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Abstract

Fishers' participation in the fishery management decision-making process is generally low, particularly in small-scale fisheries (SSF). Within the overarching goal of improving fisheries governance, fishers' participation is crucial. Yet, how can fishers participate in the decision-making processes which affect their actions, and to what extent do fisher associations represent their interests? These questions were tackled by means of an empirical case study in the "Tertúlia do Polvo" project, focusing on the octopus SSF in the Algarve region (south Portugal), where the octopus fishery is managed top-down with sporadic participation of fishers. During the study (2014 and 2015), seven participatory workshops (tertúlias) were held, involving fisher associations, management authorities and researchers, to propose and discuss management measures for the fishery. Also, a face-to-face questionnaire survey (121 valid replies) was undertaken with local fishers to gauge their opinions about the management measures proposed during the workshops. Results show a strong agreement between the outcomes achieved during the workshops and the main concerns and possible solutions identified by fishers. Taking into consideration the difficulty in structuring and assuring a transparent and effective participation of fishers in the management of their activity, the results obtained are promising. In this study, the use of a participatory process (restricted to a small group of stakeholders) combined with consultation (targeting a sample of the fisher population) allowed the validation of the overall results obtained. Such a methodological approach can be tried in other fishing communities to implement efficient and effective collaborative management, contributing to improved fisheries governance.

Keywords	Governance, participation, participatory processes, common octopus, small-scale fishery, fishing associations, fisheries management
Corresponding Author	Mafalda Oliveira
Corresponding Author's Institution	University of Algarve
Order of Authors	Mafalda Oliveira, Cristina Pita, Manuela de Oliveira, Maria Helena Guimarães, Rita Rainha, Carlos Sonderblohm, Pedro Monteiro, Frederico Oliveira, Marta Ballesteros, Jorge Goncalves, Graham Pierce, Karim Erzini

Highlights

1. Participatory and consultation approaches were used in the Algarve octopus fishery
2. Outcomes of participatory workshops were in agreement with the survey of fishers
3. Octopus fisher association adequately represent their constituencies
4. Participatory workshops improve governance, and the consultation process verifies it
5. The combined approaches can effectively contribute to improve fisheries governance

Abstract

Fishers' participation in the fishery management decision-making process is generally low, particularly in small-scale fisheries (SSF). Within the overarching goal of improving fisheries governance, fishers' participation is crucial. Yet, how can fishers participate in the decision-making processes which affect their actions, and to what extent do fisher associations represent their interests? These questions were tackled by means of an empirical case study in the "Tertúlia do Polvo" project, focusing on the octopus SSF in the Algarve region (south Portugal), where the octopus fishery is managed top-down with sporadic participation of fishers. During the study (2014 and 2015), seven participatory workshops (*tertúlias*) were held, involving fisher associations, management authorities and researchers, to propose and discuss management measures for the fishery. Also, a face-to-face questionnaire survey (121 valid replies) was undertaken with local fishers to gauge their opinions about the management measures proposed during the workshops. Results show a strong agreement between the outcomes achieved during the workshops and the main concerns and possible solutions identified by fishers. Taking into consideration the difficulty in structuring and assuring a transparent and effective participation of fishers in the management of their activity, the results obtained are promising. In this study, the use of a participatory process (restricted to a small group of stakeholders) combined with consultation (targeting a sample of the fisher population) allowed the validation of the overall results obtained. Such a methodological approach can be tried in other fishing communities to implement efficient and effective collaborative management, contributing to improved fisheries governance.

Do fisher associations really represent their members' needs and opinions?

The case study of the octopus fishery in the Algarve (south Portugal)

Mafalda Rangel (1), Cristina Pita (2), Manuela Maria de Oliveira (3,4); Maria Helena Guimarães (5), Rita Rainha (1) Carlos Sonderblohm (1), Pedro Monteiro (1), Frederico Oliveira (1), Marta Ballesteros (6), Jorge M.S. Gonçalves (1), Graham J. Pierce (7,8,9), Karim Erzini (1)

(1) Centre of Marine Sciences (CCMAR), University of Algarve, Campus de Gambelas, FCT Ed 7, 8005-139, Faro, Portugal; (2) Department of Environment and Planning & Centre for Environmental and Marine Studies (CESAM), University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal; (3) INESC TEC and Faculty of Engineering, University of Porto, Dr. Roberto Frias St., 4200-465 Porto Portugal; (4) Instituto Português do Mar e da Atmosfera I.P./IPMA, Avenida 5 de Outubro, 8700-305 Olhão, Portugal; (5) Instituto de Ciências Agrárias e Ambientais Mediterrânicas (ICAAM), University of Evora, Núcleo da Mitra, Edifício Principal, Apartado 94, 7002-554 Évora, Portugal; (6) Centro Tecnológico del Mar – Fundación (CETMAR), Rúa de Eduardo Cabello, S/N, 36208 Vigo, Pontevedra, Espanha; (7) Department of Biology & Centre for Environmental and Marine Studies (CESAM), University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal; (8) Oceanlab, University of Aberdeen, Main Street, Newburgh, AB416AA, UK, (9) Instituto de Investigaciones Mariñas (CSIC), Eduardo Cabello 6, 36208, Vigo, Spain.

