

## ***Establishing marine protected areas through bottom-up processes: insights from two contrasting initiatives in Chile***

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### ABSTRACT

1. Bottom-up participatory processes to create and manage no-take marine protected areas have been proposed as a way to scale-up marine conservation and deal with the lack of support and compliance of top-down conservation approaches. However, bottom-up conservation does not always lead to positive outcomes, thus it is increasingly important to understand the conditions that determine the establishment and implementation of these initiatives.

2. Establishment and implementation processes were compared empirically for two contrasting bottom-up no-take marine protected areas that have been developing under the same political setting, however, one has been successful and the other has stalled.

3. Using mixed methods, stakeholders' (a) motivations to participate in the no-take marine protected area initiatives, (b) communication, support and information flow networks, (c) perceived participation, and (d) satisfaction with the establishment process of the bottom-up no-take marine protected areas, were assessed.

4. Non-significant differences were found between the two initiatives in terms of stakeholders' motivations to create a no-take marine protected area.

5. Significant differences were found in stakeholders' communication, support and information flow networks, in addition to differences in participation, and satisfaction with the establishment and implementation process.

6. Results highlight that for the implementation and consolidation of bottom-up no-take marine protected areas initiatives, common interests do not necessarily lead to common action, partnerships will not emerge automatically in response to potential benefits.

7. Understanding disparities in participation, information sharing and communication are key aspects which must be considered for creating and supporting successful marine protected areas based on bottom-up participatory processes.

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## INTRODUCTION

No-take marine protected areas (Nt-MPAs) are indispensable tools for biodiversity conservation (Convention on Biological Diversity, 2004; Crawford *et al.*, 2006; Suman *et al.*, 2009; Ban *et al.*, 2011). However, the establishment and implementation of Nt-MPAs is a highly complex process as it involves ecological, fishery, socio-economic, and socio-political dimensions (Charles and Wilson, 2009; McCay and Jones, 2011; Chuenpagdee *et al.*, 2013; Gelcich *et al.*, 2013). Published evidence suggests that a large proportion of Nt-MPAs are not well enforced and that there is still resistance from fisher communities to their establishment (Mora *et al.*, 2006; Gelcich *et al.*, 2008; Suman *et al.*, 2009). This is especially noticeable when Nt-MPAs are implemented in a top-down manner (central government and/or international donor led) with lack of participation from local stakeholders (McClanahan *et al.*, 2006; Hind *et al.*, 2010; Lopes *et al.*, 2013). As a consequence, researchers and NGOs have promoted a shift towards more inclusive bottom-up (community and user led) processes for Nt-MPA design, establishment and implementation, under the assumption that this would offer better incentives for people to comply and enforce the Nt-MPA rules and regulations (Jentoft *et al.*, 1998; Pollnac *et al.*, 2001; Gutierrez *et al.*, 2011; Cinner *et al.*, 2012).

Non-governmental organizations (NGOs), development agencies and the Convention of Biological Diversity (CBD) have acknowledged the importance of traditional management practices and bottom-up participatory processes in achieving sustainability (Weible *et al.*, 2004; Convention on Biological Diversity, 2013). Unfortunately, bottom-up marine conservation initiatives are far from being a 'silver bullet' and they have been established with various degrees of success (Crawford *et al.*, 2006). Conditions that have been highlighted as important in the successful implementation of Nt-MPAs include stakeholders' predispositions towards conservation (Futtema *et al.*, 2002) and the type and level of local stakeholders' participation (Dalton *et al.*, 2012). In addition, communication, support and information flows between stakeholders have been hypothesized to influence rule compliance in Nt-MPA and other

marine management initiatives (Crona and Bodin, 2006; Bodin and Crona, 2009).

Under the current global agenda for achieving conservation and sustainability targets, it is becoming increasingly important to provide insightful case-studies that can help understand conditions that have resulted in the successful establishment of bottom-up Nt-MPAs. Importantly, owing to diversity in local political settings and heterogeneity in stakeholders, when assessing Nt-MPAs, drawing lessons from case studies may benefit from contrasting, rather than single case analysis (Agrawal, 2001; Crawford *et al.*, 2006; Chuenpagdee *et al.*, 2013).

A unique opportunity to compare empirically two contrasting bottom-up Nt-MPAs establishment processes is found in the Chilean central coast. The two bottom-up Nt-MPAs have been developed during the past 8 years, and are embedded in similar social-ecological settings and linked to the same set of formal institutions at the provincial, regional, and national scales. One initiative is achieving success and the other has stalled. In order to determine conditions that could have led to these contrasting outcomes we assessed stakeholders' motivations to participate in the Nt-MPAs initiatives, identified and compared communication, support and information flow networks, analysed the type of stakeholder participation, and measured stakeholders' level of satisfaction with the establishment process. While case studies in Chile are used as working examples to understand what determined contrasting Nt-MPA outcomes, results can inform other countries/regions wishing to engage and support bottom-up Nt-MPA developments in coastal communities.

