IDENTIFYING PERSPECTIVES AND FRAMING ATTITUDES ON SPEARFISHING IN THE CANARY ISLANDS (SPAIN)

Pablo Martín-Sosa*, José J. Castro**, Ana Gordoa***

Abstract

Spearfishing regulation in The Canary Islands (CIs) has been a conflictive subject for years since it restricts the activity in its spatial access to resources, with proponents both for and against these measures. Understanding the range of perceptions between social groups or stakeholders is important when designing and developing successful management strategies for any activity. Q-methodology is used to explore existing perceptions, or lines of thought, towards spearfishing in the CIs of five spearfishing-related key-stakeholder groups. The results show that the main perception is made up of opposing positions, either for or against recreational underwater fishing, and between the spearfishers and the non-governmental organizations (NGOs). The second line of perception, formed basically by the administration and scientists, embodies an environmental aspect. Perception factor 3, mostly represented by the commercial sector emphasizes the damage caused to this sector. Finally, factor 4 identifies a perception that contemplates spearfishing as a subsistence fishery rather than a recreational one. This study contributes to the scarce scientific information within social research on spearfishing in the CIs and concludes that there is a need for dialogue, which, given their positions and vested interests, should not be led by the sectors directly involved.

Keywords: Fisheries management, fisheries policies, stakeholder perception, recreational fisheries, social science.

IDENTIFICANDO PERSPECTIVAS Y ENMARCANDO ACTITUDES SOBRE LA PESCA SUBMARINA EN LAS ISLAS CANARIAS (ESPAÑA)

Resumen

La regulación de la pesca submarina en Canarias (IC) ha sido un tema conflictivo durante años, ya que restringe la actividad en su acceso espacial a los recursos, con defensores tanto a favor como en contra. Conocer el rango de percepciones entre los grupos sociales o *stakeholders* es importante a la hora de diseñar y desarrollar estrategias de gestión exitosas. La metodología Q se utiliza para explorar las percepciones existentes hacia la pesca submarina en IC de cinco grupos de partes interesadas clave. Los resultados muestran que la percepción principal está conformada por posiciones contrapuestas, a favor o en contra de la actividad, y entre los pescadores submarinos y las ONG. La segunda, formada básicamente por la Administración y los científicos, encarna un aspecto ambiental. El factor 3, representado por el sector comercial, enfatiza el daño causado a este sector. El último factor contempla la actividad como de subsistencia más que recreativa. Este estudio contribuye a la escasa información científica dentro de la investigación social sobre la pesca submarina en las IC y concluye que existe una necesidad de diálogo que, dadas sus posiciones e intereses creados, no debe ser liderado por los sectores directamente involucrados.

Palabras clave: gestión pesquera, política pesquera, percepción de *stakeholders*, pesca recreativa, ciencias sociales.

DOI: https://doi.org/10.25145/j.SI.2024.05.05
Revista Scientia Insularum, 5; febrero 2024, pp. 77-100; ISSN: e-2659-6644

INTRODUCTION

Marine recreational fishing (MRF) has been shown to be an important factor in fish mortality across the globe (Ihde et al., 2011; Hyder et al., 2018), with great economic (Arlinghaus and Cooke, 2008; Cisneros-Montemayor and Sumaila, 2010; Hyder et al., 2018), and social impacts (Lynch et al., 2016; Griffiths et al., 2017; Hyder et al., 2018). Within MRF activities, angling is the most popular, while spearfishing is practised by just a small fraction of fishers (Gordoa et al., 2019; Sbragaglia et al., 2021).

Spearfishing, like other forms of fishing, can have substantial negative effects on target fish populations (Frisch et al., 2012). However, this activity has received considerably little scientific attention, a fact that may negatively affect management actions and policy reforms given the scarcity of information on the relative impact of spearfishing compared to other forms of recreational fishing (Terlizzi, 2022). But the few existing results are fairly consistent on the whole, indicating that spearfishing can account for up to 12% of marine recreational fishing (Michailidis et al., 2020), or down to a minimum of 4% (Ünal et al., 2010; Gordoa et al., 2019). Yet, there has always been a great debate regarding spearfishing (Smith and Nakaya, 2002), in particular the impact that this activity may have on vulnerable coastal species, and on the desirability of banning the activity in the vicinity of protected areas (Harmelin-Vivien et al., 2015). The ban on spearfishing in non-protected areas of no specific environmental interest has been in place for more than three decades in the Canary Islands (CIs). This fact has recently generated local scientific interest on the impact of spearfishing, with Castro Hernández et al. (2018), Martín-Sosa (2019) and Jiménez-Alvarado et al. (2020) providing information on the number of existing fishers, 7,500 according to the number of spearfishing registered licenses, and participation rates, 0.3% of the total population, and 4% of the total number of recreational fishing licences. The legally restricted area, exclusively for spearfishers, is limited to about 20% of the coastline (Martín-Sosa, 2019). Figure 1 shows the areas that permit the practice of spearfishing, which are officially coded by island. The activity takes place throughout the entire year with higher catches in the summer and autumn months. Recreational spearfishing landings amount have been estimated between 478 and 914 t per year throughout the entire archipelago (Gordoa et al., 2019; Jiménez-Alvarado et al., 2020), representing between 3.99 and 7.65 % of all total landings (in biomass terms) of commercial fishing in 2018 (source, Statistics Service of the Fishery Office of CIs: https://www.gobiernodecanarias.org/agp/sgt/temas/estadistica/pesca/, which authors are aware of having a high degree of bias for different reasons, being the only available information source). During 2017 almost 670,000 fishing days were calculated by Jiménez-Alvarado et al. in 2020.

* Centro Oceanográfico de Canarias (COC-IEO), CSIC, Santa Cruz de Tenerife, Spain
** I.U. EcoAqua, Universidad de Las Palmas de Gran Canaria, Spain
*** Centro de Estudios Avanzados de Blanes (CEAB-CSIC), Spain
* Correspondence: Corresponding Author pablo.martin-sosa@ieo.csic.es

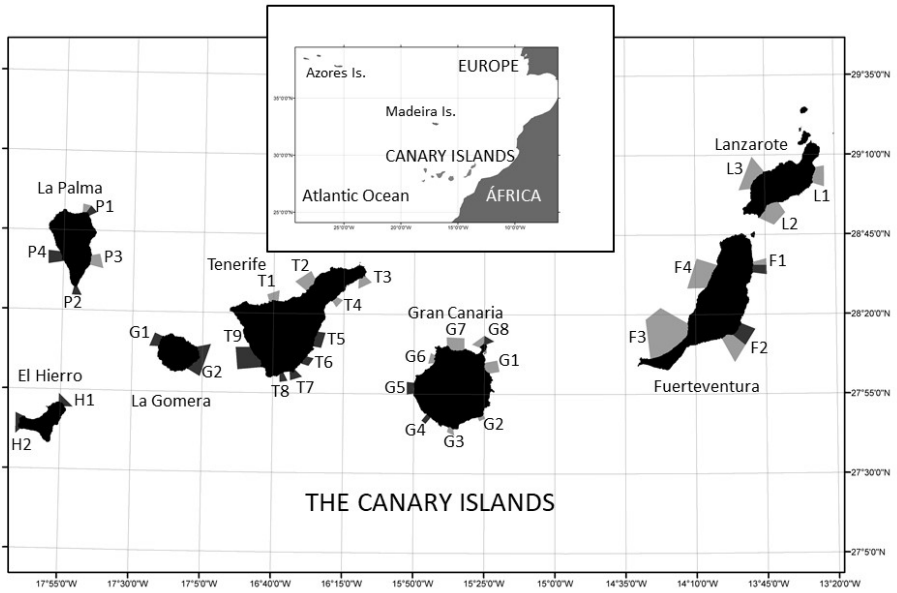

Figure 1. Map of the study area. Spearfishing open access zones for each island are lightly shaded when the management is Regional Government, darkly shaded when is Central Government (from Martín-Sosa, 2019). The official codes respond to the names of the islands (La Palma = P, El Hierro = H, La Gomera = G, Tenerife = T, Gran Canaria = G, Fuerteventura = F and Lanzarote = L)

90% of the spearfishing catch consisted of 11 species of trophic level, and mid-low levels of intrinsic vulnerability (Dedeu et al., 2019), where the parrotfish (Sparisoma cretense), a fast-growing fish, represents 30% of the catch. Other species that are often caught are several species of the Sparidae family (sea breams), the surmullet (Mullus surmuletus), the grey triggerfish (Balistes capriscus), and the glasseye (Heteropriacanthus cruentatus). Fishing bottoms that are of interest to spearfishers (shallow, rocky, vegetated bottoms) are not always found in permitted areas (Figure 1), and a large number of these are of little interest, either because of poor fish richness, or because their location is too far from residential areas (Martín-Sosa, 2019).

