



# Management of marine resources through a local governance perspective: Re-implementation of traditions for marine resource recovery on Easter Island



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## ABSTRACT

Easter Island (Rapa Nui) is one of the most isolated places in the world. The local Rapanui people have noticed an extreme decline in marine resources, which is due to the exploitation of these resources. Top-down regulations (e.g. fisherman and boat registrations and restrictions on catch-length and fishing season and location) implemented by the central fishery authorities located ~4000 km from the island do not represent the cultural heritage and interests of the Rapanui people. According to the local people, one of the traditional ways to protect marine resources was the taboo (or tapu in Rapa Nui) that regulated the fish harvest. Key informants were interviewed to assess what they knew about the tapu in fisheries and so that the feasibility of its implementation could be assessed based on current local conditions. The tapu that had the greatest potential impact on regulating open water resources, especially tuna, was the traditional belief that consumption of open-water fish during winter months would cause asthma. According to the interviewees, the real reason for this tapu was to protect the fish during its reproductive period, and the asthma threat was only a way to enforce the restriction. At present, tapu is not respected because of the high economic activity related to the tourism that demands fish like tuna all year. Even though many Rapanui people agree that tapu re-implementation would be the best alternative to recover marine resources, people also think it is difficult to implement under modern conditions. We propose to promote a participatory process for development of a local governance structure that will use local traditions and beliefs, including tapu, to support the local decision-making process for reverting the decline of marine resources.

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## 1. Introduction

Research on traditional or local ecological knowledge (TEK or LEK), particularly research on customary practices, marine tenures and taboos, is growing in interest among scientists, managers and communities (Cinner and Aswani, 2007; Foale et al., 2011), especially in the Pacific Islands, where rapid population growth has resulted in increasing pressures on limited natural resources (Govan, 2009). On Easter Island, or Rapa Nui (in the local language,

Rapa Nui refers to the island and Rapanui refers to the indigenous people and the language), the situation is not different. The local community is struggling with marine resource degradation and looking for alternatives by recognizing, in its traditional practice, solutions for reversing declining catch trends (Gaymer et al., 2013).

### 1.1. Setting the scenario; the historical Rapa Nui

Rapa Nui is famous for many reasons: for being the most remote place in the world, for its giant stone statues or moais, for the social crisis and ecological disaster that occurred on the island (Diamond, 2007) and for its extraordinary cultural and environmental history (Hunt and Lipo, 2008). The initial colonization of

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Rapa Nui is still under debate. While some authors proposed colonization occurred about 400 AD, others proposed that colonization occurred about 1200 AD (Mulrooney et al., 2009), by a Polynesian population, possibly from the Mangareva-Pitcairn-Henderson area or the Tuamotu Islands (Martinsson-Wallin and Crockford, 2002). The archeological aspects of the island have been extensively studied; however, the fishery and the relationship between the Rapa Nui and marine resources have received less attention, despite the fact that these resources were exploited since the first immigrants arrived to the island (Ayres, 1979; Hough, 1889).

The first Polynesians that arrived on Rapa Nui developed an exceptional culture in extremely isolated conditions; however, after the splendor came the inevitable crisis (Ramirez, 2008). When the first Polynesians arrived at Rapa Nui, approximately 70% of the island was covered with dense woodland, where palm dominated (Mieth and Bork, 2010). Rapa Nui suffered an ecological catastrophe due to the overexploitation of its forestry resources (Diamond, 2007; Hunt and Lipo, 2009). As a result, the island was largely deforested when the first Europeans arrived in 1722 (Diamond, 2007; Hunt, 2006; Hunt and Lipo, 2009), thus wood became scarce, affecting the canoes and/or boats construction. In 1722, Roggeveen described canoes as being of 'poor and flimsy construction' and about ten feet long (de Haedo and Roggeveen, 1908). Similarly, Cook (1784) described that he observed no more than three or four canoes on the whole island, which were small, no more than eighteen or twenty feet long, and narrow and not capable for any distant navigation. In 1852, Palmer (1870) described the existing canoes as made of small pieces of wood sewn together. This author also described seeing few large hooks (called rou), but they were not in use at this time. In contrast, nets were used for small coastal fish. After the deforestation of Rapa Nui, seaworthy canoes were impossible to build, which probably caused the loss of navigation and open water fishing.

### 1.2. The fishery in Rapa Nui

Recent reconstruction of artisanal landings in Rapa Nui for the main fishery resources showed a sharp increase in landings after 1977; however, a general decrease in landings has been observed since 2000 (Zylicz et al., 2014). Also, in a series of participatory workshops with the local community, Rapanui people identified the lack of resources from both coastal and open water fishing areas as the main marine problem (Gaymer et al., 2013). There is a perception of a dramatic reduction in the most important marine resources on the island. According to local people, lobster (ura), tuna (kahi) and coastal fish are declining in abundance over time and notably so during the last three decades (Gaymer et al., 2013).

