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# Contemporary Rāhui: Placing Indigenous, Conservation, and Sustainability Sciences in Community-led Conservation

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## Abstract

Resource sustainability requires recognizing and developing pathways to integrate local and Indigenous knowledges alongside conservation and sustainability sciences within management practices and governance. However, knowledge never occurs in a vacuum and is always mediated by the beliefs, values, or stances towards its possession or use within particular contexts. Focusing on the unprecedented renewal of a traditional practice of natural resource management in French Polynesia called rāhui, this article investigates the local conceptions, perceptions, and expectations (CPE) which mediate between community knowledges, plans, and actions, and inputs from conservation and sustainability sciences. Drawing on a multi-year ethnographic study focused on the CPE of two coastal communities around Tahiti's Taiarapu coast, our results show that the CPE which shape relationships between conservation sciences' inputs toward decision and policy-making and community governance and management over nearshore marine resources can differ meaningfully. Moreover, we suggest that evidence of such differences despite socioeconomic, cultural, or demographic similarities indicates that the specificities of local communities' CPE around conservation and sustainability sciences should be carefully considered before and alongside any conservation or management action.

**Keywords:** conservation science, community-led governance, conception, perception, Taiarapu, French Polynesia

## Introduction

*The neighboring district of Tautira rejected the rāhui for a long time. However, when I arrived in Taiarapu, I watched it being born. I saw trust building up over the meetings between local community and the team of scientists to which I still belong. And I met this resident. He was not a fisherman but a significant consumer of fish. He collected signatures, he explained to residents what the rāhui had to offer them. One day, he brought me to the church to chat with the community, residents of the Fenua*

39 *'Aihere (the rural part of the island past the end of the road). As soon as I arrived a*  
40 *fisherman lectured me: "I recognize you [from the rāhui meetings] ... how are we*  
41 *going to feed our family if we can no longer fish? Who is going to do our job? This is*  
42 *not good for us." He went on with his speech, "But I know what you do is for our*  
43 *children. I am glad you are here with us." (Fabre, fieldnote excerpt)<sup>1</sup>*  
44

45 Accelerated global environmental change, including climate change, rapid loss of  
46 biodiversity, scarcity of resources, and massive shifts in land and sea use, has ushered in a  
47 new era, conventionally referred to as the Anthropocene (Norström *et al.* 2016, Berkes 2017,  
48 Russell and Kueffer 2019), which calls for new tools towards the sustainable governance and  
49 management of resources with a strident urgency. The problem is particularly critical in island  
50 ecosystems. Where community well-being that depends on natural resources is directly  
51 impacted, rapid solutions are needed (Graham *et al.* 2017, McMillen *et al.* 2017, Friedlander  
52 2018). Among attempts to achieve sustainability in this new era of global changes, the  
53 recognition and inclusion of Indigenous and local knowledge alongside or integrated with  
54 conservation or sustainability sciences has increasingly become a key focus for work on  
55 resource management process and governance systems (Moller *et al.* 2004, Plummer *et al.*  
56 2013, McMillen *et al.* 2014, Lauer 2017, Bennett *et al.* 2019; Apetrei *et al.* 2021). Today, a  
57 variety of Indigenous resource management systems, often rooted in locally deep histories of  
58 engagement with island environments, are recognized for their critical role in responding to  
59 contemporary conservation challenges. Across the Pacific Islands, sustainable management  
60 and conservation of ecosystems increasingly involve strategies integrating ILK and deeper  
61 engagement of local communities (Jupiter *et al.* 2014, Delevaux *et al.* 2018, Artelle *et al.*  
62 2019), for instance by setting up culturally articulated restriction zones in order to better  
63 regulate marine resources (Cinner and Aswani 2007) as is the case with Bul in Palau (Ueki  
64 2000, Carlisle and Gruby 2018) or Reimaanlok in the Marshall Islands (Baker *et al.* 2011).  
65 Such initiatives develop protected areas with the involvement of local communities to  
66 integrate their specific needs, values and cultural heritages. However, research gaps remain  
67 including how to navigate such developments given the risks of conflicts between or  
68 accommodations of Indigenous and conservation and sustainability sciences within  
69 management or governance actions and practices.

70  
71 This synthesizing challenge is of material contemporary concern in French Polynesia where  
72 the resurgence of a traditional management practice referred to as rāhui (Bambridge 2016),  
73 has become centered for the work of communities to exert agency over their marine  
74 resources' ecological futures (Mawyer and Jacka 2018). In this paper, we focus our attention  
75 on contemporary rāhui in Tahiti's Tairapu peninsula, whose governance and management  
76 has been informed both by Indigenous Mā'ohi expertise, values, and practices—which we  
77 identify as a practice of Indigenous conservation—as well as by conservation and  
78 sustainability sciences. By Indigenous conservation, we mean the historically empirical,  
79 expert environmental and ecological practical knowledge of Tahitian and Mā'ohi peoples  
80 culturally grounded in the worldview of their communities towards sustainable ecological  
81 futures. In that sense, rāhui is a critical example of Indigenous conservation which reflects  
82 local and place-based marine management practices, sometimes considered "traditional" in  
83 comparison to universal/conventional conservation-based knowledge and expertise derived  
84 from the biological and ecological disciplinary sciences common to management system  
85 toolkits in Marine Protected Areas (MPAs).  
86

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<sup>1</sup> All the terms in Tahitian are written following the orthographical conventions of the Tahitian Academy with the exception of place names, which are written in their everyday representation.

87 Deeply rooted in the sociopolitical and religious dynamics of chiefly governance of marine  
88 and terrestrial resources before the French colonial era (Nordhoff 1930; Bambridge, 2016),  
89 rāhui has reemerged on the Tairapu coast as a potent tool for the conservation of marine  
90 resources, especially in nearshore coral reef environments where intensive fishing pressure,  
91 particularly in more populated areas, has led to substantial declines in many highly prized and  
92 vulnerable species (Friedlander *et al.*, 2016; Thiault *et al.*, 2019). Historically, Mā'ohi  
93 communities have established relations of continuity between land and marine tenure,  
94 resulting in systems of priority and specialized control of territories and resources (Bambridge  
95 2009, 2016, Le Meur *et al.* 2018). In the 19th and 20th century ethnographic literature, rāhui  
96 was considered a fundamental institution in Tahiti with relational practices between different  
97 individuals or groups within Tahitian society and with entities charged with sacredness inside  
98 an environmental network (Rigo 2004) and closely linked to conceptions and practices of tapu  
99 (Shore 1989, Rigo 2016). Today, the resurgence of Tahitian rāhui raises questions about the  
100 place of ecological thinking, conservation and sustainability sciences, management and  
101 governance, as ethos and as practice, within community-driven and community-led  
102 conservation actions. As Indigenous peoples and local communities (IPLCs) negotiate 'us-  
103 ness', relationships, and interactions with nature and its resources in a changing world upon a  
104 foundation of culturally-grounded and place-based values (Whaanga and Wehi 2017), the  
105 need to attend to community understandings including beliefs around, valuations of, feelings  
106 about, or expectations and hopes for the role of conservation and sustainability sciences  
107 within their planning, decision- and policy-making processes is an immediate concern.  
108