Environmental managers are obliged by the Precautionary Principle, which calls for regulatory action in the face of serious environmental risks even in the absence of full scientific certainty (Sand, 2000), and this precautionary approach has been the basis for restricting spatial access to resources for spearfishers for the last 35 years. The sector argues that it is treated unequally compared to the rest of the fishing sectors, including recreational fishing, and believes that it is an exaggeration to blame spearfishing for the artisanal fisheries decline and to attribute the overexploitation of some rocky coastal demersal resources solely to spearfishing (Martín-Sosa, 2019). Nevertheless, none of the few studies aiming to assess the impact of spearfishing in the CIs (Riera et al., 2016; Castro Hernández et al., 2018; Martín-

Sosa, 2019; Jiménez-Alvarado et al., 2020) have been able to prove the effectiveness of this precautionary approach.

Conflicts may not necessarily be problematic, but might instead be drivers of social change (Eckerberg and Sandström, 2013). Stakeholders' perception-based studies have gained importance in planning and policy processes in natural resource management over the years (Jones and Seara, 2020; Naskar et al., 2021; Kibria et al., 2022). Conservation issues are inherently complex, span multiple objectives (social, economic and ecological), across geographical scales, are dynamic, and affect or involve diverse stakeholders (Giakoumi et al., 2018; Ison et al., 2021).

The Common Fishery Policy stresses that to ensure good governance, appropriate stakeholder involvement is needed to implement measures (Hoffman and Vestergaard, 2006; European Commission, 2011, 2016; Corral and Manrique de Lara, 2017; Nielsen et al., 2018; Soma et al., 2018). Several studies have dealt with stakeholder perceptions, including those of spearfishers, as a tool in identifying governance management solutions. In these cases however, spearfishing was not the main focus of the study, the focus instead being the management of marine protected areas (Hernández-Delgado et al., 2014; Havard et al., 2015; D'Anna et al., 2016), with the protection (Retnoningtyas et al., 2021), or the control (Ulman et al., 2022) of a certain species.

The present study tries to identify the different perceptions that may exist regarding spearfishing in the CIs and to frame the attitudes of a diverse group of key stakeholders, with the aim of investigating limitations, challenges, and opportunities in an environmental, socioeconomic, and regulatory context. In multiple perspectives, there is a need to understand the different values and views of individuals with respect to important conservation issues. For this purpose, Q-methodology was applied, a method developed by the British psychologist William Stephenson in the 1930s (Stephenson, 1953), an exploratory and semiquantitative methodology which combines the benefits of both qualitative and quantitative research (Stephenson, 1953; McKeown and Thomas, 1988). Q-methodology is increasingly being used to explore the perspectives of those people involved in environmental issues (e. g. Bischof, 2010; Frantzi et al., 2009; Gänsbauer et al., 2016), whilst also providing a clear and structured way to elicit stakeholder views (Zabala et al., 2018).

The specific research questions targeted by this study were: (1) what are the distinct perceptions regarding the ecological, socioeconomic costs and benefits of spearfishing in the CIs (2) which are the major areas of agreement and disagreement between stakeholders (3) which stakeholder groups share the same perception and in which aspects (4) what is the origin of these potential different attitudes and (5) what are the most important issues, and which measures have been proposed to improve them.

MATERIAL AND METHODS

The outcome of a Q-study is a set of factors to explain the perceptions that exist among people (Addams and Proops, 2000; Bacher et al., 2014) and, in comparison with surveys, Q yields more nuanced and sophisticated opinions (Zabala et al., 2018). The researcher does not impose the topics on the participants, instead they raise their own ones (Dryzek and Berejikian, 1993). Q does not require large population samples to obtain statistically valid results (Meckstroth, 1981; Bacher et al., 2014), as it produces an in-depth view of different perspectives that exist in a given situation. These results are not intended to be generalized and to reflect the perspectives of a larger population size (Bacher et al., 2014).

Collection and selection of statements

To collect a comprehensive list of items (statements) that includes as broad a spectrum of opinion as possible on spearfishing in the CIs, open, non-structured interviews with 35 representative stakeholders were conducted during November and December of 2021. The representative stakeholders were recruited on the basis of their relevance to the study's aim and their knowledge of spearfishing in the CIs and belonged to one of five stakeholder groups: recreational fishers (including spearfishers), commercial fishers (representatives of the sector), administration (from Fisheries and Environment Offices), civil society (NGOs, companies in the maritime/marine sector) and scientists (marine ecology, anthropology, economy, and fisheries). They were encouraged to speak freely about their thoughts on spearfishing in the CIs from an environmental, socioeconomic, and regulatory perspective. A concourse of 259 statements were initially extracted from the interviews. Statements on similar aspects were combined and homogenized, including representativeness and variation, which considerably reduced the number of statements, since most of the 259 original statements were repetitions of the same concept just using different words. To ensure that the whole range of perceptions was represented, the statements were categorized according to subtopics (environment, socioeconomic and regulatory). From the whole set of original statements, 39 dealt with an environmental perspective (almost half of them on ecological impacts, many also on inter-sector discrimination and scientific knowledge), 76 related to regulatory matters (a third concerning spatial regulation, others on the licensing system, sanctions, or on the scientific basis of the regulation), and a total of 144 socioeconomic statements, this section had the highest number of duplications, basically, the same comment expressed in different ways. A balanced number from all subtopics was chosen in order to have enough statements to assess perceptions from the three different perspectives. This was done after a process of individual prioritization by each of the authors and was followed by a cross-check and discussion process. In each category, following a process of clarification and homogenization, statements were chosen that were representative of all the sub-themes that arose during the interviews (Jacobsen and Linnell, 2016; Zabala et al., 2018). To avoid any prepositioning by researchers,

the overall bias of the language of the final statements on the study subject was balanced between negative and positive comments. This process reduced the number of statements to a final Q-set of 33 (11 statements from each category).

Sorting of statements

The aim of Q is to uncover the diversity of opinions, irrespective of whether they are predominant in the population. Consequently, the sample of respondents (the P-sample) is usually a non-random selection of individuals, and the sampling strategy is primarily purposive (participants selected by criteria, and not by randomness) (Zabala et al., 2018). Out of the 35 stakeholder representatives that were interviewed only 30 participants (six from each sector) were asked to sort the Q-set to avoid the undesirable scenario of the number of participants outnumbering the number of statements (Watts and Stenner, 2005).

Participants were asked to rank the Q-set of statements by how strongly they agreed or disagreed with them. The statements were provided to the participants through a Google Form with the instruction of sorting the statements using a seven-point scale ranging from –3, least agree, to +3, most agree. Respondents were specifically told about the following degrees of agreement/disagreement of the different bins: 3: total agreement, 2: regular agreement and 1: slight agreement. Participants were given complete freedom in distributing the statements amongst the bins. In this way, a set of sorted data is collected for each participant, the pattern representing the individual perceptions. The array of scores for all the statements sorted by a single respondent is called the Q-sort. Prior to analysis, the sorts forced a normal distribution (this forcing of the sorts is a condition of the chosen analytical method). To avoid a positive or negative excess of kurtosis (the sharpness of the peak of a frequency-distribution curve), a mesokurtic distribution was used (bin -3: two statements, -2: four, -1: seven, 0: seven, 1: seven, 2: four, 3: two). Two other distribution options were discarded, a leptokurtic distribution would have had a relatively high probability of losing analytical power when identifying the 'highest' (or 'lowest') agreement, whereas a platykurtic distribution would have produced the opposite effect.

Statistical analysis

The statistical analysis was conducted using an R package *qmethod* (Zabala, 2014). The raw data is provided to function qmethod as a matrix or data frame with statements as rows and Q-sorts as columns. The number of factors to extract is necessary, and this can be decided upon by exploration of the raw data based on criteria as the total amount of variability explained, and eigenvalues higher than a certain threshold (Watts and Stenner, 2005; Zabala, 2014).