## METHODS

### Research setting

In Chile, bottom-up Nt-MPA initiatives are still uncommon. However, there is an institutional framework and mechanism allowing for their establishment. In particular, Marine Sanctuaries represent a conservation tool to protect a specific marine area and to conserve certain species with

commercial, scientific or cultural value. Two examples of bottom-up initiatives to create Marine Sanctuaries, have been the Navidad and Punta de Lobos Sanctuaries. Navidad and Punta de Lobos are located in central Chile in adjacent coastal municipalities that depend heavily on marine resource extraction, including fin-fish, benthic invertebrates, seaweed, and tourism activity, especially during the summer season. In both localities artisanal fishers rely on coastal marine resources in similar ways (Figure 1).

The Navidad Sanctuary initiative was proposed and developed jointly between the local municipality and the small-scale artisanal fisher federation of Navidad, and had the academic support of the Pontificia Universidad Católica de Chile. Its main conservation target is a small, 20 ha kelp *Macrocystis pyrifera* forest that is extremely threatened by kelp harvesting (Expediente santuario Navidad, 2009). The area is

an important habitat for 35 species of invertebrates and 16 reef fish (Expediente santuario Navidad, 2009). The area is also an important water sport hotspot for windsurfing. The Nt-MPA initiative started in 2005 and was formally approved as a sanctuary in 2012.

The Punta de Lobos Nt-MPA initiative has been driven by a neighbourhood association, formed by surf-tourism cabin owners and other local entrepreneurs. The target is to preserve intertidal and subtidal biodiversity of an exposed rocky shore of around 50 ha, which is an important habitat for key commercial benthic species. Punta de Lobos is also well recognized as a key water sport area, especially for surfing. The sanctuary initiative began to be developed in 2006 but has stalled at local and national levels since 2010. Punta de Lobos initiative leaders have been working recently on getting international support to protect the surf-spot. In 2013 Punta de Lobos

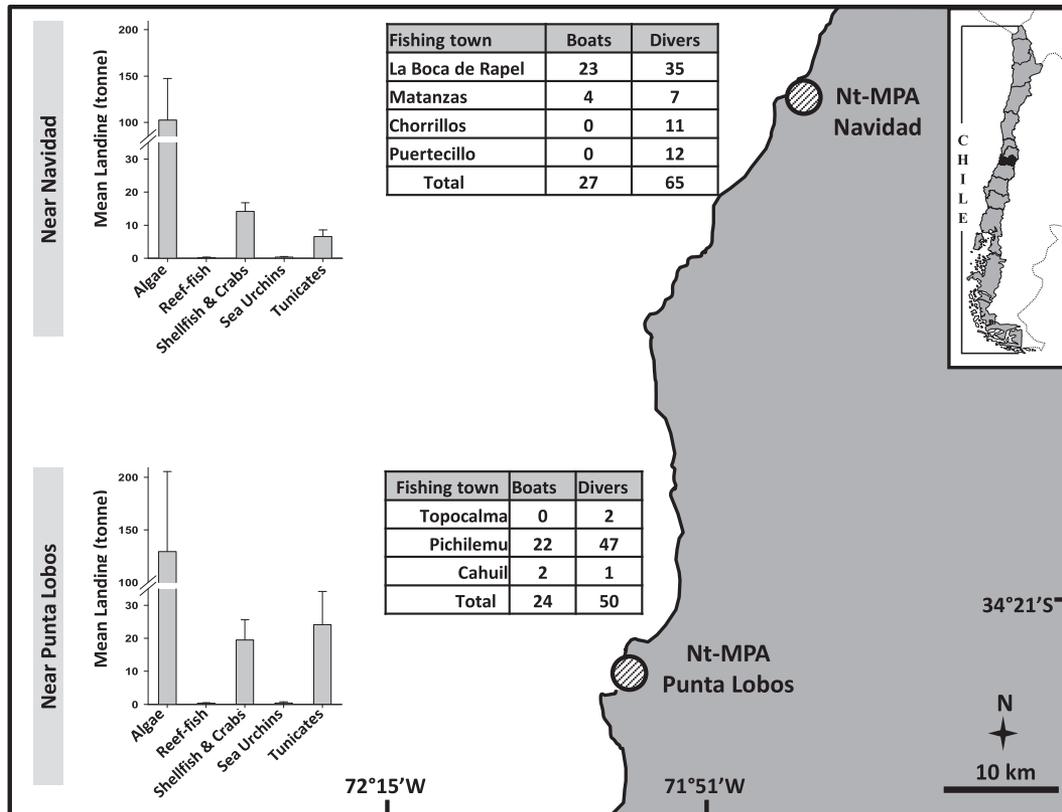


Figure 1. Map of the study area highlighting mean landings and fishing effort (number of boats and divers) for the areas near the Navidad Nt-MPA and the Punta de Lobos Nt-MPA.

