61,78,79</sup>Our framework,  
316 structured interviews, and inductive approach in the coding process allowed the discussion  
317 to be pushed further to efficiently collect the diversity of perceptions associated with marine  
318 sustainability. The rationale derived from the interviews fed the subsequent management  
319 plan produced for the Shark Fin Bay MPA network. In particular, an explicit dual goal to  
320 improve both fishing and food security was adopted for the MPA network based on our  
321 results.

322 As shown by Johnson et al. (2020), management interventions should be tailored to local  
323 contexts<sup>80</sup>. For MPAs, this can include the size and placement of the area to be under  
324 protection or the rules on harvesting<sup>32</sup>. These rules, linked to the ecological context, are also  
325 rooted in the socioeconomic context, and their reception can be different between  
326 individuals<sup>22,81,82</sup>. Marine conservation navigates in very complex systems and has to arbitrate  
327 between divergent voices. In our case study, divergences in perceptions did not appear to  
328 bear a high level of potential conflict, aside probably from the idea regularly expressed in  
329 Silanga that MPAs are “made for tourists.” Conflicts between tourism and fishing have already  
330 been demonstrated in Palawan<sup>83</sup>. Other case studies have shown how, generally, conflict can  
331 emerge when MPAs pay little attention to local stakes and become exclusionary to resource  
332 users<sup>40,83,84</sup>. On the other hand, in places where MPAs are considered more fair, social and  
333 ecological outcomes tend to be more positive<sup>39,57</sup>. Increasing participation and perception of  
334 positive outcomes often come with time<sup>55</sup>. When arbitration is needed, external actors should  
335 rely on existing formal and informal decision processes to ensure both legal and equitable  
336 outcomes. Most of the differences in perceptions between stakeholder groups could be

337 attributable to their knowledge and experience. For example, decision-makers from Taytay  
338 discussed a diversity of marine ecosystem services and MPA benefits, demonstrating a  
339 familiarity with scientific concepts, while local communities focused more on provisioning  
340 services (livelihoods and food provision in particular). There were also some disparities  
341 between different communities, as exemplified by the cases of Batas and Silanga: while most  
342 community members talked about MPAs as areas where fishing is prohibited for the benefit  
343 of local fisheries, several respondents from Batas and Silanga considered that the surrounding  
344 communities should be allowed to fish with a hook-and-line within MPAs. The presence of  
345 nearby resorts, private MPAs, and a high exogenous fishing effort in Batas can explain these  
346 differences.

347 Our framework proved beneficial in gaining a better understanding of the different  
348 perceptions local stakeholders had on marine sustainability and MPAs in particular. While  
349 MPAs can have a wide range of positive ecological and social outcomes<sup>6,10</sup>, it clarified the  
350 specific outcomes local stakeholders were expecting in Shark Fin Bay, therefore providing  
351 locally relevant goals. Another important feature evident in our case study was how certain  
352 stakeholders' perceptions were informative on other stakeholders' experiences: for instance,  
353 many non-fishing farmers and decision-makers focused on the difficulties fishers were facing.  
354 The results from this research have effectively fueled the discussions on marine conservation  
355 in the study area, showing local NGOs and decision-makers that marine conservation  
356 initiatives should have fisheries and food security as a main focus along with biodiversity  
357 benefits, and should be included as a goal in subsequent management.

358 The support from external actors can offer important opportunities for marine conservation,  
359 ranging from increased capacity to improving the links between stakeholders, such as  
360 community-government collaborations<sup>26,27,85</sup>. In Shark Fin Bay, capacity building mainly  
361 consisted of the NGO and local government unit helping local Fisherfolks Associations  
362 organize (e.g., obtaining legal recognition, organizing meetings) and providing enforcement  
363 capacity (e.g., salaries, training of guards, purchase of equipment) and monitoring capacity  
364 (e.g., scuba diving training, collaboration with citizen-science networks). In the case of small-  
365 scale fisheries management, financial or social external support should target both economic  
366 and social conditions and be maintained in time to be truly efficient<sup>86</sup>. NGOs can represent a  
367 bridge between communities and governments when undertaking conservation projects and