The analytical process has two main parts. In the first one, a multivariate data reduction technique is applied, either a centroid factor analysis or a PCA (Principal

Component Analysis). This package currently implements only the PCA solution. Results from both techniques are similar (Watts and Stenner, 2005; Zabala, 2014; Yang, 2016). Initially, a correlation matrix between Q-sorts is built, and the chosen multivariate technique reduces this correlation matrix into components. The components are ordered by the total variability that they explain, and so the first components summarize most of the variability of the initial correlation matrix. Then the first few components are selected and rotated in order to obtain a clearer and simpler structure of the data. The rotation of components in Q studies can be either manual (judgemental) or mathematically optimal (analytical). The rotation results in a matrix of component loadings with Q-sorts as rows, and components as columns, indicating the relationship between each Q-sort and component. Mathematical rotation is implemented in the package within the function qmethod (Zabala, 2014). We used *varimax*, which is the most commonly used rotation. Then, the second part of the analysis is particular to Q. It consists of a) flagging the Q-sorts that will define each component (hereafter called the factor), b) calculating the scores of statements for each factor (z-scores and factor scores), and c) finding the distinguishing and consensus statements (Zabala, 2014). The factor loading expresses the extent to which each sort agrees with a factor's viewpoint (Bacher et al., 2014).

Automatic flagging is based on two criteria: that the loading l should be significantly high (the significance threshold for a p-value < .05 is given by equation 1, where N is the number of statements), and that the square loading for a factor j should be higher than the sum of the square loadings for all other factors (equation 2, where f is the total number of factors. Some Q-sorts may be considered confounding because they load highly in more than one factor and thus they are not flagged (Zabala, 2014).

1) $$l > \frac{1.96}{\sqrt{N}}$$

2) $$l_j^2 > \sum_{i=1}^{f} l_i^2 - l_j^2$$

The z-scores indicate the relationship between statements and factors, i.e., how much each factor agrees with a statement. The z-score is a weighted average of the scores given by the flagged Q-sorts to that statement. The factor scores are obtained by rounding the z-scores towards the array of discrete values of the seven-point scale. The final outcome of the analysis is the selected number of factors, representing one perspective each. Finally, the factor comparison identifies the consensus and distinguishing statements (Zabala, 2014).

Interpretation

The interpretation of each perspective is based on the Q-sort resulting from the factor scores and on the salience and distinctiveness of the statements. Each respondent may be more closely related to one of the perspectives, and this relationship is determined by the initial loading calculations. The key elements to look at are the relative position of statements within the grid (particularly those at the extremes), the position of a statement in a perspective versus the position of the same

TABLE 1. Z-SCORES FOR FACTOR LOADINGS ACROSS ALL DIMENSIONS (FACTORS), ranging from 1 (complete agreement) to -1 (complete disagreement with the perception of that factor).

Q sorts	F1	F2	F3	F4
Factor 1				
Recreational (spearfisher)	**-0.91**	-0.04	-0.07	0.05
Recreational (spearfisher)	**-0.91**	-0.04	-0.09	0.01
Recreational (spearfisher)	**-0.90**	0.15	0.02	0.12
Civil society (nautical company and ex spear fisher)	**-0.81**	-0.12	0.20	0.00
Recreational (spearfisher)	**-0.77**	-0.20	-0.08	0.04
Civil society (environmentalist NGOs)	**0.64**	0.34	0.41	0.06
Commercial fisher (sector representative)	**0.64**	0.09	0.31	-0.21
Civil society (environmentalist NGOs)	**0.63**	0.28	0.37	-0.06
Factor 2				
Scientist (economy)	0.06	**0.73**	0.24	0.20
Administration (environment)	0.10	**0.68**	0.19	-0.03
Scientist (marine ecology)	0.36	**0.68**	-0.22	0.09
Administration (environment)	0.33	**0.63**	0.21	-0.07
Administration (fisheries)	-0.13	**0.59**	0.24	0.15
Scientist (marine ecology)	0.14	**0.59**	0.05	0.40
Administration (fisheries)	0.41	**0.58**	0.27	0.26
Administration (fisheries)	0.02	**0.57**	-0.01	0.51
Scientist (marine anthropology)	0.14	**0.57**	0.39	0.07
Commercial fisher (sector representative)	0.00	**0.51**	0.04	-0.37
Factor 3				
Commercial fisher (sector representative)	0.38	0.18	**0.72**	0.09
Civil society (marine reserves)	0.25	0.39	**0.67**	0.26
Commercial fisher (sector representative)	0.12	0.33	**0.63**	0.08
Civil society (scuba diving club)	0.31	0.13	**0.62**	0.20
Scientist (marine ecology)	-0.28	0.33	**0.61**	0.23
Commercial fisher (sector representative)	-0.01	0.38	**0.59**	-0.18
Scientist (fisheries)	0.02	0.19	**-0.42**	0.06
Factor 4				
Civil society (renewable energy company)	0.01	0.14	0.25	**0.72**
Commercial fisher (sector representative)	-0.10	-0.12	0.04	**0.71**
Recreational (spearfisher)	-0.26	0.21	-0.10	**0.71**
Administration (environment)	0.06	0.55	0.21	**0.63**
Confounded sorts				
Recreational (angler)	0.56	0.42	0.33	0.26

Q sorts	F1	F2	F3	F4
Eigenvalue	**6.19**	**5.25**	**3.81**	**2.98**
% explained variance	**21%**	**17%**	**13%**	**10%**
Number of loading Q-sorts	**8**	**10**	7	4

statement in other perspectives, and the distinguishing and consensus statements (Zabala, 2014). Moreover, the explanations gathered from respondents during the interviews added valuable information.

RESULTS

Four factors, accounting for 61% of the explained variation, were extracted, using an eigenvalue minimum threshold of 2.00. The Q-method automatically flagged the Q-sorts, with significant loadings for each factor: eight for F1, ten for F2, seven for F3 and four for F4. Table 1 shows which participants define, and thus share a factor (perception). Factor score values (rounded z-scores to provide an 'average' sort by factor) and z-scores for each statement are listed in Table 2. Next, the perceptions represented by the factors are described using their distinguishing statements and corresponding interviews to provide a context for the respondents' choices. Statements within these sections are represented in text as (*number*), and can be found within Table 2. Sort of one respondent loading significantly on more than one factor ('confounder'), was excluded from the construction of the factors' viewpoints, as is standard practice in Q-studies, in order to prevent any confusion (Watts and Stenner, 2005).

Perception 1

Respondents significantly loading for F1 were at the one extreme, four spearfishers, a representative from a nautical company, and an ex-spearfisher, whilst at the opposite end of the spectrum there were two people from environmentalist NGOs and one commercial fisher (Figure 2A). No administration or scientific respondents loaded for this factor. The arrangement of the Q sorts (participants) along the factor is segregated with an absence of gradient between the positive and negative loadings. One block has expressed a total agreement with those statements describing spearfishing as a positive activity, and an absolute disagreement with the statements depicting spearfishing as an activity with negative impacts, as can be seen in Figure 3A, no matter the topic of the statement (Figure 3B), whereas the other block thinks just the opposite. Perception 1, more than a line of thought, is made up of radical attitudes regarding spearfishing.

TABLE 2. FACTOR SCORE (F) AND Z-SCORE (Z) VALUES FOR EACH STATEMENT. BOLD VALUES FOR DISTINGUISHING STATEMENTS BY FACTOR.

