Ecosystem Services 45 (2020) 101170

Contents lists available at ScienceDirect

Ecosystem Services

journal homepage: www.elsevier.com/locate/ecoser

Marine conservation may not deliver ecosystem services and benefits to all: Insights from Chilean Patagonia

M.J Brain[a,b], L. Nahuelhual[b,c,d,*], S. Gelcich[e], F. Bozzeda[b]

[a] Programa de Magister en Ecología Aplicada, Facultad de Ciencias, Universidad Austral de Chile, Valdivia, Chile
[b] Centro de Investigación en Dinámica de Ecosistemas Marinos de Altas Latitudes (IDEAL), Universidad Austral de Chile, Valdivia, Chile
[c] Instituto de Economía, Facultad de Ciencias Económicas y Administrativas, Universidad Austral de Chile, Valdivia, Chile
[d] Fundación Bariloche, Bariloche, Argentina
[e] Center of Applied Ecology and Sustainability (CAPES) & Centro de Conservación Marina, Pontificia Universidad Católica de Chile, Santiago, Chile

ARTICLE INFO

Keywords:
Marine conservation
Marine governance
Inequality
Marine ecosystem services
Ocean grabbing

ABSTRACT

Gains in biodiversity from marine conservation might not correlate with a fair distribution of benefits, situation that has been narrowly documented. We analyzed how different social actors perceived changes in ecosystem services (ESs) and benefits from marine conservation and explored barriers preventing access to benefits, based on the Marine Protected Area of Multiple Uses (MUMPA) *Almirantazgo Sound* located in the Chilean Patagonia. We applied a semi-structured interview to artisanal fishers, tourism operators, State representatives and researchers (n = 86) and analyzed the data through frequency analysis and Covariance Analysis. Interviewees identified various ESs but prioritized food provision, maintenance of genetic diversity, and information for cognitive development, and among several benefits, they prioritized basic materials for a good life. Fishers were the most dependent on ESs and benefits, (i.e., food provision and employment/nutrition, respectively). Social actors' general perception was that the MUMPA will not change wellbeing homogeneously, which can be explained by specific access barriers, such as reduced fishing entree. Most interviewees, despite personal attributes, recognized tour operators as the main 'winners' of the MUMPA creation and fishers as the main 'losers'. For an inclusive governance, managers face the challenge of 'reshaping' the disparate images actors have on what the MUMPA is and does.

1. Introduction

There are approximately 14,000 Marine Protected Areas (MPAs henceforth) around the world, covering nearly 4.1% of the oceans and 10.2% of coastal areas under national jurisdiction (UNEP-WCMC and IUCN, 2016). Unfortunately, MPAs impacts have not received the attention they deserve and are often assumed positive (Mascia et al., 2010; Selig and Bruno, 2010). Most studies so far have focused on the magnitude of ecological impacts (e.g., Claudet et al., 2010; Lester et al., 2009; Davies et al., 2017), while socioeconomic and cultural aspects, although acknowledged, are misrepresented (Mascia et al., 2010; Yates et al., 2019).

While there is a desire to design conservation areas that are beneficial for the environment and people (i.e., a 'win-win' scenario, Chaigneau and Brown, 2016), conservation initiatives involving multiple parties and limited resources tend to encompass trade-offs as the rule rather than the exception (McShane et al., 2011; Lopes et al., 2015). The ecosystem services (ESs) approach offers a useful framework to assess such trade-offs by allowing to foresee the different factors that may affect provision and distribution of ESs along a service cascade from functions to wellbeing (Daw et al., 2016).

Conservation can produce win–win results; in other cases, it can improve ecosystems health, but with few benefits and even impairment to the wellbeing of the local population (Dowie, 2011; Kamat, 2014; Daw et al., 2016). Trade-offs can occur among ESs, social actors, and values (McShane et al., 2011; Rees et al., 2013; Daw et al., 2015) and may involve 'gains for one ES or group of people, resulting in losses for others' (Daw et al., 2015p. 6950). For instance, conservation initiatives may provide benefits for recreational fishers or tourism operators, but might displace fishers who have traditionally relied upon those areas for their livelihoods (Davies et al., 2018). Changes in local wellbeing and the emergence of inequalities have been reported even under protected areas co-management schemes (Ward et al., 2018).

A main reason for these unwanted distributive outcomes is the change in access that protected areas may entitle, which has a crucial impact on the way users experience ESs and the benefits derived from

* Corresponding author at: Centro IDEAL, Campus Isla Teja, Valdivia, Chile.
E-mail address: lauranahuel@uach.cl (L. Nahuelhual).

https://doi.org/10.1016/j.ecoser.2020.101170
Received 9 July 2019; Received in revised form 16 June 2020; Accepted 29 July 2020
Available online 28 August 2020

them (Daw et al., 2011; Hicks and Cinner, 2014; Ward et al., 2018). Access can be understood as the ability to benefit from something. In turn, access mechanisms can be influenced by formal and informal institutions and structural or relational factors (e.g., technology, markets, knowledge, identity and social relationships) (Ribot and Peluso, 2003; Ward et al., 2018). In essence, when assessing beneficiaries and disadvantaged groups associated to MPAs implementation (Cinner et al., 2014), access barriers to ESs and benefits become a key aspect to be explored. The social, economic, and institutional mechanisms that mediate interactions between people and their environments can create unequal and inefficient share of benefits (Martin et al., 2016; Dawson et al., 2018). Therefore, an increase in ESs supply from conservation does not necessarily translate into benefits received by people (Daw et al., 2011; Hicks and Cinner, 2014).

In this context, capturing social actors' perceptions regarding conservation outcomes is fundamental to build a fuller picture of the impacts of a given MPA as well as its value (Tonin, 2018; Yates et al., 2019). Studies on human perceptions can provide important insights into how local people observe, understand, and interpret the outcomes of conservation, the legitimacy of conservation governance, and the social acceptability of environmental management (Jentoft et al., 2012; Bennett, 2016).

Here, we seek to i) explain how different social actors perceive changes in ESs and benefits arising from marine conservation and ii) explore the barriers that potentially prevent the capture of ESs benefits. We ground our inquiry in the newly created Marine Protected Area of Multiple Uses (henceforth MUMPA) *Almirantazgo Sound*, which is located in the Chilean Patagonia.

As stated by Jentoff et al. (2012 p186) 'it is not the MPA itself and the promises it holds that determine how stakeholders respond; instead, it is the images that they have about what the MPA is and does that determines their reaction'. We assert that understanding the images on a variety of conservation outcomes (e.g., ESs, benefits, wellbeing, access barriers) can help to inform the design of management goals, objectives and performance indicators, which are in tune with social actors' realities (Bennett and Dearden, 2014; Cinner et al., 2014; Pascual et al., 2016).

We structured the paper as follows. Section 2 describes the study area, the research design, and data analysis. Section 3 presents the main results regarding perceptions on ESs, benefits, and access barriers. Finally, section 4 presents the discussion and conclusions.

2. Methods

2.1. Case study

The Almirantazgo Sound is located in the Timaukel Commune, Province of Tierra del Fuego, in the Magallanes region of Chile. Surrounded by big mountains and proglacial areas, this remote zone, isolated from large human settlements, is recognized as a unique and inspiring place by locals and visitors. The proposal of the MUMPA was presented by Wildlife Conservation Society to the Chilean Ministry of the Environment in June 2017, after almost a decade of collaborative research, education and conservation work. It integrated multiple actors in its design and counted with the support of the Regional Government of the Magallanes region, the Ministry of Environment, and the Municipality of Timaukel, among others (https://chile.wcs.org/). It was declared as a MUMPA in 2018 (Supreme Decree D.S. 11/2018, Ministry of Environment, July 2018) and it will protect and area of approximately 76,400 ha (Fig. 1). Its enactment is in line with the country's adherence to the Convention on Biological Diversity (CBD), in fulfillment of the Aichi Targets. Specifically, Target 11 states that 'by 2020, at least […] 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas…' (UNEP/CBD/COP/DEC/X/2).

The activities that take place in the area include the artisanal extraction of benthic resources, predominantly the Patagonian scallop (*Zygochlamys patagonica*) and Southern scallop (*Austrochlamys natans*), and tourism of special interests (Vila et al., 2017). The artisanal fishing of scallops in the region is common to that of other benthic resources and aims at optimizing the extracted biomass based on the time allocated to the activity. It consists of an extraction fleet with shellfish divers equipped with an air compressor or "hooka", a hauling fleet that is in charge of purchasing and transporting the product, mixed fleets that can extract and transport the product, and fishing companies in charge of the purchase and commercialization which, otherwise, are usually the owners of extractive and hauling boats (Guzmán et al., 2010). The official information indicates that in 2019, 137 artisanal fishing boats and 134 artisanal divers were authorized to extract these species in the region (Fishing and Aquaculture Undersecretary, consultation by Transparency Law). Considering that Almirantazgo Sound is one of the main fishing grounds for both species, it is possible to assume that most fishers from the Porvenir and Punta Arenas fleets operate in this area. Given the distance to the fishing grounds (31 and 50 nautical miles away from the area, respectively) (Servicio Hidrográfico y Oceanográfico de la Armada, SHOA, 1997), they stay in the area during the fishing season (5th of February-15th of March of each year). They are connected to international markets since Patagonian scallop and Southern scallop are mostly exported and coexist with small-scale shore collectors who live closest to MUMPA. The socioeconomic profile of these fishers and collectors is variable, though the level of education is basic for the vast majority of them.

The ocean-based tourism activity, mostly oriented to high-income visitors, is highly concentrated in few companies, corresponding to private enterprises that own large cruise ships, being Australis Cruises Company the largest in terms of tourists' landings in the past 20 years (Kirk et al., 2018). With regard to visitors once the MUMPA is implemented, they can be expected to be high-income international and national tourists following the current regional pattern.

The MUMPA was created to support the protection of flagship species such as the Southern elephant seal (*Mirounga leonina*), the Leopard seal (*Hydrurga leptonyx*) and the Black-browed albatross (*Thalassarche melanophris*). At present, its management plan is being elaborated by the Ministry of Environment and Wildlife Conservation Society (WCS) using open standards protocols and methodologies, which include the collection of opinions and interests from the different social actors that converge in the area (CMP, 2013). At the time of this research, the MUMPA managers were elaborating and validating the conceptual framework of the future management plan, through participatory workshops with different stakeholders, most of which are included in this research. During this stage, however, there was a low participation of artisanal fishers and tourism operators.