Problems related to the decrease in marine resources include coastal resources, such as the Pacific rudderfish, nanue (*Kyphosus sandwicensis*), mollusks (e.g., pure, *Cypraea caputdraconis*), and crustaceans (e.g., ura, *Panulirus pascuensis*, and rarape, slipper lobster, *Scyllarides roggeveeni*), as well as large open-water fish, such as kahi (tuna, *Thunnus albacares*, *Thunnus alalunga*, *Thunnus obesus*), kana-kana (wahoo, *Acanthocybium solandri*), and toremo (amberjack, *Seriola lalandi*) (Gaymer et al., 2013). The scarcity of tuna and other large pelagic fish for the artisanal fishery has pushed fishermen to concentrate their extractions on coastal waters, using gillnets and causing a dramatic decrease in the abundance of coastal fish (Gaymer et al., 2013). Similar problems, related to decline in landings, have been described for the small scale fishery in other Pacific Island such as Guam, Commonwealth of the Northern Mariana Islands (CNMI) and American Samoa (Zeller et al., 2007).

### 1.3. Local ecological knowledge and taboos in fishery

In contrast to Rapa Nui, fisheries in many Pacific Islands have been sustainable for many years and are regulated by traditional management practices, which have been developed by the local fishing communities (Jennings and Polunin, 1996; Johannes, 2002) and are based on local ecological knowledge (LEK). In Fiji, the Locally Managed Marine Area (LMMA) network is based upon traditional local knowledge and practices and the customary laws of the indigenous population, and it achieves positive outcomes (Techera, 2008).

Several taboos for the conservation of marine resources have been described for Oceania. These taboos, including the closing of fishing areas, closed seasons during spawning periods, allowing a portion of the catch to escape, banning the catch of small individuals and a marine tenure system, among others, were enforced by the chief of the community (Johannes, 1978; Techera, 2008). In Rapa Nui, one of the solutions proposed by local people for recovering the degraded marine resources is re-implementation of traditional restriction or prohibition called tapu (Gaymer et al., 2013), which is similar to taboos in other places in Polynesia. Tapu implementation is seen as an alternative given its low cost. Additionally, as tapu was an important tradition in the past, some people believe that it could be easy to recover this tradition (related to fisheries) and it could also be easy to enforce it.

In the past, tapu was enforced by the king (Ariki) of Rapa Nui and controlled by the chief in other places in Polynesia (Johannes, 1978). The main tapu related to fisheries was the closure of fishing season for tuna and other pelagic or open-water fish during the winter months because these fish (especially tuna) were considered poisonous (Englert, 1948; Métraux, 1971). During the tapu, only the royal canoe or vaka vaero, decorated with rooster feathers (Métraux, 1937), with expert fishermen or tangata rava ika ma'a and boat handlers (tangata tere vaka) were allowed to fish (Ayres, 1979; Métraux, 1971). Tuna captured during tapu were for the Ariki and the eldest tangata honoui (important men) (Métraux, 1937, 1971). According to Palmer (1870), tapu was fully applied when he visited the island in 1868.