First author (corresponding author): Mafalda Oliveira Rangel

Affiliation: Centre of Marine Sciences (CCMAR), University of the Algarve, 8005-139 Faro, Portugal

Address: Universidade do Algarve, Campus de Gambelas, FCT Ed.7, 8005-139 Faro, Portugal

E-mail: mrangel@ualg.pt

Phone number: +351 936 747 853

Co-author: Cristina Brice Pita

Affiliation: Department of Environment and Planning & Centre for Environmental and Marine Studies (CESAM), University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal

E-mail: c.pita@ua.pt

Co-author: Manuela Maria de Oliveira

Affiliation: INESC TEC and Faculty of Engineering, University of Porto, Dr. Roberto Frias St., 4200-465 Porto Portugal; Instituto Português do Mar e da Atmosfera I.P./IPMA, Avenida 5 de Outubro, 8700-305 Olhão, Portugal

E-mail: manuelamcoliveira@gmail.com

Co-author: Maria Helena Guimarães

Affiliation: Instituto de Ciências Agrárias e Ambientais Mediterrânicas (ICAAM), University of Evora, Núcleo da Mitra, Edifício Principal, Apartado 94, 7002-554 Évora, Portugal

E-mail: mhguimaraes@uevora.pt

Co-author: Rita Rainha

Affiliation: Centre of Marine Sciences (CCMAR), University of the Algarve, 8005-139 Faro,

Portugal

E-mail: rita_rainha@hotmail.com

Co-author: Carlos Sonderblohm

Affiliation: Centre of Marine Sciences (CCMAR), University of the Algarve, 8005-139 Faro, Portugal

E-mail: c.sonderblohm@gmail.com

Co-author: Pedro Monteiro

Affiliation: Centre of Marine Sciences (CCMAR), University of the Algarve, 8005-139 Faro, Portugal

E-mail: pmonte@ualg.pt

Co-author: Frederico Oliveira

Affiliation: Centre of Marine Sciences (CCMAR), University of the Algarve, 8005-139 Faro, Portugal

E-mail: fredoliveira@ualg.pt

Co-author: Marta Ballesteros

Affiliation: Centro Tecnológico del Mar – Fundación (CETMAR), Rúa de Eduardo Cabello, S/N, 36208 Vigo, Pontevedra, Espanha

E-mail: mballesteros@cetmar.org

Co-author: Jorge Manuel Santos Gonçalves

Affiliation: Centre of Marine Sciences (CCMAR), University of the Algarve, 8005-139 Faro, Portugal

E-mail: jgoncal@ualg.pt

Co-author: Graham J. Pierce

Affiliation: Department of Biology & Centre for Environmental and Marine Studies (CESAM), University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal; Oceanlab, University of Aberdeen, Main Street, Newburgh, AB416AA, UK; Instituto de Investigaciones Mariñas (CSIC), Eduardo Cabello 6, 36208, Vigo, Spain.

E-mail: g.j.pierce@abdn.ac.uk

Co-author: Karim Erzini

Affiliation: Centre of Marine Sciences (CCMAR), University of the Algarve, 8005-139 Faro, Portugal

E-mail: kerzini@ualg.pt

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Do fisher associations really represent their members' needs and opinions? The case study of the octopus fishery in the Algarve (south Portugal)

1. Introduction

Increasing stakeholder participation in fishery management, including fisher empowerment, citizen action and civil society involvement, reflect a common trend in public management [1]. Ever since the 2002 reform of the Common Fishery Policy (CFP), the European Union (EU) has moved towards an improvement in the fishery governance system, increasingly requiring greater stakeholder involvement, along with more decentralization, transparency and accountability in fishery management [2].

In fact, stakeholder participation has long been a part of the EU fisheries governance debate, as a way to encourage inclusion of multiple perspectives in defining management goals [3]. The involvement of stakeholders in the decision-making process is considered nowadays to be an essential element of good governance [4-6] and is gaining momentum in the public agenda [7]. Including stakeholders in the decision-making process leads to the integration of local knowledge [8], inclusion of different points of view and values [5], generation of trust and cooperation [5, 9-12], reduction in the likelihood and gravity of conflict situations [4, 10], increasing likelihood of compliance with rules and regulations, enhancing transparency in the fishery management process, and promoting the legitimacy of policies and decisions [4, 5, 8, 9, 11].

The literature on public participation highlights different degrees of involvement of stakeholders in the decision-making process, from consultation to full self-management [7, 13-15]. The inertia inherent in any top-down governance system tends to restrict the degree of stakeholder involvement. As such, stakeholder involvement needs to be carefully planned in order to ensure legitimate and meaningful participation [13].

The implementation of participatory approaches in fisheries governance is challenging, not only because of the need to ensure participation, but also due to the resources needed to guarantee that decision-making takes into consideration all the relevant sectoral interests. The identification of stakeholders to be involved is one of the preliminary steps in a participatory approach [16]. Fishers' associations are a well-established type of stakeholder group within a fisheries governance framework, whose participation has led to stronger involvement of fishers in policy-making. However, no matter how well a participatory process is planned, depending on the size of the target population, one can question whether the stance of the fishers' associations and the trade-offs that they are willing to accept within the negotiation process are aligned with the overall interests of the fishing sector of community they represent.

An attempt to develop a co-management model does not automatically legitimize it, for example if lack of trust and conflict among actors exist [17-19]. In fact, de Vos and Mol [18] emphasise that trust relationships among fishers from different localities are needed to ensure cooperation and promote the legitimacy of governance arrangements. The authors conclude that, in some of their case-studies of the Dutch fishing industry, the representatives of fishers together with other parties imposed unrealistic measures, or measures that did not match the needs of the fishers, leading to distrust. This issue must therefore be taken into careful consideration when trying to

implement new management measures based on the opinions of fishers' representatives rather than accounting for the opinions of the fishers themselves.