2.2. Research design

We conducted the research between March and December 2018 following the stages explained below.

2.2.1. Identification of social actors, ESs and NCGL

For the initial identification of social actors, we relied on an actors' map elaborated by the research team in previous years (Project N°15150003, CONICYT).

We selected 13 ESs potentially provided by the MUMPA based the Oceans and Coasts TEEB typology (TEEB, 2010) and previous studies conducted in ecosystems of similar characteristics (e.g., Christie et al., 2015; Hattam et al., 2015). The TEEB typology is among the most well-known classification systems along the Millennium Ecosystem Assessment (MEA) (2005), the Common International Classification of Ecosystem Services (CICES) (Maes et al., 2013) and the EU approach developed by the MAES (Mapping and Assessments of Ecosystem Services)

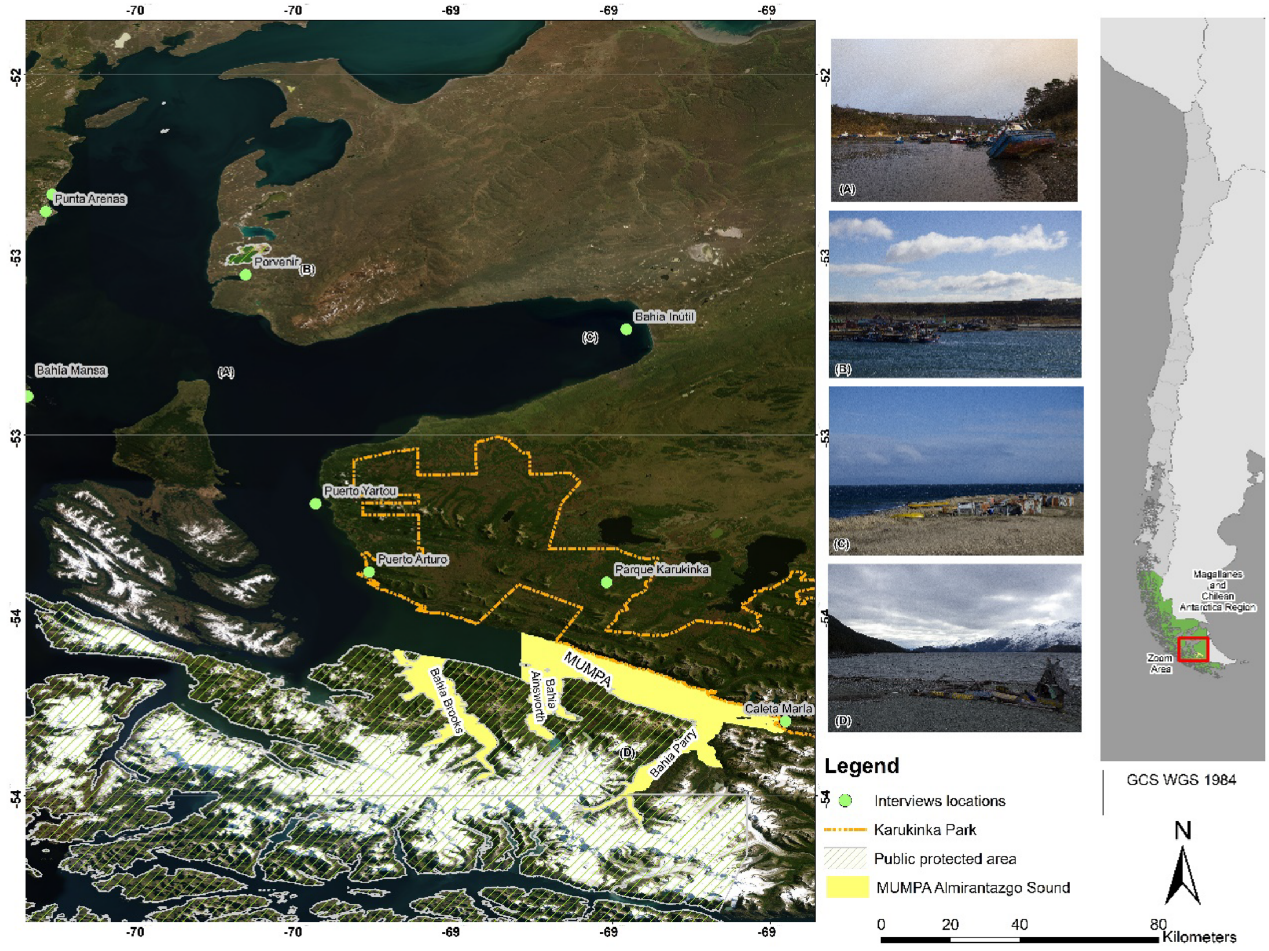

Fig. 1. Location of the MUMPA *Almirantazgo Sound* (in yellow) and interview sites (in green circles). The protected areas bordering the MUMPA are demarcated in orange (private) and light grey (public). Pictures of some of the interview locations are indicated with the letters A to D.

working group (Maes et al., 2014). The TEEB typology, like MEA's and unlike CICES, identifies "habitat services" as a separate group to highlight the importance of habitats as nursing sites for migratory species and as gene-pool "protectors" allowing natural selection processes to maintain the vitality of the gene pool, distinction that is important to our purposes.

We elaborated a preliminary list of potential benefits related to each ES based on MEA (2005) and the literature on MPAs. The final list (Table 1) also included those benefits spontaneously mentioned by the interviewees. Later, for the purposes of the analysis, we combined benefits and 'nature contributions to people' into the concept of 'nature contributions for a good life' (NCGL) from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) framework (Pascual et al., 2017). Thus, the new concept of NCGL encompasses intrinsic, instrumental and relational values, and recognizes those contributions that directly emanate from nature (instrumental), those that do not emanate directly from nature but are derived from people' relationships with it and responsibilities towards it (relational), and those values that are independent from humans (intrinsic) (Table 1). This allowed us to identify most components of the service cascade (Daw et al., 2016) without asking people for too many concepts.

2.2.2. Interview design and application

The interview design relied on published studies, mainly Cárcamo et al. (2014) and Iniesta-Arandia et al. (2014). The instrument comprised the following sections: (i) interviewee's relationship with the study area; (ii) assessment of ESs and benefits provided by the MUMPA; (iii) perception of social actors on the links between ESs provided by the MUMPA and their wellbeing; (iv) expectations regarding the creation of the MUMPA and barriers to access benefits, and; v) socioeconomic characterization of the interviewee (see interview in Supplementary Material, SM 1).

The first and second sections of the interview aimed at exploring the knowledge and familiarity of the respondents with the study area and ESs. We defined ESs in simple terms as contributions of ecosystems to people and provided a list and photos of the 13 ESs potentially provided by the MUMPA. We asked respondents to identify the ESs present in the area and prioritize the three most important ESs for them. After ESs prioritization, we handed respondents a list of potential benefits derived from ESs and asked them to determine their level of dependence on each ES prioritized and its corresponding benefits, using a five-point Likert scale, ranging from 1 'nothing dependent' to 5 'extremely dependent'. The third section aimed at exploring how the implementation of the MUMPA would affect the capture of the ESs potential contributions and the access barriers influencing that capture. This section also included questions regarding the expectations regarding the possible outcomes of the protected area and potential winners and losers. The fourth section collected respondents' personal information, such as education and income level.

We expanded a preliminary list of potential beneficiaries through the 'snowball' technique in order to reach as many people as possible. This type of sampling technique works like a chain reference, where the individuals initially sampled lead to other members of a hidden population (Frank and Snijders, 1994). We reached 86 people, all of them over 18 years of age (legal adulthood in Chile), comprising artisanal

Table 1
List of ESs, benefits and 'nature contributions for a good life' (NCGL) potentially provided by the MUMPA.

Service category (TEEB)	Ecosystem services (TEEB)	Benefits attributed to each ESs (MEA, 2005, literature, and interviewees' own responses	NCGL (MEA + IPBES)	Value type (IPBES)
Provision	Food provision	Nutrition	Basic materials for a good life	Instrumental
		Income		
		Employment		
	Medicinal resources	Use		
		Income		
		Employment		
	Ornamental resources	Use		
Regulation	Moderation of extreme events	Climate change mitigation	Security	Instrumental
		Freshwater reserve	Health	
		Ecosystem benefit	Non direct contribution	
		Employment	Basic materials for a good life	
		Climate moderation in terrestrial areas	Security	
	Waste assimilation	Decrease in adverse health effects	Health	
		Clean place		
	Pest control	No benefits are recognized	-	-
Habitat	Maintenance of life cycles of migratory species	Food chain maintenance	Non direct contribution	Intrinsic
		Employment	Basic materials for a good life	Instrumental
		Wildlife watching	Leisure	Relational
		Potential future use (tourism, research)	Existence value	Instrumental
		Place conservation	Non direct contribution	Intrinsic
	Maintenance of genetic diversity	Species maintenance	Non direct contribution	Intrinsic
		Potential use	Existence value	Instrumental
		Employment	Basic materials for a good life	Instrumental
		Wildlife watching	Leisure	Relational
Cultural	Opportunities for recreation and tourism	Rest	Leisure	Relational
		Wildlife watching		
		Employment	Basic materials for a good life	Instrumental
		Photography	Leisure	Relational
		Cultural recreation (archeology)		
	Aesthetic information	Observation and amazement	Symbolic meaning	
		Inspiration		
		Nature connection	Spiritual value	
		Employment	Basic materials for a good life	Instrumental
		Spiritual wellbeing	Spiritual value	Relational
		Potential use	Existence value	Instrumental
	Sense of place	Identity	Identity	Relational
		Social cohesion	Freedom of choice and action	
		Freedom of expression	Freedom of choice and action	
		Local knowledge	Education	
		Cultural patrimony	Identity	
		Employment (research)	Basic materials for a good life	Instrumental
	Spiritual experience	Spiritual/religious significance	Spiritual value	Relational
		Local identity	Identity	
		Potential use	Existence value	Instrumental
	Information for cognitive development	Learning opportunity	Education	Relational
		Research employment	Basic materials for a good life	Instrumental
		Knowledge for decision making	Education	Relational
		Conservation	Non direct contribution	Intrinsic
		Tourism	Education	Relational

fishers (n = 34), researchers from NGOs and Universities (n = 19), State representatives (n = 14), and tour-operators (n = 19).