was recognized as a World Surfing Reserve by the World Surfing Reserves foundation.

The Navidad and Punta de Lobos sanctuaries are used to compare empirically the bottom-up Nt-MPAs establishment processes.

## Methods

The study was divided into two main phases: (1) a qualitative exploratory phase in which in-depth interviews were performed with fisher association representatives, local council officials, and water sport associations which helped identify key stakeholders; and (2) a semi-structured questionnaire that was applied to the leaders or representatives of all engaged organizations (governmental and non-governmental) in the Nt-MPA initiatives. To complete the entire census of relevant stakeholders, a snowballing method was used (Goodman, 1961). Interviewed stakeholders were asked to identify other stakeholder groups involved or affected by the establishment of the Nt-MPA, which were subsequently surveyed until no new names were mentioned. In Navidad and Punta de Lobos the full lists included 13 and 15 stakeholder groups, respectively. Some stakeholders, especially those from government organizations at provincial and regional levels, involved in the two initiatives were asked to answer the questionnaire separately for each case. They were surveyed for both initiatives in no particular order. Questionnaire surveys were undertaken between September and November 2012.

The questionnaire had four sections. The first aimed to gain an understanding of stakeholders' motivations for participating in the Nt-MPA initiatives. Respondents were asked to assess 11 motivations including economic, social and environmental on a 5-point scale, with anchor points 'not important at all' and 'very important'. The second section aimed to assess existing relationships (hereafter linkages) among stakeholders during the Nt-MPA establishment process, drawing on Social Network Analysis (SNA) techniques (Hanneman and Riddle, 2005; Scott and Carrington, 2011). In particular, communication, support and information network flows were identified by asking respondents to select, from a pre-established list, stakeholders with whom their organizations: (a) have had any

communication about the design, establishment or administration of the Nt-MPA; (b) have received or provided support in relation to the design, establishment or administration of the Nt-MPA; and (c) have received or provided information related to the design, establishment or administration of the MPA. In every case the interviewee was asked to mention other stakeholders that were not on the list. The complete coverage of stakeholders involved in both case studies allowed the analysis of non-reciprocal and reciprocal linkages. Table 1 defines the social network properties that were measured from these data.

The third section of the questionnaire aimed to measure stakeholders' perceived participation in the Nt-MPA establishment process. Interviewees were asked to select, from a choice of five statements, the one that best represented their participation in the conservation initiative. The five statements referred to a participatory scale adapted from Pretty (1995), ranging from passive participation: 'the idea of the Nt-MPA has been imposed', to institutionalized participation: 'we have been part of the decision making about the Nt-MPA'. The final section of the questionnaire aimed to measure stakeholders' level of satisfaction with the Nt-MPA establishment process. Satisfaction was used as a means of measuring the congruency between stakeholders' expectations and outcomes (Tindall *et al.*, 2011). How satisfied interviewees were with the levels of (1) information they have about the initiative, (2) trust, (3) communication among the stakeholders involved, (4) support from other stakeholders, and (5) effective participation they have had in the initiative, was specifically asked. These perceptions were measured on a 5-point scale with anchor points 'very dissatisfied' and 'very satisfied'.

To analyse statistical differences in stakeholders' motivations for participating in the initiatives Mann-Whitney U tests were performed with the SigmaStat V3.00 software package (SPSS, INC., Chicago, IL). Cliff's Delta, used to assess the size effect, and statistical power was measured using RStudio V0.96 software package (R Project for Statistical Computing, Vienna, Austria). For the SNA, structural properties of social networks, density, centralization, and reciprocity (see Table 1

Table 1. Definition and description of the quantitative network measures used in the study