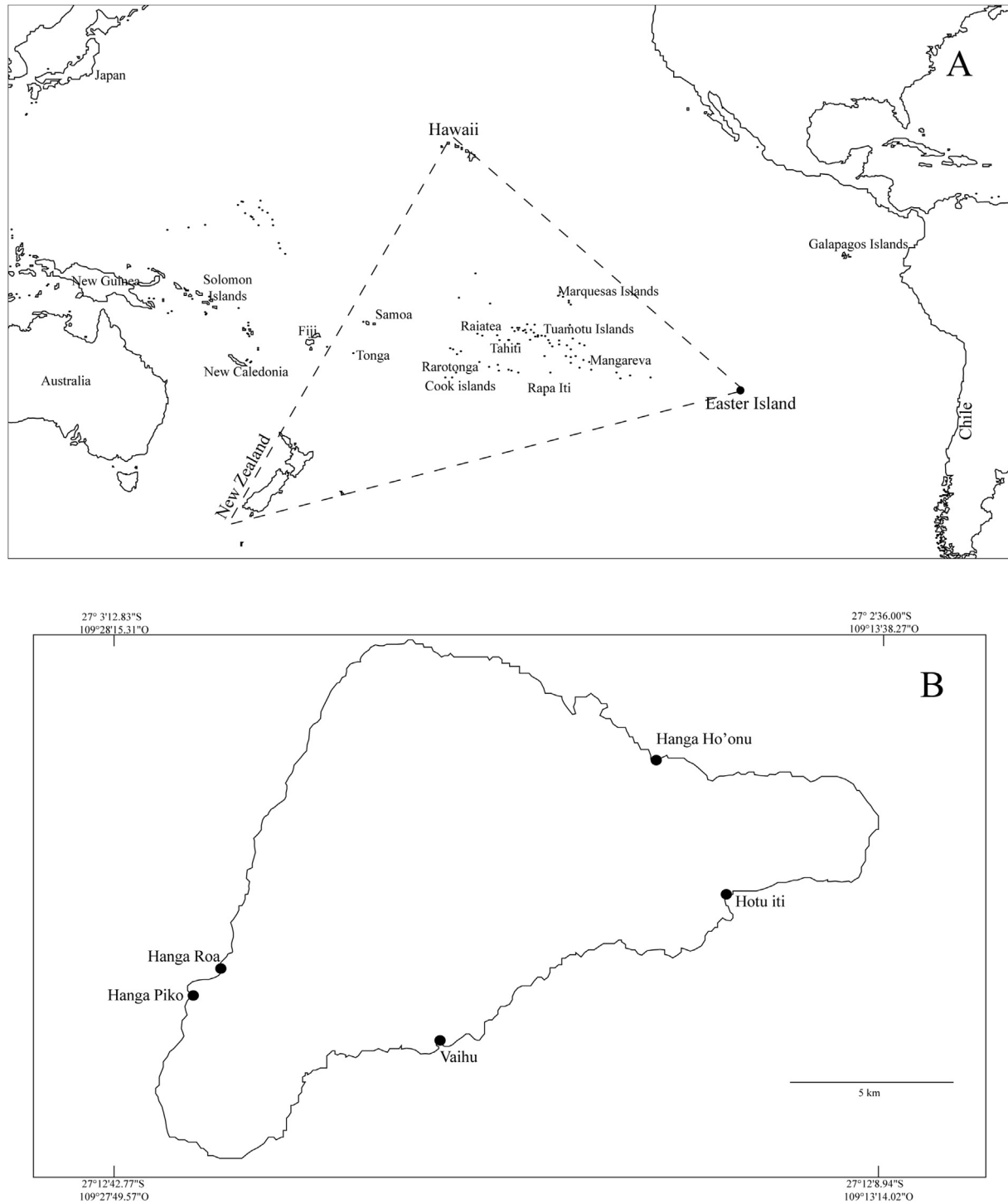
Given the importance of the tapu in the past and given that Rapanui perceive tapu implementation as a solution for marine resource recovery, we collaborated with locals to assess the current importance of tapu in fisheries and evaluated the feasibility of tapu re-implementation based on current local conditions.

## 2. Methods

### 2.1. Study site

The study was conducted on Rapa Nui (Easter Island), a small island (171 km<sup>2</sup>) located in the South Pacific Ocean and the easternmost corner of the Polynesian triangle (Fig. 1A). Rapa Nui (27° 07' S, 109° 22' W) is the most isolated island in the world, located 3700 km from the Chilean coast and 2030 km from the nearest oceanic island group (Pitcairn). In contrast to other islands in Polynesia, corals do not usually form true reefs, except in two places (Hubbard and Garcia 2003), and marine productivity is extremely limited (Friedlander et al., 2013).

Since 1888, Rapa Nui is under Chilean administration; however, Rapanui only have been considered Chilean citizens since 1966, under the Law N° 16441. According to the 2002 census, about 60% of the island populations are of Rapa Nui ethnicity. Regarding the social organization of the island, the Rapanui consider Chilean people who inhabit the island as immigrants. The Government, accepting the requirements of the Rapanui community, pushed an amendment to the Constitution of the Republic to allow, through an



**Fig. 1.** (A) Location of Easter Island (Rapa Nui) and its relation with the Polynesian triangle. (B) Easter Island and its coves.

Act, establishing measures to control the residence and free transit of foreign and Chilean people in Easter Island for the sake of sustainability and protection of the environmental, cultural and archaeological Rapanui heritage; all the former considering its status as a world heritage site and its insular characteristic. Since 2007, Rapa Nui has the status of “special territory”; however, this status does not mean the autonomy of the local government but all decisions affecting the local population must be discussed with the Rapa Nui community through the convention N°169 of the International Labour Organization.

In 1991, Chile introduced new fishery legislation in the Chilean Fishery and Aquaculture Law (FAL, Ley de Pesca y Acuicultura N° 18,892, DS N° 439). The new FAL included major transformations in small-scale, artisanal, benthic fisheries and middle-scale, artisanal fisheries that included changes relating to conservation, sea zoning, allocation of the right to fish for artisanal and industrial fleets and management schemes (Castilla, 2010; Gelcich et al., 2010). However, since the FAL was conceived for a national level, it does not take into account the historical and ecological particularities of oceanic islands that also fall under Chilean

administration. This makes the implementation of some of the new management strategies a big challenging, especially considering the lack of consideration of the particularities of working with indigenous fisher communities and specifically with Rapa Nui people (Gaymer et al., 2014). These failures are especially problematic considering 90% of the registered fishermen in the island have Rapanui ethnicity.

## 2.2. Stakeholder identification and interviews

Direct non-structured interviews were conducted with key Rapanui informants. To identify key informants, we conducted stakeholder identification by other stakeholders (Chevalier and Buckles, 2008) by asking stakeholders to identify the Rapanui people with the richest knowledge on fishing traditions and fisheries-related tapu. The interviews were conducted during three field trips between March and July 2014. Of nineteen key Rapanui informants identified, fourteen were interviewed, including two women. The other five identified informants were not located as they were off of the island. In addition to the fourteen key informants, five other people with a rich knowledge of local traditions were interviewed for a total of 19 informants. Most of the interviewed were elder and respected people of the community.