109 Here, we assess how such synthesis should take into account the distinct conceptions,  
110 perceptions, and expectations (CPE) of two Tairapu communities, Teahupo'o and Tautira,  
111 around the role of conservation and sustainability sciences and scientists to support effective  
112 community-based biodiversity conservation and natural resources management. By  
113 demonstrating both the presence of, as well as differences between, local communities' CPE  
114 mediating conservation sciences' role in a community's plans and actions, we suggest that  
115 sensitive attention to CPE can help bridge the gap between science, management and  
116 decision-making (Tadaki *et al.*, 2017; Van Riper *et al.*, 2020). To understand how both  
117 Indigenous and conservation and sustainability practitioners can better understand one another  
118 and work together, we ask the following questions: How do IPLC stakeholders feel about  
119 Indigenous conservation approaches as related to approaches grounded in conservation and  
120 sustainability sciences? How do they define the role of marine and environmental sciences in  
121 the context of community-led governance? What is a community's sense of the place of  
122 conservation in the planning and enactment of rāhui governance? Are local stances towards  
123 science or conservation the same at different rāhui sites and what might differences say about  
124 achieving sustainable management goals? To answer these questions, we explored how  
125 conservation is materially dealt with *in situ* in contemporary rāhui governance on Tairapu.  
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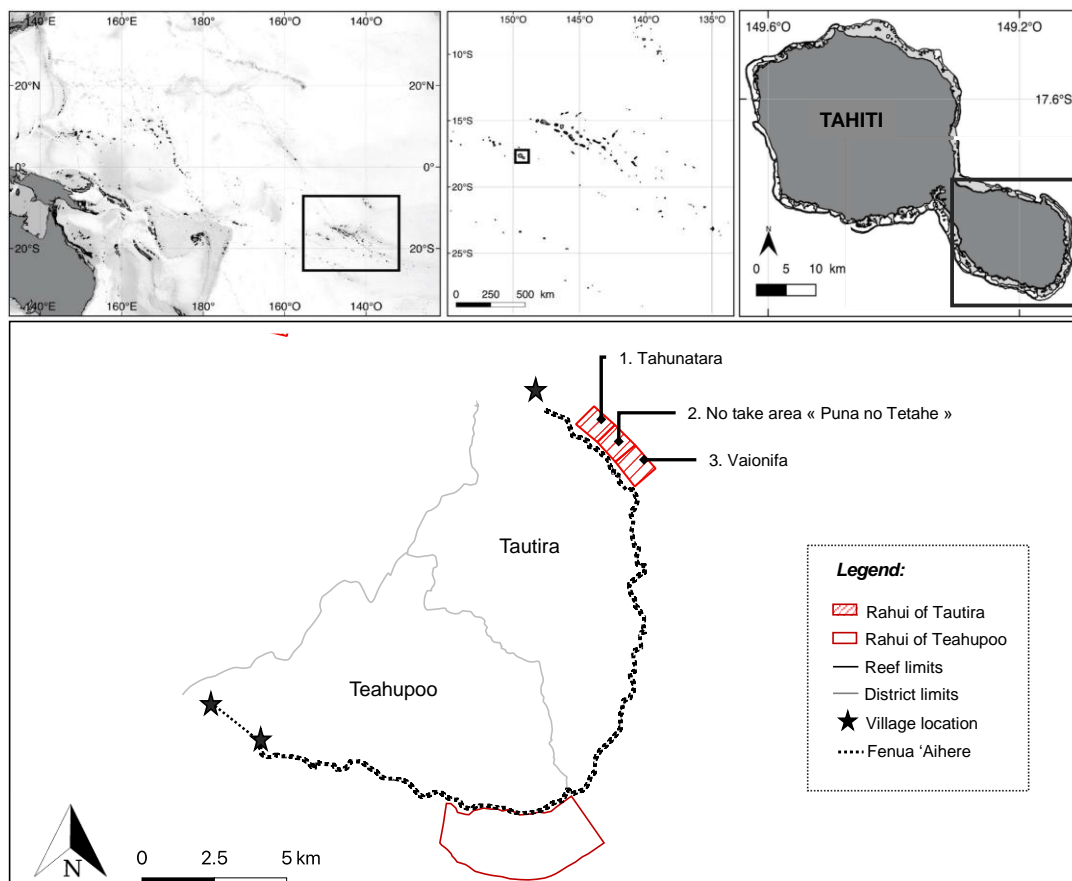
## 127 **Methods**

### 128 *Fieldwork*

129 Teahupo'o and Tautira are two distinct districts on Tahiti's Tairapu coast (Figure 1). They  
130 are respectively located on the western and eastern sides of the southern coastline but  
131 converge on an area called Fenua 'Aihere (lit. uncultivated land, in French 'la brousse')  
132 which has been under a conventional preservation law since 1952 dedicated to protection of  
133 sites of cultural, archaeological, historical, and legendary interest. This remote area, nearly  
134 2000 hectares with no roads and only accessible by boat, is also home to contemporary  
135  
136

137 communities which primarily live by subsistence fishing and farming (Table 1). Both of the  
138 rāhui areas we studied are located in the Fenua ‘Aihere. Though composed of the same  
139 extended families, Tautira and Teahupo‘o have maintained a rivalry rooted in what Samoan  
140 historian Damon Salesa refers to as a type of Indigenous deep time (Salesa 2014). Each has  
141 composed and developed its own rāhui area with community-specific rules. Teahupo‘o was  
142 the first district to re-establish rāhui, to address a decline in fishing productivity and protect  
143 themselves from outsider fishermen (including from Tautira). The rāhui of Teahupo‘o was  
144 officially implemented in 2014 and legally registered within the 6<sup>th</sup> category of French  
145 Polynesia’s Environmental Code with the appellation “Marine Managed Natural Resource  
146 Area.” Inside an area of 768 hectares, all activities (e.g. fishing, swimming, navigating,  
147 collecting resources) were prohibited for three years (Figure 1). In 2017, the prohibition was  
148 extended for three more years and the closure was renewed again in 2020. As a consequence,  
149 the protected area has not been “opened” for seven years. Administratively, the rāhui of  
150 Teahupo‘o is managed by the Department of Environment, the Territorial state agency that  
151 oversees environmental domains including the preservation and management of natural  
152 resources (through the Environmental Code). Somewhat differently, the nearby community of  
153 Tautira implemented a rāhui in 2018 with a three year closure plan. In this case, the rāhui is  
154 legally registered through the Fishery Code with the appellation “Controlled Fishing Area”. In  
155 Tahiti’s post-colonized administration, fisheries have separate governance from other  
156 environmental domains and the Department of Marine is the responsible state agency. The  
157 rāhui at Tautira only prohibits fishing activities and is subdivided into three zones with a fully  
158 closed central area—a puna (source)—as the heart of the functional system (Figure 1).  
159 Notably, the rāhui at Teahupo‘o and Tautira were both locally conceived to be for a limited  
160 period, but the legally established protection supported by the State appears to be a permanent  
161 designation. That any opening plan will thus need to be validated by the State is a persistent  
162 reminder of the governance tensions inherent in legal pluralisms around marine resource  
163 management (Bambridge 2016).