We interviewed people in Punta Arenas, Bahía Chilota, Bahía Inútil and Caleta María (see Fig. 1) at their offices or homes, and at shore ranches in the case of fishers.

2.3. Data analysis

Data analysis involved descriptive techniques and modeling techniques that sought to establish associations between socioeconomic variables, the social actor type and there perceptions. For descriptive examination, we relied on frequency analysis to explore responses distribution on i) the ESs prioritized by the different social actors and NCGL (obtained from the identified benefits), using the information from the first and second sections of the interview, ii) the level of dependency on the prioritized ESs and their respective NCGL, iii) the perceived changes in ESs and benefits, and resulting changes in NCGL (increase; decrease; no change) after the MUMPA implementation, and iv) the potential winners and losers of the MUMPA implementation.

For exploring answers' variability, we calculated the index of qualitative variation (IQV; Wilcox, 1967) using the following equation:

$$IQV = \frac{K(10,000 - \sum Pct^2)}{10,000(K-1)} \quad (1)$$

where K is the number of categories in the distribution and $\sum Pct^2$ is the sum of all squared percentages in the distribution. IQV is a measure of variability for nominal variables based on the ratio of the total number of differences in the distribution to the maximum number of possible differences within the same distribution. The index can vary from 0.00 to 1.00. When all the cases in the distribution are in one category, there is no variation (or diversity) and the IQV is 0.00. In contrast, when the cases in the distribution are distributed evenly across the categories, there is maximum variation (or diversity) and the IQV is 1.00. The IQV can also be expressed as a percentage rather than a proportion by simply multiply the IQV by 100. If the IQV is expressed as a percentage, it would reflect the percentage of differences relative to the maximum possible differences in each distribution.

For quantitative analysis of relationships between the prioritized

ESs, NCGL, access barriers, resulting changes in NCGL, and socio-economic characteristics of the respondents we used an Analysis of Covariance (ANCOVA), along univariate F-tests to identify statistically significant relationships, and adjusted (i.e., least-square) group's means to identify the nature of the relationships. We used the ratio of the groups' differences to the scale standard deviations to calculate a standardized size effect and assess the strength of relationships (Rosenthal and Rosnow, 1991). For interpreting size effects, we assumed the following: a ratio equal or inferior to 0.10 indicated a trivial effect, a ratio from 0.10 to 0.30 a small effect, a ratio from 0.30 to 0.50 a moderate effect and a ratio greater than 0.50 a large effect (Cox, 1992; Kamiński et al., 2001).

To characterize the informative contribution of each independent variable, we examined the sum of squares (SS) and Type III values. The Type III SS is generally the best method to interpret results when an interaction is part of the model as it tests for the presence of a main effect after the other main effect and interaction. Type III SS is a good test to evaluate the strength of internal relationships in an unbalanced dataset and in the presence of interactions between non-strong variables (Langsrud, 2003). The lower the F probability corresponding to a given variable, the stronger the impact of the variable on the model. Finally, to visualize the response dynamics related to the perceived barriers, we built a non-metric multi-dimensional scaling (nm-MDS) (Shepard, 1962). Multidimensional scaling (MDS and nmMDS) refers to the general task of assigning the coordinates to a set of objects such that, given a series of dissimilarity, similarity, or ordinal relationships between objects, relationships are described by the distance between points in the graph. Specifically, the non-metric MDS (nmMDS) is an adaptation of the MDS able to operate also on qualitative or semi-quantitative datasets (Shepard, 1980).

3. Results

3.1. Ecosystem services and NCGL identified and prioritized

The majority of respondents identified between nine and 12 ESs from the list of potential services of the MUMPA. Five of the 13 ESs presented (see Table 1) were at least prioritized by one social actor, whereas three ESs were the most frequently prioritized independently from the social actor, namely food provision (f_i, 0.73), maintenance of genetic diversity (f_i, 0.57) and information for cognitive development (f_i, 0.40). The ESs least prioritized were pest control (f_i, 0.00), ornamental resources (f_i, 0.01), and waste assimilation (f_i, 0.03) (see SM 2 with the prioritization of ESs by each group).

As shown in Fig. 2, artisanal fishers prioritized food provision (f_i, 0.94) as the most relevant ESs. State representatives and researchers gave equal priority to food provision (f_i, 0.71 and 0.53, respectively) and maintenance of genetic diversity (f_i, 0.71 and 0.53, respectively). Tour operators prioritized maintenance of genetic diversity (f_i, 0.58), followed by information for cognitive development and food provision (f_i, 0.42).

The ANCOVA analysis (see Table 2) suggested that social actor type, age and education were more critical variables in determining the ESs prioritized; particularly, opportunities for recreation and tourism was significantly determined by education (ratio = 0.773), whereas food provision by social actor type (ratio = 0.656) (see SM 3 for tests on regression assumptions).

Fig. 3 shows that basic materials for a good life, comprising nutrition, income, employment and use as benefits, held the highest frequency in all cases, with the exception of State representatives, who prioritized non-direct contributions (e.g., ecosystem benefits).

Fishers and researchers (f_i, 0.71 and 0.42, respectively) recognized basic materials for a good life as the most important contribution derived from food provision (their prioritized ES). State representatives most frequently recognized non-direct contributions (f_i, 0.71) as the main NCGL derived from maintenance of genetic diversity, whereas tour operators identified basic materials for a good life (f_i, 0.37) as the main contribution from maintenance of genetic diversity (see SM 4 of links between ESs and NCGL).

The lowest frequency of response was attached to more intangible benefits and resulting NCGL, such as freedom of choice and spiritual values. Indeed, health or security were barely mentioned.

3.2. Level of social actor's dependence on prioritized ecosystem services

Dependence on prioritized ESs varied from nothing to extremely dependent (Fig. 4), across social actors. As expected, the highest frequency of responses for very high and extreme dependency appeared in the fishers group with regard to food provision.

Table 3 shows the IQV calculated for each actor responses on ESs dependence. Artisanal fishers showed the highest response variation for all the ESs prioritized (95%, 97% and 99%), whereas researchers showed the lowest variation (58%, 78%, 82%).

3.3. Perception of change in NCGL due to the MUMPA

Perceptions regarding the change in benefits and therefore NCGL varied widely across social actors and prioritized ESs (Fig. 5). Most fishers agreed that the MUMPA would decrease food provision (Fig. 5 a), which contrasted with the other three groups who coincided on its maintenance. For genetic diversity, maintenance was the most frequent answer for three of the social actors' groups, with the exception of researches, for whom increase was the most frequent perception (Fig. 5 b). Finally, information for cognitive development was the only ES for which social actors perceived a possible increase, with the exception of fishers (Fig. 5 c), whose most frequent answer was maintenance of the ES.

Table 4 shows the Index of Qualitative Variation (IQV) calculated for each actor responses on changes in NCGL for each ES prioritized after the implementation of the MUMPA. Artisanal fishers showed the highest response variation for food provision (93%) and information for cognitive development (85%), whereas State representatives showed the highest variation for maintenance of genetic diversity (93%). Researchers and State representatives showed the lowest response variation for information for cognitive development (33% and 42%, respectively).

3.4. Perceived access barriers

Generally, the respondents agreed that the MUMPA could create access barriers (see SM 5 for the list of barriers). Fishers and tour operators most frequently perceived the 'entitlements' as their potential barrier (61.76% and 78.95%, respectively), understood as limited rights to extract resources or as restrictions to enter the area. The researchers perceived 'knowledge' as the major barrier (84.21%), in the sense that a minimum of knowledge or education is needed to access the benefits derived from ESs. State representatives perceived 'closeness to decision makers' as the major barrier (78.57%), for them and other stakeholders to be able to access the benefits.

The non-metric multidimensional scaling (nmMDS) graph (Fig. 6) shows the association between barriers, social actors, and three socio-economic variables (education in green; income in blue; and age in yellow). The arrangement of the socioeconomic characteristics indicates the existence of a socioeconomic gradient. The perceived barriers cross the gradient vertically. The barriers 'knowledge', 'labor opportunity' and 'closeness to decision makers' were perceived most frequently by researchers and State representative with postgraduate education. The 'exclusive markets' barrier was perceived by tour operators, fishers and researchers and, in general, by interviewees with graduate education. The 'entitlements' barrier was perceived by fishers and researchers. The barriers 'economic capital', 'technology' and 'belonging to a social organization' were perceived by tour operators,