## 2.3. Landing data collection

Landing data were collected at the Fisheries Statistical Research Department of the National Fisheries Service (Departamento del Servicio de Investigación y Estadística Pesquera del Servicio Nacional de Pesca). No information about reproductive stage, size and/or weight of fishes landed exists. Landing data were available from 1997 to 2013 for tuna (*T. albacares*, *T. alalunga*, *T. obesus*) for the main coves Hanga Roa and Hanga Piko (Fig. 1B). As tuna are traditionally the most important fish for Rapa Nui, we analyzed tuna landings and grouped all other fish landings as other fish. The monthly tuna landing from 1997 to 2013 was calculated.

## 3. Results

### 3.1. Fish landings in Rapa Nui

Landings show inter-annual peaks, with the main drops in 2002 and 2011 (Fig. 2A). Between 1997 and 2002, tuna (*T. obesus* and *T. albacares*) was the most important resource in the composition of the landings (Fig. 2A). However, from 2002 to the present, tuna landings declined while an increase in landings of other fish was registered. The most important tuna species in the landing composition is *T. albacares* (Fig. 2B). Tuna was fished year round, and there were no differences in landings during any months throughout the year (Fig. 2C) (one-way ANOVA,  $p > 0.05$ ).

### 3.2. Tapu in fisheries as a traditional method of resource sustainability

Tapu means restriction or prohibition, but according to the interviewees, tapu also means respect. In the past, tapu was enforced by the king; however, given that the king (i.e. Ariki) is not currently part of the Rapa Nui social structure, tapu cannot be enforced. Thus, if some tapu were established, they would only be based on respect. Most of the interviewees highlighted that tapu in marine resources were mainly for open-water fish (deep-sea fish for Rapanui) and they only made reference to coastal resources in a few cases (Fig. 3). Compared with the taboos described for other Pacific Islands, the tapu mentioned by interviewees only refers to closed fishing areas,

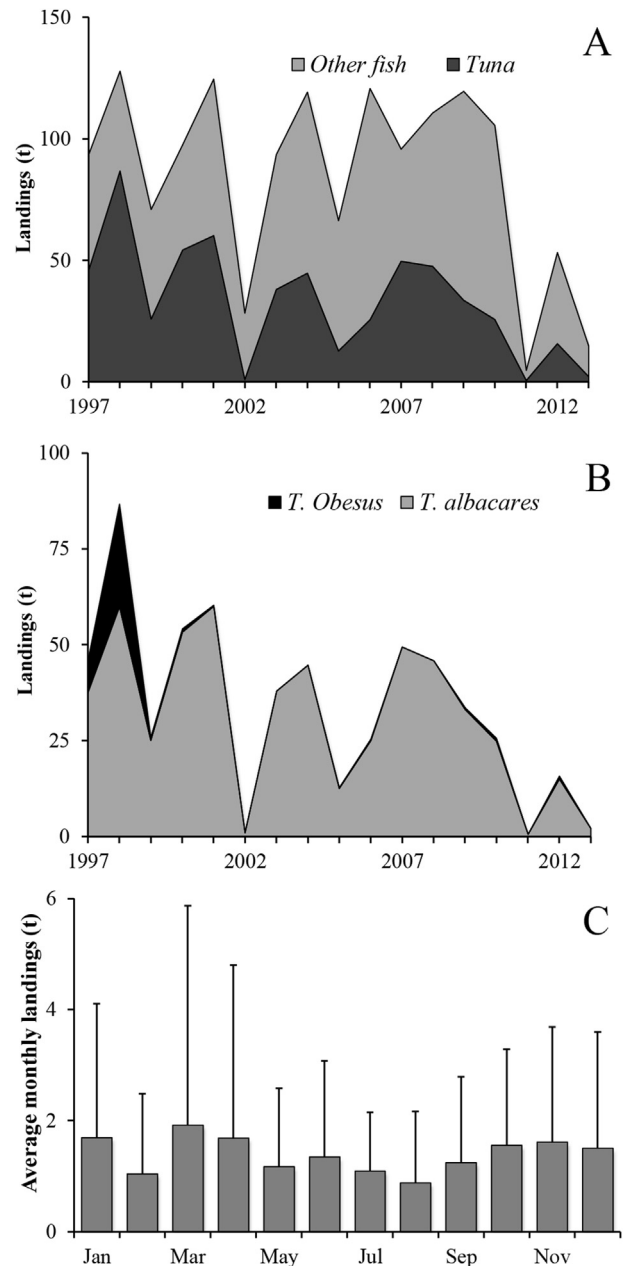


Fig. 2. Landings (t) of the main coves (Hanga Piko and Hanga Roa) in Rapa Nui. (A) Tuna and other fishes, (B) landings of *Thunnus obesus* and *Thunnus albacares* and (C) average monthly landing (and standard deviation) for tuna in the period 1997–2013.

closed fishing season during spawning periods, and allowing a portion of the catch to escape (Table 1).