164  
165 Each state agency is responsible for scientific monitoring of its associated rāhui. However, a  
166 collaboration between the European INTEGRE (INitiative des TErritoires pour la Gestion  
167 Régionale de l’Environnement) program for the development of integrated management of  
168 coastal environments, and the Fondation de France program on reef resilience, meant that  
169 scientific ecological monitoring of reef species was undertaken around Taiarapu by  
170 researchers from CRIOBE (Centre de Recherches Insulaires et Observatoire de  
171 l’Environnement, French Polynesia) in July 2016, January 2017, and December 2019. These  
172 periods of monitoring established visible feedback loops between disciplinary sciences  
173 informing the communities in their rāhui governance and management and communities  
174 informing scientists about place-based and culturally-grounded beliefs and values that support  
175 the success of rāhui based marine protection.  
176



177  
178  
179 Figure 1 Fieldwork in Taiarapu: location of the studied rāhui areas at Tautira and Teahupo‘o.

180 Table 1: Details of population, fishing dependence for local communities and rāhui at Tautira  
181 and Teahupo‘o<sup>1,2</sup>.

	<b>Tautira</b>	<b>Teahupo‘o</b>
<b>Total Population</b>		
Number of inhabitants [% of Taiarapu]	2,249 [10.8%]	1,419 [6.8%]
<b>Population (&gt;15 years)</b>		
Number of inhabitants [% of Taiarapu]	1,883 [11.7%]	1,120 [6.7%]
<b>Gender</b>		
Women [% of district]	940 [49.9%]	547 [48.8%]
Men [% of district]	943 [50.1%]	573 [51.2%]
<b>Fishing activities</b>		
Fishermen [% of Taiarapu]	725 [30%]	195 [15%]
Fishermen [% of district]	725 [38.5%]	195 [17.4%]
<b>Other activities</b>		
Farming [% of district]	87 [4.6%]	60 [5.4%]
Others [% of district]	730 [38.7%]	421 [37.5%]
Without activity [% of district]	1,004 [53.3%]	585 [52.2%]
<b>Rāhui</b>		
Type	Periodic Harvested Closure	Periodic Harvested Closure
Surface	265 ha	767 ha
Official initiation time	Since 2018	Since 2014
Description	Area subdivided into 3 zones Prohibition of all fishing activities	One entire area Prohibition of all activities

182 <sup>1</sup>ISPF 2012, 2017; <sup>2</sup>Marines Resources Department of French Polynesia (DRMM); <sup>3</sup>Environmental Department  
183 of French Polynesia (DIREN).

184

185 Because the inhabitants of Fenua ‘Aihere live a subsistence lifestyle, they regularly fish by  
186 the seaside and generally respect the rāhui which they have established. A distance of 50  
187 meters (Teahupo‘o) and 100 meters (Tautira, due to important maritime traffic) offshore  
188 allows community members to continue their activities on the coast. Beyond this distance,  
189 rāhui rules come into effect. Governance and management of rāhui is carried out by a  
190 management committee, the tōmite rāhui, which brings together all community stakeholders  
191 including the mayors (tāvana), the representatives of local associations (environmental  
192 protection, fishermen's cooperative, surf, culture, education, etc.), a representative of each  
193 prominent religion, and representatives of the corresponding State protection agency  
194 (Environmental or Fishery Department). The tōmite ensures functioning and surveillance of  
195 the rāhui. In practice, it is the people of Fenua ‘Aihere who maintain local surveillance of the  
196 area. They watch for rāhui infractions and alert the tōmite when action is warranted.

197

### 198 *Study framework*

199

200 Following Aswani *et al.* (2017) and Bennett *et al.* (2017), we approached the role of the social  
201 sciences in advancing conservation science by applying methods drawn from anthropology,  
202 psychology, and cognitive science to study the rāhui of Teahupo‘o and Tautira in the context  
203 of near-shore community-led Indigenous resource management. Our methodology highlights  
204 the idea of “conservation social science” (Mascia *et al.* 2003, Newing *et al.* 2011, Bennett *et*  
205 *al.* 2017) to refer to diverse practices drawing upon social science epistemologies and  
206 methods to understand Indigenous science (Morishige *et al.* 2018) and local conservation  
207 policy, practice and outcomes (Bennett *et al.* 2017, Bennett 2019; Moon *et al.* 2019a).

208

209 To answer our questions, we drew on naturalistic inquiry (Guba and Lincoln 1982, Lincoln  
210 2007) to develop a theoretical framework around Teahupo‘o and Tautira communities’ and  
211 conservation or sustainability scientists’ concepts, perceptions and expectations (CPE) for the  
212 rāhui tool. Perception is the ability to see, hear, or become aware of something through the  
213 senses (Bonnet *et al.*, 1989). It is not an immediate image of the world (Barrow and  
214 Tenenbaum 1986) but includes prior knowledge, expectations, experiences, and motivations  
215 to help give meaning to sensory data. Prior work suggests that perceptions are useful  
216 indicators of marine conservation goals (Gelcich *et al.* 2008, Abecasis *et al.* 2013, Bennett  
217 and Dearden 2014, Jefferson *et al.* 2014, Beyerl *et al.* 2016, Bennett *et al.* 2019). However,  
218 previous work in conservation science has rarely focused on conceptions. Conception loosely  
219 refers to the ability to form an understanding in the mind of objects or processes in the world  
220 (c.f. Moon *et al.* 2019b). While the literature engaging the relationships between perception  
221 and conception is quite vast, with roots, trunks, and branches in numerous disciplines  
222 including anthropology, cognitive science, linguistics, neuroscience, philosophy, and  
223 psychology, a critical hinge rests in the observation that people do not perceive primarily with  
224 their senses, but with their minds, famously about such apparently objective natural entities as  
225 color (Berlin and Kay 1991) or biological kinds (Conklin 1998). Finally, we elicited  
226 community members’ expectations for the rāhui. Expectations, we hypothesized, inform and  
227 reflect community members’ hopes and desires but also their doubts, anxieties, and historical  
228 wounds. Such information is crucial to develop adequate and appropriate conservation  
229 measures well-linked to local scales including the practical achievement and success of  
230 conservation and management actions.