#	Topic	Statement	F1		F2		F3		F4	
			F	Z	F	Z	F	Z	F	Z
1	Environmental	Depth hinders spearfishing to catch the biggest individuals	**-1**	**-0.90**	-2	-1.54	-3	-1.65	-3	-1.68
2		Big spawners are caught more frequently than in other fishing activities	**2**	**1.03**	-1	-0.41	-1	-0.71	-2	-1.62
3		Impact on habitats is much less important than in other activities	**0**	**-0.75**	**0**	**-0.06**	**-2**	**-1.51**	**2**	**1.03**
4		There is insufficient scientific monitoring so impact on resources is unknown	0	0.33	**3**	**1.83**	0	0.10	0	0.20
5		Impact on fishery resources is less important than in other fishing activities	-1	-0.75	-1	-0.56	0	-0.50	**2**	**1.03**
6		Spatial restriction does not preserve resources	-2	-1.23	-2	-0.81	**2**	**1.20**	-1	-0.48
7		The sector ignores the state of resources	0	0.31	1	0.40	0	0.15	0	-0.01
8		Spearfishing and commercial fishing have the same aim species	**1**	**0.73**	-1	-0.41	-1	-0.82	-1	-0.82
9		The high level of selectivity is a positive aspect of the activity	-2	-1.24	0	0.03	-2	-1.28	1	0.59
10		Conflict with other activities is environmental	**1**	**0.98**	-2	-1.91	-3	-1.65	-2	-1.20
11		Practitioners shoot everything for entertainment	**3**	**1.26**	**-2**	**-1.03**	**-1**	**-0.54**	**-3**	**-2.03**
12	Socioeconomic	The administration favors the commercial sector against recreational fishing	**-1**	**-1.20**	-1	-0.64	0	-0.39	**2**	**1.03**
13		The contribution to the economy is less than that of other fishing activities	1	1.01	1	0.81	1	0.84	1	0.61
14		Illegal sale causes conflict with commercial fishers	1	0.90	**-1**	**-0.29**	1	0.93	3	1.25
15		In access to resources all sectors should be equally treated	-2	-1.26	-3	-1.93	**-1**	**-0.73**	**0**	**0.29**
16		Practitioners come from very diverse social sectors	**-1**	**-0.93**	2	1.24	1	0.73	2	1.04
17		The lack of sanitary control produces ciguatera infections in the population	2	1.06	2	1.06	3	1.45	**0**	**0.23**
18		The illegal sale greatly harms the fishing sector	0	0.44	1	0.87	2	1.42	1	0.89
19		It is very culturally rooted	-1	-1.14	1	0.84	**0**	**0.15**	1	0.76
20		The sale of illegal fish is predominant in the spearfishing	2	1.23	0	0.11	1	0.90	-1	-0.28
21		The motivation is to obtain food for self-consumption (subsistence fishing)	-1	-1.05	**0**	**-0.20**	-2	-1.08	**0**	**0.38**
22		Spatial access restrictions discriminate spearfishing against other activities	**-3**	**-1.28**	0	-0.08	-1	-0.55	**0**	**0.53**

#	Topic	Statement	F1		F2		F3		F4	
			F	Z	F	Z	F	Z	F	Z
23	Regulation	Recreational license shouldn't be given without prior training	**0**	**-0.04**	3	1.49	3	1.62	**1**	**0.83**
24		Fines should be replaced by equipment seizure and criminal sanctions	0	0.62	1	0.17	**2**	**1.40**	**-1**	**-0.90**
25		Spatial access restrictions provide better control	3	1.28	2	1.40	**1**	**0.35**	**-1**	**-0.84**
26		Practitioners are unaware of the regulations	**2**	**1.06**	-1	-0.24	-2	-1.21	-1	-0.69
27		Exceeding legal catch limits is common among spearfishers	1	1.01	0	0.07	2	1.33	0	-0.09
28		Spatial access restrictions should be removed	**-3**	**-1.30**	**-3**	**-2.06**	-1	-0.75	-1	-0.61
29		Spatial access restrictions should be geographically rotated	0	0.53	**-1**	**-0.49**	1	0.37	1	0.83
30		Regulation is inadequate and arbitrary	-1	-1.06	0	0.04	0	0.12	-2	-1.33
31		Regulation has no scientific basis	-2	-1.22	1	0.26	0	-0.14	-2	-1.54
32		Spatial access restrictions must exist for all fishing activities	1	0.67	1	0.72	**-1**	**-0.65**	1	0.98
33		The capture of vulnerable species by spearfishing should be prohibited	1	0.91	2	1.31	1	1.09	3	1.60

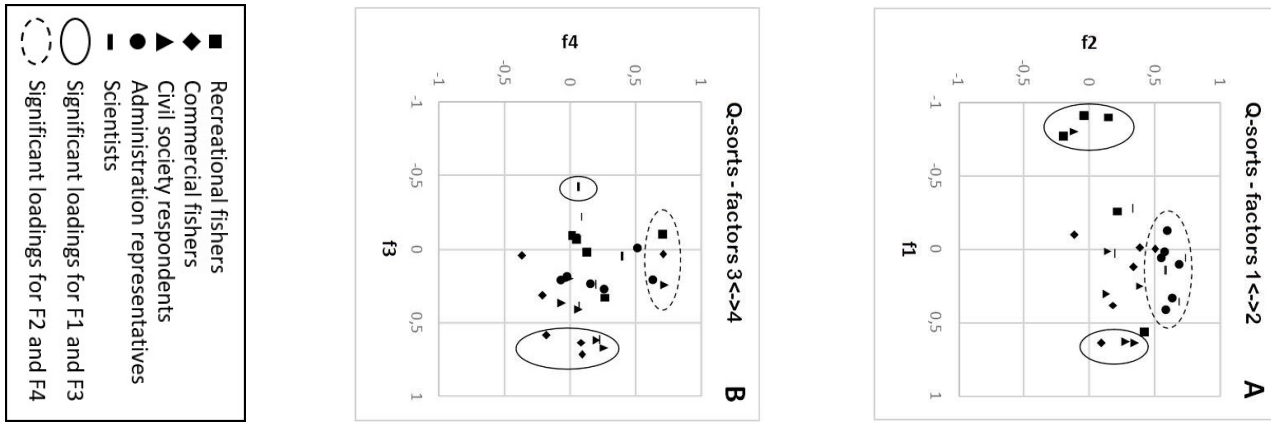

Figure 2. Q-sort loadings factor 1 vs factor 2 (A) and factor 3 vs factor 4 (B).

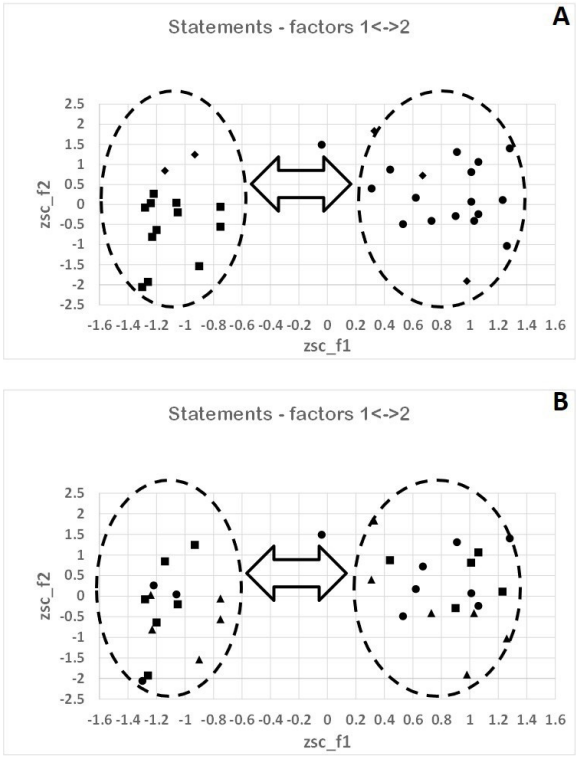

Figure 3. Statement z-scores factor 1 vs factor 2. A) showing results for positive and negative assertions, dashed circles and double arrow illustrate the segregation between positive (square), negative (circle) and neutral statements (diamond:) B) showing results by topics: environmental (triangle), socioeconomic (square): and regulatory (circle).

This perception denies that practitioners come from very diverse social sectors (*16*). Moreover, this group states that spearfishing has the same target species as commercial fishing (*8*), but consider the conflict to be environmental (*10*). This is also the group that rejects to a lesser extent than others the idea that depth hinders the catch of the larger individuals (*1*), and is the only group that supports the theory that practitioners are unaware of the regulations (*26*).

There are other statements which distinguish all factors (not only factor 1), but substantial differences have been detected between factor 1 and the other three. Thus, this perception is the only one that supports the notion that spearfishers catch more big spawning individuals than other fishers (*2*), and that the practitioners shoot everything for entertainment (*11*). On the contrary, it is the perception that denies to the greatest extent the idea that the administration favours the commercial sector (*12*) and that spatial access restrictions discriminate spearfishing against other activities (*22*). It is also the only one that rejects the idea that the activity is

culturally rooted (*19*) and that recreational licences shouldn't be given without prior training (*23*).

Perception 2

Five out of six representatives from administration, and four scientists (economy, marine ecology, and marine anthropology, 66% of the sector), together with one commercial fisher, are the sorts loading significantly for this perception (Figure 2A).

This group supports more than any other the idea that scientific monitoring is insufficient for assessing the impact on resources (*4*). It is the only group rejecting the notion that any possible conflicts with the professional fishing sector are generated by the illegal sale of the spearfishing catch (*14*), and that spatial access restrictions should be geographically rotated (*29*).