#### 3.2.1. Tapu for open-water fish

The tapu on open-water fish consisted of banning the fishing and consumption of some fishes (Table 2) during the tapu period. All interviewees mentioned that the ban included the winter months (i.e., July, August, September); however, there was no consensus about the exact starting time of the tapu. Some of the interviewees mentioned a more extended period, from March–May to September (i.e., fall to spring in the southern hemisphere). In the past, fishermen took their boats out of the water and repaired them and line fished from the shore during the tapu.

Traditional beliefs held that the consumption of open-water fish during the tapu would cause mare (asthma). They believed that the

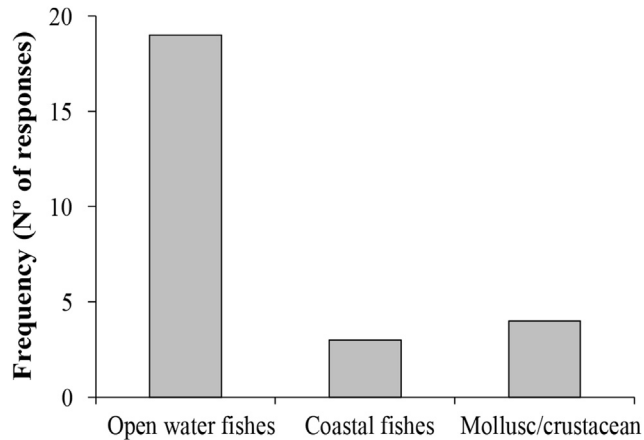


Fig. 3. Number of interviewees that mentioned the existence of tapu on fisheries in the past for different resources.

Table 1

Main tapu mentioned by Rapanui, compared with traditional conservation measures described by Johannes (1978) for other Pacific Islands. (C) = coastal resources, (OP) = open-water resources, N/A not applicable in Rapa Nui.

Methods	Mentioned by interviewees	Coastal (C) or open water resource (OP)
Closing fishing or crabbing areas	Yes	C-OP
Closed seasons or bans on fishing during spawning periods	Yes	C-OP
Allowing a portion of the catch to escape or deliberately not catch all readily-available fish or turtles	Yes	C
Holding excess catch in enclosures until needed	No	
Ban on taking small individuals	No	
Fishing in inland lagoons or for certain easily accessible species restricted to times of poor fishing conditions	N/A	
Restrictions on taking seabirds and/or their eggs	No	
Restricting the number of fish traps in an area	No	
Ban on taking turtle eggs	N/A	
Ban on taking turtles on the beach	N/A	
Ban on frequenting favorite spots on turtle nesting beaches	N/A	

fish were skinny, and had a high amount of mucus during this time because they were sick and this sickness could be transmitted to humans. Most of the interviewees mentioned the link between tapu and asthma (Fig. 4). Some of the eldest islanders confirmed that they knew of cases of people with asthma from consuming fish

Table 2

Open-water fishes for those was described tapu during winter months in Rapa Nui.

Rapa Nui name	Scientific name
Konso	<i>Ruvettus pretiosus</i>
Kahi ave ave	<i>Thunnus albacares</i>
Kahi mata tata	<i>Thunnus obesus</i>
Kana kana	<i>Acanthocybium solandri</i>
Paratoti	<i>Etelis marshi</i>
Piafri	<i>Seriola violacea</i>
Po'o po'o/Pe'i	<i>Pseudocaranx cheilio</i>
Ruhi	<i>Caranx lugubris</i>
Sierra	<i>Thyrstites atun</i>
Toremo	<i>Seriola lalandi</i>

during tapu; however, many currently doubt this relationship. Further, some of the interviewees said that the ancient people's explanation of the link between asthma and fish consumption was tricky. They believe that the real reason for this tapu was to protect the fish during their reproductive cycle (Fig. 4) and that the asthma threat was only a way to enforce the tapu and to force people to comply with the restriction. Other interviewees believe that consuming fish during tapu could produce asthma and that it was also a way to protect the reproductive cycle of such fishes (Fig. 4).

At present, tapu is not respected, and open-water fish are caught throughout the year, as we highlighted with tuna (Fig. 2C); however, many families do not consume them during tapu. This tapu was respected until the 1960s.

### 3.2.2. Tapu for coastal resources

There is no consensus about the reasons for tapu for coastal resources (fishes or benthic resources) in the past. Tapu for coastal resources (fishes or benthic resources) were only mentioned a few times compared to open water tapu (Fig. 3). Most of the interviewees declared that they did not remember tapu for coastal species; however, some of the eldest interviewees mentioned that there was a tapu for female lobster (ura vahine). Lobsters with eggs were not harvested because the lobsters were vulnerable during this period. Among shellfish, three people mentioned tapu for the pure vaka (a bulla stage of *C. caputdraconis*). The tapu is that given the thinness of its shell, the pure vaka is not harvested because it is not useful for handcrafts.