Indicator	Definition	Description	Parameter	Potential effect on bottom-up conservation initiatives
Density	Total number of observed ties divided by the total number of possible ties.	Density is an indicator of group cohesion that represents the general level of linkage among the nodes in a network. Describes how far a given network is from a complete network, in which all nodes are directly connected to every other node. The more nodes that are connected to one and other, the higher the density of the network (Scott, 2000).	Can vary from 0 (e.g. in a set of isolated nodes) to 1 (e.g. in a group where every node is tied to every other node).	High-density networks may benefit the spread of information and the development of trust among stakeholders, but may also lead to the homogenization of experience and knowledge (Bodin <i>et al.</i> , 2006).
Centralization*	Percentage of inequality or variance in the distribution of ties within a network.	Centralization is a complementary indicator of cohesion that represents to what extent the degree centrality of the most central node (i.e. the one with the highest number of direct ties to other nodes) exceeds the degree centrality of all other nodes (Freeman, 1979). It is expressed as a percentage of a perfectly centralized theoretical network, called a star network, with the same number of nodes as the observed network.	Can vary from 0% (e.g. in a network where all nodes possess the same number of ties) to 100% (e.g. in a star network, in which all nodes are tied to, and only to, one central node).	High centralization can be associated with increased coordination capacity, but may also lead to over-centralized decision-making (Crona <i>et al.</i> , 2011).
Reciprocity	Number of reciprocal linkages divided by the total number of linkages observed.	Represents the extent to which ties in a network are reciprocated (or mutually acknowledged). The degree of reciprocity in relations can be regarded as an indicator of the stability of nodes' positions in social networks (Hanneman and Riddle, 2005). Predominance of reciprocated ties may reflect a more equal and stable network; predominance of asymmetric ties may portray a hierarchical context.	Can vary from 0 (e.g. in a network where all ties are nonreciprocal) to 1 (e.g. in a network where all ties are reciprocal).	Reciprocal ties can be considered as stronger than asymmetric ties, because reciprocity is believed to increase trust and long-term obligations between individuals (Pretty, 2003).

\*The centralization measure used here is based on the degree centrality measure of individual nodes (Crona *et al.*, 2011).

for definitions of network properties), were computed using Ucinet 6.0 (Borgatti *et al.*, 2002), whereas sociograms (Figures 2(a)–(d)) were created with NetDraw (Borgatti, 2002).

## RESULTS

### Stakeholders' motivations for participating in the Nt-MPAs initiatives

Stakeholders' motivations for participating in the Nt-MPAs initiatives are shown in Table 2. No significant differences between those involved in the Navidad and the Punta de Lobos Sanctuary initiative were found for the 11 indicators measured.

### Social network analysis

*Communication network:* Communication networks for Navidad and Punta de Lobos Sanctuaries are shown in Figure 2. Results represent two very different network structures. Navidad (Figure 2(a)) presents a tight and well-connected network with a dense core and three peripheral nodes (stakeholder groups). In contrast, Punta de Lobos network (Figure 2(b)) shows a looser and more dispersed distribution of linkages, with less connected nodes than in Navidad. Also in Punta de Lobos, two groups or factions with higher internal connectivity can be identified. When considering the sector from which the different nodes come (i.e. their colour), it is clear that in Navidad stakeholders from different sectors have communicated with each other