Other statements distinguish all factors (not only factor 2), but substantial differences have been detected between this factor and the rest. This line of thought strongly rejects, more than the others, that on the subject of access to resources, all sectors should be equally treated (*15*), and that spatial access restrictions should be removed (*28*). It seems to be a line of thought that is, in some aspects, similar to the one representing factor 4: it supports, as F4, although to a lesser degree, the idea that the high level of selectivity is a positive aspect of the activity (*9*), and both factors show a neutral opinion regarding the idea that the (primary)motivation is to obtain food for self-consumption (*21*).

This group is characterized by having a preservationist component (sensitive to the natural environment and with a precautionary principle mindset), whilst not being willing to change the situation of spatial access restrictions for the activity, unless the measures are scientifically supported.

Perception 3

The group of people that can be associated more significantly to this perception are three commercial fishers, two scientists (marine ecology and fisheries) and two representatives of civil society (marine reserves and the scuba diving club). They represent a line of thought that runs in a continuous sensitivity gradient. Recreational fishers don't load significantly, and half of commercial fishers influence with a strong opinion (Figure 2B).

The group is distinguished by the thought that spatial restrictions do not preserve resources (*6*) and must not exist for all fishing activities (*32*).

Looking at other statements with substantial differences, it can be stated that this is the group with the highest level of support for replacing fines with equipment seizures and criminal sanctions (*24*), and the only group rejecting the idea that the impact on habitats is much less important than in other activities (*3*). As with perception 2, in several aspects this groups seems to have a line of thought that is quite close to the one representing factor 4: they reject with less strength than F1 and F2

thoughts that are slightly supported by F4, for instance, access to resources in all sectors should be treated equally (*15*). On the contrary, they support only slightly a statement rejected by F4, that spatial access restrictions provide better control (*25*).

In summary, this perception is highly influenced by commercial fishers, a sector that look at spearfishing as a direct competitor that should not be treated equally for commercial purposes, and as an activity that given its impact, should be under even stricter regulatory measures.

Perception 4

To this group, the overall perception of spearfishing's environmental impact on fishing resources is perceived to be lower than other fishing activities (*5*), as well as the associated health risks (*17*).

There are other statements distinguishing all factors but with substantial differences detected between F4 and the rest. Regarding management measures, their perception is the only one that considers that spatial access restrictions don´t provide better control (*25*), and that there shouldn't be stiffer fines or penalties (*24*), but at the same time, they reject the notion that regulation is inadequate and arbitrary (*30*).

A key statement for this line of perception is the view on the motivation of recreational spearfishing activity and its disadvantaged socioeconomic position. The active Q-sorts consider that the motivation is to obtain food (*21*), subsistence rather than recreational fishing, considers that the administration favours the commercial sector (*12*), and believes that spatial access restriction discriminates against spearfishing (*22*), but they are neutral regarding the idea of equal treatment in access to resources (*15*).

From an environmental perspective, they consistently reject the idea that practitioners shoot everything for entertainment (*11*), and that big spawners are targeted by spearfishing more than in other fisheries (*2*). They consider spearfishing's selectivity a positive aspect (*9*), and are convinced that spearfishing's impact on habitats is much smaller than in other fishing activities (*3*).

This eclectic group seems to consider that spearfishers have fewer rights of access to resources and consequently it also supports a discriminatory regulation for spearfishing, although the activity's environmental impact is perceived to be lower compared to other fishing activities.

Consensus

Although there were clear divisive issues between the groups, there was also a proportion of statements that were not significantly distinguishable for any factor. All four perceptions agree on being almost neutral regarding the ignorance of the sector on the state of the resources (*7*). The whole range of perceptions also slightly support the idea of spearfishing having just a low contribution to the economy compared to other fishing activities (*13*).

Other non-distinguishable statements concern thoughts on the illegal sale of the catch by spearfishing practitioners harming the artisanal fishing sector (*18*), or even being predominant (*20*), the frequency of spearfishers exceeding legal catch

TABLE 3. SYNOPSIS OF RESULTS. OVERVIEW OF THE COMPOSITION, NATURE OF IMPACT/CONFLICT AND DEGREE OF SENSITIVITY OF EACH PERCEPTION.

	Composition	Nature of impact/ conflict	Degree of sensitivity
Positioning on Spearfishing (F1)	Spearfishers fiercely defending their activity, NGOs with a difficult position to explain against the activity	No specific nature, being the differential point the attribute of the statements (favorable or unfavorable towards spearfishing)	This perception only favors polarized debates as there are no concrete aspects about the different points of view. It implies a major challenge to facilitate an environment of dialogue
Conservation Sensitive (F2)	Administration and scientific sectors strongly associated	This group is characterized by having a preservationist component (sensitive with natural environment and with the precautionary principle)	Not willing to change the situation of spatial access restrictions for the activity, unless is scientifically supported
The Impact on Commercial Fishing (F3)	Very influenced by commercial fishers	It looks at spearfishing as a direct competitor	Should not be treated equally for commercial purposes, and as an impacting activity that needs even harder regulation measures
Activity with fewer rights (F4)	Made of respondents of all the stakeholder groups but scientific, being the one with fewer loading sorts	Focused on the fact that spearfishing is close to subsistence fishing with fewer rights in spite of its lower environmental impact compared to other fishing activities	This factor is very consistent in its line of perception, and its principles rule it out as a line of thinking as it nullifies the possibilities of understanding through dialogue.

limits (*27*), the regulation having no scientific basis (*31*), and on whether the capture of vulnerable species by spearfishing should be prohibited (*33*).

Stakeholders sharing the same perception

Table 1 reveals that not all of the respondents who belong to the same stakeholder group share the same perception. Nevertheless, as has been previously mentioned, perception 1 has a strong loading of spearfishers and environmental NGO members and shows a solid positioning for or against the activity. Respondents with a preservationist outlook (i.e., administration and scientists) are associated with perception 2, while perception 3 is influenced by a clear strong loading from a substantial proportion of the commercial sector, which is concerned about the impact caused by the activity of spearfishing. Finally, perception 4 is a mixed small group of respondents that believe that spearfishing is an activity with fewer rights, but with a lower impact from an environmental perspective.

Table 3 shows a synopsis the factors, including a renaming of the factors, and an overview of the composition, nature of impact/conflict and degree of sensitivity of each perception.

DISCUSSION

In the framework of the discussion on the results obtained with the Q method the role of the researchers in the interpretation of the results is a key point. Q is a structured, systematic methodology but in the application of a Q method the researchers are not considered to be a neutral actor revealing the truth (Zabala, 2014). Q engages a researcher´s intuition and creativity, as well as their quantitative analytical skills, and allows them play an active role throughout the whole process (Zabala et al., 2018). Therefore, whilst the interpretation of the results could be very open-ended, the aim here is to give a logical and simple argumentative discourse. The four lines of perception found in this study are interpreted as sensitivities to different aspects, and not so much as different perceptions of spearfishing as a whole.

Factor 1 does not run along a gradient of intensities of opinion, on the contrary, the Q-sorts are clearly segregated and indicate opposing viewpoints. The fact that there is no segregation in the value given to statements for each factor, or that they do not focus on any particular issue (environmental, social, management), but that nevertheless the differences are marked by the attribution of the statements, favourable or unfavourable towards spearfishing, extols this interpretation. These results clearly indicate that the F1 is not an axis of opinion but a space characterized by opposing and conflicting positions on spearfishing. Thus, it is not surprising that the Q sorts contributing to the formation of this factor are the pure spearfishers together with an ex-spearfisher, versus two conservation organisations and one commercial fisher. One can understand the fisher's fierce defence of their own sector but the positioning of the conservation NGOs is not explained by any of the recently identified conservationist lines (Holmes et al., 2017). In addition to these extreme positions, most participants, including recreational anglers, have positive loadings on this factor, indicating a general tendency to support more statements against than in favor of spearfishing. Ultimately, this F1 implies a major challenge to facilitate open dialogue since it only favors polarized discussion as there are no specific aspects on the different points of view.

The second line of perception basically involves administration representatives and researchers. The differential statements of this factor are mainly of an environmental nature and their point of view or perspective is on the natural environment: habitat and resources. This explains why it is the factor with the highest level of researcher participation. Moreover, the position of administration representatives is probably driven by the precautionary principle, taking into account the degree of fragility of the resource populations in the CIs due to the limited platform and nutrient concentration (Martín-Sosa, 2019), and to the overall state of the resources (Castro et al., 2015). On the other hand, this factor does not show any positioning with respect to spearfishing activity. These results indicate that it is the only line of perception, among those found, that makes dialogue between sectors possible. This factor considers that there are not enough studies to know the impact of spearfishing, although it does believe that this impact is lower than with other fishing activities. The need to carry out studies to find out the impact of the

activity is highlighted, but unlike F3, F2, it refers to the impact on the resources and not on the commercial sector.