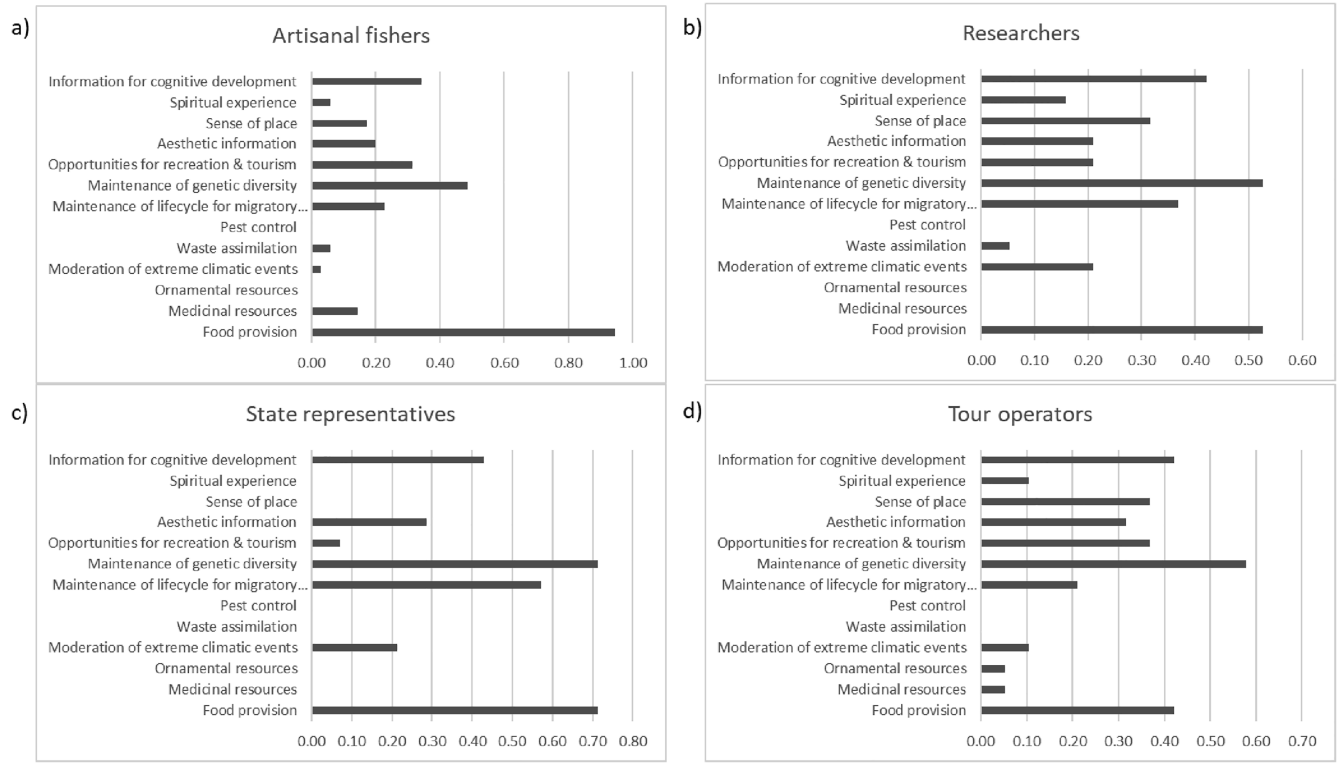

Fig. 2. Ecosystem services prioritized by each group of social actors as indicated by the relative frequency of response: a) Artisanal fishers; b) Researchers; c) State representatives; d) Tour operators.

researchers and State representatives. The perception of barriers did not seem particularly influenced by the socioeconomic variables. However, unexpected and interesting patterns emerged such as the similarity of barriers perception between the most distant age groups (under 30 and over 81) and among the most distant income ranges (very low and very high income). Obviously, the two-dimensional representation cannot show the distance between the factors considered according to the dimensionality of the analysis. However, in Dim 1 a gradient of income and education is highlighted, while in Dim 2 a gradient linked to the considered barriers seems to emerge.

Table 5 shows the results obtained when exploring the association magnitude between variables. Overall, the estimated ANCOVA models and the performed statistical tests showed an average fitting with the recorded observations. This is probably due to the low covariance level of the database. In fact, the adjusted R^2 values ranged from the minimum of 0.027 corresponding to the model on the number of ESs identified by the interviewees, up to a maximum of 0.267 corresponding to the model on mean dependence on prioritized ESs. However, in five out of six models the dependent variables showed a good association (p-value less than 0.05) with the independent variables. Some significant results were found in the case of mean dependence, which was explained by the type of social actor, age and education (ratio = 0.8, 0.51, and 0.7, respectively).

Table 2
ANCOVA results: relations between socioeconomic characteristics of the interviewees and ESs prioritized. Numbers highlighted represent strong associations as indicated by groups' differences/scale standard deviations ratios greater than 0.5.

Prioritized ESs[a]	Social actor type	Residence	Distance to MUMPA	Age	Education	Income	Gender
1	**0.66**	0.00	0	**0.54**	0	0	0
2	0	0.20	0	0.00	0.48	0.27	0
3	0	0.34	0	**0.66**	0.37	0	0.18
4	0	0.00	0	0.21	0.24	0	0
5	0	0.16	0	0.00	**0.61**	0.50	0
6	nd[b]	nd	nd	nd	nd	nd	nd
7	0.25	0.00	0	0.00	**0.57**	0.43	0.21
8	0	0.18	0	0.19	0.31	0	0
9	0.41	0.19	0	0.28	**0.78**	0.50	0
10	0.11	0.00	0	0.24	0	0	0
11	0.36	0.00	0.13	0.00	0.28	0	0.14
12	0	0.19	0	0.00	0.46	0.28	0
13	0	0.00	0.22	0.18	0	0	0.15

[a] 1: Food provision; 2: Medicinal resources; 3: Ornamental resources; 4: Moderation of extreme events; 5: Waste assimilation; 6: Pest control; 7: Maintenance of lifecycle for migratory species; 8: Maintenance of genetic diversity; 9: Opportunities for recreation and tourism; 10: Aesthetic information; 11: Sense of place; 12: Spiritual experience; 13: Information for cognitive development.

[b] nd: non defined, because no one in the sample prioritized this ESs.

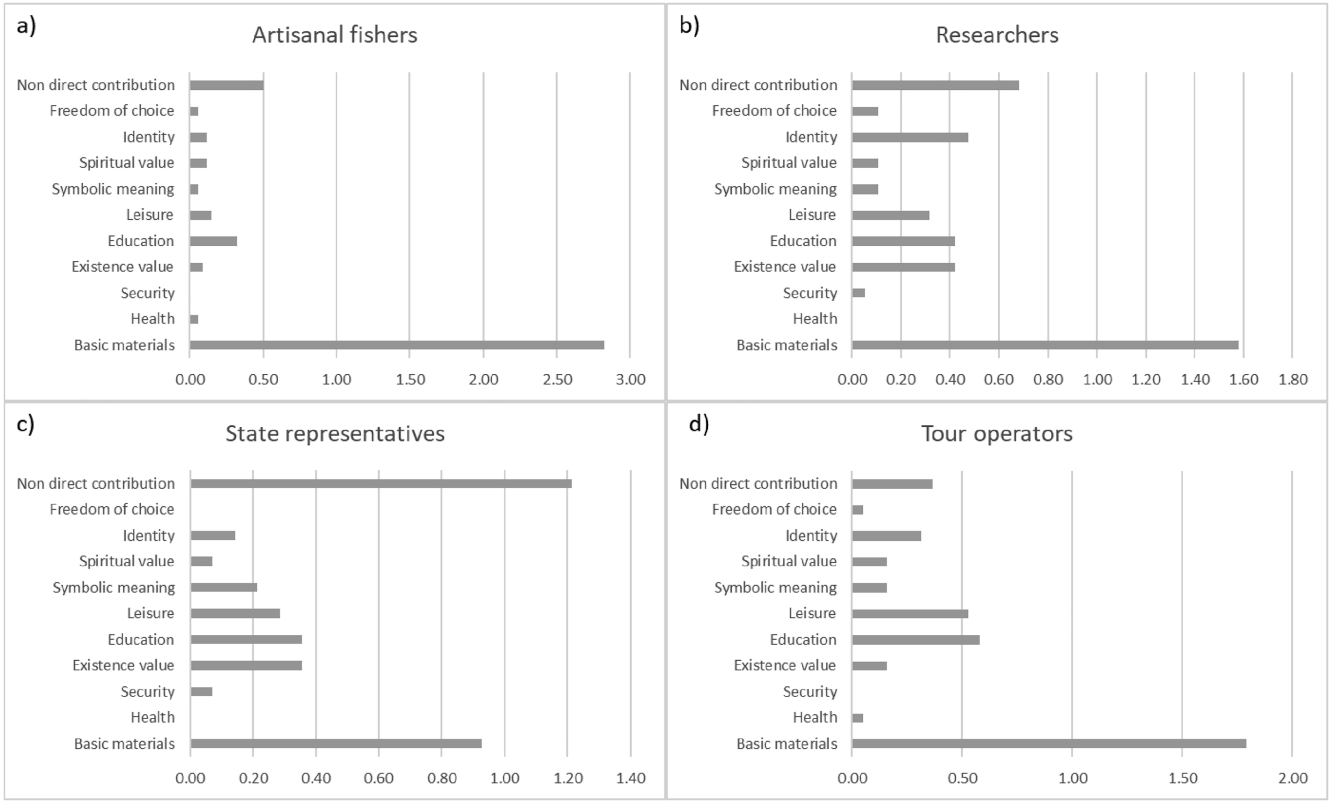

Fig. 3. Nature contributions for a good life (NCGL) identified by each group of social actors as indicated by the relative frequency of response: a) Artisanal fishers; b) Researchers; c) State representatives; d) Tour operators.