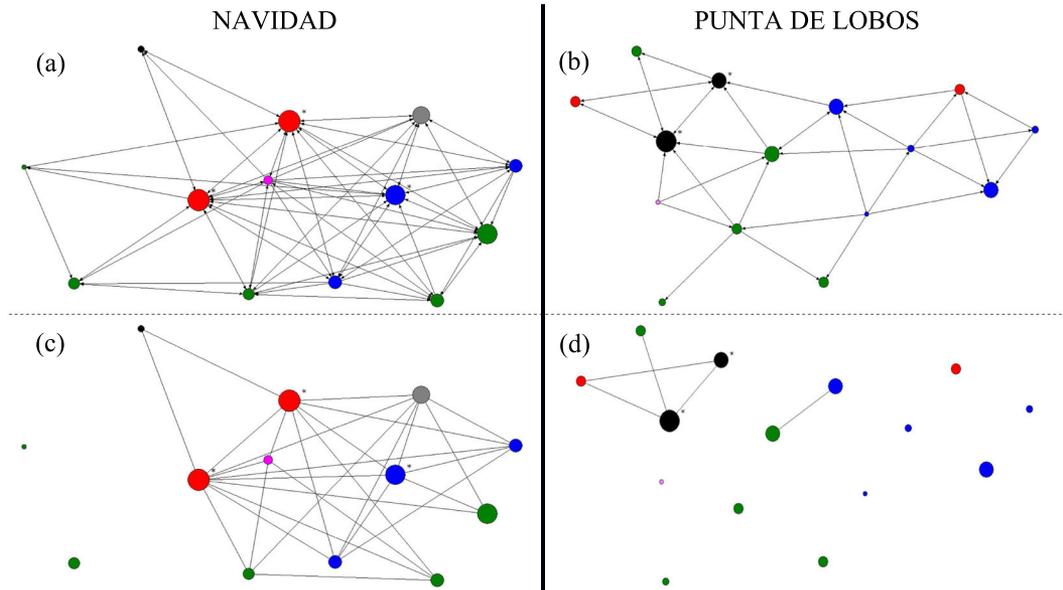


Figure 2. Communication networks with respect to the design, establishment, and administration of marine sanctuaries in Navidad and Punta de Lobos. Grey lines represent communication linkages and the arrows show who nominated whom. In (a) and (b) all linkages measured are shown; in (c) and (d) only reciprocal linkages are shown. Nodes (circles) represent the stakeholders involved in the initiatives and node colour indicates their sector: red = municipal, blue = fishermen organizations, pink = NGOs, black = private and sport organizations, green = government agencies, grey = universities. The size of nodes expresses how many times each stakeholder was nominated by the others, as a proportion of all linkages (e.g. normalized in-degree centrality). Nodes marked with \* are the founders/promoters of the initiatives.

with respect to the conservation initiative. So while Navidad data suggest a multi-sectorial network, Punta de Lobos data suggest network fragmentation associated with sectorial differences. Figures 2(a) and (b) show that government institutions (green nodes), which are common to both initiatives, have different positions in each case. Although these agencies have jurisdiction over both proposed sanctuaries, it can be seen that in the Navidad network all the green nodes are well-connected, with high numbers of linkages with other nodes (Figure 2(a)). In contrast, in Punta de Lobos green nodes are poorly connected with other stakeholders (Figure 2(b)). When only reciprocal linkages of the communication network (Figures 2(c) and (d)) are considered, in Navidad (Figure 2(c)), only a few non-reciprocal linkages disappear and the central core of stakeholders is maintained, with the same principal nodes. Just two government sector nodes are disconnected from the network. Contrastingly, in Punta de Lobos (Figure 2(d)) the network breaks into two small disconnected components together with multiple isolated nodes. Results show that, both in Navidad and Punta de Lobos the nodes with higher centrality are the founder and promoters of the Nt-MPA initiatives. In Navidad these were the Municipality Major, the Coastal Border office and fisher associations. In Punta de Lobos it was the Surf Club and Neighbourhood Association.

The visual analysis of communication networks in Figure 2 is supported by quantitative network measures (Table 3). The number of linkages is substantially greater for Navidad than for Punta de Lobos. Density values, which represent the overall level of linkage among the nodes, show that the network in Navidad is denser (0.55) than in Punta de Lobos (0.17). On average, in Navidad stakeholders have 6.5 linkages, whereas in Punta de Lobos they have only 2.4. Navidad shows higher network centralization (see definition in Table 1) than Punta de Lobos (36.4% and 16.5%, respectively), showing that in the former, linkages are more often concentrated around the most central nodes (see interpretation in Table 1). Levels of reciprocity, namely the extent to which ties in the network are reciprocated, are higher for Navidad (0.57) than for Punta de Lobos (0.16).

*Support network:* The support network measures for Navidad are higher than for Punta de Lobos (Table 3). Density is almost 0 in Punta de Lobos, which implies that in terms of receiving support, these nodes are not connected. In Navidad the density of the support network is 0.37, and the average number of support linkages is 4.4. In terms of centralization levels, Navidad shows a notably more centralized support network

Table 2. Stakeholders' motivations for participating in the no-take marine protected areas initiatives; average importance in a Likert scale from 1 to 5 and standard error in parenthesis, p\* results from Mann–Whitney statistical analysis and Cliff's Delta size effect

Type	Indicator	Navidad	Punta de Lobos	p*	Cliff's Delta
Environmental	Protection of nature	4.8 (0.2)	4.2 (0.4)	0.289	0.256 (small)
	Protection of coast border	4.6 (0.2)	4.1 (0.3)	0.465	0.179 (small)
	Keep beauty and tranquility of the place	4.6 (0.2)	4.1 (0.3)	0.477	0.173 (small)
Economic	Economic development of tourism	4.3 (0.1)	4.0 (0.3)	0.976	0.057 (negligible)
	Increase on marine resources	4.5 (0.2)	3.6 (0.3)	0.068	0.435 (medium)
	Added value to activities and products	4.4 (0.3)	3.9 (0.4)	0.476	0.174 (small)
Social	Local pride	4.5 (0.2)	4.1 (0.3)	0.327	0.237 (small)
	Recreation place for community	4.3 (0.2)	3.9 (0.3)	0.603	0.128 (negligible)
	Mental wealth, relaxation	3.9 (0.2)	3.5 (0.3)	0.496	0.166 (small)
	Opportunity for environmental education	4.9 (0.1)	4.4 (0.3)	0.515	0.160 (small)
	Local empowerment	4.6 (0.2)	4.1 (0.3)	0.412	0.198 (small)