Higher loading contributors to the third line of thought come mainly from the commercial fishing sector, although scientific and civil society sectors are also represented. Participants from the administration and the recreational sectors don't significantly load for this factor. This explains why it is the only line of opinion that considers that spatial access restrictions must continue being a restrictive measure only for spearfishing, and that there should be stiffer sanctions for that activity. These results suggest that this point of view has a direct correlation with the negative impact that spearfishing may have on the commercial fishing sector. Although no studies have been carried out in the CIs assessing the impact that spearfishing or recreational fishing has on commercial fishing, the reality is that this idea is of such concern as to determine one of the main lines of perception. This conviction is also not conducive to dialogue, given the belief that fines should be higher and the regulatory system more restrictive, but it does provide clues for future action. It clearly shows the need to evaluate spearfishing in relation to commercial fishing.

With perception 4 there is a small heterogeneous group of respondents focused on the conviction that recreational spearfishing is a subsistence, rather than recreational activity. They consider it should have less rights than commercial fishing, and consequently more restrictive or discriminatory regulation is considered legitimate, even though its environmental impact is considered low. However, it is very likely that this perception refers to the entire recreational fishing sector and not exclusively to spearfishing. This factor is very consistent in its line of perception, and its principles rule it out as a line of thinking as it nullifies the possibilities of understanding through dialogue.

When assessing the impact of fishing activities, to be able to assess the impact on resources or on other sectors, it is first essential to define whether the objective is environmental or social in nature. In the particular case of this study, where the first and third factors are explained by the positioning for or against spearfishing, and to the economic damage it can cause to the commercial sector, there is a clear indication that the conflict is of a socio-economic nature, as has been observed in other regions (Kearney, 2002; Cooke et al., 2016; Voyer et al., 2017). The conflicts and/or competition between recreational and commercial fishing generally refers to recreational angling (rod and line from the shore or boats in the case of CIs), which is by far the most common form of recreational fishing (Cooke et al., 2016). For example, in Spain this represents around 95% of recreational fishing licenses (Gordoa et al., 2019). Therefore, from now on we will refer to the recreational sector (and not just spearfishing) as a whole with respect to the commercial sector.

The basis of the conflict between recreational and commercial resource users moved from physical competition for fish to economic and legal arguments over social priorities (Kearney, 2001). Support for the recreational sector comes from the argument that a recreationally caught fish produces more economic benefits than one caught by a commercial fishery, whilst support for the commercial sector highlights the fact that for commercial fishers fishing is a livelihood rather than merely a leisure activity (Charles, 1992; Pitcher and Hollingworth, 2002). However, fish-

ing for leisure may contribute to the health and social well-being of society through relief on public health and support services (Griffiths et al., 2017). Although, unlike the commercial sector, recreational fishers have not been required to contribute to sustainable fisheries management (e.g. catch reporting), they have also not received the same benefits in terms of harvest rights (MacKenzie and Cox, 2013). This mismatch in harvest rights, management responsibilities, and objectives leads to misunderstandings and conflicts between competing user groups (Goodyear, 2007; Mitchell et al., 2008; Borch, 2010). Thus, it cannot be ruled out that the regulation of spearfishing in the CIs, excluding the practice from access to resources on 80% of the coastline for more than three decades, has been the root of the existing conflict. Moreover, spatial management practices that seek to segregate or remove one sector from a given area may be counterproductive to the general interest, as has been observed in other regions (Voyer et al., 2017). In any case, and bearing in mind that the current trend is moving in the direction of policy integration, there is a need to put a much greater emphasis on marine spatial planning (Pascoe, 2006), and implementation that comes about through dialogue with, and between, relevant stakeholders (Ritchie and Ellis, 2010).

In order to solve a conflict, it is necessary to investigate the reasons for its origin, whilst in this case it is also necessary to understand why a regulatory measure, that in principle does not seem to have had any effect on the state of the resources where spearfishing is banned (Riera et al., 2016; Goikoetxea et al. 2019), continues to be maintained. It is clear that if this measure is maintained it is not due to Political pressure or influence, something that occurs in other areas (Charles, 1992), as the number of spearfishers outnumber commercial fishermen by six to one (Gordoa et al., 2019). What is possible is that there exists a dominant, and not necessarily conscious, social opinion on fishing rights that influences decision-making in fisheries regulation. Although no statement specifically mentioning fishing rights was defined in this study, one that is directly related was included (15): in access to resources all sectors should be equally treated. The scores for this statement were negative in all groups, except for *The Activity with fewer rights* group that gave an almost neutral opinion, indicating that there is a dominant view that the recreational sector should not be treated in the same way as the commercial sector. It can therefore be inferred that the Canarian society considers that the recreational fisher should not have the same fishing rights as the commercial fisher. The competent administration may therefore be reluctant to remove existing restrictions on spearfishing which implies that the basis of the conflict remains almost structurally in place.

On the basis of the argumentative principle outlined by Arlinghaus (2005) – that there is a need to identify, understand and manage human conflict in recreational fisheries because such conflicts may hamper progress towards generating sustainable recreational fisheries - the current situation of spearfishing in the CIs could become unblocked through social dialogue. However, and based on the results, it can be concluded that the leaders of this dialogue should not be those who are in principle the main actors (recreational fishers and commercial fishers), but instead, those who have no definitive position. The issues for discussion in this round table dialogue should cover those aspects that have been considered a priority. In other

words, it is necessary to define priority research objectives in order to avoid conflicts and to manage spearfishing and recreational fisheries as a whole, and in such a way that it ensures their environmental and social sustainability.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Author Contributions

Methodology, Investigation: P.M.S., J.J.C., A.G.
Software, Resources: P.M.S.
Data curation, Writing, Visualization: P.M.S., A.G.
Formal analysis, Supervision: J.J.C., A.G.
Conceptualization: A.G.

Funding

The present study was partially funded by the project ESMARES2 from the Instituto Español de Oceanografía (IEO-CSIC), under the framework of the tasks ordered to the IEO by the Ministerio de Transición Ecológica y Reto Demográfico (MITERD) of the Spanish Government for the application of the Marine Strategy Framework Directive (MSFD) in Spanish waters.

Acknowledgments

The authors would like to thank all participants of this study that have devoted their time and effort. Thanks to Santiago Barreiro and Bertín García for map editing. The initial analysis for the content of this manuscript has been presented at the International Symposium on Artisanal and Recreational Fishing in Islands Systems (ISARFIS-ISMS 2022).

REFERENCES

Addams, H. L., and Proops, J. L. R. (2000). Social discourse and environmental policy : an application of Q methodology. Edward Elgar, Cheltenham.

Arlinghaus, R. (2005). A conceptual framework to identify and understand conflicts in recreational fisheries systems, with implications for sustainable management. *Aquat. Resour. Cult. Dev.* 1, 145–174. doi: https://doi.org/10.1079/ARC200511.

Arlinghaus, R., and Cooke, S. J. (2008). Recreational Fisheries: Socioeconomic Importance, Conservation Issues and Management Challenges. *Recreat. Hunting, Conserv. Rural Livelihoods Sci. Pract.*, 39–58. doi: https://doi.org/10.1002/9781444303179.ch3.

Bacher, K., Gordoa, A., and Mikkelsen, E. (2014). Stakeholders' perceptions of marine fish farming in Catalonia (Spain): A Q-methodology approach. *Aquaculture* 424–425, 78–85. doi: https://doi.org/10.1016/j.aquaculture.2013.12.028.

Bischof, B. G. (2010). Negotiating uncertainty: Framing attitudes, prioritizing issues, and finding consensus in the coral reef environment management "crisis." *Ocean Coast. Manag.* 53, 597–614. doi: https://doi.org/10.1016/j.ocecoaman.2010.06.020.

Borch, T. (2010). Tangled lines in New Zealand's quota management system: The process of including recreational fisheries. *Mar. Policy* 34, 655–662. doi: https://doi.org/10.1016/j.marpol.2009.12.005.