The Portuguese octopus trap and pot fishery is managed at the national level, mostly through a centralized top-down decision-making process, with sporadic participation of fishers, and is characterized by a low level of compliance with rules and regulations [11]. The Algarve region (south Portugal) was responsible for around 35% of the total national landings of octopus (which amounted to 7,692 t in 2015) [20, 21]. Considering the overall importance of the Algarve octopus trap and pot fishery in the region and the country, this fishery was selected as a case study to implement a bottom-up participatory approach aimed at improving the fishery governance system. The project, designated "Tertúlia do Polvo", included a multi-stakeholder participatory process consisting of a series of workshops involving the octopus fishers' associations in the Algarve, the public administration in charge of policy-making, and researchers [12, 20]. This participatory process was the first step in analysing the possibility of implementing a management system defined by the EU H2020 EcoFishMan Project as a Responsive Fisheries Management System (RFMS) [7, 22, 23]. Although the process was widely advertised and open to all interested individuals, fishers were represented by their associations rather than attending individually. This participatory process resulted in a list of management actions, and assignment of priorities to them, as suggested by representatives of the fisher associations [12].

The objective of the present study is to identify the extent to which the results from the workshops are aligned with the overall interests of the fishers. This question is relevant for several reasons. On the one hand, participatory approaches are promoted with the premise that the decisions made will be implemented with greater acceptance than if the decisions are made by a centralized public authority [1, 14]. On the other hand, a multi-stakeholder approach implies negotiations, trade-offs and the achievement of a compromise and, in the case of the Algarve octopus fishery, trade-offs were made between social and economic and conservation and ecological objectives. Therefore, the outcomes might not fully reflect the interests of all stakeholder groups, individual fishers or associations. Since fishers are the actors who will need to comply with the new, improved management actions, it is important to understand whether the compromises reached during the workshops are all acceptable to fishers.

To the best of our knowledge, only a few scientific studies have evaluated whether a participatory decision-making approach to fisheries management is in accordance with the interests and perspectives of the overall fishing community (e.g. de Vos and van Tatenhove [18] who studied the Dutch industry, or Lleonart et al. [24] who studied the sand eel fishery of Catalonia). The present analysis contributes with empirical data to the overall discussion regarding the importance of the use of participatory decision-making in fisheries management. Furthermore, by providing a step-by-step description of the approach we aim to contribute with an example of how collaborative management can be implemented.

2. Methodology

2.1 The case study: Algarve octopus fishery and management

In Portugal, the *Octopus vulgaris* (from here on referred to as octopus) is targeted almost exclusively by the licenced small-scale fishery (SSF: vessels employing static gears and <12m in total length), which is a major component of the Portuguese fleet which, in 2015, employed 70% of all fishers and accounted for 90% of registered vessels (12.9% of the total Gross Tonnage (GT))

of fishing vessels, and 41.0% of the total fishing power (kW)) [21]. Octopus is fished throughout the year and is the most important landed species in terms of value (35,823,000 euros in 2015), and fourth most important fished species in terms of weight of landings (7,675 t in 2015), after chub mackerel, horse mackerel and sardine [25]. The Portuguese octopus SSF is especially important in the Algarve region (south of Portugal), where it provides employment and income to many fishers [11]; in 2015, 1719 octopus fishers (or related activities) were employed in this region (according to the Portuguese Government's Directorate General for Natural Resources, Safety and Maritime Services; DGRM).

Official data from DGRM indicates that the largest octopus SSF fleet is that of the Algarve (548 fishing vessels in 2014 and 570 in 2015), where octopus is the most important species in landings, both in terms of quantity and value (1,995 t in 2015), regardless of the high variability in landings registered in these years. Most of the octopus is caught using traps and pots, with only around 10% of landings attributed to bottom trawling [26].

[FIGURE 1. ABOUT HERE]

Octopus fisheries are not managed under the Common Fishery Policy (CFP), and each EU Member State is responsible for managing its own fishery [11]. In Portugal, the legal framework for this fishery is mainly defined by the regulatory decree nº 1102 - D/2000, and management is carried out by DGRM, with scientific support provided by the Portuguese Institute for the Sea and Atmosphere (IPMA) [11, 12].

There have been several attempts since the late 1990s to regulate the small-scale pot and trap fishery fleet, with various legislative ordinances put in place (Table 1), driven mainly by fishers' demands [11, 27]. This is still considered a top-down management process since consultation with fishers is sporadic, not structured, and decision-making is centralized within public authorities. Pita et al. [11] described this process, summarizing the existing regulations and technical measures regarding gear design, bait used and the definition of a Minimum Landing Weight (750g).

Although the involvement of fishers in the decision-making process is still limited, it has increased over the last 15 years as they became more organized, forming associations. Belonging to an association is not compulsory, and fishers can belong to one or more associations, usually because of harbour/neighbourhood proximity and/or market agreements. Associations have become increasingly professionalized (e.g. hiring trained administrative staff to deal with bureaucratic problems experienced by the members, or to manage first sale auction markets), and have developed a greater capacity to lobby and defend their interests [11]. Furthermore, the wide year-to-year fluctuations in octopus landings have alarmed the fishing community, resulting in increasing pressure from the associations on the public administration to act (even though this fluctuation is probably mainly environmentally driven) [11]. Formal participation of fishers in the decision-making process started in 2010 [11]. In this regard, the southern region of Portugal played an important role in defining regulations at the national level, as most of the changes in regulations were a direct result of pressure from Algarve octopus fishers on the fisheries administration. In fact, of the 14 published octopus fishery regulations, eight were implemented solely for the Algarve (Table 1).