Table 3. Quantitative network measures for Navidad and Punta de Lobos

Network	Measure	Navidad	Punta de Lobos
Communication	N° of Linkages	85	36
	Density	0.55	0.17
	Centralization	36.4%	16.5%
	Reciprocity	0.57	0.16
Support	N° of Linkages	58	4
	Density	0.37	0.01
	Centralization	60.6%	13.2%
	Reciprocity	0.52	0.33
Information	N° of Linkages	53	7
	Density	0.3	0.03
	Centralization	68.2%	8.8%
	Reciprocity	0.6	0

(60.6%) than Punta de Lobos (13.2%). Reciprocity is also higher in Navidad (0.52) than in Punta de Lobos (0.33).

**Information Flow Network:** The information flow network measures (Table 3) show the same overall pattern as the other networks; with number of linkages, density, centralization and reciprocity being higher in Navidad than Punta de Lobos network. Network reciprocity is 0 in Punta de Lobos and 0.6 in Navidad, which is the highest value for this indicator in the three networks analysed.

### Stakeholders' participation

Stakeholders' responses were assessed for their perceived participation in the Nt-MPA initiatives (Figure 3). For Punta de Lobos, the distribution is concentrated in the low participation levels: 50% of Punta de Lobos stakeholders are categorized as "passive participation (imposed)". In Navidad, stakeholders' perception of their participation followed an opposite trend. The majority of the stakeholders felt that they participated actively,

with 25% of responses in the 'institutionalized participation' category, and 60% in the 'functional participation' category.

### Stakeholders' level of satisfaction with the Nt-MPA establishment process

Stakeholders' level of satisfaction with the Nt-MPA establishment process was assessed (Figure 4). Navidad stakeholders' level of satisfaction with the process was significantly higher than that of Punta de Lobos stakeholders in terms of: (a) information about the initiative ( $P < 0.01$ ; size effect = 0.922 (large); power = 0.736), (b) trust ( $P < 0.01$ ; size effect = 0.916 (large); power = 0.731), and (c) communication ( $P < 0.01$ ; size effect = 0.738 (large); power = 0.572) among the stakeholders involved, (d) support relationships with other stakeholders ( $P < 0.01$ ; size effect = 0.898 (large); power = 0.709), and (e) effective participation in the initiative ( $P < 0.01$ ; size effect = 0.755 (large); power = 0.582). Navidad stakeholders' response averages were always above the 'Neither satisfied nor dissatisfied' level, while in contrast the responses of Punta de Lobos stakeholders were concentrated below the indifference line (i.e. 'Neither satisfied nor dissatisfied').

## DISCUSSION

The focus of this study has been on an understudied aspect of marine protected areas, namely the establishment and implementation of bottom-up Nt-MPAs. The two bottom-up Nt-MPA initiatives analysed in this study are influenced by the same national, regional, and local political setting; however,

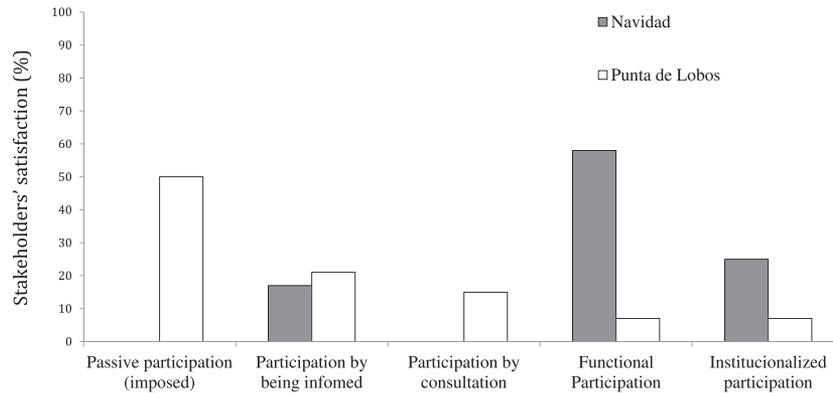


Figure 3. Frequency distribution of stakeholders' perception regarding the type of participation in the initiative of establishing no-take marine protected areas in Navidad and Punta de Lobos. Categories (adapted from Pretty, 1995) are ordered from lower participation (left section of the axis), to higher participation (right section).