Castro, J.J, Divovich, E., Delgado de Molina Acevedo, E., Barrera-Lujan, A. (2015). Over looked and under-reported: a catch reconstruction of marine fisheries in the Canary Islands, Spain, 1950-2010. *Sea Around Us* 26, 143–154. Available at: https://www.researchgate.net/publication/291957895_Over-looked_and_under-reported_A_catch_reconstruction_of_marine_fisheries_in_the_Canary_Islands_Spain_1950-2010.

Castro Hernández, J. J., Jiménez Alvarado, D., Guerra Marrero, A. M., and Sarmiento Lezcano, A. (2018). Estimación del impacto de la pesca submarina de recreo en las zonasacotadas para dicha actividad en el Archipiélago Canario. 1–133. Available at: www.fpct.ulpgc.es.

Charles, A. T. (1992). Fishery conflicts: A unified framework. *Mar. Policy* 16, 379–393. doi: https://doi.org/10.1016/0308-597X(92)90006-B.

Cisneros-Montemayor, A. M., and Sumaila, U. R. (2010). A global estimate of benefits from ecosystem-based marine recreation: Potential impacts and implications for management. *J. Bioeconomics* 12, 245–268. doi: https://doi.org/10.1007/s10818-010-9092-7.

Cooke, S. J., Hogan, Z. S., Butcher, P. A., Stokesbury, M. J. W., Raghavan, R., Gallaghe, A. J., et al. (2016). Angling for endangered fish: Conservation problem or conservation action? *Fish Fish.* 17, 249–265. doi: https://doi.org/10.1111/faf.12076.

Corral, S., and Manrique de Lara, D. R. (2017). Participatory artisanal fisheries management in islands: Application to the Canary Islands (Spain). *Mar. Policy* 81, 45–52. doi: https://doi.org/10.1016/j.marpol.2017.03.011.

D'Anna, G., Fernández, T. V., Pipitone, C., Garofalo, G., and Badalamenti, F. (2016). Governance analysis in the Egadi Islands Marine Protected Area: A Mediterranean case study. *Mar. Policy* 71, 301–309. doi: https://doi.org/10.1016/j.marpol.2015.12.009.

Dedeu, A. L., Boada, J., and Gordoa, A. (2019). The first estimates of species compositions of Spanish marine recreational fishing reveal the activity's inner and geographical variability. *Fish. Res.* 216, 65–73. doi: https://doi.org/10.1016/j.fishres.2019.03.025.

Dryzek, J. S., and Berejikian, J. (1993). Reconstructive Democratic Theory. *Am. Polit. Sci. Rev.* 87, 48–60. doi: https://doi.org/10.2307/2938955.

Eckerberg, K., and Sandström, C. (2013). Forest conflicts: A growing research field. *For. Policy Econ.* 33, 3–7. doi: https://doi.org/10.2307/2938955 10.1016/j.forpol.2013.05.001..

European Commission (2011). Reform of the Common Fisheries Policy. 11. Available at: http://ec.europa.eu/fisheries/reform/com_2011_417_en.pdf.

European Commission (2016). Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the conservation of fishery resources and the protection of marine ecosystems through technical measures, amending Council Regulations (EC) No 1967/2006, (EC) No 1098/2007, (EC) No. *Off. J. Eur. Union* 0074, 44. Available at: http://eur-lex.europa.eu/resource.html?uri=cellar:41312a57-e771-11e5-8a50-01aa75ed71a1.0024.02/DOC_1&format=PDF.

Frantzi, S., Carter, N. T., and Lovett, J. C. (2009). Exploring discourses on international environmental regime effectiveness with Q methodology: A case study of the Mediterranean Action Plan. *J. Environ. Manage.* 90, 177–186. doi: https://doi.org/10.1016/j.jenvman.2007.08.013.

Frisch, A. J., Cole, A. J., Hobbs, J. P. A., Rizzari, J. R., and Munkres, K. P. (2012). Effects of Spearfishing on Reef Fish Populations in a Multi-Use Conservation Area. *PLoS One* 7. doi: 10.1371/JOURNAL.PONE.0051938.

Gänsbauer, A., Bechtold, U., and Wilfing, H. (2016). SoFISHticated policy – social perspectives on the fish conflict in the Northeast Atlantic. *Mar. Policy* 66, 93–103. doi: https://doi.org/10.1016/j.jenvman.2007.08.013 10.1016/j.marpol.2016.01.014.

Giakoumi, S., McGowan, J., Mills, M., Beger, M., Bustamante, R. H., Charles, A., et al. (2018). Revisiting "success" and "failure" of marine protected areas: A conservation scientist perspective. *Front. Mar. Sci.* 5, 1–5. doi: https://doi.org/10.3389/fmars.2018.00223.

Goikoetxea, J., Fernández, A., Andreu, A., Pestano, P.M. 2019. Impacto de la pesca recreativa submarina sobre las poblaciones de Sparisoma crentese (Linnaeus, 1758) en las aguas interiores de la isla de Tenerife (Islas Canarias). *Scientia Insularum: Revista de Ciencias Naturales en islas*, 71-81, 2019 DOI: https://doi.org/10.25145/j.Si.2019.02.04.

Goodyear, C. P. (2007). Recreational Catch and Release: Resource Allocation between Commercial and Recreational Fishermen. *North Am. J. Fish. Manag.* 27, 1189–1194. doi: https://doi.org/10.3389/fmars.2018.00223 10.1577/m06-210.1.

Gordoa, A., Dedeu, A. L., and Boada, J. (2019). Recreational fishing in Spain: First national estimates of fisher population size, fishing activity and fisher social profile. *Fish. Res.* 211, 1–12. doi: https://doi.org/10.1016/j.fishres.2018.10.026.

Griffiths, S. P., Bryant, J., Raymond, H. F., and Newcombe, P. A. (2017). Quantifying subjective human dimensions of recreational fishing: does good health come to those who bait? *Fish Fish.* 18, 171–184. doi: https://doi.org/10.1111/faf.12149.

Harmelin-Vivien, M., Cottalorda, J. M., Dominici, J. M., Harmelin, J. G., Le Diréach, L., and Ruitton, S. (2015). Effects of reserve protection level on the vulnerable fish species Sciaena umbra and implications for fishing management and policy. *Glob. Ecol. Conserv.* 3, 279–287. doi: https://doi.org/10.1016/j.gecco.2014.12.005.

Havard, L., Brigand, L., and Cariño, M. (2015). Stakeholder participation in decision-making processes for marine and coastal protected areas: Case studies of the south-western Gulf

of California, Mexico. *Ocean Coast. Manag.* 116, 116–131. doi: https://doi.org/10.1016/j.ocecoaman.2015.06.017.

Hernández-Delgado, E. A., Shivlani, M., and Sabat, A. M. (2014). Ecosystem-Based and Community-Based Model Integration to Designate Coral Reef No-Take Marine Protected Areas: A Case Study from Puerto Rico. *Nat. Resour.* 05, 538–560. doi: https://doi.org/10.4236/nr.2014.510049.

Hoffman, E., and Vestergaard, O. (2006). Review of Marine Protected Areas as a Tool for Ecosystem Conservation and Fisheries Management. *Area*, 151.

Holmes, G., Sandbrook, C., and Fisher, J. A. (2017). Understanding conservationists' perspectives on the new-conservation debate. *Conserv. Biol.* 31, 353–363. doi: https://doi.org/10.1111/cobi.12811.

Hyder, K., Weltersbach, M. S., Armstrong, M., Ferter, K., Townhill, B., Ahvonen, A., et al. (2018). Recreational sea fishing in Europe in a global context—Participation rates, fishing effort, expenditure, and implications for monitoring and assessment. *Fish Fish.* 19, 225–243. doi: https://doi.org/10.1111/faf.12251.

Ihde, T. F., Wilberg, M. J., Loewensteiner, D. A., Secor, D. H., and Miller, T. J. (2011). The increasing importance of marine recreational fishing in the US: Challenges for management. *Fish. Res.* 108, 268–276. doi: https://doi.org/10.1016/j.fishres.2010.12.016.

Ison, S., Pecl, G., Hobday, A. J., Cvitanovic, C., and Van Putten, I. (2021). Stakeholder influence and relationships inform engagement strategies in marine conservation. *Ecosyst. People* 17, 320–341. doi: https://doi.org/10.1080/26395916.2021.1938236.

Jacobsen, K. S., and Linnell, J. D. C. (2016). Perceptions of environmental justice and the conflict surrounding large carnivore management in Norway — Implications for conflict management. *Biol. Conserv.* 203, 197–206. doi: https://doi.org/10.1016/j.biocon.2016.08.041.