[TABLE 1. ABOUT HERE]

The Portuguese trap and pot octopus fishery faces several important management and governance challenges. These are mostly related with the excessive fishing effort due to the use of far more gear than allowed by law, the landing of undersized octopus, unpredictable revenue generated by the octopus fishery, and environmentally driven fluctuations in recruitment [11, 28]. Pita et al. [11] also report other types of challenges connected with social interactions between communities. The existence of 14 octopus fisher associations along the Algarve region [12] indicates high organizational capacity, but also reflects lack of trust and cooperation among associations [11] and highlights the challenges of putting forward any management measures based on collaboration.

2.2. The collaborative methodological approach

The methodological approach in the present study included five phases (Figure 2). In the first phase, management actions considered necessary to improve the current management of this fishery were compiled. In the second phase the analysis and systematization of phase 1 outcomes was developed. Phase 2 outcomes were discussed during phase 3, which corresponded to workshops based on participatory tools and skilled facilitation. In phase 4, the overall fishery community was consulted to understand their reaction to what was concluded during the phase 3 workshops. In the final phase a comparative analysis of the results obtained during phase 3 and 4 was undertaken.

[FIGURE 2. ABOUT HERE]

The compilation of management actions considered to be useful for improving the management of the octopus fishery in the Algarve region, collected in phase 1, was carried out through a consultation process with fishers' representatives, researchers and authorities. An open-ended questionnaire was designed to identify the most important management actions to change/implement in the management of the octopus fishery in the Algarve. At this stage stakeholders were identified using the research team's knowledge of the community; the questionnaire was sent by email to every fishing association in the region, as well as to the public administration with fisheries management responsibilities and to the research community involved with the octopus fishery. All entities replied to the questionnaire by email or telephone and a list of 51 management actions was compiled. Taking into consideration the large number of actions identified and the overlap between some of those actions, Phase 2 consisted of a review of all actions and a systematization of information, which resulted in the identification of 17 management measures (some comprising several actions). This process was validated by all participants during Phase 3, which included seven workshops that took place from April 2014 to April 2015. Each workshop aimed at discussing a subset of the 17 management measures, so that all measures were discussed. Each workshop lasted for three hours and was structured and led by a skilled facilitator. In each workshop, there were periods of discussion in small groups, production of factsheets for summarizing the main points, and a plenary session was held to present and discuss the conclusions of the small groups. All sessions were video-recorded and transcribed. The number of workshops was determined based on the final goal, which was to detail how the 17 management measures could be put

into action and which ones were more consensual and relevant for the workshop participants.

Phase 4 consisted of a closed-ended face-to-face questionnaire carried out with fishers, to explore whether the management measures identified and discussed during the participatory workshops were accepted by a sample of fishers from the octopus fisher community that would have to comply with them. In other words, were representatives really considering the opinions and needs of their constituencies when engaging in the participatory processes in the octopus fishery?

In the questionnaire, respondents were asked to rate each of the 17 management measures using a scale ranging from 1 (strongly agree) to 5 (strongly disagree). The face-to-face questionnaire survey was carried out from December 2014 to July 2015 in nine Algarve fishing ports, covering all ports with an important octopus pot and trap fishery (see Figure 1). Fishers were selected randomly from the studied area, with only one interview carried out *per* vessel. A total of 121 completed questionnaires was obtained, corresponding to 22% of the fleet of 548 vessels operating in the Algarve region in 2014.

During the data analysis (Phase 5), content analysis was developed with data from the workshops discussions, while the questionnaires results were analysed with descriptive statistics and Principal Component Analysis (PCA). Content analysis of the transcription from the workshops was combined with the factsheets produced during each workshop. From this analysis, the management measures were divided in 3 groups:

1) **consensual**, i.e., the actions that were considered important to implement by all participants,

2) **not consensual**, i.e., those that were considered important to implement by only some of the participants and,

3) **needing further discussion**, i.e. those for which additional information was needed, or which were considered to be difficult to implement due to their complexity, lack of capacity to implement them, and/or due to foreseeing unwillingness of the fishing community to comply.

The analysis of the data collected by the questionnaire survey, related to the answers regarding the importance given to the 17 management measures (further detailed in section 3.3), included the recoding of data to a three-point scale: agree (1 and 2 from the 5-point scale), neutral (3) and disagree (4 and 5). This recoding improved the internal consistency of the answers, tested afterwards using a reliability analysis [29, 30]. The analysis was based on the calculation of a correlation using Cronbach's α [31] of 0.5, following the assumptions of Hair et al. [32] and considering the data and the sample size [33]. This test is needed to confirm the internal consistency required to apply Principal Component Analysis (PCA). The PCA summarises the information content n original variables in a smaller number, q , of derived variables, the principal components, which are linear combinations of the original variables. In the present case PCA was undertaken to classify the 17 management measures ranked by level of importance by the respondents of the questionnaire to a smaller number of factors or components. Factor loadings $\geq |0.45|$ were considered for the classification. Additionally, Pearson's chi-squared test (χ^2) was used to evaluate the independence of specific answers considered relevant for further discussion.

All statistical analysis was undertaken using the software IBM SPSS® Statistics, version 21.

3. Results and Discussion

3.1. Participants of the workshops

Figure 3 shows the number of participants in each of the seven workshops. The average participation was 20 persons, with a minimum of 11 and the maximum of 24.

[FIGURE 3. ABOUT HERE]

While a core group of representatives of the fishing industry participated in almost all workshops, the number of participants varied between workshops, probably due to the wide public dissemination, which may have led some participants to choose to attend a specific workshop, according to their particular interests. As each workshop was independent, with specific measures discussed, the variability in participation between sessions does not influence the conclusions attained. When previously discussed issues were brought up, the conclusions from previous sessions were presented and discussed, but on no occasion was there any disagreement with the conclusions attained in the previous session(s).