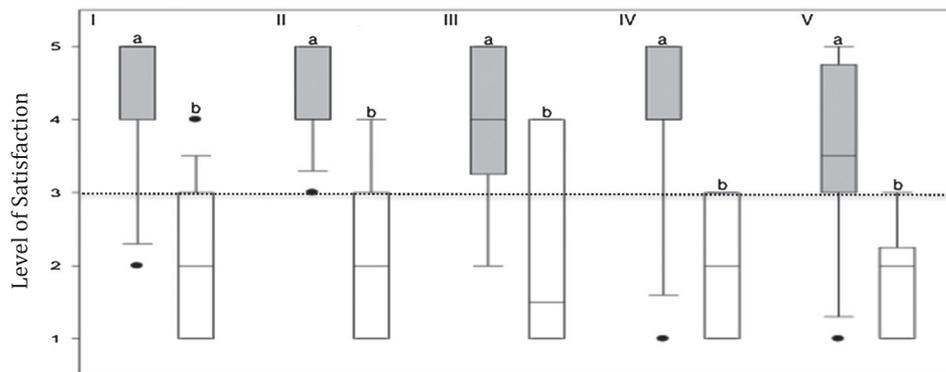


Figure 4. Stakeholders' level of satisfaction with the no-take marine protected areas establishment process in Navidad (grey bars) and Punta de Lobos (white bars) in terms of (I) information about the initiative, (II) trust among stakeholders involved, (III) communication among the stakeholders involved, (IV) support relationships between stakeholders, and (V) participation in the initiative, in a scale from 1 to 5. Letters a and b show significant differences with  $P < 0,001$  in Mann-Whitney statistical analysis. The dotted line in the middle is the 'Neither satisfied nor dissatisfied' level, so the answers above this line show satisfaction and the answers below it show dissatisfaction. Black dots represent outliers.

they have had different outcomes. The Navidad bottom-up Nt-MPA initiative has been recently declared a Marine Sanctuary, while the Punta de Lobos initiative is stalled and lacks a shared view at the local scale. Establishing and consolidating Nt-MPAs demand several collective tasks. These include communication, coordination of actions, mechanisms for solving conflicts, and information sharing (Ostrom, 1990). Given these needs, a minimum organizational structure and the development of trust and reciprocity between stakeholders are needed for bottom-up Nt-MPAs to be successful (Ostrom, 1989, 1990; Gelcich *et al.*, 2009). The process of building these social settings takes time and energy; results show evidence of this process occurring at Navidad but not in Punta de Lobos. In essence, bottom-up partnerships for Nt-MPAs will not emerge

automatically in response to potential benefits. There is a need to address transaction costs associated with differences in participation, communication and engagement at local scales, as one way to support bottom-up Nt-MPAs.

The results show that for Navidad and Punta de Lobos stakeholders, there is a positive attitude and motivation to participate in the Nt-MPAs for all indicators measured. Congruence in motivations to participate in Nt-MPA initiatives has been reported as an important factor that enhances support between stakeholders (Oracion *et al.*, 2005). In both cases stakeholders had positive expectations of the benefits that conservation tools like Nt-MPA may bring to the community and in both cases there were similar economic, social and environmental motivating factors. Klein *et al.*

(2008) pointed out that similar motivating factors are a critical aspect to assure positive future outcomes of MPA initiatives. Despite similarities in what motivated people, the Navidad and Punta de Lobos initiatives have had contrasting outcomes. Thus, the motivations for participating in MPAs represent important enabling conditions, but these are not always enough to achieve the desired outcomes.

Social network analysis helped explore the relational conditions that may explain the differences in outcome for both Nt-MPA initiatives. Communication, trust, and information flows between stakeholders have been identified as important elements in bottom-up management and conservation of natural resources (Crona and Bodin, 2006; Bodin and Crona, 2009; Marin *et al.*, 2012). In fact, the results show contrasting communication, support, and information flow networks, with high density and centralization of linkages in Navidad, where conservation initiatives have consolidated. To better understand the levels of cohesion among a set of stakeholders it is important to analyse how linkages are distributed among the stakeholders involved (Prell, 2011; Sandström, 2011). Results from this present study suggest that the combination between high levels of network density and centralization would help explain more effective mobilization of information and resources within the Navidad network, compared with Punta de Lobos. In both cases the early promoters of the Nt-MPAs played the most central roles in the networks (i.e. showed highest number of linkages); however, it was only in Navidad that a critical density of linkages and flows concerning the conservation initiative was achieved, enabling stakeholders to mobilize and successfully establish the Nt-MPA.