A few people mentioned tapu for some coastal fish (Fig. 3). Among these fish were ra'emea (*Thalassoma purpurum*), mori and marari (*Anampses caeruleopunctatus*, male and female, respectively). Those fish were tapu because they were for 'making the sea beautiful,' and everybody must have the chance to see those fish in the sea, as mentioned by one of the interviewees. Some people also mentioned that there was a tapu for nanue (*K. sandwicensis*). The Rapa Nui recognize seven stages for *K. sandwicensis* (Randall and Cea, 2011), and from those, nanue para and nanue motea were tapu (the yellow and the albino phases, respectively) because they guide the fish schools. In the 1960s, Rapa Nui fishermen built a rocky wall (pirca) in the intertidal pools of the Hotu Iti cove. During the seven days prior to the full moon, during the high tide, they closed the wall, trapping the nanue schools. In the morning, during the low tide, they caught the fish for their own consumption, releasing the others. If any nanue para or nanue motea were among the catch, they released them as well; however, before the release,

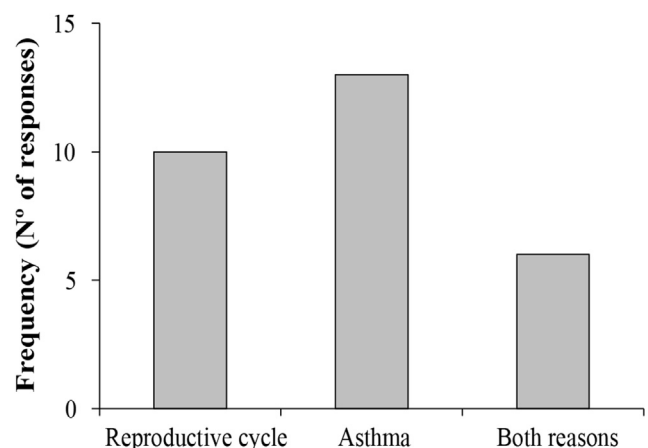


Fig. 4. Number of responses for reasons for establishing tapu for open-water resources in the past. One interviewee could give more than one reason for tapu implementation.

the fishermen bit the right pectoral fin to show other fishermen that this fish was a guide and that other fishermen must release it in future catches.

### 3.2.3. Tapu at present

According to the interviewees, tapu are generally not respected currently. Only in a few cases did people say that some tapu are respected but by a minority of the island population. Although tapu are not in use in the present, some people declared that they do not consume open-water fish during the tapu season; however, they catch them and sell them to local restaurants and hotels. The consensus is that tapu in the fisheries were lost in the 1960s. In 1967, commercial flights from Chile to Easter Island began (Gaymer et al., 2013). The Rapanui agreed that tapu were lost due to increased tourist demand for fish and increased numbers of non-Rapanui people living on the island who do not respect the Rapa Nui traditions. In addition, the interviewees agreed that the Rapanui were more worried about money, especially the youngest islanders, which have resulted in the loss of traditions and respect for the tapu.

Regarding currently respected tapu, some fishermen state that when they catch nanue para or nanue morea with their nets, they release them after biting their fins, as their ancestors did in the past. According to fishers' references, another tapu that still exists refers to moray eel fishing (koreha, *Gymnothorax* spp). The moray eel is caught only in the winter because the summer is its breeding season (which fishermen recognize due to the presence of eggs). A similar tapu occurs with the ko'iro (conger, *Conger cinereus*), as fishermen do not fish it from November to January because it is in its breeding season. Among shellfish, the tapu for pure vaka (a bulla stage of *C. caputdraconis*) is still respected and was mentioned by at least one interviewee.

## 4. Discussion

Based on our results, it is possible to state that the tapu on current fisheries are probably a small fraction of what tapu were in the past, when the first immigrants arrived to the island. According to Routledge and Routledge (2017), it is difficult to collect this kind of information 'when some of the facts are forgotten or only vaguely remembered'. The stories collected by ethnographers could be shaped by the contemporary social context rather than on the pre-contact period (Mulrooney et al., 2009). Even with the island's fragmented history and eroded traditions, in the present study we corroborated that tapu or taboo in Rapa Nui fisheries are similar to those described in other Polynesian islands (Johannes, 1978). The latter describe a series of conservation measures or restrictions traditionally employed in tropical islands, including closing fishing areas, or ra'ui (Tiraa, 2006), closing fishing for seasons or during spawning periods, allowing a portion of the catch to escape or deliberately not catching all fish, and banning the fishing of small individuals. Some of these restrictions have been described in the present study for Rapa Nui. This finding is novel, given that previous studies in Rapa Nui described the fishing restrictions or tapu only described for open-water fish (Ayres, 1979; Englert, 1948; Métraux, 1971; Pakarati, 2010).