368 improving their social and ecological fit<sup>21</sup>. In our case study, the rest of the community was  
369 involved in discussions on the planned MPAs after the initial discussions held between NGO  
370 members and community representatives. Then, the discussion was raised at the municipal  
371 level, and subsequent public hearings involving both community and government  
372 representatives were held before a formal vote for the MPAs to be legislated. Aside from  
373 potential benefits, external interventions, particularly top-down approaches, can also carry  
374 risks. In particular, MPAs have proved to be potentially exclusionary interventions, negating  
375 local users' legal or perceived rights when improperly involving them<sup>10,12</sup>.

376 The marine conservation community at large will have to do better to settle how external  
377 actors should participate in managing marine resources, always keeping in mind the explicit  
378 goal of ensuring equitable management. Our framework can contribute to this by helping to  
379 identify local perceptions of marine importance, environmental threats, management  
380 options, and MPA goals and thus guide their social and ecological fit. While this work focuses  
381 on coastal and marine ecosystems and MPAs, its approach could be transferred to other  
382 domains, for instance, to improve the fit of terrestrial protected areas also characterized by  
383 strong social and ecological interactions<sup>42</sup> or to study other area-based management tools<sup>43</sup>.

384



385 4. Limitations of the study

386 Our approach also showed some limitations, mostly coming from our position as researchers  
387 who are outsiders from these communities and, for some of us, not natives of the Philippines.  
388 This might have caused certain respondents to refrain from speaking about sensitive issues  
389 such as illegal fishing. We tried to mitigate this by interviewing a wide array of respondents  
390 while insisting on the anonymity of their answers and, in practice, had many of them open up  
391 on these challenging themes. We also made sure to use vocabulary and concepts that are  
392 commonly used by these communities.

393 5. STAR METHODS

394

395 KEY RESOURCES TABLE

REAGENT or RESOURCE	SOURCE	IDENTIFIER
Deposited data		
Original dataset (interviews, thematic coding)	This paper	<a href="https://github.com/victor-brun/perception-sfb">https://github.com/victor-brun/perception-sfb</a>
Software and algorithms		
Rstudio version 4.3.2	R Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing. (2020)	<a href="https://posit.co/download/rstudio-desktop/">https://posit.co/download/rstudio-desktop/</a>

396

397 RESOURCE AVAILABILITY

398

399 **Lead contact**

400 Further information and requests for resources should be directed to and fulfilled by the Lead

401 Contact, Victor Brun ([vbrun@ocean-climate.org](mailto:vbrun@ocean-climate.org)).

402

403 **Materials availability**

404 This study did not generate new unique reagents.

405

406 **Data and code availability**

- 407 • Data is available in the “*data*” folder in supplemental items (Data S1).
- 408 • Code is available in the “*R*” folder in supplemental items (Data S1).
- 409 • Both data and code are also available on the first author’s GitHub
- 410 (<https://github.com/victor-brun/perception-sfb>).

411

## 412 EXPERIMENTAL MODEL AND STUDY PARTICIPANT DETAILS

413 Participants were respondents to the semi-structured interviews. Prior informed consent was  
414 obtained from all participants. The influence of gender on responses was analyzed as part of  
415 the results, and no significant difference was found through the study. 64 respondents were  
416 selected through purposive sampling, asking for recommendations from residents,  
417 representatives of Fisherfolks Associations, and different municipal offices.