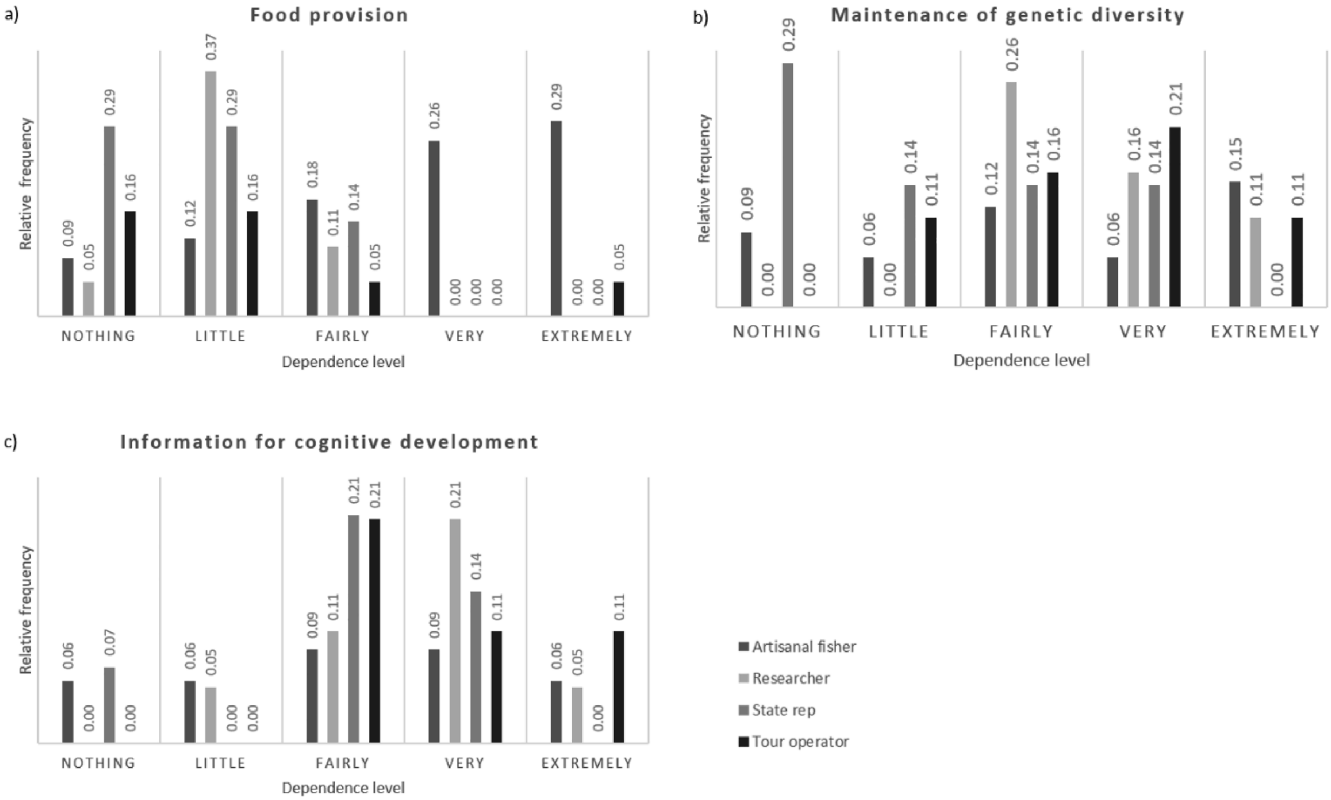

Fig. 4. Dependence level on prioritized ESs for each group of social actors (dark grey: fishers; light grey: researchers; grey: State representatives (rep); black: tour operators) as indicated by the relative frequency of response (Y axis): a) Food provision service; b) Maintenance of genetic diversity service; c) Information for cognitive development.

Table 3
Index of qualitative variation (IQV) for the answers on level of dependence perceived for the services prioritized by each social actor.

ESs prioritized	Social actor type			
	Artisanal fisher	Researcher	State representative	Tour operator
	IQV (%)			
Food provision	95	58	80	86
Maintenance of genetic diversity	97	78	90	91
Information for cognitive development	99	82	76	78

Table 4
Index of qualitative variation (IQV) for the answers on changes in NCGL for each ES prioritized after the implementation of the MUMPA.

ESs prioritized	Social actor type			
	Artisanal fisher	Researcher	State representative	Tour operator
	IQV (%)			
Food provision	93	93	84	89
Maintenance of genetic diversity	81	87	93	69
Information for cognitive development	85	33	42	80

3.5. The primary beneficiaries of MUMPA creation

Half of fishers (50%) saw tourism operators as primary beneficiaries, although 21% saw themselves as beneficiaries as well (Table 6). Researchers had wider perceptions regarding beneficiaries, which included tourist entrepreneurs, universities and future generations. The same was true for State representatives, whose perceptions largely coincided with the previous group. Finally, near half of tour operators (47%) perceived themselves as primary beneficiaries followed by future generations.

4. Discussion and conclusions

Protected areas are currently the primary strategy employed worldwide to maintain ESs and mitigate biodiversity loss (UNEP-WCMC and IUCN, 2016; Maestro et al., 2019), but their impacts on human communities are poorly understood, heavily contested, and largely unaccounted for in MPAs design and management (Humphreys and Clark, 2020). This is partly because performance assessments tend to focus only on ecological outcomes and do not count with the required data to assess causal effects (Jentoft et al., 2012; Gurney et al., 2014). To address these limitations we propose several outcomes (ESs, benefits, NCGL, dependency, access barriers), a range of social perceptions from a representative sample of social actors, and a combination of qualitative and quantitative data analyses to explore perception patterns and causal associations.

Our results corroborate both the potentiality of MPAs to provide ESs and the capacity of social actors to identify a myriad of ESs, but also the narrower prioritization of 'more tangible' services, as previous studies have found both in terrestrial and MPAs (e.g., Ward et al., 2018). The prioritization of ESs was relatively similar across actor groups (see Fig. 2) and was influenced by age, level of education and income, as seen in other studies (Daw et al., 2012; Oteros-Rozas et al., 2014). In particular, people in the 30–65 years range tended to prioritize

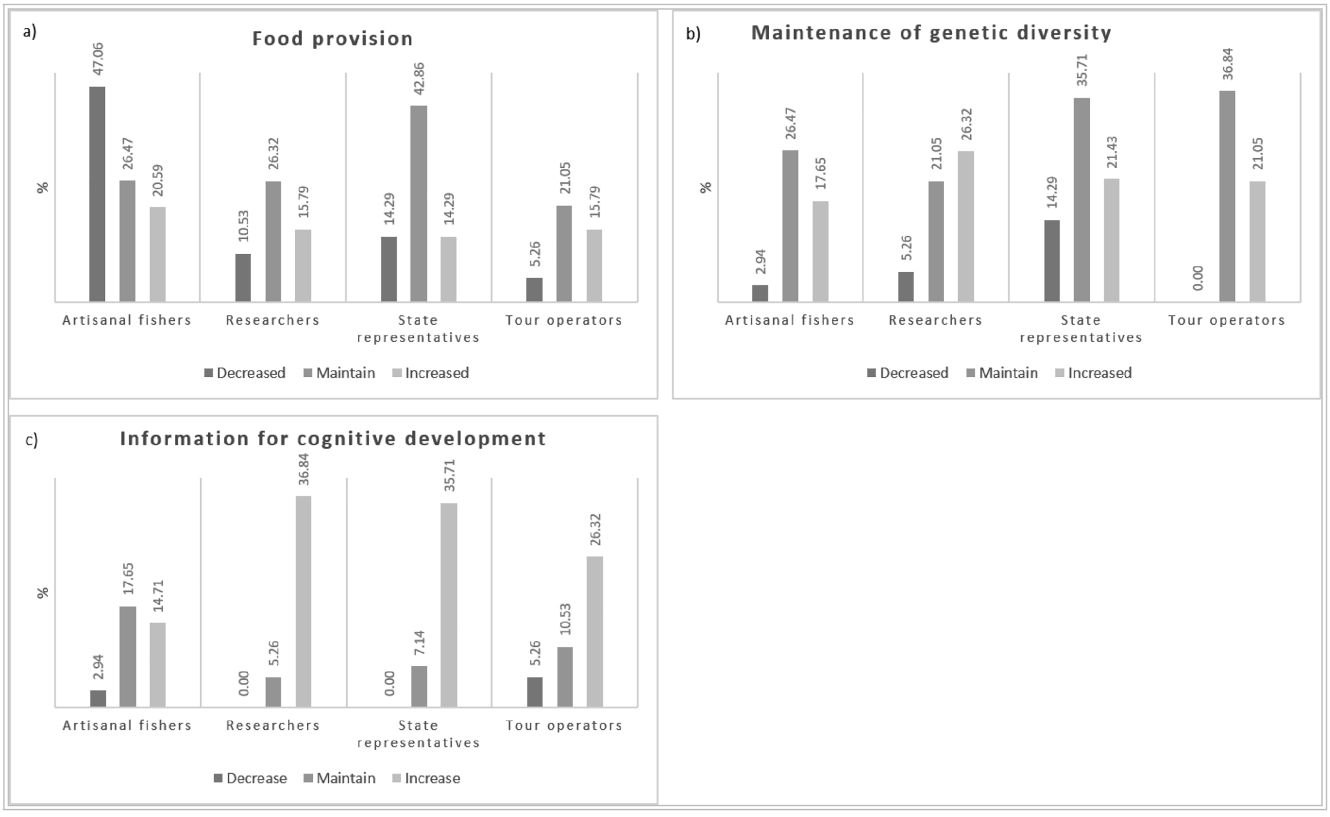

Fig. 5. Perception of change in NCGL for each ES prioritized after the implementation of the MUMPA. Y-axis represents the relative frequency of responses expressed in percentage.