In Rapa Nui, the most important tapu (or the tapu that is best remembered by the islanders) is the tapu of seasonal restrictions for open-water fish. The month and the mechanism that initiated the tapu are unclear. Englert (1948) mentioned that the tapu was from May to October, while Métraux (1971) described a shorter season, from July to September. Ayres (1979) mentioned that tapu was probably related to seasonal pelagic fish movements and traditional fishing seasons cannot be matched to calendar months; thus, its duration is difficult to specify. According to Routledge and

Routledge (2017), there is a relationship between the cult of the tangatamanu (the bird man) and the end of the tapu season. The arrival of the sacred bird, the manutara (grey-backed tern, *Sterna lunata*), in September inaugurated the open-water fishing season. Nevertheless, an explanation from ethnoastronomy suggests that the open-water fishing season (or the end of the tapu) started with the heliacal rising of the Pleiades asterism (matariki, the eyes of the king) in mid-November (Belmonte and Edwards, 2007; Edwards and Edwards, 2010). The open-water fishing season lasted until mid-April, when matariki disappeared from the sky (Belmonte and Edwards, 2007; Edwards and Edwards, 2010).

### 4.1. Tapu and the reproductive season

Most of the islanders stated that tapu for deep-sea fish was enforced by introducing the pain of asthma as a way to protect the reproductive season of such fish. Sun et al. (2005) described that the yellowfin tuna spawns throughout the year in tropical waters, but seasonally in subtropical waters in the western and central Pacific Ocean. A common feature among tuna species is that spawning occurs at sea-surface temperatures of approximately 24 °C and higher (Schaefer, 2001). The northward and southward seasonal movements of the 24 °C isotherms are responsible for the pronounced seasonal spawning of tunas in the subtropical regions (Schaefer, 2001). Adults (larger than approximately 100 cm) spawn, probably opportunistically, in waters >26 °C (Itano, 2000). In Hawaii, tuna spawning has been recorded in the boreal summer, from June to August (Itano, 2000), while Sun and Yah (1992) describes spawning as occurring from October to March for the sector 10–25°S/150–130°W. For the surrounding waters of Rapa Nui, the gonadic analysis of *T. albacares* showed that between November and December the gonads are beginning the development stage (stage II and III) (Bahamonde et al., 1993).

Accordingly, the tapu season banned the fishery in the pre-spawning season, contrasting with fishermen's explanations. Even though the maximum sea surface temperature (SST) in Rapa Nui is recorded from January to March, with a temperature range of approximately 24 °C to 26 °C, there is an inverse relationship with maximum chlorophyll a, which occurred from April to September (Testa, 2014), coincident with the tapu months described in the present research. The success of fish larvae is matched or mismatched to the production of their food, and the stocks release their larvae into the annual production cycle to secure the survival of the larvae (Cury and Roy, 1989). Around Rapa Nui, tuna larvae (*T. albacares* and *Thunnus* sp) were detected in November 1999. The larvae of *Thunnus* sp had a mean size of 4.0 mm (Donoso et al., 2000) and these larvae has sizes consistent with ~5-days hatched larvae (Kaji et al., 1999). In addition, it is interesting to note that many islanders declared that they do not consume deep-sea fish in the winter given the high amount of mucus in the fish. An increase in mucus production in the fish has been related to their reproductive stage, providing nutritional and immune benefits to fish (Gona, 1979; Shephard, 1994; Tort et al., 2003). Despite scientific studies that have demonstrated the benefits of the presence of mucus, the common belief is that layers of mucus accumulate on the skin and gills of fish that are stressed by disease (Shephard, 1994), similar to the common Rapanui belief.

### 4.2. Food taboo

Food taboos, whether scientifically correct or not, are often meant to protect humans and are based on observations that certain allergies and depression are associated with the consumption of some taboo food items (Meyer-Rochow, 2009). In addition, food taboos for particular groups of people aid in the

cohesion of the groups and help to maintain their identity and to create a feeling of belonging (Meyer-Rochow, 2009). The consumption restrictions for certain species undoubtedly aid fish conservation; thus, ritual actions sometimes generate concrete ecological consequences (Johannes, 1978).

Previous studies on Easter Island have described that during tapu, fishing was prohibited and fish caught in this season were considered poisonous (Métraux, 1971). In relation to poisonous tuna, ‘scombroid poisoning’ has been described as a series of symptoms that result after eating scombrid fish, especially jack mackerel (*Trachurus murphyi*) and tuna (Auerswald et al., 2006). “Scombroid poisoning” is caused by ingestion of more than 1 mg histamine per kg bodyweight (Auerswald et al., 2006). There are three reasons for the elevation of post-mortem histamine concentration in fish: (a) a high content of free histidine, (b) the presence of bacterial histidine decarboxylase, and (c) environmental conditions, such as high temperature (Morrow et al., 1991). Symptoms associated with scombroid poisoning are varied, but in rare and severe cases, cardiac and respiratory complications have been observed in individuals with preexisting conditions (Hungerford, 2010; Morrow et al., 1991). The prevalence of asthma in Rapa Nui is 3 times higher than in Santiago, Chile (Moreno, 1995), and this could potentially be related to episodes of scombroid poisoning; however, we have no direct evidence to support this statement.