231

232 Practically, we identified CPE in individual interviews by coding discursive moves that  
233 indicated the speaker's conceptual, perspectival, or expectational stance vis-à-vis rāhui and  
234 the seascape, conservation science, and coral reef management and conservation practices.  
235 Since individuals live in a social environment characterized by interactions and relations, we  
236 also wanted to be aware of the impact of social groups on CPE. In a sense, rāhui is a form of  
237 social thinking and shared knowledge that guides different ways of interpretation toward  
238 shared positions (Jodelet 1989) and reflects Indigenous science (Morishige *et al.* 2018) and  
239 local values around and orientations toward the social. The social context of CPE was studied  
240 through meeting participation and collective discussion. All the elements that inform CPE  
241 according to sociogeographically situated stakeholders are represented on a diagram in Figure  
242 2.

#### 243 244 *Data collection*

245  
246 Initial data collection took place during a 10-month research period from February to  
247 November 2017. During this time, the science team in which we participated was responsible  
248 for supporting and facilitating the contemporary rāhui projects around Tairapu in  
249 collaboration with scientists from CRIOBE alongside the administrative support of the  
250 government of French Polynesia. Because the rāhui of Teahupo'o was introduced in 2014, the  
251 dynamic of rāhui management was already underway prior to the survey. Escorted by a key  
252 partner—locally respected as a Tahu'a<sup>2</sup> (expert) across many areas such as navigation,  
253 fishing, agriculture, medicine, among others—we interviewed 11 local stakeholders and  
254 participated in three tōmite meetings. In Tautira, data-collection was different as there were  
255 no rāhui in 2017. However, we were present for the emergence of a community-led push for  
256 rāhui here as well due to the actions of several local tāvana (mayors) who invited CRIOBE  
257 scientists and others involved in the rāhui at Teahupo'o to lead a series of meetings exploring  
258 the possibility of a rāhui in this community. In this context, we interviewed 10 local  
259 stakeholders and led nine meetings at Tautira village and communities in the Fenua 'Aihere  
260 (the southernmost coast of Tahiti island beyond the end of the road—access here requires  
261 travel by sea for visitors and community members alike) to share knowledge and address their  
262 expectations. During a final meeting, the community decided to adopt a rāhui framework for  
263 Tautira. In this context, the role of CPE in facilitating a better preparation for planning a rāhui  
264 implementation was evident and it was clear that neglecting CPE would be a risk when  
265 defining a management plan which depended on local buy-in.

266  
267 Data collection continued from September 2018 through June 2019, a 10-month consecutive  
268 research in place. This longer period allowed us to collect deeper information on the recent  
269 rāhui implementation at Tautira with a new round of interviews. For each interview, we  
270 brought a visual image of the rāhui area (with a flyer) to support the discussion and to  
271 improve mutual understanding of individual CPE linking rāhui and engagements with  
272 conservation and sustainability sciences and practitioners, sometimes also supporting the  
273 State and its administrative agencies. In total, during this period we conducted 15 interviews  
274 and participated in six meetings at Teahupo'o, and we conducted 21 interviews and observed  
275 two meetings in Tautira. Across these contexts we sought to document the plurality and  
276 diversity of views and the complexity of individual expectations evidenced in meeting and  
277 interviews. Examples of local communities' CPE mediating Indigenous and conservation and  
278 sustainability sciences approaches is presented in Table 2.

---

<sup>2</sup> Tahu'a: Specialist or expert in one domain. Example: tahu'a pure (priest), tahu'a tahutahu (sorcerer), tahu'a rā'au (traditional medicine man), etc., online dictionary of the Fare Vāna'a (Tahitian Academy).