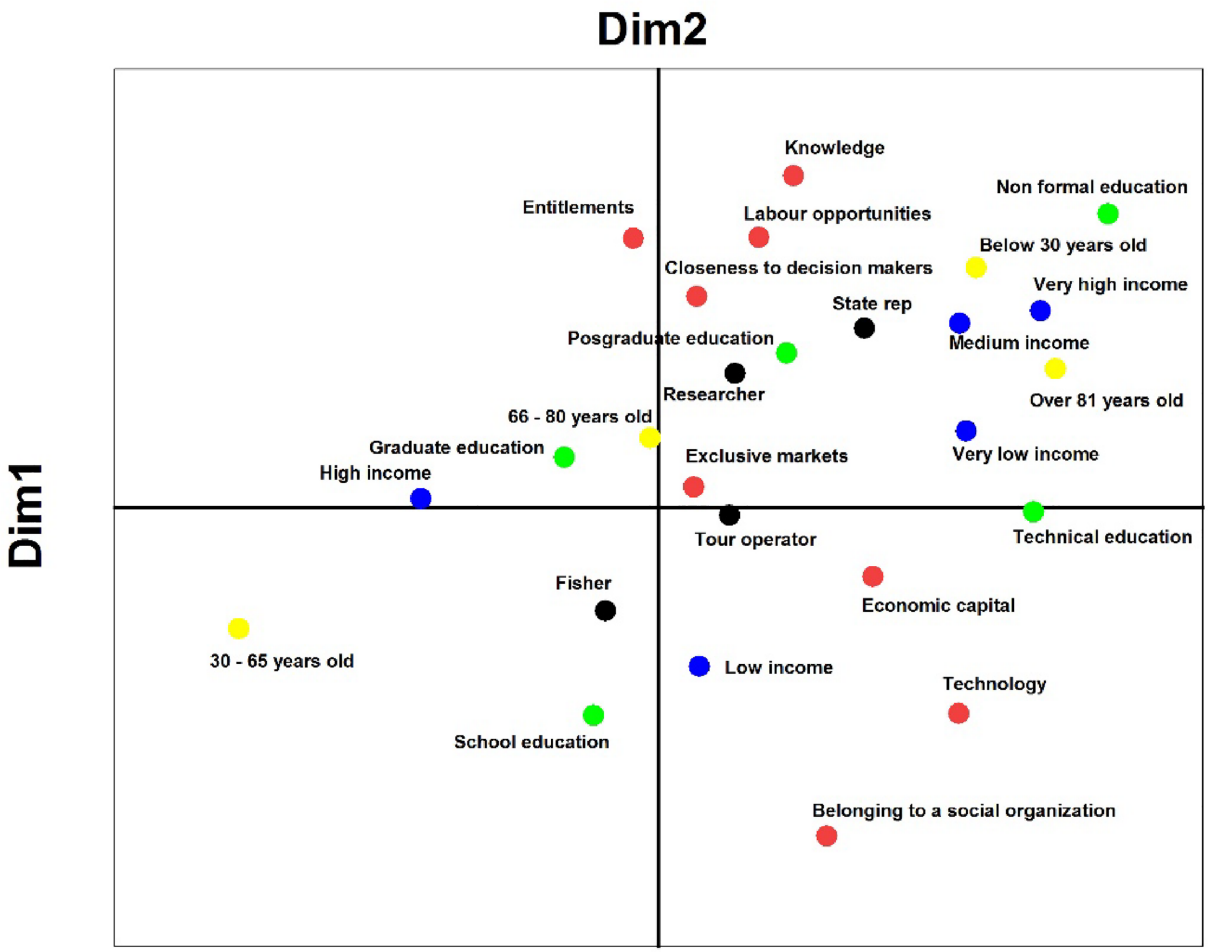

Fig. 6. Non-metric multidimensional scaling (nmNMDS) of the access mechanisms as barriers identified by social actors and socioeconomic variables (age, education and income) visualized in two dimensions (Dim1 and Dim2). The relative closeness of the variable's positions along axis 1 reflects their tendency to be associated. Colors show the different type of variables (red: access barriers; yellow: age; blue: income level; green: education).

provisioning services, which may be related to being active workers who value production activities. Those with higher education level tended to prioritize habitat services, which may be linked to their training as conservation administrators or academics.

The prioritization of food provision, specially by fishers, is in line with previous findings that reveal the higher importance that local actors place on direct use ESs (Kari and Korhonen-Kurki, 2013; Iniesta-Arandia et al., 2014). Provisioning ESs are easier to relate to local economic activities and economic wellbeing (income and employment), as stated by fishers: '[fishing] *is our surviving wage*', *'It is our main economic activity*' (Artisanal fisher, Bahía Mansa, September 2018; F13). Researchers also identified some aspects related to the local economy: '*It is very important [food provision] for a group of artisanal fishers … there are many families involved*' (Researcher, Punta Arenas, September 2018; R21).

The prioritization of maintenance of genetic diversity by all groups (see Fig. 2) is noteworthy. This outcome could be attributed to the exposure of regional social actors to conservation speeches by NGOs and environmental authorities, which is corroborated in statements such as '*The areas of reproduction are especially important for Albatrosses and the Southern elephant* seal' (Researcher, environmentalist NGO, September 2018; R20). As in other countries, NGOs and government conservation agendas are still primarily focused on biological conservation, habitat protection, protection of emblematic species, and heritage preservation (Pelletier et al., 2005; Martín-López et al., 2009; Potts et al., 2014), which continue to be the prevalent ecological indicators to judge conservation success (Andelman and Fagan, 2000). This is also reflected in the way the press media announced the creation of the MUMPA in 2018, highlighting the 'value' of the Almirantazgo Sound as '*A key location for species such as the Southern elephant seal, the Leopard seal and the Black-browed albatross, among others*' (in press Ministry of Environment, Chile, 2018).

Table 5
ANCOVA analysis: relations between socioeconomic characteristics and different perceptions on ESs. Numbers in bold represent a strong association due to high ratio values (> 0.5).

Dependent variables	Social actor	Residence	Distance to area	Age	Education	Income	Gender
Total ESs recognized	0	0	0	0	0	0.38	0.025
Total NCGL recognized	0.30	0	0	0.13	0	0	0
Mean dependence on ESs prioritized	**0.8**	0	0	**0.51**	**0.7**	0	0.25
Change in NCGL after MUMPA	0.25	0	0	0.24	0	0	0
N° of barriers identified	0.35	0	0	0	0	0	0

Table 6
First ranked beneficiaries perceived by respondents in each social actor group after the implementation of the MUMPA Almirantazgo Sound. Relative frequencies of the responses are expressed as a percentage. The gradient of grays reflects the magnitude of responses; from light gray (lower frequency of responses) to dark gray (higher frequency of responses).

Main potential beneficiary	Social actors' perception on major beneficiaries of MUMPA			
	Artisanal fishers	Researchers	State representatives	Tour operators
No beneficiaries	3	0	0	0
Artisanal fishers	21	16	21	5
Industrial fishers	3	0	0	0
Indigenous communities	6	5	0	0
Tourist entrepreneurs	50	26	14	47
Universities and research centers	6	21	21	16
Local economy	0	5	7	0
Future generations	0	16	21	21
Public services	0	0	7	5
Municipalities	6	0	0	0
NGOs	0	11	7	5
Big investors	6	0	0	0

Despite the fact that we did not find strong associations between the number of NCGL and socioeconomic variables (see Table 4), the results clearly show that most interviewees point at 'basic materials for a good life' as the main NCGL provided by the MUMPA (see Fig. 3), comprising income, employment nutrition and direct use. On the contrary, the least ranked contributions were those more intangible, such as freedom of choice and spiritual values. These findings corroborate the direction and strength of the relations between ESs and human wellbeing depicted in conceptual frameworks such as Millennium Ecosystem Assessment (2005), where provision services have the strongest links to most wellbeing components, whereas cultural ESs have the weakest. While intangible aspects of nature (e.g., cultural ESs) have been promoted as an important argument for conservation, in practice humans tend to recognize and value those services and benefits more directly observed and experienced (through direct use), as the environmentalist paradox suggests (Raudsepp-Hearne et al., 2010).

As expected, the level of dependency on ES and their derived benefits was highly determined by type of stakeholder and occupation and it seems to be influenced by a higher permanence in the area. Thus, fishers were the most dependent group since some of their main fishing sites are located within the MUMPA borders: '*The scallop is the only resource that can be extracted in summer*; '*We do not know what will happen, but if there is strict protection, the current identity of the place will disappear*' (Artisanal fisher, Bahía Santa María, October 2018; F14). The mention of 'identity' by fishers corroborates that cultural ES and intangible NCGL are also important as a source of individual and relational values.

The higher dependence on ESs and benefits may explain, in part, the more pessimistic view of fishers regarding the future of fishing and food provision in the MUMPA (Fig. 4). This perception contrasts with the optimistic expectations of State representatives regarding all ESs, standpoint that can be explained by the degree of involvement they have in the design and management of the MUMPA. Likewise, tourism operators know from experience that the implementation of a MUMPA of such scenic characteristics and biodiversity components, can benefit them, given the tourist attractions that become available (e.g., sighting of particular fauna like the Southern elephant seal). Instead, the development of local tourism initiatives is difficult or even unfeasible given the size and remoteness of the MUMPA, as stated by some fishers: '*To be able to develop tourism I would have to make a very large investment, to increase the size of my boat*' (Artisanal fisher, Bahía Chilota, October 2018; F27). Instead, in MPAs with easier access, fishers can aspire to diversify their income through tourism activities such as tours (Lopes et al., 2015), without incurring major investments. This finding is in line with the observation that MPAs and MPAs networks have not been selected based on the contribution that ESs can make in supporting societal benefits (Potts et al., 2014).

In part, the general perceptions can be related to the access barriers that social actors perceive that could arise with the implementation of the MUMPA. The barrier 'entitlements' identified in a larger proportion by fishers, is directly related to effects that have been observed after the creation of MPAs elsewhere (Mascia and Claus, 2009). As one fisher stated: '*The ecosystem service [food provision] will increase, because scallop extraction quotas will be set, but my benefits will decrease*' (Artisanal fisher, Bahía Chilota, October 2018; F32). On the contrary, people with privileged information, higher education, and/or specialized training can more easily find labor opportunities, which reflects that the benefits derived from a given ES are context dependent (Lopes et al., 2015; Villasante et al., 2016).

The results reflect an interaction between what the MUMPA is and what it promises, and the images that stakeholders have about what MUMPA is and does (Jentoft et al., 2012). Images, in this case, are representations (of an issue or the world) people draw from when they determine what to think about the MPAs, and therefore, the more diverse the images, the greater the governability challenge (Jentoft et al., 2012).

Some of the images closely reflect what the MUMPA is and promotes (the governing system)— e.g., a unique place. However, images diversify when it comes to the 'system to be governed' and the 'governing interactions' (outcomes). Artisanal fishers see the current system (Almirantazgo Sound as they knew it before the MUMPA) as one that supports fishing on which they depend directly and one holding sense of place and relational values. However, their images about the outcomes of the MUMPA are pessimistic: '*My benefits in relation to the provision service and the sense of identity will decrease because there will be strict control to enter the area*'; '*it will not reduce conflicts between users, it will create them*' (Artisanal fisher, Bahía Mansa, September 2018; F13). Tour operators see the system as a very attractive one that serves to diversify their tourism destination options; however, they do not depend on the MUMPA, since there are other protected areas that can provide similar opportunities for them. State representatives see the actual system as one that contributes to the local economy, recognizing the historic extraction of food resources in the area and the need to regulate uses; they are generally optimistic about MUMPA outcomes, which they see as an opportunity for accessing scientific information that can support fisheries management and as an opportunity to develop tourism. For researchers, the MUMPA will offer great opportunities for research: '*It is a natural laboratory available and that needs to be studied*' (Researcher, Punta Arenas, October 2018; R18).