Social network analysis showed there were also important differences between the two Nt-MPA initiatives regarding the level of reciprocity in communication and support between stakeholders. Reciprocity has been pinpointed as an indicator of the stability and institutionalization of stakeholders' positions in social networks (Hanneman and Riddle, 2005). Reciprocal linkages are more desirable in a network because they reflect stronger relations. Hence, not only the presence or absence

of the linkage is important in the consolidation of Nt-MPAs, but above all the quality of the interaction, and how it generates enabling conditions. The importance of reciprocal linkages relies not only on the present outcomes, but also on future management capabilities of Nt-MPAs. Thus, the present state of these networks may determine post-implementation outcomes.

It is interesting to note that government stakeholders, who were represented by the same interviewee in both cases, are connected in different ways in Navidad and Punta de Lobos. In Navidad, government institutions are well embedded in the network, while in Punta de Lobos they are disconnected. Therefore, even within the same institutional setting, government stakeholders play different roles. This suggests that having the basic legal and policy infrastructure is not enough to achieve desired outcomes. What is probably needed is the development of communication, support and trusting relationships between local stakeholders and regional and national authorities. This is in line with other studies that have pointed out that social networks can be more important than formal institutions in the governance of natural resources (Carlsson and Berkes, 2005; Scholz and Wang, 2006). Building social networks that can enable and consolidate Nt-MPA processes entail high transaction costs, and long-term commitment that is based on complex relationships between local stakeholders and government officials.

Participation in Nt-MPA processes tends to promote desired changes by having community members empowered with a sense of ownership (Pollnac and Pomeroy, 2005). Results show dramatic differences in terms of participation. In Punta de Lobos, half of the stakeholders felt that the Nt-MPA idea had been imposed by other stakeholder groups. In this way, although the initiative emerged as a bottom-up process it was perceived as a 'top-down' one. This is an essential point to consider, as NGOs and governments try to trigger bottom-up conservation processes (Christie and White, 2007). In Navidad, the collaborative work aimed at facilitating dialogue and solutions, which led to the establishment and implementation of the Nt-MPA (Gelcich *et al.*, 2011), paved the way for a consolidation

process with 60% of stakeholders perceiving that their participation was functional and active.

Results highlight that even if private incentives and motivations to engage in Nt-MPAs are high, successful establishment and consolidation will not happen spontaneously by stakeholders acting independently (Hodge and McNally, 2000). While international support to designate Punta de Lobos as a World Surfing Reserve could help develop the Nt-MPA initiative, it is critical to consider what investments in increasing communication and trust must be developed before stakeholders can consolidate an Nt-MPA scheme and ensure on-the-ground conservation outcomes.

The formal study of social networks identified key conditions for the establishment of bottom-up Nt-MPA. However, it is important to keep in mind that network measures describe relational patterns at a given point in time, which can either facilitate or hinder certain marine conservation processes and outcomes. Some salient characteristics can be more favourable during some stages of a process than in others. High centralization can be useful and necessary during the establishment phase of a bottom-up Nt-MPA when objectives are clear and action-taking is necessary (Bodin *et al.*, 2006); but increased centralization in a later phase could lead to authoritarian decision making and exclusion. Thus, an important research frontier is to monitor the evolution in time of social network structures and how they relate to the consolidation and long-term sustainability of the Nt-MPAs.

Participatory bottom-up processes for coastal management and conservation are currently being advocated as a solution in many parts of the world (Hind *et al.*, 2010; Macedo *et al.*, 2013). In addition, there are important calls towards having legislation that ensures on-the-ground community participation (Hind *et al.*, 2010; Gelcich, 2014). While this case study has compared two contrasting bottom-up initiatives in Chile, the results go beyond the case studies and can inform agencies and NGOs wanting to support bottom-up marine conservation processes through the establishment of Nt-MPAs. External agents can in fact support these processes by facilitating dialogue and finding solutions (White and Runge,

1995), however, it is important that the type and level of participation, information sharing and trust are considered as the basic enabling conditions for successful bottom-up Nt-MPAs.

## CONCLUSION

The use of mixed methods within a marine conservation setting highlights that for the successful establishment and implementation of bottom-up Nt-MPA initiatives, understanding disparities in participation and communication is a key aspect to be considered. Bottom-up marine conservation approaches are not a panacea and common interests do not necessarily lead to common action (Olson, 1965). Partnerships will not emerge automatically in response to potential benefits. Thus NGOs, managers, and agencies aiming to promote these processes must give special consideration to understand and support establishment and implementation stages, where relations between stakeholders are forged.

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