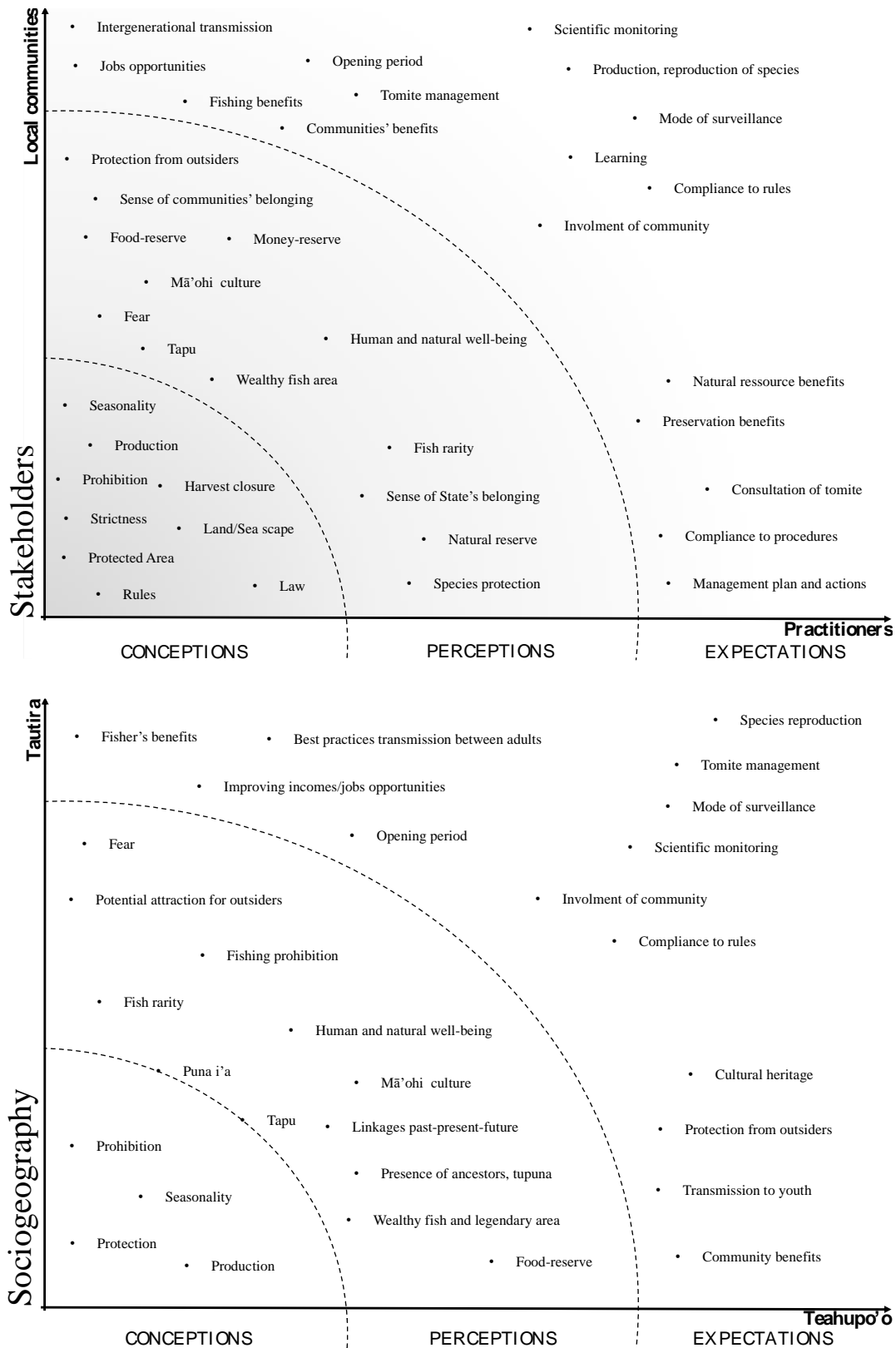


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## Results

According to stakeholders, conceptions, perceptions and expectations (CPE) progressively diverge between local community world views and values and administration representatives along a gradient of conceptions to perceptions and expectations. Conceptions observed highlighted the evolution and adaptation of rāhui as a cultural practice as evidenced in Indigenous approaches to seasonality, the continuum of the land/sea concept, harvest opening periods, and conventional approaches to fishing prohibition, rules and law (like any other MPA). When local community CPE align or do not align with the rāhui framework, the perceptions of who benefits or how the rāhui operates illuminate important facets of Indigenous and community roles in governance relative to other marine protection schemes. For instance, a reciprocal sense of belonging appears as a critical divergent element vis a vis other marine protections. As locally conceived, it is up to the communities who establish rāhui to determine who is targeted for benefits, for instance local fishermen, thus emphasizing a reciprocal identity between community and rāhui. Another divergent element is the role of tōmite management as a legitimate local community entity, versus the viewpoint of State agencies that members of tōmite only have a consultative opinion. Notably, though rāhui practice is deeply rooted in Mā'ohi culture, CPE also show common foundational perceptions around the intersection of human and environmental well-being and expectations about the efficiency of surveillance, compliance with rules and community involvement.

Sociogeographical conceptions that link rāhui to Indigenous science and conservation are similar in Tautira and Teahupo'o and include four key ideas: (i) restriction, especially of fishing activities, (ii) protection of coral habitats, (iii) the importance of seasonality, founded on knowledge, skill, or experience and (iv) the goal of (re)production for reef species. Those conceptual ideas and strategies are set up to achieve Indigenous conservation goals including asserting the legitimacy of the cultural practice and application of rāhui, sustainable fishing practice, and the maintenance of local maritime territoriality highlighted by local knowledge and authority over decisions regarding rāhui. The rāhui tool is used at both sites in a context of fish rarity and is tightly associated with the idea of the necessity of regenerating reef species by stopping fishing from outsiders and finding solutions to lagoon fishermen's difficulties; thus, the fishing ban. But such conceptions here lead to divergent perceptions and expectations about the rāhui at Tautira or Teahupo'o (Figure 2).



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Figure 2: Diagram of the CPE model of rāhui according to stakeholders (local communities vs administrative practitioners – *upper panel*) and the local sociogeographical situation (in Tautira vs Teahupo‘o – *lower panel*)

320 Results show that rāhui actions for conservation highlight the importance of culturally-  
321 grounded and place-based values. Indeed, we observe that stakeholders in Tautira sometimes  
322 compared rāhui as a protection tool to Marine Protected Areas (MPAs), a distinctly  
323 contemporary and post-colonial form of permanent and unbroken conservation. But we  
324 observe *in situ* that rāhui may be expected to feature open seasons for harvest or even the end  
325 of a fishing ban.

326  
327 Interestingly, stakeholders expressed some anxiety about their own relationships to the freshly  
328 established rāhui. It was not clear if informants fear a permanent designation as an obstacle to  
329 their own harvesting rights or if anxiety or fear around the term rāhui is due to its connections  
330 with invisible and potentially dangerous spiritual or more-than-human presences in the Fenua  
331 'Aihere (similar to dynamics seen in the Marquesas or elsewhere across Polynesia  
332 (Donaldson, 2018; Donaldson, 2019). However, we observed from key informants that the  
333 historical and cultural power of rāhui seemed less activated in Tautira, where people were  
334 more concerned with the fishing implications. Others underlined the importance of  
335 seasonality, and not just about opening and closing seasons but also ideas rooted in  
336 Indigenous biological knowledge of reef species. In Teahupo'o, the importance of legends,  
337 ancestors, and history related to rāhui and its geographical place point to expectations strongly  
338 geared towards cultural transmission, benefits to the community of Teahupo'o, and protection  
339 against outsiders. Nevertheless, at both sites, Mā'ohi interest in biological conservation  
340 appears to be read through a cultural framework wherein enhancing the resource goes hand in  
341 hand with the development (tupu) of cultural agency and futurity. The CPE fronted a desire to  
342 culturally-ground activities through tapu (in this case, sacred restriction as one of the  
343 mechanisms of the rāhui) to preserve natural resources for transmission to future generations.  
344 Notably, a stance toward protecting the community from outsiders by adapting the rāhui tool  
345 to mobilize conventional conservation approaches—i.e. through a legal appellation of rāhui  
346 based on existing legal frameworks that in reality do not adequately map onto pre-colonial  
347 practices—was also evident within the CPE.

348  
349 The different results in CPE in Tautira highlight the non-homogeneity of community-led  
350 Indigenous resource management (Figure 2), where the most important activity is fishing and  
351 30% of the population are professional lagoon fishers, versus 17% in Teahupo'o (Table 1).  
352 The rāhui ban on fishing therefore is perceived as risking decreased harvest and promising  
353 further difficulties to come. As can be seen in Table 1, more than half of the inhabitants in  
354 both districts are not employed in the formal labor sector. Thus, most of the informants in  
355 Tautira expressed some worry about rāhui, from a fear that reopening marine areas for fishing  
356 would be repeatedly deferred, as at Teahupo'o, or that the area would attract more outsiders in  
357 response to the productive (conceptual) nature of rāhui (puna, reproduction of species) which  
358 would also be detrimental for local fishermen. Expectations here were therefore oriented  
359 towards a better yield for the fishermen of Tautira and an improvement of their income. The  
360 strict objective of natural resources conservation inscribed in the fisheries code and the ZPR  
361 principle in the case of Tautira locally reads as a way to improve fishery yields. However, we  
362 note common elements in Figure 2 (perceptions of human well-being, expectations of a  
363 successful area for fish reproduction, surveillance and compliance with rules, monitoring of  
364 results) that link rāhui to conventional approaches of conservation. As can be seen in Table 2,  
365 local feelings about Indigenous and conservation sciences approaches strongly support the  
366 development of pathways to better integrate approaches through sensitive alignment to local  
367 CPE.