3.2. General descriptive statistics on the questionnaire results

A total of 121 fishers was interviewed. A majority of the respondents were older than 40 years old (62.7%), with 21 to 40 years fishing experience (61.2%), married or co-habiting (72.7%). Most fishers had a low formal education level, consistent with the findings of Pita et al. [6] in Fuzeta (Algarve) and Tzanatos et al. [34] in Greece.

The majority of fishers interviewed belonged to at least one fisher association (71.1%) and believed that they were properly represented by their organization (91.1%). With regard to knowledge of the existence of the project “Tertúlia do Polvo”, only 33.9% knew about the workshops.

A majority of fishers also indicated an interest in having a Management Plan (MP) for the octopus Algarve fishery (71.9%), stating that this would improve their activity by providing a more focused and long-term plan for the fishery. Therefore, these results indicate that a MP developed with the fishing community would probably have good chances of being accepted by the fishers (Table 2).

[TABLE 2. ABOUT HERE]

Pearson's chi-square tests of independence were used to test for a relationship between the acceptance of a Management Plan for the Algarve octopus fishery and being part of or being well-represented by a fisher association. Results show that there is no relationship between these replies ($p > 0.1$). Therefore, the willingness to accept more organized management of this fishery appears to be transversal among octopus fishers and independent of membership

of (or satisfaction with) a fishery association. In fact, fishers seem to see a Management Plan as a positive and important measure, independently of belonging to an association.

3.3 The proposed management measures: combined analysis of the workshops and questionnaire results

The 17 management measures identified during the “Tertúlia do Polvo” project are presented in Table 3, where the degree of consensus on the importance of each measure achieved during the participatory workshops and the degree of importance attributed to each measure by the local fishers who responded to the questionnaire are shown. Results indicate that the measures considered consensual (and important) during the workshops by all the participants were also ranked as important by fishers responding to the questionnaire. Definition of an exclusive working group for a future Management Plan (MP), creation of a label, improving communication among associations and introduction of on-board monitoring were all considered important by over three-quarters (76% to 87%) of the interviewed fishers and also by all the participants of the workshops. The fact that these measures were consensually important (among fishers and in the workshops) indicates an alignment between the interest of fishers and the associations that represent them.

[TABLE 3. ABOUT HERE]

Of all the proposed measures, the implementation and enforcement of a Closed Season, with duration and timing defined according to expert knowledge, was consensual and considered the most important measure by the workshop participants [12, 20]. Interestingly, a substantial majority of interviewed fishers also agreed with the implementation and enforcement of a Closed Season (83% and 85%, respectively). In fact, a formal request for the definition of a Closed Season for the octopus fishery in the Algarve was prepared during the workshops and sent to the Portuguese fisheries authority [12, 20]. Although the administration indicated interest in the proposed Closed Season, it has yet to be implemented.

It must be emphasized that, in the case of the Algarve octopus fishery, a formal experimental closure was implemented in August 2005, as a regional ordinance, but it was removed soon afterward by the administration [12]. The willingness of workshop participants and fishers to repeat such a management action reinforces the likelihood of successful implementation. Nonetheless, in the current format of governance, management actions need to be regulated by the public administration, and the lack of action so far may indicate the absence of conditions which would allow the combination of the current top-down policy-making system with collaborative approaches, where fishers contribute to the creation of the necessary management actions.

Regarding the increasing of Minimum Landing Weight, consensus was reached during the workshops regarding the importance of this measure but not about its implementation. Nevertheless, some reluctance was disclosed by representatives of fishers regarding the implementation of this measure, mainly due to their uncertainty about how it would be accepted by the fishing community they represented. Also, “maintaining a Minimum Landing Weight” was considered as a measure “needing further discussion” during the

workshops, and it was acknowledged that this measure is currently not adequately enforced. The worries of fishers' representatives seem to have been justified as 74% of the fishers surveyed disagreed with increasing the Minimum Landing Weight, while 75% agreed with maintaining the current Minimum Landing Weight. These workshop results highlight the importance given by the participants to the fishing community's opinions and concerns, since despite the consensus on increasing Minimum Landing Weight for octopus, it was also clearly stressed that to promote such a measure, the favourable opinion of the fishing community was essential.

In fisheries management, the definition of a Minimum Landing Size/Weight is a commonly used measure to ensure reproduction before capture and is generally based on the length (L_{50}) or biomass (W_{50}) at which half of the females are mature [27, 35]. For the octopus this measure should be carefully considered, as this species is a terminal breeder and reproduction thus does not usually happen before capture (unless a female is taken while she is guarding her eggs). Moreover, the legal Minimum Landing Weight (750g) seems to be inadequate considering the W_{50} concept. In fact, Pereira [27] reported that, considering that most octopus survive capture and release, the Portuguese Institute for Fisheries and Atmosphere (IPMA) had already proposed a Minimum Landing Weight of 1500g for the Portugal octopus fishery, although the W_{50} calculated at the time was 2259g. Nevertheless, the measure was considered unacceptable by fishers' representatives because, in their opinion, the resulting short-term decrease in catches would have a negative impact on fishing communities which are highly dependent on this resource. A Minimum Landing Weight of 750g was then legislated. This outcome suggests an inability or unwillingness to consider the likely long-term benefits of management measures which would result in a short-term decline in catches.

Jouffre and Caverivière [36] proposed the combination of a Minimum Landing Weight and a Closed Season for the common octopus fishery of Senegal (350g or 500g and a closure of two months from July to August) as an acceptable management strategy. The authors emphasised that this combined strategy (Minimum Landing Weight and Closed Season) seems better than the implementation of each measure separately, based on results of previous studies simulating the effects of these separate measures on catches [37, 38]. The importance of using combined measures as a strategy for improving the management of this fishery in the Algarve was also discussed during the workshops [12, 20] and one of the final conclusions of the workshops was the recognition that only the combination of several measures would promote profitability and sustainability in this fishery.