Tapu for open-water fish and especially for tuna did not apply to the Ariki, as him and the tangata honui (the important men) could eat the fish without being poisoned. The first tuna fished after the end of the tapu was for the Ariki and the tangata honou (Métraux, 1937, 1971). In Samoa, skipjack tuna could only be allowed in the royal canoe, reflecting the importance of tuna as a special meal in the chief’s diet (Dye and Steadman, 1990).

In Polynesia, because the chief’s authority was rooted in controlled access to important resources, increased opportunities for the control of animal food may have influenced the development of political institutions (Dye and Steadman, 1990) and local governance. In this way, it is probable that the ancestral fishery tapu was a way to maintain the social order and to provide the Ariki with special meals, more than as an instrument for resource conservation.

Tuna is a highly prestigious fish, but it was not characteristic of central east Polynesia in the past. Evidence from a range of archeological sites in the Pacific suggests that very few prehistoric fishermen managed to catch it in any quantity (Leach et al., 1997). Archeological research in Rapa Nui has demonstrated that offshore fishing was of limited importance for the Rapa Nui population (Hunt and Lipo, 2009). This was possibly associated to the lack of large canoes for sailing and fishing offshore (Hunt and Lipo (2009). Chicken, rats and coastal fish were the most important sources of protein (Ayres, 1985; Hunt and Lipo, 2009; Steadman et al., 1994). The most important fish were jacks or trevallies (Carangidae) and wrasses (Labridae), while nibblers (Kyphosidae) and offshore fish, such as tuna (Scombridae), were less important (Martinsson-Wallin and Crockford, 2002).

#### 4.3. The tapu loss

The old Rapanui society was entirely destroyed in 1862 when Peruvian slave traders kidnapped a large part of the population, including the Ariki (i.e. king), his family members and a considerable number of the erudite men or maori (Edwards and Edwards, 2010; Métraux, 1937). This severe population decline would have resulted in the loss of traditional knowledge about Rapanui society (Mulrooney et al., 2009). When missionaries arrived in 1864, they faced complete ignorance of the past and a disintegrated social

organization (Métraux, 1937). In 1877, only 111 Rapanui survived and remained on the island; in this condition and as a result of such tragic events, there was no interest in preserving the traditions and beliefs (Métraux, 1971).

Most of our interviewees declared that tapu were lost because the new generations did not respect them. Similarly, in other parts of Polynesia, the growth of urban Port Moresby, in Papua New Guinea, and the inroad of western culture have eroded the ceremonial fishing for tuna (Pulsford, 1975). Johannes (1978) noted three main reasons why traditional conservation or management systems could be eroded: (a) the introduction of monetary economies, (b) the breakdown of traditional authority, and (c) the imposition of new laws and practices by colonial powers. Two of these reasons were mentioned by the interviewees, the introduction of the monetary economy that changed the traditional subsistence fishery and the breakdown of traditional authority.

## 5. Conclusions

Tapu are, to the collective mind of modern Rapanui society, an alternative for resource management and conservation; however, at present, the figure of the Ariki to enforce them does not exist. People think it is difficult to implement tapu under modern conditions. In addition, we detected an absence of a local governance structure that could support tapu or implement any other management or conservation measure based on local ecological knowledge. On the other hand, any initiative coming from the central Chilean government is rejected by the Rapanui people, given its top-down origin and because the most common management strategies do not fit well with the Rapanui traditions and worldview (Gaymer et al., 2014). This is for instance the case for explaining the lack of implementation of the FAL at Easter Island, where the mismatches between the national visions of fisheries management and the local culture, traditions and beliefs regarding fisheries would make this an extremely difficult task. Also, has been described that centralized governance system has slow response rates, being thus unable to cope with dynamic changing systems (Aburto et al., 2014). This contrasts with the ability of communities to quickly adapt traditional laws and local governance in response to external changes (Hviding, 1998).

At present, the local Rapanui community has begun discussing what they want to do in relation to marine management and conservation. This bottom-up process could create the necessary local governance structure to ‘reinvent’ the tapu, implementing novel actions for reverting marine resource decline tendency. This modern tapu must be based on social agreements and be implemented as a management alternative built on local traditions and biological criteria. The Fijian LMMA are established on the basis of local governance arrangement and local rules and without a national legal framework for top-down control (Techera, 2008). A similar system has been described in Rarotonga, Cook Islands where the traditional ra’ui were re-implemented based on the respect of traditions and the local chief (Tiraa, 2006). Among the strengths of traditional law are its culture-specific and local-specific nature (Johannes, 2002). In this sense, the way forward in Rapa Nui is to generate local capacity to facilitate a process that could develop a governance structure in line with local traditions and beliefs to support the decision-making process at local level.

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