**Table 2: CEP articulations of Indigenous and conservation sciences approaches at Tautira and Teahupo‘o, Tairarapu.**

	Local feelings about Indigenous conservation approach	Local feelings about conservation and sustainability sciences approach
<b>Selection of Quotations</b>	“The rāhui, it has always existed since the ancestors, and all Tahitians know the rāhui ... If there are still grandparents who are living here, we are able to ask them to explain what is the rāhui.” (Pāpā‘ū, Teahupo‘o)	“Rāhui is rāhui. It is not a MPA.” (Teahupo‘o leader of Rāhui Tōmite)
	“Te ‘ōpani e tai’a te o tau... you have to stop when there are laying seasons, that’s the rāhui. There are seasons. Now, rāhui, people understand as something which lasts for a long time. No ... there are seasons, like before.” (Ancient Fisherman from Tairarapu)	“This is the Tahitians’ fault. Ah ‘aivāna‘a ... that means scientists ... understand ... you see, they don’t want to know ... after they say ... huh, looking for money for them ... No! They came to inform us, and maybe our children could work with them, in collaboration.” (Mama from Tairarapu)
	“The rāhui is to protect but also to produce.” (Tautira Fisherman).	“They are the ones who will inform their parents, so that they respect the lagoon, because here, almost all the parents are fishermen.” (local MEA referent, Tautira)
	“The rāhui is [for] the community’s engagement, it is required to open for the communities” (Teahupo‘o leader of Rāhui Tōmite)	“I can’t open if I don’t know about the reproduction inside the rāhui.” (President of Rāhui Tōmite of Teahupo‘o)
	“The rāhui belongs to the communities. Fenua ‘Aihere people are doing surveillance. Even Teahupo‘o fishing boats, when they go fishing. When they see people in the rāhui, they call the city hall, squarely at the city hall [...] Every day. There is a grandma who lives in Fenua ‘Aihere with her daughter, her children and her mo‘otua (grandchildren). When they see, they call the city hall.” (Tahu‘a, Teahupo‘o)	“We never see scientists coming from Environmental Department. You know the team here [from CRIOBE], they are in the field. And because I’m also in the field, you have to evolve like that. If not, what is the word you gave? Indeed, the word you gave to the fishermen, you have to support ... This is what the fishermen are expecting [...] The Environmental Department is the provider who comes without asking us and only they have the report. How can we evolve like that?” (Teahupo‘o leader of Rāhui Tōmite)
<b>Local Understanding Objectives</b>	Maintaining the spirit of the traditional rāhui, honoring the invisible presence of ancestors, preserving regular/occasional opening as an IRM practice, cultural conservation as integral to a local Tahitian subsistence lifestyle.	Developing productive collaboration with on-the-field scientists by taking advantage from scientific methodologies and monitoring to transmit rāhui practice, addressing conflicts around the legal administrative framework that uses the cultural appropriation of the term rāhui to suit State conservation or management interests that diverge from local CPE.
<b>Implications</b>	Better integrating Indigenous and non-Indigenous conservation approaches will benefit from attention to community CPE.	

369 **Discussion**

370

371 The CPE of the two Tairapu communities, Teahupo‘o and Tautira, suggests that the  
372 integration of Indigenous conservation with conservation and sustainability sciences to  
373 advance the success of rāhui implementation could be advanced by sensitive attention to local  
374 communities’ specific and, at times, divergent CPE mediating that integration. Supporting  
375 effective community-based conservation of biodiversity and management of natural resources  
376 should vigorously take into account the non-homogeneity of Indigenous and local  
377 communities’ CPE around the role of conservation and sustainability sciences and scientists  
378 in decision-making and policy towards successful collaborations and desired outcomes. In  
379 particular, our study addressed four important questions.

380

381 *How do IPLC stakeholders feel about Indigenous conservation approaches as related to*  
382 *approaches grounded in conservation and sustainability sciences?*

383

384 Rāhui exemplifies a strong Indigenous, Oceanian, and Mā‘ohi approach to conservation  
385 (Table 2). Its reemergence in French Polynesia, and particularly around the Tairapu coasts  
386 provided a significant site for reflecting on how a conservation sciences approach to resource  
387 management and governance integrated with an Indigenous and community-led approach as  
388 long as the diverse conservation sciences practices support and align with local CPE. In the  
389 case of the rāhui at Tairapu, conventional approaches to biological and ecological science  
390 were mediated by social scientists who had previously worked on the comprehension of  
391 place-based local needs with the communities in Teahupo‘o and Tautira and were thus  
392 positioned to take into account not only the importance of ILK but the culturally-grounded  
393 CPE of stakeholders in integrating ILK within conservation planning and enactments. Thus,  
394 prior coordination between Indigenous and conservation and sustainability sciences  
395 approaches to conservation played a fundamental role in rāhui conception, design, and  
396 implementation. Over time, the mixed conservation approach grounded the practice of rāhui  
397 as an adaptation aligned with local CPE. Indeed, in Teahupo‘o, the rāhui area embraced  
398 Mā‘ohi culture and resulted in the perceived reimplementing of a Tahitian rāhui practice  
399 (essentially different from MPAs), which valued the presence of ancestors at sites on the  
400 cultural landscape like puna i‘a (stone sites associated with particular species’ seasonal  
401 management and use, Nordhoff 1930), and supported the institution and agency of the local  
402 rāhui tōmite. In Tautira, the rāhui implementation involved important relationships and  
403 interactions between local communities and scientists, which ultimately took root as  
404 arrangements defining the boundaries and design, objectives, expectations, and conditions of  
405 the protected areas to improve fishermen incomes. In the literature, such interactions are the  
406 foundation for tailoring coral reef management to local contexts in a way that acknowledges  
407 the importance of people’s values (Kochalski *et al.* 2019, Thiault *et al.* 2020), local peer-to-  
408 peer social networks (Christie *et al.* 2009), cultural ecosystems services (Chiesura and De  
409 Groot, 2003; Hicks *et al.*, 2013; Satz *et al.*, 2013), customary management (Cinner and  
410 Aswani 2007, McMillen *et al.* 2014, Delevaux *et al.* 2018), and local forms of territoriality  
411 (Roué 2012, Bambridge 2013; Donaldson 2019). As Aswani *et al.* (2015) demonstrated, ILK  
412 learning can inform and guide the requisite decision-making process and offer a practical way  
413 for management efforts to become more efficient. Here, we note that the incorporation of  
414 Indigenous and local knowledges with conservation and sustainability sciences can be further  
415 advanced by taking into account the CPE which mediate between these distinct epistemic  
416 cultures (Cetina 2009). Attention to the mediating roles of CPE at the local level can yield  
417 positive results and outcomes, as happened at Tairapu. The most notable pessimistic feelings

418 about a conservation sciences approach rest on ongoing legal framework contradictions that  
419 seem to categorize rāhui as MPAs whereas local community stakeholders do not agree.