Decreasing fishing effort was unanimously considered important during the workshops, but participants could not find a consensual way to achieve a reduction, even though several methods were proposed and discussed, such as the individual tagging of fishing traps or sets of traps, as already implemented in the Experimental Plan for Octopus Management in Galicia (Spain) [39, 40]. During the workshops and the questionnaire survey, participants and fishers both recognized that this is a very sensitive issue, since the number of traps used is often far greater than that permitted by law [12, 20]. Pita et al. [11] observed that, in fact, the excessive number of traps deployed in the Algarve waters is a problem that causes and/or increases conflicts, raising important issues regarding social justice. In relation to this point, 54% of fishers surveyed acknowledged the importance of reducing fishing effort, with 44% thinking otherwise. Taken together, these observations highlight doubts about the ability of fishers to cooperate with each other.

During the workshops the only management measure considered as “not consensual” concerned the use of live bait. This is in fact the most controversial issue, with some fishers strongly in favour of using live bait and others having the opposite opinion [20]. Ordinance 230/2012, which prohibits the use of live bait in the Algarve (Table 1), explicitly mentions that this is an indirect measure to try to control the excessive number of traps being deployed in the Algarve. This is because the use of live green crabs (*Carcinus maenas*) as bait instead of dead small pelagic fish such as Atlantic Chub Mackerel (*Scomber colias*) removes the need for daily re-baiting of traps, which arises when using dead bait due to scavenging of the bait by amphipods [29]. Thus, using live crabs allows for the use of more lines of traps at the same time. Interviewed fishers were also split regarding this issue, with 52% agreeing with the prohibition of live bait (Table 3).

Several other measures were considered as “needing further discussion” by the participants of the workshops (Table 3). For example, the imposition of schedules and days-at-sea limits, as a way to decrease fishing effort, was intensively debated during the workshops and two scenarios were discussed: fishing schedules and weekend stops. However, there was no consensus, probably due to the complexity of the measures. In fact, for some areas of the leeward Algarve, the access to the sea is highly conditioned by the lagoon inlets and the definition of schedules and days-at-sea could further reduce the number of available fishing days, while the same would not happen in the windward Algarve where access to the sea is not conditioned by lagoon inlets. In fact, in the workshops, different port-specific hydrological conditions, together with the loss of “windows of opportunity” for fishing were considered as the main constraints for the implementation of such management measures [12]. Interestingly, and indicating that the outcomes of the workshops are in line with fishers’ preferences, a majority (62%) of the interviewed fishers disagreed with the definition of schedules and days-at-sea.

Regarding the setting of vessel quotas, the initial proposal was to define a fixed daily maximum allowable catch according to boat size and number of crew members [12], as already implemented in the octopus fishery in Galicia (Spain) [39, 40]. As a result, the daily quota would imply a decrease in fishing effort and at the same time, would presumably increase the market value of the resource. Nevertheless, the participants believed that this measure would not have the fishers’ support, and could result in an increase in illegal landings [20]. In fact, the fisher survey indicated that the community is divided, with 49% disagreeing with vessel quotas and 48% agreeing with this measure. The outcomes of the workshops show that arguments put forward included the possible impact of the measure on the overall fishing community, indicating a concrete attempt to represent and consider their interests during the deliberation process.

Management measures related with surveillance were also considered as “needing further discussion” during the workshops and by the respondents of the questionnaire. In fact, this subject was addressed with care, and a difficult relationship between fishers and enforcement authorities was recorded both in the workshops and during the questionnaire survey. Generally, fishers considered that surveillance is not carried out properly and lacks impartiality. Despite the common argument that a surveillance system promoted by fishers could be complex and difficult to implement, 59% of fishers agree with such a measure.

3.4. A combined view of the questionnaire results

The PCA analysis classified the 17 management measures into five management action groups, and allows us to improve our understanding of which management actions could be combined in a Management Plan and which measures would not be accepted. Table 4 shows the existence of five factors that explain 59.3% of total variance. For the purposes of analysis, names of each factor were given according to corresponding measures.

Factor 1, explaining 14.5% of the variance, was named “Participation”, considering that the combined measure was strongly related to certification of the fishery, communication within the sector, and definition of an exclusive working group, which seem to be major issues for this fishing community. These management measures were extensively discussed during the workshops and identified as consensually important measures for this fishery.

The second factor (explaining 12.1% of the variance) was designated “Fishing effort”. This factor includes the issue that causes the highest degree of conflict in this fishing community. Although reduction of fishing effort was agreed to be important at the workshops, only 54% of the fishers supported it – this is perhaps the main point on which fisher associations and individual fisher opinions seem to diverge. The second factor also included the concern for keeping the prohibition of using live bait (again something on which fishers were divided). In fact, it includes the consensual reduction of fishing effort, but also the concern for keeping the prohibition of using live bait. The implementation of local legislation for the Algarve octopus fishery is also taken into consideration in Factor 2 (in line with the regional bait restrictions).

The third factor was labelled “Effort, Control and Quotas” since it includes actions related with surveillance, schedules and days-at- sea, vessel quotas and maintaining the ordinance that prohibits the use of live bait. The factor integrates most of the measures considered as “needing further discussion” during the workshops and questionnaire (Table 3).

The fourth factor was named “Closed Season” and accounts for 11% of the sample variance. Its designation was selected because it includes the implementation and reinforcement of a Closed Season, which were considered the most important measures during the workshops and among fishers (Table 3).