418

## 419 METHOD DETAILS

420

### 421 **Sampling**

422 64 respondents were selected through purposive sampling, asking for recommendations from  
423 residents, representatives of Fisherfolks Associations, and different municipal offices. The  
424 first group included 53 residents from five local districts spread around Shark Fin Bay: Batas,  
425 Depla, Mabini, Sandoval and Silanga, with about 10 individuals per district, men and women  
426 (58% and 42%), fishers (42%), farmers (14%), and people with other or mixed livelihoods  
427 (25%). Due to important social homogeneity in these districts and high flexibility in local  
428 livelihoods<sup>87</sup>, the respondents' activities at the time of the survey did not appear to affect  
429 their perceptions, which was indicated in the important similarities in their perceptions. The  
430 second group included 11 decision-makers: five district elected officials or *barangay captains*  
431 and six decision-makers from the municipality of Taytay, representatives of the Office of the  
432 Municipal Environment and Natural Resources, Office of the Municipal Agriculturist, Office of  
433 the Municipal Tourism Development and Management. Most decisions pertaining to coastal  
434 resources management are taken at the municipal scale, making these actors central to all

435 discussions on marine sustainability. Prior informed consent was obtained from all  
436 participants before the interview started and interviews were recorded.

437

#### 438 **Interview guide**

439 Structured interviews were conducted using an interview guide (available in supplemental  
440 items) organized around seven sections: i) environmental stressors in the province, ii)  
441 ecosystem services, iii) local environmental stressors and links with fishing activities, iv)  
442 proposed management options to tackle environmental stressors, v) goals of MPAs and  
443 benefits expected, vi) perception of SEF and other NGOs, and vii) visions for the future. All  
444 respondents were confronted with the same set of initial questions, but precisions were  
445 asked to engage in deeper discussions on each topic. Interviews with community members  
446 were conducted in Filipino and with decision-makers in English. They lasted between 20 and  
447 30 minutes.

448

#### 449 **Analyses**

450 We transcribed and translated all interviews to English and performed a content analysis and  
451 thematic coding<sup>88</sup>. We used an inductive approach to identify individual codes (that we  
452 termed perceptions) and classified them across the four categories of our framework (Table  
453 S1, supplemental items). We coded these perceptions in a matrix associating each respondent  
454 with the set of perceptions derived from their responses. For example, when a respondent  
455 talked about dynamite and cyanide fishing being an issue for coral reefs, the columns  
456 corresponding to “dynamite fishing” and “cyanide fishing” were checked. This coding was  
457 performed twice and checked in order to ensure its consistency. Individual perceptions were  
458 coded to be as specific as possible at first in order to allow for subsequent groupings in larger  
459 themes. For example, dynamite fishing and cyanide fishing were both grouped under the  
460 “destructive fishing practices” theme. The number of respondents for each theme was then  
461 summed to measure their relative importance in discourses. These data, along with the  
462 content of the interviews, allowed us to distinguish the dominant discourses from the more  
463 marginal perceptions and those potentially conflicting between stakeholders. Data  
464 manipulation and analyses were conducted in R Studio version 4.3.2<sup>89</sup>.

465

466 QUANTIFICATION AND STATISTICAL ANALYSES

467 This study relied on qualitative data and no statistical test was conducted. Quantitative  
468 analyses only included a measure of the frequency of themes discussed based on the thematic  
469 coding of interview transcripts conducted.

470 6. Supplemental items

471

472 DATA S1: R code used and data analyzed to produce Figure 1.

473 7. Author contributions

474 V.B. and J.C. conceived the project. V.B. collected and analyzed the data. V.B., J.R.V.M.,  
475 A.J.C, L.A.C., G.G.G., and J.C. identified relevant literature and participated in the  
476 development of the conceptual framework. V.B. wrote the initial manuscript, and J.R.V.M.,  
477 A.J.C, L.A.C., G.G.G., and J.C. reviewed and edited it.

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485 9. Declaration of interests

486 The authors declare no competing interests.

487 10. Legends

488

489 *Figure 1. Main perceptions of different stakeholders grouped in the four perception categories proposed in our*  
490 *framework.*

491

492 *Table 1. List of themes identified through content analysis. Each theme is composed of several individual*  
493 *perceptions detailed in the data provided in Supplemental items. The description is a synthesis of the*  
494 *perceptions of respondents as aggregated in each theme.*

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496

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