Whereas dissimilar images are an essential part of democratic systems, MPAs governance faces the challenge of bringing them closer, clarifying them, or changing them for the better. To favor this transition, conservation managers need to undertake the following issues:

a) Understanding the social constructs that generate those images (Stepp et al., 2003; Teh and The, 2011). In the case at hand is relevant, for example, to understand why fishers picture themselves as losers. Reasons might be subjective and rooted in the fact that marine policies have usually deprived them from fishing rights, or objective, as long as the MUMPA establishes real restrictions (fishing zones, closures, and higher surveillance). Indeed, a growing amount of research identifies the notion of "ocean grabbing": the contested characteristic of MPAs as places where marine conservation actions can deprive small-scale fishers of resources, and/or undermine access to areas that have been historically important to local communities (Bennett et al., 2015). In this sense, transparency is essential to provide information and create confidence. This is particularly sensitive in the Chilean Patagonia where conservation initiatives have been associated with eco-extractivism or

eco-colonization practices (Núñez et al., 2019).

b) Clarifying confounding images (e.g., MUMPA as a barrier versus an opportunity), for which is crucial to create spaces for exchange, promote participation, and to ensure an equal representation of all actors in the governing body. Interaction allows adjusting the images over time, since images are not necessarily stable but are generally subject to change, and may evolve as social actors become engaged in the discussion (Jentoft et al., 2012). A mounting research corroborates that conservation is more effective if it includes local communities and other stakeholders (bottom up approach) affected by the management process and its impacts (Tonin, 2018; Thiao et al., 2019). Yet, this has proven particularly challenging in the case of the MUMPA, where fishers are the great absentees (Vila et al., 2017) and therefore the odds to change their perceptions are reduced.

c) Bridging images through the incorporation of new languages. The concepts of ESs, benefits, NCGL and values can be used as 'boundary objects' to 'converse and conserve' but mainstreaming these approaches into planning requires managers to move beyond traditional conservation features (e.g. habitats) and explicitly recognize that conservation is about people as much as it is about species or ecosystems (McKinley et al., 2019; Humphreys and Clark, 2020). In the case at hand, bridging extreme images together (e.g., winners versus losers) implies concrete actions towards improving benefit distribution, this is removing or preventing access barriers from arising, a matter that is never anticipated in management plans and usually neglected. Recently, a 'code of conduct' for marine conservation has been proposed (Bennett et al., 2017) which, among several other social standards, highlights the need to ensure social wellbeing and equitable distribution of benefits. However, at present, most MPAs in Chile do not yet pass the 'test of conduct'.

Fulfilling international standards and goals regarding conservation is not just about having a percentage of ocean under protection (as celebrated by Chilean latest governments with regard to SDG 14). It is also about the way in which those goals are achieved: democratically or hierarchically; fairly or consolidating historical inequalities; including social–ecological wellbeing into conservation principles or perpetuating models of biological conservation focused on iconic species alone.

According to our findings, we can conclude that the MUMPA mobilizes disparate images regarding changes and distribution of ESs, benefits and NCGL. Managers face the task to reconcile these images and implement the mechanisms that will allow a fair distribution of benefits among all once the area is implemented, as the highest conservation standards demand. Otherwise, the MUMPA risks widening the historical inequalities that have characterized Chile for decades. We expect these results can contribute to this discussion at a critical moment when the creation of MPAs is both celebrated and contested, and it is at the center of intense disputes on how to achieve marine protection targets and, at the same time, recognize local and indigenous rights to the sea (Araos et al., 2020; Hiriart-Bertrand et al., 2020). This is particularly important in the context of the current social unrest the country, where inequality and inequity are the main reasons of the October-2019 social outbreak.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This research was funded by FONDAP Grant N° 15150003. We thank Ximena Vergara and Gonzalo Campos for their assistance in interview application and figures preparation, and Sergio Estay for his valuable comments on data analysis.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ecoser.2020.101170.

References

Andelman, S.J., Fagan, W.F., 2000. Umbrellas and flagships: Efficient conservation surrogates or expensive mistakes? Proc. Natl. Acad. Sci. 97 (11), 5954–5959.
Araos, F., Anbleyth-Evans, J., Riquelme, W., Hidalgo, C., Brañas, F., Catalán, E., Diestre, F., 2020. Marine indigenous areas: conservation assemblages for sustainability in southern chile. Coastal Manage. 1–19.
Bennett, N.J., Dearden, P., 2014. Why local people do not support conservation: community perceptions of marine protected area livelihood impacts, governance and management in Thailand. Marine Policy 44, 107–116.
Bennett, N.J., Govan, H., Satterfield, T., 2015. Ocean grabbing. Marine Policy 57, 61–68.
Bennett, N.J., 2016. Using perceptions as evidence to improve conservation and environmental management. Conserv. Biol. 30 (3), 582–592.
Bennett, N.J., Teh, L., Ota, Y., Christie, P., Ayers, A., Day, J.C., Franks, P., Gill, D., Gruby, R.L., Kittinger, J.N., Koehn, J.Z., 2017. An appeal for a code of conduct for marine conservation. Marine Policy 81, 411–418.
Cárcamo, P.F., Garay-Flühmann, R., Squeo, F.A., Gaymer, C.F., 2014. Using stakeholders' perspective of ecosystem services and biodiversity features to plan a marine protected area. Environ. Sci. Policy 40, 116–131.
Chaigneau, T., Brown, K., 2016. Challenging the win-win discourse on conservation and development: analyzing support for marine protected areas. Ecol. Soc. https://doi.org/10.5751/ES-08204-210136.
Christie, M., Remoundou, K., Siwicka, E., Wainwright, W., 2015. Valuing marine and coastal ecosystem service benefits: Case study of St Vincent and the Grenadines' proposed marine protected areas. Ecosyst. Serv. 11, 115–127. https://doi.org/10.1016/j.ecoser.2014.10.002.
Cinner, J.E., Daw, T., Huchery, C., Thoya, P., Wamukota, A., Cedras, M., Abunge, C., 2014. Winners and losers in marine conservation: fishers' displacement and livelihood benefits from marine reserves. Soc. Nat. Resour. 27 (9), 994–1005.
Claudet, J., Osenberg, C.W., Domenici, P., Badalamenti, F., Milazzo, M., Falcón, J.M., Bertocci, I., Benedetti-Cecchi, L., García-Charton, J.A., Goñi, R., Borg, J.A., 2010. Marine reserves: fish life history and ecological traits matter. Ecol. Appl. 20 (3), 830–839.
Conservation Measures Partnership (CMP). 2013. Open Standards for the Practice of Conservation Version 3.0 / April 2013. [Accessed: May 25th 2019.] Available online:.] http://cmp-openstandards.org/wp- content/uploads/2014/03/CMP-OS-V3-0-Final.pdf.
Cox, D.R., 1992. Causality: some statistical aspects. J. R. Stat. Soc.: Ser. A (Statistics in Society) 155 (2), 291–301.
Davies, T.E., Maxwell, S.M., Kaschner, K., Garilao, C., Ban, N.C., 2017. Large marine protected areas represent biodiversity now and under climate change. Sci. Rep. 7 (1), 9569.
Davies, T.E., Epstein, G., Aguilera, S.E., Brooks, C.M., Cox, M., Evans, L.S., Ban, N.C., 2018. Assessing trade-offs in large marine protected areas. PLoS ONE 13 (4), e0195760.
Daw, T., Brown, K., Rosendo, S., Pomeroy, R., 2011. Applying the ecosystem services concept to poverty alleviation: the need to disaggregate human well-being. Environ. Conserv. 38, 370–379.
Daw, T.M., Cinner, J.E., McClanahan, T.R., Brown, K., Stead, S.M., Graham, N.A., Maina, J., 2012. To fish or not to fish: factors at multiple scales affecting artisanal fishers' readiness to exit a declining fishery. PLoS ONE 7 (2), e31460.
Daw, T.M., Coulthard, S., Cheung, W.W., Brown, K., Abunge, C., Galafassi, D., Peterson, G.D., McClanahan, T.R., Omukoto, J.O., Munyi, L., 2015. Evaluating taboo trade-offs in ecosystems services and human well-being. Proc. Natl. Acad. Sci. 112 (22), 6949–6954.
Daw, T.M., Hicks, C.C., Brown, K., Chaigneau, T., Januchowski-Hartley, F.A., Cheung, W.W., Perry, C., 2016. Elasticity in ecosystem services: exploring the variable relationship between ecosystems and human well-being. Ecol. Soc. 21 (2).
Dawson, N., Martin, A., Danielsen, F., 2018. Assessing equity in protected area governance: approaches to promote just and effective conservation. Conserv. Lett. 11 (2), e12388.
Dowie, M., 2011. Conservation refugees: the hundred-year conflict between global conservation and native peoples. MIT Press, Cambridge, Massachusetts, USA.
Frank, O., Snijders, T., 1994. Estimating the size of hidden populations using snowball sampling. J. Off. Stat. 10 (1), 53–67.
Gurney, G.G., Cinner, J., Ban, N.C., Pressey, R.L., Pollnac, R., Campbell, S.J., Tasidjawa, S., Setiawan, F., 2014. Poverty and protected areas: an evaluation of a marine integrated conservation and development project in Indonesia. Global Environ. Change 26, 98–107.
Guzmán, L., Daza, E., Vargas, C., Leal, E., Vargas, C., Castillo, V., Bazán, V., Bucarey, D. and Lara, E., 2010. Evaluación de bancos de ostión del sur (Chlamys vitrea) en seno de Almirantazgo y canal Beagle, Región de Magallanes y Antártica Chilena. Informe Final Corregido. FIP N°2008-28. 144 pp.
Hattam, C., Atkins, J.P., Beaumont, N., Börger, T., Böhnke-Henrichs, A., Burdon, D., Sastre, S., 2015. Marine ecosystem services: linking indicators to their classification. Ecol. Ind. 49, 61–75.
Hicks, C.C., Cinner, J.E., 2014. Social, institutional, and knowledge mechanisms mediate diverse ecosystem service benefits from coral reefs. Proc. Natl. Acad. Sci. 111 (50), 17791–17796.