420

421 *How do Mā'ohi and local communities understand and value marine and environmental*  
422 *sciences in the context of community-led governance?*

423

424 In the context of community-led governance, sharing marine and environmental dynamics  
425 such as monitoring or evaluation of rāhui with local communities is central to ensuring that  
426 the measures taken are effective. Around Tairarapu, the scientific ecological monitoring  
427 promised by researchers from CRIOBE is expected to produce useful knowledge. The distinct  
428 expert role of scientists is thus well-perceived and understood to contribute evidence of the  
429 (re)production of the conceptual function of rāhui for the rāhui tōmite. According to local  
430 communities, conservation and sustainability sciences require a strong emphasis on cross-  
431 generational environmental education and awareness while training local users and officials in  
432 reef monitoring and peer-to-peer enforcement frameworks (Aswani *et al.* 2015). In Tairarapu  
433 IPLC stakeholders want to advance such environmental education through the rāhui practice  
434 (Filous *et al.* 2021). The resurgent rāhui here supports both Indigenous and conservation  
435 sciences approaches through cultural transmission to the young (Teahupo'o) and by  
436 improving fishing practices and evolving CPE (Tautira). In this context, establishing  
437 contemporary rāhui was followed by the recent implementation of Marine Educative Areas  
438 (MEA) in Teahupo'o and Tautira to raise awareness of the importance of coral reef protection  
439 and conservation among youths. The local MEA referents are actually local rāhui leaders who  
440 have regular relationships with conservation scientists. But to be fully accepted, scientists  
441 have to spend time on site with IPLC stakeholders to insure durability of rāhui co-  
442 management development. Here, the legitimacy of scientists' approaches and ecological  
443 monitoring was accepted because methodologies were adapted for IPLC stakeholders to  
444 incorporate their beliefs and values. And yet, before rāhui implementation, conservation  
445 sciences methods did not engender trust, but suspicion. In Teahupo'o and Tautira, it took  
446 several years to inspire trust between scientists and local communities. Mistrust was partly  
447 fueled, on one hand, by historical experiences and legacies of colonization, and on the other  
448 hand, by the belief of some individuals and communities that they will be the ones who will  
449 indirectly suffer the direct and indirect negative consequences of a protected area. Scientists  
450 must be exceptionally careful in their actions and words to change local perceptions about the  
451 social consequences of their interventions, but at the same time they should not hesitate to  
452 fully engage the predictive capacity of disciplinary sciences to help people adapt to a  
453 changing environment. In this case, direct threats to the sustainability of coral reefs were felt  
454 to be confronted by the establishment of partnerships in which Indigenous communities and  
455 scientists support each other's goals and share knowledge of biological and cultural resources  
456 in a mutually beneficial manner. Even without perfectly tailored legal frameworks supporting  
457 them, contemporary rāhui should be seen as an emerging, evolving community-based  
458 approach to natural resources management where co-management and integration of  
459 scientists' and users' CPE is an enabling condition for success (Di Franco *et al.* 2016, Bennett  
460 *et al.* 2019, Silva *et al.* 2021). All stakeholders have to work on adapting themselves during  
461 the different steps of rāhui implementation, management and monitoring.

462

463 *What is the community's sense of the place of an Indigenous conservation approach in the*  
464 *planning and enactment of rāhui governance?*

465

466 Legally, the enactment of rāhui governance in Tairarapu aligned the practice with the MPA  
467 goal of a permanently protected area to suit strong conservation interests. If the marriage of

468 Indigenous and conservation and sustainability sciences approaches leads to agreement on,  
469 respectively, a rāhui ending at Teahupo‘o, and a regular rāhui opening at Tautira, this will  
470 require changes to the ministerial decrees in which each rāhui is inscribed. During the  
471 previous meetings at both sites, local communities had the choice to collaborate with the  
472 State. As we can see in the recorded CPE, such a choice responds to important expectations of  
473 communities from Teahupo‘o and Tautira who agree on respecting and complying with rāhui  
474 rules because they lay the foundation for sustainable future areas for fishing and a robust food  
475 reserve. This is only possible through developing efficient enforcement and surveillance of  
476 rāhui. The legal framework was actually supposed to support and respond to IPLC goals  
477 relative to CPE. However the absence of a specifically tailored law on rāhui or the State’s  
478 official recognition of Indigenous management rights continues to be an obstacle to  
479 understanding between Tairapu communities and conservation and sustainability science  
480 practitioners including representatives of state agencies. Local authorities can react in case of  
481 infractions but the outcomes of marine conservation and related management interventions  
482 depend to a large extent on community-scale compliance with these rule systems (Rohe *et al.*  
483 2017) and require community engagement and enforcement (Goetze *et al.* 2018). In Tairapu,  
484 such engagement comes from an Indigenous approach by developing and applying local,  
485 often informal, norms to protect rāhui. As shown in Table 2, despite conflictual relationships  
486 between rāhui tōmite and State environmental agencies regarding rāhui surveillance and the  
487 absence of an operational management plan, surveillance is locally organized for the rāhui of  
488 Teahupo‘o by communities living at Fenua ‘Aihere. In practice, local norms connected with  
489 rāhui prevail over State norms, including monitoring decisions between members of rāhui  
490 tōmite. For example, the procedure in Teahupo‘o for reef monitoring is to request  
491 authorization to access the rāhui area from the rāhui tōmite. This also requires separate  
492 authorization from the Department of Environment as the administrative manager of rāhui  
493 (and also members of tōmite). In accordance with CPE, ecological monitoring is locally used  
494 to inform fishermen about the efficiency of the rāhui in accomplishing the goals of many  
495 years of restriction.

496  
497 Another example of the difficulties in considering Indigenous approaches to conservation is  
498 linked to the management role of the tōmite, which is basically to develop rāhui surveillance.  
499 Rāhui tōmite leaders argue that the presence of scientists doing fieldwork is important and has  
500 value for local communities, yet highlight tensions with state practitioners regarding  
501 monitoring. The tōmite, with the support and the involvement of the residents of Fenua  
502 ‘Aihere, because of their attachment to rāhui, prefer to organize the entire surveillance by  
503 themselves in their own way. Similarly, our interviews noted a series of misunderstandings  
504 and discordances between scientists and rāhui tōmite members over lack of local financial  
505 support, with problems of fuel reimbursement, leadership interventions, and the  
506 disappearance of markers. Thus, the role of tōmite is at the heart of deeper social and cultural  
507 issues including trust and power relationships, post-colonial trauma, or post-colonial CPE,  
508 visible within contemporary rāhui contexts.

509  
510 *Are local stances towards science or conservation the same at different rāhui sites and what*  
511 *might differences indicate regarding achieving sustainable management goals?*

512  
513 Communities’ stances towards Indigenous and conservation and sustainability sciences  
514 approaches differ in Teahupo‘o and Tautira. In Teahupo‘o, rāhui conception and  
515 implementation was the result of three years of deepening interrelationships between  
516 communities, social scientists, and state practitioners. Social science methodologies were  
517 used at first to understand how the territory was locally represented through exchanges on

518 toponyms, legends, and Mā‘ohi values around particular sites. This co-produced knowledge  
519 between IPLC stakeholders and conservation sciences teams was used to support the  
520 community’s own definition of rāhui boundaries and geography, grounded by a strong role for  
521 Mā‘ohi culture. Thus the rāhui site is not just a protected area suiting foreign conservation  
522 interests but actively reaffirms politically sensitive cultural and territorial roots through local  
523 CPE about how to sustainably manage critical natural resources into the future, specifically,  
524 for future generations. Moreover, rāhui establishment also connects conservation and  
525 sustainability science practitioners to a set of informal norms and actions regarding local  
526 communities’ values, e.g. those that strongly discourage fishing activity from fishers whose  
527 homes lie outside the district.