The final factor was called “Collaborative management” and explains 11% of the variance. This factor highlights the verified willingness of fishers to engage in a type of governance where responsibilities are shared.

Thus the PCA highlights several sets of measures (factors 1,4 and 5) that might form part of a consensual management plan as well as others (factors 2 and 3) that are generally not favoured, because they include measures that are not consensual or are difficult to implement.

[TABLE 4. ABOUT HERE]

4. Conclusions

The “Tertúlia do Polvo” was a project focusing on the octopus fishery, promoted by the research community, in which the overall process mimicked the typology of a collaborative governance where management actions are collectively defined. The inclusion of a consultation phase within the overall methodological approach was found to be useful since

it allowed the validation of the outcomes developed in a participatory approach.

The results achieved indicate the usefulness of the combination of phases of co-construction and of consultation. In the specific case study, a well-established relationship between the outcomes of the participatory approaches and the views of the larger fishing community that would be affected by the implementation of such decisions was highlighted. Nonetheless, if this step-by-step process were to be replicated in another context, the same might not be found and some modification of the process would then be needed. For example, the participatory component could be reviewed to ensure that the interests that were not represented would be present in a second iteration of the deliberation process.

For the octopus fishery in the Algarve there seems to be a high degree of consensus regarding measures that do not require changes in fishing strategies but that enhance communication within the sector, valorisation of the resource and improved monitoring of the fishery. Also, measures that were recognised to contribute to the common good, such as the implementation of a closure, achieved general consensus among all interested parties and also amongst fishers. The measures that would have a direct impact on the fishing activity and revenue generated by this fishery (such as changing Minimum Landing Weight, decreasing fishing effort, or allowing the use of live bait) have to be evaluated with caution, since there is a lack of consensus among fishers. These latter measures are something of a “mixed bag”. An unwillingness to accept a higher MLW and divided opinions about reduced fishing effort suggest that long-term gains may be of lesser interest than short-term losses or perhaps that the potential long-term gains are not fully understood. In relation to the use of live bait the issue seems to be that around half of the fishers were unwilling to give up illegal practices.

For the specific case study, the basis for a change in the governance model appears to be in place regarding willingness to participate, the capacity to represent collective interests and to negotiate in a structured and constructive environment. The experiment presented here shows that in the period of one year, 17 management actions were identified, detailed and prioritized in a dialogue process that included divergent interests. Furthermore, we believe that the biggest obstacle that was found was the incapacity or unwillingness of the current management authorities to change legislation in accordance to management actions considered to be needed by all those consulted, including the management body itself. In fact, during the “Tertúlia do Polvo” project, a formal request for the implementation of a Closed Season was developed with the participation of the authority’s representatives and formally sent to the national administration, but to date (formal request made in July 2015), it has not yet been implemented.

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FIGURE CAPTIONS

Figure 1 – Map of the Algarve (south Portugal) with the octopus (*Octopus vulgaris*) registration ports (6 nautical mile buffer where small scale fisheries can operate is indicated).

Figure 2 – Diagram of the methodological approach undertaken during the “Tertúlia do Polvo”: participatory process (Phase 1 to 3), questionnaire survey (Phase 4) and data analysis (Phase 5) (adapted from Sonderblohm [12]).

Figure 3 - Number and typology of participant involved in each workshop of the project “Tertúlia do Polvo”.

SOUTH PORTUGAL

IBERIAN PENINSULA

ATLANTIC
OCEAN

WINDWARD

LEEWARD

Lagos Alvor Portimão

Albufeira Quarteira

Faro Olhão Fuzeta Sta. Luzia

-200

6 Nautical miles buffer

0 10 km

-9°0'0.0"

-8°30'0.0"

-8°0'0.0"

-7°30'0.0"

37°30'0.0"

37°0'0.0"

TABLE CAPTIONS

Table 1 - Portuguese legislation specific to the octopus fishery in Portugal. The geographical scope of each regulation is identified (adapted from Sonderblohm et al. [20]).

Table 2 - Descriptive statistics for questions regarding octopus management. Results presented in percentages (N=121).

Table 3 – Management measures identified by the participants of the project “Tertúlia do polvo” at the beginning of the process, the main outcomes obtained from the discussion process, and descriptive statistics for the opinion of fishers regarding the octopus fishery management measures proposed based on the fisher survey.

Table 4 - Principal Components Analysis (PCA) rotated matrix of the responses of fishers about the management measures proposed by the fishing associations (N=121).

Table 1 - Portuguese legislation specific to the octopus fishery in Portugal. The geographical scope of each regulation is identified (adapted from Sonderblohm et al. [20]).

YEAR	LEGISLATION	MAIN ISSUE	GEOGRAPHICAL SCOPE
1987	Portaria N°281-D/1987	Weekend prohibition for fishery	National
1987	Portaria N° 281-C/1987	Minimum landing weight for octopus (750g)	National
1997	Portaria N° 375-A/1997	Minimum landing weight for octopus (500g)	National
2000	Portaria N° 1102D/2000	Regulation for the octopus trap fishery	National
2001	Portaria N° 27/2001	Minimum landing weight for octopus (750g)	National
2005	Portaria N° 635/2005	Experimental one-year closing season	Algarve
2005	Portaria N° 840/2005	Spatial corrections to the closing season	Algarve
2008	Portaria N° 249/2008	Changes to the minimum distance to shoreline	Algarve
2009	Portaria N° 447/2009	Changes to the Portaria N° 1102-D/2000	National
2010	Portaria N° 193/2010	Changes to the minimum distance to shoreline	Algarve
2010	Portaria N° 1054/2010	Prohibition of the use of live bait (<i>Carcinus maenas</i>) for 120 days	Algarve
2011	Portaria N° 132/2011	Authorization of the use of live bait (<i>Carcinus maenas</i>) for one year	Algarve
2012	Portaria N° 97-A/2012	Extension of the use of live bait (<i>Carcinus maenas</i>) for a 120 days	Algarve
2012	Portaria N° 230/2012	Prohibition of the use of live bait (period <i>Carcinus maenas</i>)	Algarve

Table 2 - Descriptive statistics for questions regarding octopus management. Results presented in percentages (N=121).