Jiménez-Alvarado, D., Guerra-Marrero, A., Sarmiento-Lezcano, A., Meyers, E. K. M., and Castro, J. J. (2020). First assessment of the spearfishing impact in the Canary Islands. *Reg. Stud. Mar. Sci.* 38, 101385. doi: https://doi.org/10.1016/j.rsma.2020.101385.

Jones, K., and Seara, T. (2020). Integrating Stakeholders' Perceptions into Decision-Making for Ecosystem-Based Fisheries Management. *Coast. Manag.* 48, 275–288. doi: https://doi.org/10.1080/08920753.2020.1773211.

Kearney, R. E. (2001). Fisheries property rights and recreational/commercial conflict: Implications of policy developments in Australia and New Zealand. *Mar. Policy* 25, 49–59. doi: https://doi.org/10.1016/S0308-597X(00)00035-X.

Kearney, R. E. (2002). Co-management: the resolution of conflict between commercial and recreational fishers in Victoria, Australia. *Ocean Coast. Manag.* 45, 201–214.

Kibria, M. M., Dilshad, T., and Al Asek, A. (2022). Policy implications based on stakeholders' perceptions for integrated management of the Halda River: Bangabandhu Fisheries Heritage of Bangladesh. *Water Policy* 24, 517–533. doi: https://doi.org/10.2166/wp.2022.003.

Lynch, A. J., Cooke, S. J., Deines, A. M., Bower, S. D., Bunnell, D. B., Cowx, I. G., et al. (2016). The social, economic, and environmental importance of inland fish and fisheries. *Environ. Rev.* 24, 115–121. doi: https://doi.org/10.1139/er-2015-0064.

MacKenzie, C. J. A., and Cox, S. P. (2013). Building legitimacy of the recreational fishing sector in mixed commercial-recreational fisheries. *Ocean Coast. Manag.* 75, 11–19. doi: https://doi.org/10.1016/j.ocecoaman.2013.01.004.

Martín-Sosa, P. (2019). Spearfishing in The Canary Islands: is the devil as black as it seems to be? Sci. Insul. Rev. Ciencias Nat. en islas 2, 9–36. doi: https://doi.org/10.25145/j.si.2018.01.01.

McKeown, B., and Thomas, D. (1988). Q Methodology. doi: https://doi.org/10.4135/9781412985512.

Meckstroth, T. W. (1981). Political Subjectivity: Applications of Q Methodology in Political Science. By Steven R. Brown. (New Haven: Yale University Press, 1980. Pp. xiv + 355. $35.00, cloth; $9.95, paper.). Am. Polit. Sci. Rev. 75, 737–738. doi: https://doi.org/10.2307/1960969.

Michailidis, N., Katsanevakis, S., and Chartosia, N. (2020). Recreational fisheries can be of the same magnitude as commercial fisheries: The case of Cyprus. Fish. Res. 231, 105711. doi: https://doi.org/10.1016/j.fishres.2020.105711.

Mitchell, R. W. D., Baba, O., Jackson, G., and Isshiki, T. (2008). Comparing management of recreational Pagrus fisheries in Shark Bay (Australia) and Sagami Bay (Japan): Conventional catch controls versus stock enhancement. Mar. Policy 32, 27–37. doi: https://doi.org/10.1016/j.marpol.2007.04.003.

Naskar, M., Sarkar, U. K., Mishal, P., Karnatak, G., Saha, S., Bandopadhyay, A., et al. (2021). Assessing vulnerability of wetland fisheries to climate change: a stakeholders' perception-based approach. Clim. Dev. 0, 1–17. doi: https://doi.org/10.1080/17565529.2021.1956410.

Nielsen, K. N., Aschan, M. M., Agnarsson, S., Ballesteros, M., Baudron, A., Borges, M. de F., et al. (2018). A framework for results-based management in fisheries. Fish Fish. 19, 363–376. doi: https://doi.org/10.1111/faf.12257.

Pascoe, S. (2006). Economics, fisheries, and the marine environment. ICES J. Mar. Sci. 63, 1–3. doi: https://doi.org/10.1016/j.icesjms.2005.11.001.

Pitcher, T. J., and Hollingworth, C. E. (2002). "Fishing for Fun: Where's the Catch?," in Recreational Fisheries (John Wiley & Sons, Ltd), 1–16. doi: https://doi.org/10.1002/9780470995402.ch1.

Retnoningtyas, H., Yulianto, I., Soemodinoto, A., Herdiana, Y., Kartawijaya, T., Natsir, M., et al. (2021). Stakeholder participation in management planning for grouper and snapper fisheries in West Nusa Tenggara Province, Indonesia. Mar. Policy 128, 104452. doi: https://doi.org/10.1016/j.marpol.2021.10445.

Riera, R., Menci, C., Sanabria-Fernández, J. A., and Becerro, M. A. (2016). Do recreational activities affect coastal biodiversity? Estuar. Coast. Shelf Sci. 178, 129–136. doi: https://doi.org/10.1016/j.ecss.2016.05.02.

Ritchie, H., and Ellis, G. (2010). "A system that works for the sea"? Exploring Stakeholder Engagement in Marine Spatial Planning. J. Environ. Plan. Manag. 53, 701–723. doi: https://doi.org/10.1080/09640568.2010.488100.

Sand, P. H. (2000). The precautionary principle: A European perspective. Hum. Ecol. Risk Assess. 6, 445–458. doi: https://doi.org/10.1080/10807030091124563.

Sbragaglia, V., Arlinghaus, R., Blumstein, D., Coll, M., Dedeu, A., Diogo, H., et al. (2021). Spearing into the future: a global review of marine recreational spearfishing. doi: https://doi.org/10.32942/osf.io/f5whn.

Smith, A., and Nakaya, S. (2002). S Pearfishing – Is It Ecologically Sustainable ? 3rd WORLD Recreat. Fish. Conf. 21-24 MAY 2002. North. Territ. Aust. 2, 2000–2003.

Soma, K., Nielsen, J. R., Papadopoulou, N., Polet, H., Zengin, M., Smith, C. J., et al. (2018). Stakeholder perceptions in fisheries management - Sectors with benthic impacts. Mar. Policy 92, 73–85. doi: https://doi.org/10.1016/j.marpol.2018.02.019.

Stephenson, W. (1953). The study of behavior; Q-technique and its methodology. Chicago, IL, US: University of Chicago Press.

Terlizzi, A. (2022). Ecological , Social and Economic Aspects of Italian Marine Spearfishing Tournaments. 9, 1–11. doi: https://doi.org/10.3389/fmars.2022.891246.

Ulman, A., Ali, F. Z., Harris, H. E., Adel, M., Mabruk, S. A. A. A., Bariche, M., et al. (2022). Lessons From the Western Atlantic Lionfish Invasion to Inform Management in the Mediterranean. Front. Mar. Sci. 9, 1–12. doi: https://doi.org/10.3389/fmars.2022.865162.

Ünal, V., Acarli, D., and Gordoa, A. (2010). Characteristics of marine recreational fishing in the Çanakkale Strait (Turkey). Mediterr. Mar. Sci. 11, 315–330. doi: https://doi.org/10.12681/mms.79.

Voyer, M., Barclay, K., McIlgorm, A., and Mazur, N. (2017). Connections or conflict? A social and economic analysis of the interconnections between the professional fishing industry, recreational fishing and marine tourism in coastal communities in NSW, Australia. Mar. Policy 76, 114–121. doi: https://doi.org/10.1016/j.marpol.2016.11.029.

Watts, S., and Stenner, P. (2005). Doing Q methodology: Theory, method and interpretation. Qual. Res. Psychol. 2, 67–91. doi: https://doi.org/10.1191/1478088705qp022oa.

Yang, Y. (2016). A Brief Introduction to Q Methodology. Int. J. Adult Vocat. Educ. Technol. 7, 42–53. doi: https://doi.org/10.4018/ijavet.2016040104.

Zabala, A. (2014). Qmethod: A package to explore human perspectives using Q methodology. R J. 6, 163–173. doi: https://doi.org/10.32614/rj-2014-032.

Zabala, A., Sandbrook, C., and Mukherjee, N. (2018). When and how to use Q methodology to understand perspectives in conservation research. Conserv. Biol. 32, 1185–1194. doi: https://doi.org/10.1111/cobi.13123.

SUPPLEMENTARY MATERIAL

No Supplementary Material