528  
529 In the case of Tautira, both Indigenous and conservation sciences have also been at the heart  
530 of rāhui conception. The community was at first reluctant to implement any seascape  
531 protection because of the importance of fishing activities (Table 1). Local CPE in Figure 2  
532 show the fear engendered by the term “rāhui” for fishers faced with need to maintain and  
533 improve their incomes. But to address the growing difficulties confronting nearshore  
534 fishermen, the inhabitants gradually supported the idea of establishing a rāhui in part of the  
535 lagoon. Based on recent experiences in Melanesia (Goetze *et al.* 2016, 2017, 2018, Carvalho  
536 *et al.* 2019), scientists presented to community members a theoretical model of rāhui that was  
537 in better alignment with local perceptions and expectations, with opening periods and  
538 rotations to ultimately help fishermen improve their harvest. The model was based on a  
539 central no-take area (puna no te Tetahee, Figure 1) which then feeds two other areas opened  
540 alternatively on either side of the puna. The alternating open areas would always be supplied  
541 by proximity to the no-take area. Communities in Fenua ‘Aihere finally accepted this  
542 conceptual model of rāhui and the municipality of Tautira started a collection of signatures to  
543 justify the adoption of rāhui according to the theoretical ecological model. In a sense, the  
544 rāhui model in Tautira is an adaptation integrating Indigenous and conservation and  
545 sustainability sciences approaches with a rotative closure within the permanent puna area. It  
546 will concretely provide more local autonomy over fishing activities, which are expected to  
547 improve the income of fishermen and, more broadly, help them cope with environmental  
548 changes. In this context, bridging scientific and Indigenous knowledge highlighted the  
549 importance of trust-building and community involvement in all stages of research (Bizzarri  
550 and Czerny 2015, Silva *et al.* 2021), and the importance of shared interests in project  
551 objectives, settings, and outcomes (Apetrei *et al.* 2021).

552  
553 Though deployed in support of the application of public policies, conservation and  
554 sustainability sciences thus become a tool serving the interests of IPLC stakeholders as well  
555 as national, regional, or global conservation ecology interests. Fundamentally, the application  
556 of the rāhui system, despite the evolution of culturally-grounded CPE, evidenced that  
557 culturally-grounded Indigenous resource management is a highly valuable tool supporting  
558 more balanced integration and exchange between stakeholders. At both sites, local  
559 expectations include the means to carry out surveillance, such as boat access, fuel costs, and  
560 job opportunities. Such local efforts for protection strongly produce better compliance with  
561 rules and conservation in rāhui areas. Importantly, in Tautira efforts from the State agencies to  
562 develop rāhui in collaboration with IPLCs is also envisioned as a springboard to introduce  
563 management tōmite inside current legal frameworks and to highlight the need to establish  
564 legal rights for local rāhui development. Regarding achieving sustainable management goals  
565 and conservation planning in the Anthropocene, we observe an evolution from the pre-  
566 colonial form of rāhui as an optimization of fish stock by “prohibition for postponed  
567 consumption” that fed island societies for hundreds of years, towards the contemporary rāhui



568 as optimization of fish stock for sustainable resource management “not necessarily  
569 postponed”. Critically, the contemporary practice also conserves potent cultural conceptions  
570 about the sacred, about place, as well as responsibilities to maintain and transmit culture  
571 itself.

## 572 573 **Conclusion**

574  
575 Resurgent rāhui in French Polynesia are fostering new mechanisms as customary law and  
576 traditional forms of marine resource management and governance are woven into  
577 contemporary actions. By inviting social scientists, ecologists, and State resource managerial  
578 institutions to assist in implementing rāhui, communities and local political initiatives are  
579 hybridizing (Fabre *et al.*, in prep) Indigenous and conservation and sustainability values and  
580 sciences. Such governance systems are meant to directly respond to local desires to develop  
581 place-based, culturally-grounded and community-based management of marine resources,  
582 supported by conventional conservation approaches (Aswani and Ruddle 2013, Aswani *et al.*  
583 2017, Sterling *et al.* 2017, Morishige *et al.* 2018, Eckert *et al.* 2018). In this context, local  
584 communities are emerging as leaders in contemporary resource management based on  
585 Indigenous knowledge relative to rāhui (Bambridge *et al.* 2019).

586  
587 By fostering new hybrid mechanisms, rāhui in Tairapu demonstrate the strengths of  
588 integrating Indigenous and conservation and sustainability sciences approaches into resource  
589 management and governance. The ways that resource management approaches are perceived,  
590 conceived, expected, and experienced *in situ* by local and other stakeholders, concretely  
591 mediates the integration pathways for disciplinary sciences and models within community-led  
592 conservation actions. Moreover, examination of these dynamics through our CPE framework  
593 shows and that the dynamics of community-led rāhui governance for resource management or  
594 conservation action evidence the material importance of place-based and cultural values.  
595 Importantly, our findings revealed the non-homogeneity of community-led Indigenous  
596 resource management. In one instance we saw how a conservation sciences approach in  
597 alignment with rāhui broadly addressed issues of culture and territoriality and, in the other, we  
598 saw how rāhui was taken to primarily support the local fishing economy. However, in both  
599 cases, contemporary rāhui involve conservation and sustainability sciences approaches in the  
600 plans and actions of local communities, despite the foundational role of Indigenous  
601 approaches to management. Such interactions produce an adaptive knowledge of nature as a  
602 self-constructive activity based on the construction of a “we” (Bambridge, D'Arcy, and  
603 Mawyer 2021) where all parties need to be understood to better align goals and social  
604 contemporary expectations. This work further suggests the crucial role of the social sciences  
605 in rāhui conception and implementation. We highlighted how contemporary rāhui led by local  
606 communities can Indigenize and decolonize marine conservation efforts (Tuhiwai-Smith  
607 1999) through ILK while conservation and sustainability sciences can still inform and guide  
608 the decision-making process and offer practical ways to be more efficient and better  
609 integration of all stakeholders. Community members’ sensitive, diverse, and potentially  
610 shifting CEP around the ecological futures of their nearshore waters, offers distinct evidence  
611 that Indigenous management systems are adaptable to changing environments, seasonal and  
612 cyclical behaviors, and social conditions. Our analysis of the proposed synthesis between  
613 Indigenous and conservation and sustainability sciences approaches to reemergent rāhui  
614 practices in Tahiti thus highlights the importance of supporting, incorporating, and combining  
615 Mā‘ohi science in Indigenous cultural renewal.

616  
617

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619

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630

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