SURVEY ITEMS	FREQUENCY OF OCCURRENCE (%)		
	YES	NO	NO INFORMATION
<i>Do you think that a specific Management Plan would improve the octopus fishery at the Algarve?</i>	71.9	24.8	3.3
<i>Are you a member of a fishers' association?</i>	71.1	27.3	1.7
<i>Do you feel that you are properly represented by your fishers' association?</i>	91.9	8.1	0
<i>Were you Informed about the participative meetings associated with "Tertúlia do Polvo"?</i>	33.9	65.3	0.8

Table 3 – Management measures identified by the participants of the project “Tertúlia do polvo” at the beginning of the process, the main outcomes obtained from the discussion process, and descriptive statistics for the opinion of fishers regarding the octopus fishery management measures proposed based on the fisher survey.

SURVEY ITEMS: MANAGEMENT MEASURES identified during the workshops of the project “Tertúlia do Polvo”	WORKSHOP OUTCOME	FISHER’S OPINIONS (questionnaire) Frequency of occurrence (%)		
		Disagree	Neutral	Agree
<i>Create exclusive working group for definition of a Management Plan (MP)</i>	Consensual	12.40	4.96	82.64
<i>Implement certification process</i>	Consensual	19.83	4.13	76.03
<i>Improve communication amongst fishing associations for definition of a MP</i>	Consensual	9.92	3.31	86.78
<i>Initiate on board monitoring (CCMAR, University of Algarve) for a future MP</i>	Consensual	19.01	4.96	76.03
<i>Definition of a closed season</i>	Consensual	14.88	1.65	83.47
<i>Reinforce surveillance during closure</i>	Consensual	12.40	2.48	85.12
<i>Reduce fishing effort</i>	Consensual	43.80	2.48	53.72
<i>Increase minimum landing weight</i>	Consensual*	73.55	2.48	23.97
<i>Derogate the ordinance 230/2012 (prohibition of using live bait)</i>	Not consensual	52.07	4.96	42.98
<i>Maintain the ordinance 230/2012 (prohibition of using live bait) with changes</i>	Not consensual	66.94	14.88	18.18
<i>Schedules and days-at-sea</i>	Needing further discussion	61.98	2.48	35.54
<i>Vessel quotas</i>	Needing further discussion	48.76	4.13	47.11
<i>Increase surveillance for the octopus fishery</i>	Needing further discussion	49.59	4.13	46.28
<i>Reduce surveillance for SSF</i>	Needing further discussion	52.07	9.09	38.84
<i>Implement a surveillance system made by fishers</i>	Needing further discussion	58.68	2.48	38.84
<i>Implement local legislation for the Algarve octopus fishery</i>	Needing further discussion	43.80	9.09	47.11
<i>Maintain minimum landing weight</i>	Needing further discussion	24.79	0.00	75.21

Note: “Consensual” - considered important by all participants; “Not consensual” – considered important by only some of the participants; “Needing further discussion” – additional information was needed, considering the difficulty to implement due to complexity, lack of capacity to implement, and/or the unwillingness of the fishing community to comply. Opinions were measured on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree), subsequently reduced to a three-point scale (disagree, neutral, agree).

* Participants acknowledged the importance of the measure but indicated that they would need to consult their associates prior to its implementation.

Table 4 - Principal Components Analysis (PCA) rotated matrix of the responses of fishers about the management measures proposed by the fishing associations (N=121).

	PC1 Participation 14.5%	PC2 Fishing effort 12.1%	PC3 Effort, Control and Quotas 11.3%	PC4 Closed season 10.9%	PC5 Collaborative Management 10.5%
Implement certification process	.732	.196	-.107	.140	.166
Improve communication amongst fishing associations for definition of a MP*	.825	.149	.085	.086	-.073
Create exclusive working group for definition of a MP*	.704	-.270	.256	.064	.101
Reduce fishing effort	.072	.829	.057	.113	.006
Derogate the ordinance 230/2012 (prohibition of using live bait)	-.041	-.450	-.391	-.034	.432
Increase surveillance for the octopus fishery	-.018	.417	.453	.159	.009
Schedules and days-at-sea	-.055	.243	.684	.028	.176
Vessel quotas	.139	.032	.543	.299	.096
Maintain the ordinance 230/2012 (prohibition of using live bait) with changes	.136	-.096	.656	-.231	.021
Closing season	.104	.079	.035	.816	.111
Reinforce surveillance during closure	.126	.065	.021	.821	-.042
Implement a surveillance system made by fishers	-.076	-.080	.193	.029	.766
Implement local legislation for the Algarve octopus fishery	.287	.485	.085	-.075	.532
Initiate on board monitoring (University of Algarve) for a future MP*	.397	.081	.064	.147	.557

Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 6 iterations.

*MP: Management Plan.

The PCA analysis suggests the exclusion of the measures “Reduce surveillance for SSF”, “Increase minimum landing weight for common octopus” and “Maintain minimum landing weight for common octopus”, since there is no correlation with these variables and the remaining. After excluding these variables, the analysis was validated (KMO=0.663; p-value of Bartlett’s sphericity test = 0.000).