Hiriart-Bertrand, L., Silva, J.A., Gelcich, S., 2020. Challenges and opportunities of implementing the marine and coastal areas for indigenous peoples policy in Chile. Ocean Coast. Manag. 193, 105233.
Humphreys, J., Clark, R., 2020. Some consequences of policy instabilities for marine protected area management. In: Humphreys, H., Clark, R. (Eds.), Marine Protected Areas. Elsevier, Sience, Policy and Management, pp. 149–156.
Iniesta-Arandia, I., García-Llorente, M., Aguilera, P.A., Montes, C., Martín-López, B., 2014. Socio-cultural valuation of ecosystem services: uncovering the links between values, drivers of change, and human well-being. Ecol. Econ. 108, 36–48.
Jentoft, S., Pascual-Fernandez, J.J., De la Cruz Modino, R., Gonzalez-Ramallal, M., Chuenpagdee, R., 2012. What stakeholders think about marine protected areas: case studies from Spain. Human Ecology 40 (2), 185–197.
Kamat, V., 2014. " The Ocean is our Farm": Marine Conservation, Food Insecurity, and Social Suffering in Southeastern Tanzania. Human Organization 73 (3), 289–298.
Kamiński, M., Ding, M., Truccolo, W.A., Bressler, S.L., 2001. Evaluating causal relations in neural systems: Granger causality, directed transfer function and statistical assessment of significance. Biol. Cybern. 85 (2), 145–157.
Kari, S., Korhonen-Kurki, K., 2013. Framing local outcomes of biodiversity conservation through ecosystem services: a case study from Ranomafana, Madagascar. Ecosyst. Serv. 3, e32–e39.
Kirk, C., Rozzi, R., Gelcich, S., 2018. El turismo como una herramienta para la conservación del elefante marino del sur (mirounga leonina) y sus habitats en tierra del fuego, reserva de la biosfera cabo de hornos. Chile. Magallania (Punta Arenas) 46 (1), 65–78.
Langsrud, O., 2003. ANOVA for unbalanced data: use Type II instead of Type III sums of squares. Stat. Comput. 13 (2), 163–167.
Lester, S.E., Halpern, B.S., Grorud-Colvert, K., Lubchenco, J., Ruttenberg, B.I., Gaines, S.D., Airamé, S., Warner, R.R., 2009. Biological effects within no-take marine reserves: a global synthesis. Mar. Ecol. Prog. Ser. 384, 33–46.
Lopes, P.F., Pacheco, S., Clauzet, M., Silvano, R.A., Begossi, A., 2015. Fisheries, tourism, and marine protected areas: Conflicting or synergistic interactions? Ecosyst. Serv. 16, 333–340.
Maes, J., Teller, A., Erhard, M., Liquete, C., Braat, L., Berry, P., ... and Paracchini, M. L. 2013. Mapping and Assessment of Ecosystems and their Services. An analytical framework for ecosystem assessments under action, 5, 1-58.
Maes, et al., 2014. Indicators for mapping ecosystem services – 2nd MAES Working Paper. European Union. https://doi.org/10.2779/75203.
Maestro, M., Pérez-Cayeiro, M.L., Chica-Ruiz, J.A., Reyes, H., 2019. Marine protected areas in the 21st century: Current situation and trends. Ocean Coast. Manag. 171, 28–36.
Martín-López, B., Montes, C., Ramírez, L., Benayas, J., 2009. What drives policy decision-making related to species conservation? Biol. Conserv. 142 (7), 1370–1380.
Martin, A., Coolsaet, B., Corbera, E., Dawson, N.M., Fraser, J.A., Lehmann, I., Rodriguez, I., 2016. Justice and conservation: the need to incorporate recognition. Biol. Conserv. 197, 254–261.
Mascia, M.B., Claus, C.A., 2009. A property rights approach to understanding human displacement from protected areas: the case of marine protected areas. Conserv. Biol. 23, 16–23.
Mascia, M.B., Claus, C.A., Naidoo, R., 2010. Impacts of marine protected areas on fishing communities. Conserv. Biol. 24, 1424–1429.
McKinley, E., Pagès, J.F., Wyles, K.J., Beaumont, N., 2019. Ecosystem services: a bridge or barrier for UK marine stakeholders? Ecosyst. Serv. 37, 100922. https://doi.org/10.1016/j.ecoser.2019.100922.
McShane, T.O., Hirsch, P.D., Trung, T.C., Songorwa, A.N., Kinzig, A., Monteferri, B., et al., 2011. Hard choices: Making trade-offs between biodiversity conservation and human well-being. Biol. Conserv. 144 (3), 966–972.
Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-being: Synthesis. Island Press.
Núñez, A., Aliste, E., Bello, A., Astaburuaga, J.P., 2019. Eco-extractivismo y los discursos de la naturaleza en Patagonia-Aysén: nuevos imaginarios geográficos y renovados procesos de control territorial. Revista Austral de Ciencias Sociales 35, 133–153.
Oteros-Rozas, E., Martín-López, B., González, J.A., Plieninger, T., López, C.A., Montes, C., 2014. Socio-cultural valuation of ecosystem services in a transhumance social-ecological network. Reg. Environ. Change 14 (4), 1269–1289.
Pascual, M., Rossetto, M., Ojea, E., Milchakova, N., Giakoumi, S., Kark, S., Melia, P., 2016. Socioeconomic impacts of marine protected areas in the Mediterranean and Black Seas. Ocean Coast. Manag. 133, 1–10.
Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., Maris, V., 2017. Valuing nature's contributions to people: the IPBES approach. Curr. Opin. Environ. Sustainability 26, 7–16.
Pelletier, D., García-Charton, J.A., Ferraris, J., David, G., Thébaud, O., Letourneur, Y., Claudet, J., Amand, M., Kulbicki, M., Galzin, R., 2005. Designing indicators for assessing the effects of marine protected areas on coral reef ecosystems: a multidisciplinary standpoint. Aquat. Living Resour. 18 (1), 15–33.
Potts, T., Burdon, D., Jackson, E., Atkins, J., Saunders, J., Hastings, E., Langmead, O., 2014. Do marine protected areas deliver flows of ecosystem services to support human welfare? Marine Policy 44, 139–148.
Raudsepp-Hearne, C., Peterson, G.D., Tengö, M., Bennett, E.M., Holland, T., Benessaiah, K., MacDonald, G.K., Pfeifer, L., 2010. Untangling the environmentalist's paradox: why is human well-being increasing as ecosystem services degrade? Bioscience 60 (8), 576–589.
Rees, S.E., Attrill, M.J., Austen, M.C., Mangi, S.C., Rodwell, L.D., 2013. A thematic cost-benefit analysis of a marine protected area. J. Environ. Manage. 114, 476–485.
Ribot, J.C., Peluso, N.L., 2003. A theory of access. Rural sociology 68 (2), 153–181.
Rosenthal, R., Rosnow, R.L., 1991. Essentials of behavioral research: Methods and data analysis Vol. 2 McGraw-Hill, New York.
Selig, E.R., Bruno, J.F., 2010. A global analysis of the effectiveness of marine protected areas in preventing coral loss. PLoS ONE 5 (2), e9278.
Servicio Hidrográfico y Oceanográfico de la Armada de Chile (SHOA). 1997. Tablas de distancia. 4ta edición, actualizada al 2008.
Shepard, R.N., 1962. The analysis of proximities: Multidimensional scaling with an unknown distance function. I. Psychometrika 27 (2), 125–140.
Shepard, R.N., 1980. Multidimensional scaling, tree-fitting, and clustering. Science 210 (4468), 390–398.
John Richard Stepp Eric C. Jones Mitchell Pavao-Zuckerman David Casagrande Rebecca K. Zarger Remarkable Properties of Human Ecosystems CE 7 3 10.5751/ES-00577-070311 http://www.ecologyandsociety.org/vol7/iss3/art11/.
TEEB The Economics of Ecosystems and Biodiversity (TEEB): Ecological and economic foundations 2010 Earthscan London.
Teh, L.C., Teh, L.S., 2011. A fuzzy logic approach to marine spatial management. Environ. Manage. 47 (4), 536–545.
Thiao, D., Westlund, L., Sambe, B., Diadhiou, H.D., Dème, M., Mbenga, A., Diop, M., 2019. A perception-based participatory monitoring and evaluation approach to foster effective co-management of the marine protected areas in Northwest Africa. Ocean Coast. Manag. 175, 1–16.
Tonin, S., 2018. Citizens' perspectives on marine protected areas as a governance strategy to effectively preserve marine ecosystem services and biodiversity. Ecosyst. Serv. 34, 189–200. https://doi.org/10.1016/j.ecoser.2018.03.023.
UNEP/CBD/COP/DEC/X/2-CBD COP 10 e Tenth Meeting of the Conference of the Parties to the Convention on Biological Diversity. Nagoya, Japan 18e29 October 2010. Strategic Plan for Biodiversity 2011e2020," (United Nations Environment Programme, 2010).
UNEP-WCMC and IUCN. 2016. Protected Planet Report 2016. UNEP-WCMC and IUCN, Cambridge UK and Gland, Switzerland.
Vila, A., Püschel, N., Rodríguez, M., Guijón, R., Kusch, A., 2017. Propuesta Área Marina Costera Protegida de Múltiples Usos Seno Almirantazgo. Tierra del Fuego, Región de Magallanes y de la Antártica Chilena. Informe técnico. Wildlife Conservation Society –Chile, Santiago 124 p. + anexos.
Villasante, S., Lopes, P.F., Coll, M., 2016. The role of marine ecosystem services for human well-being: Disentangling synergies and trade-offs at multiple scales. Ecosyst. Serv. 17, 1–4. https://doi.org/10.1016/j.ecoser.2015.10.022.
Ward, C., Stringer, L., Holmes, G., 2018. Changing governance, changing inequalities: Protected area co-management and access to forest ecosystem services: a Madagascar case study. Ecosyst. Serv. 30, 137–148.
Wilcox, A. R. 1967. Indices of Qualitative Variation (No. ORNL-TM-1919). Oak Ridge National Lab., Tenn.
Yates, K.L., Clarke, B., Thurstan, R.H., 2019. Purpose vs performance: What does marine protected area success look like? Environ. Sci. Policy 92, 76–86.